



Planet Depos®
We Make It *Happen™*

Transcript of Eli Saber, Ph.D., Volume 2

Date: August 13, 2024

Case: Meta Platforms, Inc., et al. -v- VL Collective IP LLC (PTAB)

Planet Depos

Phone: 888.433.3767

Email: transcripts@planetdepos.com

www.planetdepos.com

**Meta 1054
Meta v. VL Collective
IPR2023-00924**

Conducted on August 13, 2024

300		302	
1 UNITED STATES PATENT AND TRADEMARK OFFICE 2 BEFORE THE PATENT TRIAL AND APPEAL BOARD		1 A P P E A R A N C E S	
3 - - - - -x		2	
4 META PLATFORMS, INC., :		3 ON BEHALF OF THE PETITIONER:	
5 INSTAGRAM, INC., WHATSAPP LLC, :		4 W. TODD BAKER, ESQUIRE	
6 META PLATFORMS TECHNOLOGIES, :		5 KIRKLAND & ELLIS LLP	
7 LLC, and GIPHY, INC. :		6 1301 Pennsylvania Avenue, NW	
8 Petitioner, :		7 Washington, DC 20004	
9 v. :		8 (202) 389-5000	
10 VL COLLECTIVE IP LLC, :		9	
11 Patent Owner. :		10	
12 - - - - -x		11 ON BEHALF OF THE PATENT OWNER:	
13		12 PHILIP EKLEM, ESQUIRE	
14 Deposition of		13 REICHMAN JORGENSEN LEHMAN & FELDBERG	
15 ELI SABER, PH.D.		14 400 Madison Avenue, Suite 14D	
16 Volume 2		15 New York, NY 10017	
17 Rochester, New York		16 (212) 381-1965	
18 Tuesday, August 13, 2024		17	
19 8:49 a.m. Eastern Standard Time		18	
20		19 ALSO PRESENT:	
21 Job No.: 548231		20 Dr. Chandra Bajaj	
22 Pages: 300 - 624		21	
Reported By: Kadi A. Harmon		22	
301		303	
1 Deposition of ELI SABER, PH.D., held at the		1 C O N T E N T S	
2 offices of:		2 EXAMINATION OF ELI SABER, PH.D. PAGE	
3		3 By Attorney Baker 6	
4 Hilton Garden Inn Rochester Downtown		4 By Attorney Eklem 314	
5 155 East Main Street		5	
6 Rochester, NY 14604		6	
7 (585) 232-5000		7 PREVIOUSLY MARKED EXHIBITS	
8		8 (Originals Retained by Counsel.)	
9		9 EXHIBIT PAGE	
10 Pursuant to notice, before Kadi A. Harmon,		10 VL Collective 2007 Supplemental Declaration 306	
11 Court Reporter and Notary Public in and for the		11 of Eli Saber, Ph.D.	
12 State of New York.		12 Meta 1001 US 7,436,908 Sigal et al. 308	
13		13 Meta 1009 Tracking Loose-limbed People 348	
14		14 Meta 1003 Provisional Patent 377	
15		15 Application	
16		16 Meta 1053 US 6,597,801 Cham et al. 400	
17		17 Meta 1006 Dressed Human Modeling, 413	
18		18 Detection, and Parts	
19		19 Localization by Liang Zhao	
20		20 Meta 1016 Stochastic Tracking of 3D 438	
21		21 Human Figures Using 2D Image	
22		22 Motion	

PLANET DEPOS

888.433.3767 | WWW.PLANETDEPOS.COM

Meta 1054
Meta v. VL Collective
IPR2023-00924

Conducted on August 13, 2024

1 VL Collective 2004 Declaration of Eli Saber, 445 2 Ph.D. 3 Meta 1011 Generating Spatiotemporal 497 4 Models from Examples 5 Meta 1052 Supplemental Declaration of 504 6 Chandrajit Bajaj, Ph.D. 7 Meta 1015 Attractive People 519 8 Meta 1019 PAMPAS: Real-Valued 560 9 Graphical Models for 10 Computer Vision 11 VL Collective 2009 Emails 567 12 VL Collective 2010 Emails 567 13 Meta 1007 US 6,301,370 Steffens et al. 574 14 Meta 1008 US 7,200,266 Ozer et al. 594 15 16 17 18 19 20 21 22	304 1 in this matter, IPR 2023-00924. Thank you for 2 making the time this morning for us to continue 3 our conversations. 4 I'm going to hand you what has been 5 previously marked as Exhibit 2007. 6 (Previously marked VL Collective Exhibit 7 2007 was introduced and retained by Counsel.) 8 Q Are you familiar with that document? 9 A I am. 10 Q And will you confirm that that's your 11 signature on Page 72? 12 A It is. 13 Q And is there any reason today why you 14 can't give full and complete answers to the 15 questions that I've provided? 16 A No. 17 Q I want to talk a little bit before we jump 18 into the substance of the matter about your 19 preparation process for today's deposition. 20 A Okay. 21 Q You've identified a list of documents in 22 Exhibit 2007. Did you review each of the
305 1 PROCEEDINGS 2 THE COURT REPORTER: Okay. Would you 3 raise your right hand, please? 4 Do you swear or affirm that the testimony 5 you provide today will be the truth, the whole 6 truth and nothing but the truth? 7 THE WITNESS: I do. 8 THE COURT REPORTER: Thank you. 9 ATTORNEY BAKER: Good morning. I am Todd 10 Baker. I'm from Kirkland & Ellis, here on behalf 11 of Petitioner, Meta Platforms. And with me online 12 via Zoom is Dr. Chandra, C-h-a-n-d-r-a; Bajaj, 13 B-a-j-a-j. 14 ATTORNEY EKLEM: This is Phil Eklem with 15 Reichman Jorgensen Lehman & Feldberg on behalf of 16 Patent Owner, VL Collective IP, LLC, and the 17 witness. 18 EXAMINATION 19 BY ATTORNEY BAKER: 20 Q All right. Good morning, Dr. Saber. 21 A Good morning. 22 Q So we're here for your second deposition	306 1 documents that you discuss? 2 ATTORNEY EKLEM: Objection to form. 3 A I have reviewed the documents that I 4 needed to review. 5 (Reporter clarification.) 6 Q How did you determine what documents you 7 needed to review? 8 ATTORNEY EKLEM: And I caution the witness 9 not to divulge the substance of communications you 10 had with counsel during the preparations, but to 11 the extent you can answer the question without 12 doing so, you can answer. 13 A Well, I read through my original 14 declaration, my supplemental declaration, and the 15 exhibits that are listed in these declarations, I 16 reviewed as I needed. 17 Q And do you recall the exhibit number of 18 your original declaration? 19 A No. I do not. 20 Q We'll look that up. That's fine. 21 ATTORNEY EKLEM: I think we can say it's 22 2004. 307

PLANET DEPOS

888.433.3767 | WWW.PLANETDEPOS.COM

Meta 1054
Meta v. VL Collective
IPR2023-00924

Conducted on August 13, 2024

1 ATTORNEY BAKER: 2004. 2 Q And did you review the transcript from 3 your first deposition? 4 A I have. 5 Q You read the whole thing? You read 6 portions? 7 A I read the relevant portions that I 8 needed. 9 Q Okay. Are there any documents outside the 10 ones we just discussed that you reviewed in 11 preparation for today's deposition? 12 ATTORNEY EKLEM: The same caution to the 13 witness. 14 A Not that I recall off the top of my head. 15 Q Because I'm confident we'll be referring 16 this throughout the day, I'm going to go ahead and 17 hand you what has been previously marked as Meta 18 Exhibit 1001. 19 (Previously marked Meta Exhibit 1001 was 20 introduced and retained by Counsel.) 21 Q Dr. Saber, do you agree that the meaning 22 or claim construction of claim term 1E is in	308 1 A Each claim has its own details and 2 discussions. 3 Q Okay. We can do that. 4 So does Claim 1 recite the term track or 5 tracking? 6 A Well, Claim 1, the word tracking is not 7 literally printed there in the claim, but Claim 1 8 obviously is a method claim that discusses, you 9 know, a spatio-temporal model -- 10 (Reporter clarification.) 11 A Claim 1 discloses a spatio-temporal model. 12 It discloses a video with LD images, object 13 probabilities. So it discloses a variety of 14 things that have to do with what the invention is 15 about. 16 Q But just -- I want to be direct: Does 17 Claim 1 recite the term track or tracking, yes or 18 no? 19 A As I mentioned, the word tracking is not 20 literally typed there in the claim, but the claim, 21 you know, discusses obviously this particular 22 invention that has to do with object detection and
309 1 dispute between the parties? 2 A Yes. I understand there are claim 3 constructions that are in dispute between the 4 parties. 5 Q And is claim limitation 1E one of those 6 terms? 7 A Claim limitation 1E is one of those terms. 8 Q And in your supplemental declaration, you 9 provide your opinion regarding the meaning of 10 limitation 1E, correct? 11 A I have. 12 Q And as part of your review, you reviewed 13 each of the claims of the '980, Claims 1 14 through 16? 15 A I have. 16 Q Okay. Would you agree that the '980 17 claims are limited to object detection? 18 ATTORNEY EKLEM: Objection to form. 19 A Well, the claims are written there. The 20 limitations and the claims are there. We can walk 21 through each claim separately if you like. 22 Q Okay.	310 1 tracking. 2 Q Do any of the '980 claims recite the term 3 track or tracking? And that's a yes or no 4 question. 5 A So as I said earlier, the word tracking 6 may not be typed literally in the claims but this 7 invention is about graphical object models for 8 detection and tracking and the claims obviously 9 claim the -- the invention of object detection and 10 tracking as you -- as you read those claims in 11 light of the specification. 12 Q So we're going to probably go through this 13 approach for a lot of the day and I am going to 14 ask to see if you will agree with this request. 15 If I ask a yes or no question that you answer yes 16 or no, but I'm happy for you to provide an 17 explanation afterwards. 18 So if I say yes or no, is this true, you 19 can say yes or no and then explain. Is that fair? 20 A Well, I'll answer as I see fit for the 21 question that you are asking. 22 Q That's fine. 311

Conducted on August 13, 2024

312 1 A As best as I can. 2 Q We'll see how this goes. But if I ask a 3 yes or no, if you can say yes or no and then 4 explain, I think it will go a lot faster. 5 Does Claim 1 recite the term graphical 6 model, yes or no? 7 A So, again, as I mentioned earlier, the 8 word graphical model isn't typed there literally 9 in the claim, but this invention obviously 10 discusses graphical object models for detection 11 and tracking. 12 You see, the title of the invention is 13 Graphical Object Models for Detection and 14 Tracking. So what's being claimed there is -- you 15 know, if you read the claims in light of the 16 specifications, like if you look, for instance, at 17 Claim 3, the word graphical model is literally 18 there in the claim. 19 Q Does you Claim 1 recite the term graphical 20 model, yes or no? 21 A Well, as I said, the word graphical model 22 isn't typed there literally in the claim, but the	314 1 A Again, as I mentioned to you earlier -- 2 and my answer isn't going to change -- is this 3 invention is about object -- graphical object 4 models for detection and tracking. So the claims 5 claim the -- the invention that's being disclosed 6 here in the specification and when you read the 7 claims in light of the specifications, you 8 understand what's being claimed. 9 And we can walk through these steps. It 10 talks about spatio-temporal model, which obviously 11 has to do with video and object detection and 12 tracking across a variety of frames, et cetera. 13 Q So the '980 specification is eight columns 14 long. How does one decide what we import from the 15 specification and what we do not into the claims? 16 ATTORNEY EKLEM: Objection to form. 17 A Well, I'm not importing from the 18 specifications. I read -- as POSITA, I read the 19 claims, I apply plain and ordinary meaning, 20 unless -- 21 (Reporter clarification.) 22 A -- plain and ordinary meaning to the terms
313 1 claim claims the invention that when you read that 2 in light of the specifications, you understand 3 what the authors are doing. 4 Q So you indicated that the title of the 5 patent is Graphical Object Models for Detection 6 and Tracking, correct? 7 A Correct. You read that correctly. 8 Q How about the preamble? How does the 9 preamble read? 10 Does it read: A computer implemented 11 method for object and detection; is that correct? 12 A You read that correctly. 13 Q So the term object detection is explicitly 14 provided for in Claim 1? 15 A That's correct. 16 ATTORNEY EKLEM: Objection to form. 17 A The term object detection -- the words 18 object detection are explicitly there in the 19 claim. They're there printed on the piece of 20 paper. 21 Q But object tracking is not explicitly 22 written in the claims, correct?	315 1 in the specification, unless a construction has 2 been proposed. And when you read the claims, you 3 read the claims in light of the specification. 4 Q What is the plain and ordinary meaning of 5 spatio-temporal model? 6 A Well, so as you see here in my 7 declaration -- I am on Page 32 of the 8 declaration -- the supplemental declaration. 9 So you see on that particular page, and 10 starting with the page before it, you see where -- 11 there's the word spatio-temporal model in 12 Element 1/9[a]. 13 And Paragraph 24 states: I understand the 14 Patent Owner sets forth the following claim 15 constructions for spatio-temporal model. 16 And if you go to Page 32, at the top of 17 the page, there is a Patent Owner construction 18 there. 19 (Reporter clarification.) 20 Q Is the Patent Owner's construction the 21 plain and ordinary meaning of spatio -- 22 spatio-temporal model?

Conducted on August 13, 2024

316 1 A So that's essentially what -- initially, 2 you know, if you look at this construction, this 3 construction defines what is spatio-temporal model 4 in the context of the '980 patents, and that's 5 essentially what you would understand from reading 6 the claims and the specification of the '980. 7 Q That wasn't my question. 8 My question is: What is the plain and 9 ordinary meaning of spatio-temporal model, and 10 does that match the Patent Owner's construction on 11 Page 32 of your declaration? 12 ATTORNEY EKLEM: Objection. Form. 13 A So if you look at Paragraph 25, you see in 14 Paragraph 25 there is a discussion there or 15 where -- where that terminology has come from. So 16 you see there, you know, the inventors repeatedly 17 and unambiguously define spatio-temporal model in 18 '980 patent. 19 So if you look at the -- read through the 20 claims, you read through in light of the 21 specification. And there is a series of citations 22 there from the '980 that cite to various places in	318 1 specification to understand the context that's 2 being applied. 3 You know, MPEG-1 has a spatio-temporal 4 model, too, that's different from what's in the 5 '980. So it's -- it's a broad term that you would 6 have to read the claims carefully. You have to 7 read that in light of the specification, read the 8 specification to understand the context of how 9 spatio-temporal model is being utilized in the 10 '980. 11 Q But you agree that the term 12 spatio-temporal model was a broad term in the 13 2004/2005 time frame? 14 ATTORNEY EKLEM: Objection to form. 15 A Well, people use different terms -- you 16 know, terms of the English language could have 17 different meanings in different context. So 18 that's why you have to read the claim, you have to 19 read the specification to understand the context 20 of how this particular term is being applied or 21 utilized in this '980, and that's essentially what 22 you come to the conclusion.
317 1 the specification where spatio-temporal model has 2 been utilized and defined and described in the 3 specification, and that's how you come to 4 understand what a spatio-temporal model is in the 5 context of the '980. 6 Q But I'm asking you what the plain and 7 ordinary meaning is? 8 A Well, obviously this is -- essentially 9 this describes it like a POSITA would read this. 10 This construction you read here is what a POSITA 11 would understand. 12 When I read the claims and I read that in 13 light of the specifications, I come to that 14 understanding. 15 Q All right. Let's assume it's May 26th, 16 2004, the day before this provisional is filed. 17 Does the spatio-temporal model have a plain and 18 ordinary meaning? 19 A Spatio-temporal model is a -- essentially 20 is a broad term. There are -- you know, people 21 have used it in different ways. So you have to 22 read the claim and you have to read the	319 1 So it's a general term. I know people use 2 it in different context. In the context of '980, 3 the -- what you see in that construction is what a 4 POSITA would understand. 5 (Reporter clarification.) 6 Q What is the plain and ordinary meaning of 7 temporal model? 8 A Well, so as you see, you have 9 spatio-temporal model, right? So the temporal 10 model refers to the time -- essential a time 11 series or a time sequence, a time type of entity. 12 But as a spatial refers to something, you know, 13 spatially. But these are -- these general terms 14 that you would have to read the claims and read 15 the specification to understand how -- what's the 16 context of how these terms are being utilized. 17 Q If a model changes over time, is it a 18 temporal model? 19 A Well, I have to see what -- what -- what 20 the changes are, what does it look like. I mean, 21 you're asking me kind of a general question. 22 I would have to see the details of what it

Conducted on August 13, 2024

320 1 looks like. I'm talking about here -- 2 specifically, here about the '980. I'm not 3 talking in general hypotheticals. 4 The '980 patent has a description of a 5 spatio-temporal model. When you need the 6 specifications, you come to the conclusion that 7 you see there. 8 Q Do you know what it means to say something 9 has a plain and ordinary meaning? 10 A Yes. 11 Q Do you agree that means it has a meaning 12 outside of the context of a particular writing or 13 teaching? Do you agree with that? 14 A Well, you have a plain and ordinary 15 meaning to what -- to what it would mean to a 16 person of ordinary skill of the art, but you still 17 have to look at the context of how this term is 18 being utilized because terms have plain and 19 ordinary meanings, but they could be utilized in 20 slightly different context. You have to come -- 21 you have to understand the context to understand 22 how -- that's why you have the specification in	322 1 In the '980 -- when you read the '980 2 claims and you read the specifications, you know, 3 carefully, a POSITA would come to the conclusions 4 that I have listed there in my declaration and the 5 support for that is in those citations that you 6 see in Paragraph 25. 7 Q Does Claim 1 limit the type of 8 spatio-temporal model? 9 A Well, Claim 1 says it's providing a 10 spatio-temporal model for an object to be 11 detected. 12 Q Correct. 13 A And then as you read through the claim, 14 there are certain things that are being done based 15 on that spatio-temporal model. 16 Q Is the term spatio-temporal model recited 17 again after Step 1A? 18 A Well, it's utilized in the remaining 19 steps. I mean, you don't keep saying the same 20 word again and again, but it's -- it's utilized to 21 do the remaining steps that are in Claim 1. 22 Q Are there -- are there further limitations
321 1 the claims. 2 Q So if I asked you the plain and ordinary 3 meaning of an automobile, would have to have 4 context to tell me what it is? 5 A Well, if you said automobile, that could 6 be a Corvette, any race car. It could be a Dodge 7 Ram, it could be a -- you know, a Yugo. I don't 8 know if they still make those. 9 It could be a variety of the different 10 automobiles. So do -- I need to know whether 11 we're talking about an automobile in a race 12 context or if we're talking about an automobile in 13 an Uber context. So the context depend -- you 14 know, defines how this terminology is being 15 utilized. 16 Q So in the context of object detection, are 17 there different types of spatio-temporal models? 18 ATTORNEY EKLEM: Objection to form. 19 A I mean, again, yes. I would -- you know, 20 there are different -- people have used different 21 types of spatio-temporal models in doing object 22 detections.	323 1 provided on the term spatio-temporal model in 2 Claim 1? 3 A I don't know what you mean by -- 4 Q Does it say that it's graphical? 5 Does Claim 1 recite that the 6 spatio-temporal model is graphical? 7 A No. Claim 1 does not state that 8 spatio-temporal model is graphical. But Claim 1 9 does state that you have a spatio-temporal model, 10 you measure an object, you determine probability. 11 These steps are based on that spatio-temporal 12 model that's being listed there or defined -- 13 Q And that could mean any spatio-temporal 14 model, couldn't it? 15 There's no limitation on the nature or the 16 type of spatio-temporal model in Claim 1, correct? 17 ATTORNEY EKLEM: Objection to form. 18 A Well, I think you're misrepresenting 19 what's being specified. 20 Q How? 21 A Well, the spatio-temporal model that's 22 defined in Claim 1 has to be able to support the

Conducted on August 13, 2024

324 1 remaining limitations of -- the remaining elements 2 of Claim 1. 3 Q Okay. 4 A So it's got to be capable -- when you 5 define that model, it's got to be able to do these 6 other steps. So it's not just any spatio-temporal 7 model. It's got to have the capabilities for you 8 to support the remaining elements of the claim. 9 Q Are there any particular elements that you 10 think that spatio-temporal model generically 11 cannot achieve? 12 ATTORNEY EKLEM: Objection to form. 13 A I don't know what you mean by your 14 question. 15 Q So Step 1 requires providing a 16 spatio-temporal model, correct? 17 A Element 1[a], yes. 18 Q And you also provide a video, correct? 19 A Element 1[b], yes. 20 Q And there's no limitation or further 21 narrowing of what a spatio-temporal means or 22 requires, correct?	326 1 are connected in any way? 2 ATTORNEY EKLEM: Objection to form. 3 A So, again, when the read the claim, you 4 got to read the claim in light of the 5 specification that's -- that's there. You know, 6 otherwise, there's no need for a specification. 7 You just have claims and you're done. 8 So when you look at the next step, 9 measuring the object as a collection of components 10 in each image. So you understand there has to be 11 an object and those collection of components have 12 to define that object. It's not just a random set 13 of things. They've got to define what that object 14 is. 15 Q What is the object? Does Claim 1 define 16 what the object is? 17 A Whatever the object -- an object in 1A is 18 the object that's being referred to in 1C. 19 Q Could the object be a human? 20 (Reporter clarification.) 21 A Certainly. I mean, if you look, for 22 instance, at Figure -- if you look at
325 1 ATTORNEY EKLEM: Objection to form. 2 A I don't know what you mean by -- by that, 3 but there is -- there are a list of elements there 4 in Claim 1 that all have to do -- so, for 5 instance, if I look at element -- if I looked at 6 Claim 1 preamble, as you -- as you stated, it's a 7 computer implemented method. Okay? It's a method 8 claim for object detection. 9 If I look at Claim 1A, it states: There's 10 providing a spatio-temporal model for an object to 11 be detected. 12 So it's a spatio-temporal model and object 13 to be detected. 14 So I go to Step 1B, it says: Providing a 15 video comprising a plurality of images, including 16 the object. 17 So if there's a plurality of images that 18 include the object that's listed in Claim 1 as an 19 object. So that's the object we're talking about. 20 Q Okay. Let me ask a couple other questions 21 about Claim 1. 22 Is there a requirement that the components	327 1 Figure 1 -- 2B, I'm sorry -- 2B and then Figure 3, 2 so obviously this is an example of a object that 3 the authors are discussing. And then, I think, 4 Figure 2B provides a graphical model for this -- 5 this particular object. 6 Q Could the object be a car? 7 A That, I think, is in Figure 2A. 8 Q It's a simple question. That's all I'm 9 asking you is a simple question. 10 A Yeah. So -- 11 Q Okay. 12 A Yeah. So the object has to be the object 13 that you are trying to detect. 14 Q Could the object be a flock of birds? 15 ATTORNEY EKLEM: Objection to form. 16 A Well, in that case, you would have to 17 basically look at each bird as an object. So you 18 can have each of the birds as an object. 19 Q Could each of the birds be a component? 20 A Again, you would have to look at the birds 21 and how they're -- just like you divide -- divide 22 a human into these components, you would have to

Conducted on August 13, 2024

328 1 divide -- you would divide, essentially, the bird 2 into the head and the wings and feet or whatever. 3 So you have a collection of components 4 that essentially define what the object is. 5 Q So I'll ask my earlier question again: Is 6 there a requirement that there's any connectivity 7 between the components in Claim 1? 8 ATTORNEY EKLEM: Objection to form. 9 A The components have to define the object. 10 So the components -- I have an object, and I have 11 a collection of components that define that 12 object. So they're not just the random pieces. 13 They're not just a chair from here and a cup of 14 coffee from there. It's -- it's a set of 15 components -- a collection of components that 16 define what the object is. They got to define -- 17 So you have an object as your first level, 18 as you see in Figure 2A, for instance, and you 19 have a collection of components that go with that 20 object. They've got to define the object. 21 Q And Step C says: Measuring the object as 22 a collection of components, correct?	330 1 Each node in the graphical model corresponds to a 2 position and scale of the component or the object 3 as a whole in an image at a given time instant? 4 ATTORNEY EKLEM: Objection to form. 5 A You read the sentence correctly. 6 Q Does Claim 1 or 9 require a measurement of 7 the position and scale of the whole object? 8 A I don't know what you mean. Claim 1 9 is -- so you're measuring the object as a 10 collection of components in each image. So you 11 have the object. You have a collection of 12 components that define that object. And in each 13 image is referring to the images that you 14 collected in 1B as a plurality of images that 15 include the object. 16 Q So we agree that Claim 1 recites measuring 17 the collection of components? 18 ATTORNEY EKLEM: Objection to form. 19 A I think you're misrepresenting what 20 Claim 1C says. You're -- it's measuring the 21 object as a collection of components. It's not 22 measuring the components. It's measuring the
329 1 A In each image. 2 Q In each image? 3 A You read that correctly. 4 Q Are a chair and cushion, for example, a 5 collection of components? 6 ATTORNEY EKLEM: Objection to form. 7 A Well, again, if the cushion is sitting on 8 the chair, it is essentially a part of the chair. 9 So the point here is the collection of components 10 have to define the object, so have to be -- define 11 the object itself. They're not just a random 12 collection. They've got to define. 13 So that's why you're measuring the object 14 as a collection of components in each image. So 15 you have an object. You have the collection of 16 components. That collection of components have to 17 define that object. 18 Q Can you place -- to the extent you have 19 not already -- the '980 patent in front of you. 20 And can you turn to Column 2, Line 60? 21 A Column 2, Line 60. Yes, sir. 22 Q Do you agree that Column 2, Line 60 reads:	331 1 object. So you have an object and you have a 2 collection of components that define that object. 3 That is crystal clear in the claim. 4 Q Does that require measuring the component? 5 Does that require measuring the position 6 and scale of each component? 7 A So you're measuring the object. So you 8 have the object and you have the components of the 9 object. So you need to be able to measure the 10 object. You need to be able to measure these 11 collection of components. These collection of 12 components define the object. 13 So you got to have the object. You got to 14 have a collection of components. They're separate 15 entities. 16 Q Are you measuring the whole object or are 17 you measuring the components in Step C? 18 A You're measuring both. You're measuring 19 the object so you have an understanding of the 20 object, and you also have the components of that 21 object. So you have to know what these components 22 are. They make up the object.

Conducted on August 13, 2024

332 1 Q In Step 2 -- I'm sorry -- Claim 2 of the 2 '980. 3 A Claim 2? 4 Q Claim 2. 5 A Okay. 6 Q There are detectors provided for each of 7 the collection of components, correct? 8 ATTORNEY EKLEM: Objection to form. 9 A Well, Claim 2 states: The computer 10 implemented method of Claim 1. 11 So it's dependent on Claim 1, wherein 12 providing the spatio-temporal model for the 13 object. So it's talking about the A, 14 spatio-temporal model from Claim 1A for the 15 object. Again, the an object in 1A to be detected 16 comprises providing detectors for each of the 17 collection of components. 18 Q So there are detectors provided for each 19 of the collection of components, correct? 20 A So comprises providing detectors for each 21 of the collection of components. 22 Q So does Claim 2 recite providing the	334 1 position and scale of the component or the object 2 as a whole. 3 So each node in the graphical model, 4 please. If you look at Figure 2A, you'll see 5 these nodes in the graphical model corresponds to 6 a position and scale of the component. These are 7 the pieces that are labeled 201 in Figure 2A. 8 These are the components. Or the object as a 9 whole. That's what labeled 203 in Figure 2A, and 10 similarly in Figure 2B, in an image at a given 11 time instant. 12 So in an image at a given time instant. 13 Because you have frames -- video frames. So each 14 frame is at a given time instant. So you have an 15 image there at a given time instant because you 16 have the frames. Each frame or each image in that 17 particular each image, the graphical model 18 provides a node for either the components or the 19 object and defines the position and scale. 20 Q My question was: Does Claim 2 require 21 providing a detector for the object, yes or no? 22 A Well, it's understood. I mean, when you
333 1 detector for the object? 2 A Well, it says comprises providing 3 detectors for each of the collection of 4 components. 5 Q Correct. 6 A So it doesn't -- 7 Q So does Claim 2 recite providing a 8 detector for the object? 9 A It doesn't say -- it doesn't -- it doesn't 10 provide one. It just says it comprises this. 11 That means it -- it contains this. That doesn't 12 mean it's the only thing it does. It comprises 13 providing detectors for each of the collection of 14 components. 15 But see, as you -- as you pointed out, 16 to -- if you go back to Column 2, Line 60, the one 17 you pointed me to earlier. 18 You see where it says there: Each node in 19 the graphical model corresponds? 20 So we have -- we have a node. We have 21 a -- in a graphical model. So as you see here, 22 like, for instance, Figure 2A, corresponds to a	335 1 read Claim 2 -- you read Claim 1 measuring the 2 object, right? So you have to be able to measure 3 the object. That means you have to be able to 4 detect where the object is. You've measured the 5 object, and the object corresponds to a collection 6 of components in each image. 7 Now, Claim 2 states that the 8 spatio-temporal model comprises providing 9 detectors for each of the collection of 10 components. So it doesn't exclude from having one 11 for the object. 12 Q But it doesn't provide for one, does it? 13 It doesn't provide, as part of the 14 measuring, the object as a collection of 15 components. It doesn't require a detector for the 16 object as a whole, correct? 17 A No. You're not correct. You're 18 measuring -- you're measuring the object. 19 Q As a? 20 A You're measuring the object. 21 Q As a? 22 A And you have a collection of components

Conducted on August 13, 2024

336 1 that define the object. The object is not 2 synonymous with a collection of components. 3 Q What's the purpose of the detectors? 4 ATTORNEY EKLEM: Objection to form. 5 A Well, the detectors -- how should I say 6 this? 7 I think you're not understanding what -- 8 Q I asked the question: What are the 9 purpose of the detectors? 10 Not about what I understand. What is the 11 purpose of the detector? 12 A Okay. So you have an object. You have 13 a -- you have a series of frames. You have a 14 series of frames. You have a series of video 15 frames. In each video frame, you have the object 16 and the object comprises a collection of 17 components. 18 So what you -- and then when you read the 19 specification, you come to this understanding. 20 You want to detect each of these components. You 21 also want to detect the object because that's how 22 you define the joint probability density functions	338 1 the collection of components. And that's clear 2 when you look at the figures and you read the 3 specification. 4 Q So why does Claim 2 only provide detectors 5 for the collection of components? 6 ATTORNEY EKLEM: Objection to form. 7 A It's not only. It just says it comprises 8 providing detectors. Because in Claim 1, you've 9 measured the object. You have a detector. You 10 have the ability to measure the object. 11 And in Claim 2, it comprises providing 12 detectors for each of the collection of 13 components. It doesn't exclude from providing 14 detectors for the object. You have to be able to 15 measure the object as a whole, and that's clear 16 from the figures in the specification that you 17 read. 18 Q Why do you have to measure the object as a 19 whole? 20 ATTORNEY EKLEM: Objection to form. 21 A I think you're not understanding what's 22 being explained.
337 1 and all the things that are being done in the 2 specifications. 3 Q Is the joint probability function defined 4 in Claim 1 or 2? 5 A Well, I'm just saying -- 6 Q It's a very simple question. 7 Is the joint probability distribution 8 defined in Claim 1 or 2? 9 A The spatio-temporal model that's being 10 defined in Claim 1 -- 11 Q Is generic, isn't it? 12 ATTORNEY EKLEM: Objection to form. 13 A Has -- you have to be able to measure the 14 object. You have to -- 15 Q As a collection of -- 16 (Reporter clarification.) 17 A So as I mentioned to you earlier, you have 18 the object. You have a collection of components. 19 These are not -- the object isn't equal to the 20 collection of -- it's not synonymous in the sense 21 like Dr. Bajaj would like to make it appear so. 22 You have the object. Separately you have	339 1 Q I'm understanding. 2 Does TLP measure the objects as a whole in 3 your opinion? 4 A We're definitely not -- 5 Q I asked generically why you have to 6 measure the object as a whole. You're saying I 7 don't understand. I think I do. 8 Why do you have to measure the object as a 9 whole? 10 A Well, it improves the quality of the 11 tracking when you have an understanding of the 12 object. So you see in the figures here, you have 13 a layer for the -- separately for the object and 14 you have a layer separate for the components. 15 So it helps in the -- improving the 16 accuracy of your algorithm. When you can look at 17 the object across the frames, you can look at the 18 components, you can look at that spatially and 19 temporally. That improves the overall accuracy. 20 Q So it's not required. You think it's a 21 benefit? 22 ATTORNEY EKLEM: Objection to form.

Conducted on August 13, 2024

340 1 A It's discussed in -- the '980 does that. 2 Q Does Claim 1 limit itself to a two-layer 3 model? 4 ATTORNEY EKLEM: Objection to form. 5 A I think -- 6 Q Claim 1 -- does Claim 1 recite anything 7 about a two-layer model? 8 A I think we've already answered this 9 question. 10 Q Yes or no? 11 A It's not a yes or no question. 12 Q Does it recite it? 13 Is that a yes or no question, whether it 14 recites it? Whether the words two-layer model -- 15 is that a yes or no question? 16 A Claim 1 provides for a spatio-temporal 17 model. 18 Q Yes. 19 A Okay. That model has to be able to 20 support 1B, 1C, 1D and 1E. It has to be able to 21 provide for an object and its collection of 22 components that are separate from the object but	342 1 later image. 2 So you have to be able to look at a prior 3 image and a later image, relative to the current 4 image. So it comprises detecting the object in a 5 current image, you have to be able to look at the 6 prior image and a later image to make that happen. 7 Q And that requires a graphical -- a 8 graphical model to do those things? 9 ATTORNEY EKLEM: Objection to form. 10 A Well, it requires -- so Claim 4 depends 11 from Claim 1, right? So Claim 1 has defined the 12 spatio-temporal model, has provided the video, has 13 measured the objects and you have a collection of 14 components, defined the probability and detected 15 it. 16 Now, Claim 4, it's build -- it's 17 essentially building on that and saying when in 18 determining the probability that's in 1D, a 19 probability, that the object is in each image 20 comprised in detecting the object itself. 21 So you have got to be able -- so obviously 22 it relies on the proper spatio-temporal model that
341 1 make up the object. They're not just random 2 components. 3 So it's got to -- so this way, as you go 4 through the claim, you have to detect the 5 probability that the object is each image, or 6 determine the probability -- I'm sorry -- and then 7 detect the object. 8 So the spatio-temporal model has to have 9 the capability of supporting 1B, 1C and 1D and 1E 10 in Claim 1. 11 Q Does Claim 4 recite a graphical model? 12 A The words graphical model aren't there in 13 Claim 4. But Claim 4 does recite wherein 14 determining the probability that is referred to in 15 Claim 1D as a probability that the object is in 16 each image. That's the images that you've 17 collected in 1B, comprises detecting the object in 18 the current image. So you're detecting the 19 object. That's the object that is referred to 1A 20 as an object. In the current image, according to 21 measurements of the object, as a collection of 22 components determined from a prior image and a	343 1 defines all these things for you to do this -- 2 however that model is constructed has got to 3 provide for the ability for you to detect in the 4 prior image and later image, relative to the 5 current image. 6 Q Let's just try to simplify it. 7 Do the words graphical model appear in any 8 of the claims besides Claims 3 and 11? 9 A So the words graphical model aren't 10 physically printed in the other claims. But the 11 spatio-temporal model that's defined in Claim 1, 12 where Claim 2 to Claim 8 depend from, and 13 similarly, Claim 9, where 10 to 16 depends from, 14 has to provide the abilities and the capabilities 15 for you to be able to practice these claims. 16 So it's got to have the ability to have an 17 object, to have a collection of components that's 18 separate from the object, and you're able to do 19 all these things that are described. 20 Q Let's turn briefly to Claim 8 of the '980. 21 A Yes, sir. 22 Q Does Claim 8 provide that the

Conducted on August 13, 2024

344 1 spatio-temporal model has N components? 2 ATTORNEY EKLEM: Objection to form. 3 (Reporter clarification.) 4 A Well, Claim 8, to be accurate and precise, 5 state -- it depends from Claim 1. 6 It states: The computer implemented 7 method of Claim 1 wherein a joint probability 8 distribution -- that you see in that equation 9 there -- for the spatio-temporal model with the N 10 components is. So the spatio-temporal model has N 11 components. 12 Q Thank you. 13 A It's with N components. It's not -- so 14 you have the object, you have these N components. 15 And they're separate. You see in the equation, 16 you see that big O superscript? That's the 17 object. And you see C0 through CN superscript? 18 Those are the components. 19 Q Let's turn your attention to Column 4 of 20 the '980, please. 21 A Column 4. Yes, sir. 22 Q Lines 43 to 45, doesn't the '980 indicate	346 1 patent. 2 Q Uh-huh. 3 A You see on top the figure where -- where 4 you have the object. 5 Q Uh-huh. 6 A So that's a single layer. 7 So if I were to not look at the 8 components, just look at the object layer on top, 9 that would be a single-layer model where you have 10 essentially the object. 11 A single object layer model can be built 12 with bi-directional temporal constraints. So you 13 see in that figure, you have the object OT. You 14 have OT plus 1 and OT minus 1, let's just say. So 15 you have temporal constraints on the object. 16 That's an alternate approach, but that's not, 17 obviously, his -- the preferred embodiment that's 18 being discussed. 19 Q And could you also look at Figure 2A and 20 say that we're going to look at the components as 21 the single layer. So the bottom half. 22 ATTORNEY EKLEM: Objection to form.
345 1 that in lieu of a two-layer model, that a single 2 object layer model could be built; is that 3 correct? 4 A With bi-directional temporal constraints. 5 So the lines read: Alternatively, a 6 single object layer model can be built with 7 bi-directional temporal constraint. That's an 8 alternate thing. 9 Q So if you have a single-layer model, as 10 discussed in Column 4, then wouldn't a joint 11 probability distribution be based on the 12 probability that the collection of components is 13 in each image? 14 ATTORNEY EKLEM: Objection to form. 15 A No. I think you're missing -- you're 16 missing the point here. So -- 17 Q Okay. Maybe. I'll rephrase. 18 So if there's a single-layer model, would 19 there be a node for just the object? 20 ATTORNEY EKLEM: Objection to form. 21 A So if you look at -- the easiest way to 22 explain this is if you look at Figure 2A in your	347 1 Q Isn't that also another way of looking at 2 Figure 2A? 3 ATTORNEY EKLEM: Objection to form. 4 A No. That's not. 5 Q Well, Claim 1 says: Measure the object as 6 a collection of components. 7 So if you look at Figure 2A and you look 8 at the single layer as the components, would that 9 also not be a correct reading of the description 10 at Column 4, Lines 43 to 45? 11 ATTORNEY EKLEM: Objection to form. 12 A No. It would be an incorrect description. 13 I mean, the object is the entire object, the 14 automobile, the person. 15 Q Okay. 16 A So that single layer would be the entire 17 object. If you want to have a two-layer model, 18 you would have the object and the components. You 19 wouldn't have a layer of just the components. It 20 doesn't make sense in this case. 21 Q So you're not aware of any spatio-temporal 22 model where the model is measured as a collection

Conducted on August 13, 2024

348 1 of components? The object is measured of 2 collection of components? 3 ATTORNEY EKLEM: Objection to form and 4 scope. 5 A We're not discussing any. We're just 6 discussing the '980. So if you want me -- let me 7 finish my answer. 8 So if you want me to opine on something, 9 you would have to show me what is the exhibit you 10 want me to look at, take a look at it. If I have 11 already looked at it before, I could opine on it. 12 If not, I would have -- need time to study it so I 13 could properly opine on it. 14 Q Does TLP measure a collection -- measure 15 an object as a collection of components? 16 A Do you have a copy? 17 Q I do. 18 ATTORNEY BAKER: I'm handing the witness 19 what's been previously marked as Exhibit 1009. 20 (Previously marked Meta Exhibit 1009 was 21 introduced and retained by Counsel.) 22 A So do you also have a copy of my prior	350 1 That's not the same thing as the object that's 2 being described here that this two-layer model 3 that we're talking about in the '980. 4 Q I asked whether TLP measures an object as 5 a collection of components. 6 A TLP looks at the components, and utilized 7 those to do its tracking -- 8 Q Of? 9 A -- loose-limb people. 10 (Reporter clarification.) 11 Q Are people objects? 12 A People are objects, but TLP is detecting 13 the components and using that to -- to do the 14 tracking. 15 Q Of an object, correct? 16 A But it's distinctively different in the 17 way it does it from the '980. 18 Q I just asked whether the TLP or other 19 object detection systems, whether it was known to 20 measure an object as a collection of components -- 21 ATTORNEY EKLEM: Objection. 22 Q -- without measuring the object as a
349 1 declaration? 2 Q I do. But are you able to answer the 3 question from reviewing the TLP? I believe it's 4 been explained numerous times. 5 A So if you look at the supplemental 6 declaration -- I'm on Paragraph 65. 7 Q Okay. 8 A So Paragraph 65 answers your question. 9 And obviously we've explained that more in detail 10 in the prior declaration. That's why I asked for 11 it. 12 So the one -- 1 and 9A of the '980 provide 13 for a spatial model, where you have an object 14 that's detected based on probabilities of the 15 object, and you also have separately a collection 16 of components. 17 So as I previously explained in the prior 18 declaration, and I'm kind of summarizing here, TLP 19 does not disclose detecting an object or 20 determining the probability that an object is in 21 each image. TLP focuses or instead detects 22 components, which are obviously distinct entities.	351 1 whole? 2 ATTORNEY EKLEM: Objection to form. 3 A Well, TLP measures a collection of 4 components, uses that to track -- to track the 5 object. But that's -- TLP is distinctively 6 different from what's done in the '980 where you 7 have an object and you have collection of 8 components and you have this two-layer model. 9 That's distinctively different from what is in 10 TLP. And I think we've explained that very well 11 in the prior declaration and summarized in the 12 supplement. 13 Q But Claim 1 explicitly cites measuring the 14 object as a collection of components, just as TLP 15 does, correct? 16 ATTORNEY EKLEM: Objection to form. 17 A No. That is incorrect. It's not correct. 18 Q We just agreed that TLP teaches measuring 19 the object as a collection of components, did we 20 not? 21 A We disagree on your interpretation of 22 Claim 1 and what's on -- and also on your

Conducted on August 13, 2024

352 1 interpretation of between TLP and the '980. I've 2 explained to you clearly the difference. 3 Q Does measuring the collection of -- 4 measuring the object as a collection of 5 components, does that have a plain and ordinary 6 meaning? 7 ATTORNEY EKLEM: Objection to form. 8 A Well -- 9 Q That's a yes or no question. 10 Does it have a plain and ordinary meaning? 11 A Things have ordinary meanings in the 12 context of what's being described. When I tell 13 you a human crossed the river to get to the bank, 14 you don't know whether the bank is a bank where 15 you put financial dollars in or whether it's the 16 bank of the river where that person wants to sit 17 and sunbathe. So the wordings have context and 18 you need to look at the context to understand the 19 wording. 20 So when you read Claim 1 in context and 21 read in light of the specification, you clearly 22 understand what the authors are claiming, which is	354 1 Anything outside of that is a misrepresentation of 2 what's being described in the '980. 3 Q The name of the game is the claims. Have 4 you ever heard of that before? 5 A I'm not an attorney, sir. I'm just here 6 as a POSITA, as an expert explaining to you 7 technically. I'm not attorney. So I have no 8 legal training, nor do I claim to do so. 9 Q Do you believe that the patent claims in 10 the '980 are clear? 11 A I've explained to you several times now, 12 when you read the claims, you read the claims. 13 I'm instructed by counsel multiple times on 14 multiple IPRs -- I think I've served over 50 IPRs. 15 And at almost every one of them, I'm instructed by 16 counsel that you read the claims in light of the 17 specification. 18 So as a POSITA, I start by reading the 19 claims. I look to the specification. You know, I 20 read that claim in light of the specification to 21 understand what is the claimed invention that's 22 being claimed.
353 1 distinct from TLP. And clearly in the '980, there 2 is an object and separately the collection of 3 components. They're not the same entity that you 4 keep trying to make them to be. 5 Q I just don't see anywhere where any of the 6 claims require what you're saying has to be 7 relationship between the object and the 8 components. 9 A Well, I -- 10 ATTORNEY EKLEM: Objection to form. 11 A I think it's -- clearly a person reading 12 the '980 patent as a POSITA would clearly 13 understand what I'm explaining to you. It's 14 crystal clear when you look at the figures, you 15 read the -- you read the patent specification. 16 You look at the formulas that are described here 17 in the joint probability distribution that you see 18 there, and I could walk you through that 19 distribution at every step. 20 It's crystal clear that you have an object 21 and you have a separate collection of components, 22 and that's what the authors are intending.	355 1 And when you read the claims here in light 2 of the specification, you look at the 3 formulations. You look at the diagrams. You look 4 at the details. It's crystal clear that the 5 authors intended to have an object and a separate 6 collection of components that are separate layers. 7 And the formulations clearly point to that. 8 Anything outside of that is a misrepresentation of 9 what's being done here. 10 Q Did your counsel caution you about 11 incorporating or importing limitations from the 12 specification into the claims? 13 ATTORNEY EKLEM: Objection to form. 14 (Reporter clarification.) 15 Q Did your counsel caution you against 16 importing limitations from the specification into 17 the claims? 18 ATTORNEY EKLEM: Objection to form. 19 And I'm going to caution the witness not 20 to divulge the substance of communications he had 21 with counsel. 22 To the extent you can answer without doing

Conducted on August 13, 2024

356 1 so, you can answer the question. 2 A Again, I'm not a legal expert, as you 3 already know. 4 Q You've done 50 of these. 5 A But I'm not -- I'm not an attorney. I'm 6 not a trained attorney. I'm not -- I don't have 7 any legal training. I'm here as an expert in -- a 8 technical expert, and I'm explaining to you. When 9 I read the claims in the eyes of a POSITA, in 10 light of the specification, it's crystal clear 11 what I've explained to you earlier. Anything 12 outside of that is a misrepresentation of what's 13 being described. 14 Q So let me ask it a little differently. 15 If it's your belief that Claim 1 requires 16 a graphical model comprising nodes corresponding 17 to each of the collection of components and to the 18 object, if Claim 1 requires that, that's the 19 invention, why does Claim 3 separately define that 20 limitation? 21 ATTORNEY EKLEM: Objection to form. 22 Mischaracterizes his testimony.	358 1 A Are you there? 2 Q Column 3, 50 to 55? 3 A 55 to 65. 4 Q 55 to 65. 5 A You see where it says: P, open 6 parentheses, you see there's an X, a series of 7 X's? 8 Q Yes. 9 A The bottom of that is zeros, and then 10 there's a dot, dot, dot, all the way to capital T. 11 So it's essentially zeros one, two, three, all the 12 way to capital T. 13 You see the top is a superscript. 14 Q Uh-huh. 15 A You see there's the letter O there? And 16 there's a little CO, C1, all the way to CN? 17 Q Uh-huh. 18 A So that O represents the object. The C 19 with zero through CN represents the components, 20 the N components, that make up that object. 21 Q Uh-huh. 22 A If the authors intended not -- just to
357 1 Q If it's already in Claim 1, why recite it 2 in Claim 3? 3 ATTORNEY EKLEM: Same objection. 4 A I think I'm not understanding your 5 question correctly, or you're not understanding my 6 prior answer correctly. In Claim 1, Claim 1 7 doesn't claim a graphical model. 8 Q Okay. 9 A It just claims a spatio-temporal model. 10 Q Uh-huh. 11 A From which -- and then it provides for a 12 video for a plurality of images. It does measure 13 the object. You have a collection of components. 14 Those are separate entities. You determine a 15 probability that the object is in each image, and 16 then you detect the object in each image upon 17 comparing, claim and et cetera, for the rest of 18 it. Claim 3 claims that the spatio-temporal model 19 is a graphical model. See? 20 Now, let me show you something. So if you 21 go to Column 3, and I'm looking at Line 55 to 65. 22 Q Go ahead.	359 1 have the object as a collection of components, as 2 you keep eluding to, you wouldn't need XOO. You 3 would just start with XOCO to XOCN, and the 4 capital O would not exist at that point. 5 And then the next piece, you see like you 6 look down below. Where it says equal, you have 7 the 1 over Z, and you have that big Pi symbol? 8 Q Uh-huh. 9 A Which is a multiplication symbol, as you 10 are well aware I'm sure. 11 Q Product, yup. 12 A Yeah. So you see where it says: IJ 13 underneath it? 14 Q Uh-huh. 15 A And then you see where it says Psi, the 16 letter Psi, the Greek letter of Psi? So you see 17 that it says IJ -- Psi IJ XIO XJO? 18 Q Uh-huh. 19 A Yeah. So that's talking about the object 20 layer itself. 21 Q Uh-huh. 22 A Object to object, from frame to frame. So

Conducted on August 13, 2024

360 1 you see where it says where, you know, if you go 2 to Column 4, the very first line, it says: Psi I. 3 It's a typo. It should say J, not K. 4 XIO XJO is the temporal compatibility of 5 objects stayed between Frame I and Frame J. 6 So if you didn't have an object, you just 7 had a collection of components, you wouldn't need 8 that particular product. You would just go -- you 9 would skip the very first product, and you would 10 skip the second product, because that also has an 11 object. And all you would have is the third one, 12 which is just component to component. 13 The authors clearly intended to have an 14 object entity, and separately a collection of 15 components as you see in the figure. And that's 16 why this joint distribution is written the way it 17 is. 18 Q Is Claim 1 or Claim 9 part of the joint 19 probability distribution that we're discussing 20 here? 21 ATTORNEY EKLEM: Objection to form. 22 A So again, Claim 1 claims a spatio-temporal	362 1 Q So let's go back to this joint probability 2 distribution. 3 A Yes. 4 Q Or do you want to take a break? 5 A I think it would be a great idea. 6 ATTORNEY BAKER: All right. Let's take a 7 break. 8 (Recess from 9:57 a.m. until 10:12 a.m.) 9 BY ATTORNEY BAKER: 10 Q Let's look at Paragraph 20 of your 11 supplemental declaration. One second. I can't 12 find this. 13 It's actually Paragraph 19. If you go on 14 the top of Page 27, do you see where you 15 testified: That similarly Claims 4/12 expressly 16 recite detecting object based on an analysis that 17 includes the object probabilities for, quote, a 18 prior image and a later image relative to the 19 current image? 20 Do you see that? 21 A You read that sentence correctly. 22 Q Okay. Let's look at Claim 4 of the '980.
361 1 model that has to provide for the ability to have 2 an object and a collection of components. However 3 that's being done, that's in Claim 1. 4 So you have to have an object. You have 5 to have a collection of components that are 6 separate from the object. And when you read the 7 specification and you read the claim and write the 8 specification, any technical expert that you would 9 put this in front to would come to that 10 conclusion. I can guarantee you, I can take this 11 and put it in front of a class of graduate 12 students and they would all come to that 13 conclusion. 14 Q They wouldn't come to the conclusion that 15 Claim 1 recites a generic spatio-temporal model? 16 ATTORNEY EKLEM: Objection to form. 17 Q They wouldn't come to the conclusion that 18 the claim requires measuring an object as a 19 collection of components? 20 ATTORNEY EKLEM: Objection to form. 21 A I think we've -- I've already answered 22 that a few times.	363 1 A Yes. 2 Q Doesn't Claim 4 recite that detecting the 3 object in a current image according to 4 measurements of the object as a collection of 5 components determined from a prior image and a 6 later image relative to the current image; is that 7 correct? 8 A Well, it says: Wherein determining the 9 probability that the object is in each image 10 comprises detection. 11 And the rest of it, you read correctly. 12 Q Does Claim 4 provide for object 13 probabilities for a prior image and a later image 14 relative to the current image? 15 A So Claim 4, I mean, clearly states to 16 determine the probability that the object, that 17 object is referring to -- so obviously Claim 4 18 depends from Claim 1, as you are well aware. So 19 that object in Claim 4 is referring to the N 20 object in Claim 1. 21 Q Okay. 22 A Because in each image comprises detecting

Conducted on August 13, 2024

364 1 the object in a current image -- 2 Q Uh-huh. 3 A -- according to measurements of the object 4 as a collection of components determined from a 5 prior image and a later image relative to the 6 current image. 7 So when you're detecting the object in the 8 current image according to measurements, that 9 doesn't mean you don't have a probability for the 10 object and the components. You have a collection 11 of components. 12 Q Uh-huh. 13 A Separately you have an object. And that's 14 why it comprises detecting the object in a current 15 image according to measurements of the object and 16 you have the collection of components. So -- and 17 you have a prior image. You have a later image, 18 and relative to the current image. So it seems 19 clear to me. 20 Q Are you saying that Claim 4 provides for 21 some type of object probabilities to be measured 22 from a prior image to a latter image?	366 1 next is the measurement of the object as a 2 collection of components, correct? 3 A Well, you keep -- 4 ATTORNEY EKLEM: Objection to form. 5 A You keep saying the same thing, and I keep 6 telling you that -- the exact opposite. You keep 7 saying the same thing. Measuring the object is a 8 collection of components. Because I guess that 9 must be -- 10 Q It's in the claim. 11 A No. You have an object. Separately you 12 have a collection of components. So whenever I 13 say the object is measured as a collection of 14 components, I always mean you have an object. 15 Separately you have a collection of components. 16 That's crystal clear from the '980. 17 There's no debating that. It's a hundred percent 18 clear. You see the figures there. You see the 19 equations there. As I mentioned to you earlier, I 20 can take that and put it in front of a graduate 21 student and would come to that conclusion. You 22 have an object. You have a two-layer model in
365 1 ATTORNEY EKLEM: Objection to form. 2 A Well, I don't know if I understand what 3 you're asking, but Claim 1 has clearly a 4 spatio-temporal model for an object to be 5 detected. That spatio-temporal model has to have 6 the capability. It's constructed to allow for the 7 object to be looked at spatially, for the object 8 to be looked at temporally. 9 Q Uh-huh. 10 A That spatio-temporal model has to have the 11 ability to have a collection of components for 12 each of those objects and compute probabilities. 13 Claim 4 brings in that you're going to do that at a 14 prior image and a later image relative to the 15 current image. So the -- 16 Q Based on -- sorry. Continue. 17 A I'm sorry. So the window in Claim 4 is 18 essentially W equal 3. You have a prior image, 19 current image, later image. So you have a W equal 20 3 window in a sense. 21 Q And what's being passed from -- what 22 information is being passed from one frame to the	367 1 this '980. It's crystal clear. 2 Q Do you have a two-layer model in Claim 4? 3 A Well, you have an object. You have a 4 collection of components. So you have -- you 5 know, when you read the claims in light of the 6 specification, it's clear what the inventors 7 are -- have intended. 8 Q How do I know which part the inventors 9 intended from the description to read into the 10 claims and what parts to leave out? What are my 11 guidelines? 12 ATTORNEY EKLEM: Objection to form. Asked 13 and answered. 14 A I'm not reading anything into the claims. 15 You keep saying the same things and I'm just 16 telling you, I'm not reading -- I'm reading -- I'm 17 a technical expert. I'm reading the claims from 18 the eyes of a POSITA. 19 I'm not a legal attorney. I read them in 20 light of the specification as I've been instructed 21 by counsel on many IPRs. And when you read the 22 claims in light of the specification, when you

Conducted on August 13, 2024

368 1 look at the figures, you look at the equation that 2 I showed you earlier, the conclusion is clear. 3 You have an object. You have the components. 4 They're two separate layers. 5 Q So that equation you're referring to, 6 that's Claim A, and that depends from Claim 1? 7 A Yes, sir. Claim A depends from Claim 1. 8 Q Does Claim 4 depend from Claim A? 9 A I'm sorry? 10 Q Does Claim 4 depend from Claim A? 11 A No. Claim 4 depends from Claim 1. 12 Q So there's no joint probability 13 distribution defined in Claim 1 or 4, correct? 14 A Claim 4 depends from Claim 1, which has a 15 spatio-temporal model that's defined so to allow 16 for the object, and separately the collection of 17 components to be measured and compute 18 probabilities and what have you, what we've been 19 talking about. 20 Claim 4 just says you have a window of 3, 21 W equal 3. So a prior image, a later image and a 22 current image. Claim 1, you can have a window of	370 1 spatio-temporal model because it has motion 2 estimation. JPEG does not. So JPEG is strictly a 3 spatial model applied on multiple frames. 4 So when you go to W equal 1, which the 5 authors -- if you go to Column 7, Line 20, you see 6 where it says note that with W equal 1, the 7 algorithm resembles single frame component-based 8 fusion. Single frame component-based fusion. 9 So when you write the paper or we write 10 papers or I'm giving a lecture in a classroom, you 11 give the general formulation. And then you say 12 okay. If you let N equal 1, or W equal 1, this 13 essentially simplifies to such and such a case, so 14 that the student or the reader will understand, 15 you know, the scope of what's going on. 16 But this is not -- the W equal 1 is a 17 scenario where you have a single frame. You don't 18 a spatio-temporal model with W equal 1. You just 19 have a spatial thing. 20 Q And in the patent world, if that's what 21 you want to claim when you say W greater or equal 22 than 3?
369 1 a hundred. 2 Q You could have a window of one. 3 A No. You don't have a window of one. 4 Because if you have a window of one, then you 5 don't have a spatio-temporal model. You don't 6 have a spatio-temporal model. 7 Q So you know of no spatio-temporal models 8 where the model has one shape and one frame and a 9 different shape in a different frame? 10 ATTORNEY EKLEM: Objection to form and 11 scope. 12 A I'm going to give you an example. So I'm 13 sure you are aware of JPEG, correct? 14 Q I am. 15 A So JPEG is an image compression algorithm. 16 You are also aware of what we refer to as motion 17 JPEG. So motion JPEG essentially takes a video 18 and compresses each image separately, as if it is 19 its own entity, without doing any temporal motion 20 estimations at all. 21 MPEG brings in the motion estimation 22 between frames. So MPEG brings in a	371 1 ATTORNEY EKLEM: Objection to form. 2 Argumentative. 3 Q So you gave me the -- 4 A No. 5 Q -- technical world and how you'd write 6 papers, and I want to give you the legal world. 7 If that's your invention, you claim W greater than 8 equal than 3, correct? 9 If you describe W is greater than equal 10 than 1, then you tell me that's part of your 11 invention? 12 ATTORNEY EKLEM: Objection to form. 13 Argumentative. 14 A So the invention claims a spatio-temporal 15 model. So that means you have to have a spatial 16 modeling. You have to have temporal modeling. 17 Q Uh-huh. 18 A Just looking at a series of range 19 independently is not a temporal model. You have 20 to have a spatial -- like JPEG is a spatial. 21 Moving JPEG is a spatial applied to video frames. 22 MPEG is spatio-temporal.

Conducted on August 13, 2024

372 1 Q Is a dynamic model a temporal model? 2 ATTORNEY EKLEM: Objection to form. 3 A I would have to see what – just what the 4 model is. 5 Q If I was one of your students, and I said: 6 Sir, is a dynamic model a temporal model, what 7 would you say? 8 A I would have to see what exactly the model 9 looks like, what the equations look like. I would 10 have to read – 11 Q What would be the point of being dynamic 12 and changing if it's not temporal? 13 ATTORNEY EKLEM: Objection to form. 14 You guys are talking over each other 15 again. Can you just slow it down? 16 A So I can have a dynamic model in a single 17 frame. I could have – I mean, I would have to 18 see the specifics. I can't answer such a general 19 hypothetical thing. 20 Q Do you know what a linear dynamic model 21 is? 22 A Yes, generally speaking. But again, I	374 1 explain it. 2 Q And if you apply linear dynamic model to a 3 video, is that a temporal model? 4 ATTORNEY EKLEM: Objection to form and 5 scope. 6 A I would have to see the specifics. I 7 mean, I would need to know – I would need to see 8 the specifics. 9 Q What would you need to know? 10 A Well, I would need to see what the paper 11 or whatever it is that you're describing – 12 Q What would you be looking for in the paper 13 to answer these questions? 14 A So I would look to see, well, first of 15 all, how the model is defined. What are the 16 equations of the model? You know, is it computing 17 motion? Is it defining probabilities? What is it 18 doing? I mean, you're asking me – 19 Q It's for object detection. 20 A Again, I need to see the specifics. You 21 know, the devil is usually in the details. 22 Q To determine whether or not it's a
373 1 would have to see the specifics. 2 Q What's your general understanding of what 3 a linear dynamic model is? 4 ATTORNEY EKLEM: Objection to scope. 5 A First of all, it's outside the scope of 6 this discussion. 7 Second is, I would need to see what the 8 context of what you're talking about. I mean, a 9 dynamic model could be where things are changing. 10 I have a graphical model, for instance, for an 11 image and I'm changing the components. 12 Dynamically, as I'm iterating through the 13 image, and let's say I'm doing segmentation. 14 Okay. I did segmentation for my Ph.D. work. So 15 I'm doing segmentation, and I'm segmenting the 16 image and I'm changing regions dynamically. If 17 I'm doing that in a linear setting, you know, 18 rather than say quadratic or something else, you 19 can call that a linear dynamic model. 20 But I would have to see the specifics. I 21 would need to see the paper that you're referring 22 to, what exactly is being done, and then I could	375 1 temporal model? So a linear dynamic model applied 2 to a video, you would need to see the specifics in 3 order to know it's a temporal model? 4 A Yes. Yes. I would need to see the 5 specifics of what you're doing. You know, motion 6 JPEG is applied to video. It's not a temporal 7 model. 8 Q So for object detection? 9 A JPEG is obviously for compression. But I 10 could have an object detection algorithm that's 11 applied in a similar manner. 12 So the point is, I can't answer something 13 hypothetically in the sky. I would need to see 14 the details of the algorithm, the equations of the 15 algorithm, you know, how the – how this algorithm 16 is structured, what the author is intending. Then 17 I can answer the question. 18 Q Is there something called a kinematic 19 model? 20 ATTORNEY EKLEM: Objection to form. 21 A Yes. 22 Q Is it different than a dynamic model?

Conducted on August 13, 2024

376 1 ATTORNEY EKLEM: Objection to form and 2 scope. 3 A Again, I would need to see the details of 4 what you're talking about. 5 Q Let's look at the provisional, 6 Exhibit 1003. 7 But before I go there, you say you have to 8 know the details of the model. Are you aware of 9 any linear dynamic models that are used as 10 temporal models? 11 ATTORNEY EKLEM: Objection to form and 12 scope. 13 Q Do they exist? 14 A I'm sure there are different descriptions. 15 The point is, the devil is in the details. 16 Q I'm just asking: Do they exist? 17 In the 2004 time frame, are you aware of 18 any linear dynamic models which you would have 19 considered to be temporal models? 20 ATTORNEY EKLEM: Objection to form and 21 scope. 22 A I would have to see some specifics. I	378 1 introduced and retained by Counsel.) 2 Q Are you familiar with this document? 3 A Yes. I am. 4 Q Let's take a look at the abstract. 5 According to the provisional, the 6 abstract, in particular AdaBoost detectors are 7 used to define the likelihood and form proposal 8 distributions for components, correct? 9 A You are reading a sentence somewhere in 10 the abstract? 11 Q About two-thirds down. 12 A Yeah. I see that. 13 So you see that -- the sentence before 14 that, you see that two-layer structure of the 15 graphical model allows inference over the entire 16 object as well as individual components. 17 Q Uh-huh. 18 A So you see that prior sentence? 19 Q Uh-huh. 20 A So it's clearly talking about the entire 21 object, as well as individual components. And 22 it's clearly describing the two-layer model, as
377 1 can't -- 2 Q You have no memory and no recollection? 3 A I don't -- I mean, 2004, that's 20 years 4 ago, right? 5 Q Okay. 6 A So I would have to see -- you know, put 7 something specific in front of me. I can take a 8 look at it. 9 Q Is it possible for a linear dynamic model 10 to be utilized as a temporal model? 11 ATTORNEY EKLEM: Objection to form and 12 scope. 13 A You can design things to be utilized in 14 different ways. But the point is, the devil is in 15 the details. I would have to see what the 16 invention or the scope of the, you know, proposal 17 or whatever it is that's being done, and then 18 examine it carefully, and I'm happy to provide you 19 an answer. 20 Q All right. I'm going to hand you what's 21 been previously marked as Exhibit 1003. 22 (Previously marked Meta Exhibit 1003 was	379 1 you see obviously in Figure 2. 2 Q What did I ask you about? 3 A So I'm getting -- so the -- that's the 4 context. 5 ATTORNEY EKLEM: Objection. Form. 6 A That's the context. 7 So the AdaBoost detectors are used to 8 define the likelihood and form proposal 9 distributions for components. 10 Q Okay. Thank you. 11 And the AdaBoost detectors would be used 12 to define the likelihood and form proposal 13 distributions for the components in a single 14 image, correct? 15 ATTORNEY EKLEM: Objection to form. 16 A I don't know what you mean by a single 17 image. I mean, it's a -- 18 Q Is it on an image by image basis, the 19 AdaBoost is applied? 20 ATTORNEY EKLEM: Objection to form. 21 A Well, to look and see how AdaBoost is 22 applied, we would have to go through Section 2.4,

Conducted on August 13, 2024

380 1 which I'm happy to go through with you. The 2 details are in Section 2.4. 3 Q And I would turn your attention to 2.5 as 4 well. 5 A Yes. 6 Q And doesn't 2.5 teach: To form a proposal 7 distribution for a component, we run corresponding 8 AdaBoost detectors over an image at a number of 9 scales? 10 A See, I think -- 11 Q Is that correct? 12 A -- you're missing an important component 13 here, that is, I think missing from the 14 description. 15 So you see where it says in Section 2.4, 16 AdaBoost image likelihoods? 17 Q Uh-huh. 18 A So that's the likelihood model. See, if 19 you go back, for instance, to the patent, just so 20 it's a little clearer. You see Column 3 in the 21 patent, that big equation in Line 60 we were 22 talking about in the patent itself?	382 1 the likelihood of an object or component being in 2 a certain location in the image. 3 Q Okay. So let's stick with the equation, 4 since you're there in Column 3. 5 A Sure. 6 Q There are four products, right, in that 7 joint probability distribution? 8 A There are five products. 9 Q One, two -- yup. There are five products. 10 One in the middle, four in the bottom, right? 11 A Yes, sir. 12 Q The bottom four? 13 A Yes, sir. 14 Q Those all -- each of those products is for 15 a single image analysis, right, that's just for 16 Image I? 17 ATTORNEY EKLEM: Objection to form. 18 A So if you look at the text underneath the 19 equation and on Column 4, just so we're clear and 20 specific, the first one, Psi IJ, the one in the 21 middle, is the temporal compatibility of object 22 states between Frame I and Frame J. This is what
381 1 Q Where are you? 2 A Column 3, Line 60 in the patent. Let me 3 know when you're there. 4 Q I'm there. 5 A Now, do you see in that equation, there 6 are two different Greek letters. There is the Psi 7 letter, and there's three of those. And there's 8 the Phi letter, and there's two of those. 9 Q Uh-huh. 10 A The Phi letters are the likelihood. 11 Q Uh-huh. 12 A The Psi letters are the compatibility 13 across the various frames. 14 Q Uh-huh. 15 A So the Phi letters is the likelihood part 16 that this AdaBoost is being applied to. See, if 17 you look at the patent on the next page, you see 18 where it says AdaBoost image likelihood, which is 19 the exact same title as the provisional? 20 I'm on Column 5, Line 25. 21 Q Uh-huh. 22 A That's describing the process to define	383 1 talks about the object to object across frames. 2 Psi IK, which is the second one in the -- 3 so in that equation would be the first one at the 4 bottom row, left component, would be the spatial 5 compatibility of the object and its components at 6 Frame I. So this is the spatial compatibility 7 between the object O and the components starting 8 the second layer underneath the object. 9 Q One frame, right? 10 A In Frame I. 11 Q Next product? 12 A The next product that you see there is a 13 spatial compatibility between object components at 14 Frame I. So these are the component to component 15 versus object to component. So the previous 16 one -- 17 Q All within Frame I though, right? 18 A So in Frame I -- 19 Q Uh-huh. 20 A And then, when you go to the next one, you 21 get into the two likelihoods. 22 Q Frame I though still, right?

Conducted on August 13, 2024

384 1 A Frame I. But you got to understand -- 2 Q I have a question about the four at the 3 bottom, and I let you go and start talking about 4 the whole thing. I asked for the four products at 5 the bottom. That's a single frame analysis. That 6 was my question, correct? 7 ATTORNEY EKLEM: Objection to form. 8 Argumentative. 9 Q I mean, I asked a question and you got way 10 off track. I'm stopping now to remember what my 11 question is to bring it back around. 12 A Yeah. But just to make sure that things 13 are clear, you see these products have underneath 14 them, IK and IKL and so on? Because they're 15 product summations across the various frames. So 16 you know those compatibilities and likelihoods are 17 within the frame. 18 The first -- the one in the middle, the 19 second line one, is the compatibility across 20 frames, and you bring in all these together into 21 one equation. So there's a joint distribution 22 that comprehends spatial and temporal. That's why	386 1 compared to a threshold? 2 ATTORNEY EKLEM: Objection. Form. 3 A I don't know what you're talking -- what 4 you're asking about. 5 Q Do you see the threshold discussion on 6 Line 3 of Section 2.5? 7 A Yes. But you're talking here about -- 8 again, you're talking here about the likelihood. 9 Q Of? 10 A The -- so you see that you have object and 11 components. 12 Q I'm in the provisional. 13 A Right. But what I'm telling you is you're 14 talking here about just the likelihood part. 15 Q Of what? 16 A So what was your question again? 17 Q AdaBoost detectors are used to define the 18 likelihood and form proposal distributions for 19 components, correct? 20 (Reporter clarification.) 21 A Well, they are doing that, yes. But they 22 are also doing that for the object. Because you
385 1 this has, you know, the probabilistic model has 2 spatio-temporal in design. 3 Q So let's go back to my original question. 4 The provisional teaches the use of the 5 AdaBoost detectors to define the likelihood and 6 form proposal distributions for components in a 7 single image, correct? 8 A Yeah. So as it says, you can see there in 9 the provisional and the patent, it's pretty much 10 the same language, right? It's the AdaBoost image 11 likelihoods. There's a section there in the 12 patent on Column 5 starting on Line 25, which is 13 Section 2.4, and eventually 2.5 in the 14 provisional. 15 So discussing how the likelihoods are 16 modeled and computed using the AdaBoost algorithm, 17 which is, you know, essentially AdaBoost stands 18 for adaptive boosting. 19 (Reporter clarification.) 20 Q And doesn't Section 2.5 of the provisional 21 indicate how a proposal distribution is computed 22 for each component over the entire image and then	387 1 see, you have a two-layer structure. So if you go 2 back to the abstract and what you've pointed to, 3 the two-layer structure of the graphical model 4 allows inference over the entire object, as well 5 as individual components. So I'm doing this 6 inference over the entire object, as well as 7 individual components that make up the object. 8 AdaBoost detectors are used to define the 9 likelihood and form proposal distributions for the 10 components. You also have to do the same thing 11 for the object. Because you need that likelihood 12 as well. Otherwise you don't have -- you don't 13 have a likelihood for the object and it doesn't 14 meet what's being described here. 15 Q But doesn't Section 2.5 teach how the 16 proposal distribution is computed for each 17 component over the entire image and then compare 18 it to a threshold? 19 A Yes. I mean, this is just talking about 20 the proposal process. But you would do the same 21 thing for the object. So this is -- I mean, 22 they're not going to say, well, let me do this for

Conducted on August 13, 2024

388 1 every component and then go over every one of 2 them. They give you a generic description because 3 AdaBoost is a, you know, fairly well-known 4 algorithm. 5 So you see, you know, they describe 6 AdaBoost. They reference there -- they reference 7 there. So AdaBoost is -- the structure of an 8 AdaBoost algorithm, as I explained to you in my 9 previous deposition, is -- you know, the overall 10 structure is fairly -- is well understood. It's 11 how you apply it in your specific case. But you 12 would have to do that for the components. You 13 would also have to do that for the object to get 14 the likelihood for the object. Otherwise you 15 don't have the likelihood for the object. 16 Q And, for argument's sake, if there's no 17 node corresponding to the object, you would apply 18 the AdaBoost to each of the components, correct? 19 ATTORNEY EKLEM: Objection to form. 20 (Reporter clarification.) 21 ATTORNEY EKLEM: Objection to form. 22 A That is not the case.	390 1 Q I'm not disagreeing. I'm saying your 2 statement about the fact that you have to measure 3 the object as a whole and apply AdaBoost detectors 4 to the object is dependant on there being a 5 two-layer graphical model with a separate node 6 corresponding to the object, correct? 7 ATTORNEY EKLEM: Objection to form. 8 Mischaracterizes his testimony. 9 A So if you look, for instance, at the 10 abstract where you pointed to, and I pointed you 11 to for your prior context, you see it says that 12 the two-layer structure of the graphical model. 13 So clearly the authors have intended a two-layer 14 structure for the graphical model allows inference 15 over the entire object, as well as individual 16 components. So they clearly distinguished: 17 Here's the entire object, and here's the 18 individual components. 19 The entire object is not the same thing as 20 the components as you keep trying to make it out 21 to be. You have an entire object, you have 22 individual components, and then you apply AdaBoost
389 1 Q I said for argument's sake. 2 ATTORNEY EKLEM: Objection to form. 3 A I mean, if you want to argumentatively say 4 for some other case, when if you just had the 5 object as a collection of components, you would 6 apply it to the components. But this is not the 7 case here. 8 The case here is you have a two-layer 9 model, clearly described, clearly outlined and 10 clearly represented in the figures, as you see in 11 Figure 2. So your algorithm has to be applied to 12 the components. You also have to have a 13 likelihood for the object. Because otherwise, the 14 algorithm wouldn't know what to do with that 15 likelihood. 16 Q So if what you said is true, if it's a 17 two-layer graphical model, then what you've said 18 is accurate, correct? 19 ATTORNEY EKLEM: Objection to form. 20 A Well, the -- what's being described here 21 is that model. See? If you look at the 22 provisional abstract, which you've pointed to.	391 1 and they do it in the bottoms-up approach. So you 2 start with the components and then you go to the 3 object, because that increases your level of 4 accuracy. Because if you know where the 5 components are, you can put them together in a 6 sense to get to the object. 7 So if you see -- if you go to Column 6 of 8 the patent, you see Column 6 on Line 14ish/15ish, 9 Column 6 of the patent. You see where it says, 10 for example -- I'm in Column 6, Line 15ish. 11 For example, if the whole appearance of an 12 object is too complicated to model as a whole and 13 can be only be modeled in terms of components, a 14 uniform likelihood can be assumed over the object 15 state space. 16 So it's not that they ignore it. They 17 said: Well, if it is too complicated to do, maybe 18 it's taking too much time. We just cannot assume 19 a uniform distribution over the object state 20 space. They're still going to model the 21 likelihood of the object. They're just going to 22 make an assumption, it's uniform so it's --

Conducted on August 13, 2024

392 1 potentially could be anywhere, equally likely. So 2 the authors intended to have a likelihood for the 3 object and separate likelihoods for the 4 components, as you see clearly from the equations 5 that we've been discussing. 6 Q Are you willing to answer hypotheticals? 7 A I don't usually like to answer 8 hypotheticals because it's hard to understand the 9 complete scope of the hypothetical, what exactly 10 all the constraints are. You know, have to take 11 time to study exactly what's going on. 12 So typically hypotheticals are difficult 13 to -- to limit the strain to include all the 14 proper assumptions and everything. So I prefer to 15 just stick to the scope of what's being discussed 16 here. 17 Q Let's try one on for size. You tell me if 18 you're willing to answer it. 19 Let's assume that there are detectors for 20 each of the components of an object, but not a 21 detector for the whole object. Do you understand 22 that assumption?	394 1 together, you increase the level of accuracy. And 2 that's essentially what AdaBoost tried to do. 3 So if you're given a component that you 4 applied AdaBoost to, and you've got a certain 5 likelihood for it, and you have a separate 6 component, so you can define the likelihoods for 7 these components. But you still have to have a 8 likelihood for the object node itself. Because 9 otherwise the equations wouldn't work. 10 Q Why do you have to have an object node? 11 ATTORNEY EKLEM: Objection to form. 12 A Well, that's what the authors -- 13 Q My hypothetical was no object node, no 14 detector for an object. Don't you say -- 15 A Well, that's -- that's -- 16 (Reporter clarification.) 17 A So you can apply AdaBoost to the 18 components and get a likelihood. Okay. In the 19 invention that we're talking about here, in the 20 '980, that is taking place, but it's also applied 21 to the object. And if the object is too 22 complicated, the authors are telling you instead
393 1 A Okay. 2 Q All right. If you then use AdaBoost for 3 the output of the detectors for each of the 4 components, could you determine the likelihood of 5 the components individually? 6 ATTORNEY EKLEM: Objection. Form. 7 Incomplete hypothetical. 8 A Again, hypotheticals are very hard to 9 limit constraints, assumptions, et cetera. 10 If I have a component that I've applied 11 AdaBoost to, and I explain how AdaBoost is 12 typically applied, do you still remember how that 13 is? 14 Q Continue. I do. 15 A So essentially AdaBoost is an adaptive 16 boosting algorithm that you essentially take 17 features. So you take feature one for a 18 component. You classify using it. And you take 19 feature two, and you classify using it. Let's say 20 these are weak features and not, you know, the 21 classification accuracy may be 60 percent or 22 something. As you start to put multiple features	395 1 of computing a likelihood, we'll assume a uniform 2 distribution where it's equally likely over the 3 object space. So they either compute it or assume 4 it. But it's not that it doesn't exist, but it's 5 got to be there for them -- for the modeling 6 that's described in the '980 to take place. 7 Q Or, as described in Column 4, Lines 43 and 8 45, a single object layer model can be built, 9 correct? 10 ATTORNEY EKLEM: Objection to form. 11 A So as we talked about earlier, so in 12 Column 4, Lines 43 to 45, that's an alternative 13 scenario. Again, this is, just like the W equal 1 14 thing kind of case. It's a special case in a 15 sense. It's an alternative scenario where you can 16 have a single layer that's bi-directional with 17 proper temporal constraints for the object. But 18 clearly the embodiments that's being described 19 here and what's claimed is a spatio-temporal model 20 that has objects and components separate from the 21 object. 22 Q Why couldn't it be proper temporal

Conducted on August 13, 2024

396 1 constraints for the components? Why does it have 2 to be a proper temporal constraint for the object? 3 ATTORNEY EKLEM: Objection to form. 4 A I think I've already answered that many 5 times now. 6 Q What if the object is too complex to be 7 modeled? In that situation, wouldn't you have a 8 single layer model where the object is modeled as 9 a collection of components? 10 ATTORNEY EKLEM: Objection to form. 11 A I think you're misunderstanding the single 12 layer. So the single layer, the object is modeled 13 as an objection, not as a collection of 14 components. 15 Q Where is that taught? 16 A Well, you see where it says: 17 Alternatively, the single object layer model can 18 be built with bi-directional temporal constraints. 19 So if you look at Figure 2, see? In 20 Figure 2A. 21 Q Uh-huh. 22 A You see, you have the first layer as the	398 1 component layer and just use the object layer. 2 Q Well, if in the context of Claim 1 and if 3 you're measuring the object as a collection of 4 components, why wouldn't you use a model where 5 it's just the bottom layer of Figure 2A? 6 ATTORNEY EKLEM: Objection to form. 7 A Because that's not what's claimed. Why 8 would you? Why would I purchase a Lamborghini? 9 Because it's not what's claimed. 10 Q Claim 1A says: Modeling the object as 11 a -- sorry. Not Claim A. 12 Claim 1C says: Measuring the object as a 13 collection of components. 14 If you used a single-layer model in 15 Figure 2A where the single layer is the bottom 16 layer, could you not implement Claim 1? 17 A That's not what's implemented in Claim 1, 18 and you wouldn't come to that conclusion. Because 19 when you say a single layer, it's typically 20 understood by a POSITA, you're modeling the object 21 layer, not the components. So that's typically 22 what we mean when we say single layer means you're
397 1 object layer. You have the next layer down as the 2 component layer. 3 Q Uh-huh. 4 A So if you were to remove the component 5 layer and just stick to the object layer, you're 6 just modeling the object now. That -- that's 7 alternative scenario. That's not what the authors 8 are claiming here, right? This is just an 9 alternative approach. 10 Q Where does the '980 explain that you would 11 remove the top layer with the object nodes rather 12 than keeping the bottom layer where the components 13 are connected? 14 A I don't understand what you're asking. 15 Q Two layers. You've decided to chop off 16 the bottom layer. Why don't you chop off the top 17 layer for the 2A? 18 A Well, if POSITA reading this alternatively 19 disclosure that you had mentioned, alternatively a 20 single object layer model can be built with 21 bi-directional temporal constraints, would come to 22 the understanding that you would take out the	399 1 modeling the object. 2 When you go to the second layer, you're 3 modeling the components. When you go to the third 4 layer, you're now modeling subcomponents. You 5 don't just go to the third layer and model 6 subcomponents without modeling the object. That 7 doesn't make sense. 8 Q Do you ever model an object as a 9 component, as a collection of these components, 10 without modeling the object itself? Does that 11 occur in the 2004 time frame? 12 A This -- 13 ATTORNEY EKLEM: Objection to form. 14 A This is not what's being claimed here. I 15 would have to sit down and look and see whether 16 something like that has been done or not. But 17 this is not what's being claimed here. You're 18 misrepresenting the claims in the invention. 19 Q Let's look briefly at Cham. I promise we 20 won't spend too much time on it. 21 A Let's look at what? 22 Q Briefly at Cham, Exhibit 1053.

Conducted on August 13, 2024

400 1 A Do you have it, Cham? 2 Q I'm going to hand it to you. I promise it 3 won't take long. 4 I'm handing you what's been previously 5 marked as Exhibit 1053. 6 (Previously marked Meta Exhibit 1053 was 7 introduced and retained by Counsel.) 8 A Thank you, sir. 9 Q Can you turn to Column 6, Lines 13 to 16? 10 A Column 6, Lines 13 to 16. 11 Q Do you see it? Cham, Column 6, Lines 13 12 to 16? 13 A Yes. 14 Q Do you have an understanding of what image 15 and feature space mean in that sentence? 16 A Yes. 17 Q Can you explain it to me, please? 18 A So first of all, Cham is talking about -- 19 it's a method for object registration by a 20 selection of models with dynamically ordered 21 features. So Cham is talking about object 22 registration between images. Not the same thing	402 1 features he's referring to. Like, you have edge 2 features. You have corner features that describe 3 the visual signature of the object. And in fact, 4 there are parameters called the model state that 5 encodes the configuration of the features. 6 So that vector of parameters essentially 7 encodes, you know, this corner is next to this 8 corner in this sequence. So you encode the 9 configuration because the corners are randomly 10 there on the image. 11 So then your Lines 13 says: Registration 12 can be defined as the surge for the model state 13 that minimizes the cost function between the 14 projection and the model features onto image or 15 feature space and the image itself. 16 Q What is the image and what is the feature 17 space? Are they the same? Are they different? 18 A Yes. 19 Q Please be professorial and teach. 20 ATTORNEY EKLEM: Objection to form. 21 A Yes. So I'm getting there. 22 Q Okay.
401 1 as object tracking. 2 Q I didn't ask about any -- 3 A I understand. Just to put the proper 4 context of what we talked about. 5 So you see it says: The object -- I'm 6 looking at the context starting at Line 8. 7 So you see where it says: The object 8 model can be further decomposed into two main 9 components. A set of features, such as templates, 10 edge features, corner features. 11 So you have an object, a car. The corner 12 features on the car that describe the visual 13 signature of the object. 14 So slight -- you know, remember when you 15 open, like, a kid's cartoon book? You open a 16 cartoon where you color? 17 Q Uh-huh. 18 A So when you open a cartoon book, you see 19 the contour of an object and you go in and color 20 them. 21 Q Uh-huh. 22 A So essentially, these are the kind of	403 1 A So the image space is the image that you 2 capture. Like, I got a picture of the car. 3 That's my image space. 4 Q Okay. It says image or feature space. I 5 just want to make sure. 6 A Yes. I'm explaining. 7 Q Okay. 8 A So you have an image space. And so you 9 have the image. That's -- you know, I took a 10 photograph of a car. That's my image. 11 Q Okay. 12 A Now, I went in that image and I found five 13 corners, right? Each corner has an XY location. 14 Q Uh-huh. 15 A That is a feature space. I can see those 16 XY locations if I put them into a vector. That's 17 defined features for that particular car. 18 Q Okay. 19 A Do you see that? 20 Q The feature space relates to where the 21 features of the car, or the edges of the car -- 22 A That's one way. That's one way to do it.

Conducted on August 13, 2024

404 1 Q Okay. 2 A I could have looked at the color of the 3 pixels and say those are features. So in this 4 case, they're doing registration. So they're 5 trying to say: Okay. I see -- I have an image 6 here, and I have an image there. I see an object 7 in that image. I see an object in that image. I 8 want to register this object to that object in 9 variant of, let's say, translations and rotations 10 and state of variations. 11 So I need to determine features on object 12 one. I need to find the corresponding features on 13 object two. And I need to find the transformation 14 between them so I can properly register the 15 objects. And we do this all the time. And the 16 way you do this is via a cost function like least 17 squares. 18 (Reporter clarification.) 19 Q So let's say the model features are edge 20 features. You project those onto the image? 21 A Well, you have the edge features in the 22 image. You also have -- if I have an edge feature	406 1 that correct? 2 ATTORNEY EKLEM: Objection to form. 3 A Where are you reading in the Cham, sir? 4 Q Column 3, Line 49 to 51. 5 A Yes. So a search is preferably based on 6 maximizing a comparison function. It would be 7 like, for instance, at least squares. I'm 8 comparing this to this, and in lead square sense, 9 and I would try to minimize that lead squares so 10 when I get the right correspondences, that cost 11 should go to minimum, ideally zero. But it never 12 does go to zero. And that what he's referring to 13 as cost function in Column 6, Line 15ish. 14 Q And search regions are found within an 15 image or feature space; is that correct? 16 A Well, the features are in the -- you have 17 the image. So you have the features physically in 18 the image. You also have the coordinates because 19 you're doing registration here. So you have the 20 coordinates of the features. So you could put 21 that into a separate feature space and say the XY 22 coordinate of these features are, you know, this
405 1 here, I know the XY values, right? 2 Q Uh-huh. 3 A Now, I go to another -- because I'm doing 4 registration, I go to a second image and I find 5 that edge in the second image. I have its XY 6 values, which are different from the first image. 7 Then I'm going to say this XY value of the first 8 image corresponds to this XY value in the second 9 image, and that's what helps you compute the 10 transformation, like a fine transformation. 11 And a fine transformation has six 12 parameters. Four parameters that define the 13 rotation scale and sheer, and two parameters that 14 define translation. So you technically need a 15 minimum of six equations to find those parameters. 16 But typically we do more than six equations, 17 because more than six correspondences, and that's 18 why you use these squares. And that's what the 19 cost function that they're referring to. 20 (Reporter clarification.) 21 Q Cham indicates that a search is preferably 22 based on maximizing the comparison function; is	407 1 feature has an X of 10 and a Y of 15. And then 2 when you go to second image, that exact same 3 feature, the correspondence matching, has a 4 coordinate of 25/32. So obviously the object has 5 moved, so you correspond those two points. And 6 when you get enough points correspondences, you 7 can then compute the transformation to register 8 the two objects. 9 Q What was the search region in that 10 discussion you just provided? 11 ATTORNEY EKLEM: Objection to -- 12 Q Is there a search region that you used? 13 ATTORNEY EKLEM: Objection to form. 14 Q As part of the registration process? 15 A Yes. So you have an image. 16 Q Uh-huh. 17 A You have the features and the image. 18 Here's my car features. Here's my corners. Let's 19 say the car has four corners. 20 Q Get -- 21 A Say six corners. Six corners. So I have 22 the car; I have six corners, right?

Conducted on August 13, 2024

408 1 Each corner has an XY value. So I take 2 corner one and I'll go to the second image and 3 say: I'm searching for corner one in that image, 4 right? 5 So I will make assumptions and do a search 6 in that image for that feature. And when I find 7 the correspondence, I'll say this corner one in 8 image one is -- corresponds to this corner one in 9 image two. And since the corner has an XY value, 10 so now I have essentially two equations. I have 11 to correspond the X and the Y. And if I find two 12 more corners ideally speaking, I now have six 13 equations I can solve for six unknowns and find 14 the transformation coefficient. But typically, we 15 find more than three because of noise and so on. 16 So that's why you use at least squares cost 17 function. 18 Q Understood. 19 Let's go to Paragraph 29 of your 20 supplemental. 21 ATTORNEY EKLEM: We've been going for 22 about an hour. Is now a good time for a break?	410 1 snippets that I put into the declaration, 2 Dr. Bajaj basically misinterprets the 3 spatio-temporal model. 4 Q In what way? 5 A I don't know what you mean, in what way. 6 Q You said he misinterprets it. 7 Misinterprets it how? 8 A So if you look on Page 32 of my 9 supplemental, right above Paragraph 25. So you 10 see the Patent Owner construction versus 11 essentially Dr. Bajaj's Petitioner -- although, I 12 mean, a formal construction wasn't proposed but 13 you see the difference between them. 14 Q That's your understanding of his 15 interpretation, but he explicitly says during 16 cross-examination that the ability for the model 17 to change configuration and time is what provides 18 the temporal element of it being a spatio-temporal 19 model. 20 If you believe that is incorrect, can you 21 explain why? 22 A Well, I mean, if you look at the
409 1 ATTORNEY BAKER: It's a good -- we're 2 changing topics. Let's take a break. 3 (Recess from 11:13 a.m. until 11:23 a.m.) 4 BY ATTORNEY BAKER: 5 Q Dr. Saber, if you would turn to 6 Paragraph 29 of your supplemental declaration, 7 Exhibit 2007. 8 So in your direct testimony, you indicate 9 that Dr. Bajaj's construction also incorrectly 10 interprets the temporal aspect of spatio-temporal 11 model as being satisfied if the model is equal to 12 change the configuration and time, correct? 13 A You read that sentence correctly. 14 Q What is the basis of your opinion? 15 A When you read Dr. Bajaj's report, you read 16 his deposition testimony, you clearly come to the 17 conclusion that he is misinterpreting what the 18 claims and the '980 spatio-temporal model is 19 about. 20 Q What about his deposition testimony is 21 inaccurate? Let's be precise. 22 A So, I mean, if you look at some of the	411 1 construction -- Petitioner's construction, where 2 when you read Dr. Bajaj's report and you read his 3 deposition testimony, you come to the conclusion 4 that, you know, that the construction is being 5 applied or the definition is being applied is a 6 spatial model where an image analysis takes into 7 account information -- excuse me -- from a 8 proceeding image. 9 So you're essentially, like, you're doing 10 a spatial analysis. And that's not what the '980 11 is doing. So you have a spatio-temporal model in 12 '980 that has temporal connectivity, as well as 13 spatial connectivity. It's not just applying to 14 the images over time. There's a temporal element. 15 It's not applied spatially in images over time 16 essentially. 17 Q What if the model changes configuration 18 over time? Doesn't that provide a temporal 19 aspect? 20 A No. 21 Q Why not? 22 A You have to have the temporal aspect in

Conducted on August 13, 2024

412 1 the context of the '980. So again, we're always 2 talking about the context of the '980 and what's 3 being described in the '980. In the context of 4 the '980, if you look at the equation we've been 5 looking at it -- let's go to Column 3, Line 60 for 6 a moment. 7 So you see that middle multiplication, IJ 8 Psi IJ? That Psi IJ, if you go to Column 4, first 9 line, is the temporal compatibility of object 10 state between Frame I and Frame J. So you have to 11 have a specific temporal compatibility across the 12 frames. This is not just an analysis within the 13 frame that applied to the next frame. It's not -- 14 that's not there. You got to have that temporal 15 connectivity, that temporal compatibility to be in 16 the context of what the '980 is doing, and that's 17 what the '980 is describing. 18 Q We've been down this road again. Does 19 Claim 1 or 9 define a joint probability 20 distribution for the spatio-temporal model? 21 A I think I've answered this question many 22 times. My answer isn't going to change throughout	414 1 Q So what he describes is limited by its 2 title? 3 A Well, that's what he describes. The 4 abstract obviously provides more details on what's 5 being described, and the rest of the thesis 6 provides the details. 7 Q So I'll ask again. Zhao describes using a 8 dynamic human body model, correct? 9 ATTORNEY EKLEM: Objection to form. 10 A Well, I mean, I want to be specific and 11 accurate and precise. I want to use the same 12 language as -- 13 Q Is the only language in the title? 14 A Well, I want to be specific. I don't want 15 to conflate the language or convolute language 16 with something that's, you know, has claim 17 language in it or something else to try to get 18 through a -- Zhao's title is: Dressed Human 19 Modeling, Detection and Parts Localization. 20 So we can go over the abstract and discuss 21 what's being described. I just want to be precise 22 and accurate from what the thesis is to give Zhao
413 1 the day. 2 So Claim 1 claims a spatio-temporal model. 3 If you read the claim in light of the 4 specification, it is clear to a POSITA that you 5 are looking at a spatio-temporal model that has a 6 probabilistic framework that takes into account 7 spatial and temporal connectivity and 8 compatibility. And you have an object, the 9 collection of components that separate from the 10 object. You can take that as my answer for the 11 entire deposition. 12 ATTORNEY BAKER: Let's take a look at 13 Zhao. 14 (Previously marked Meta Exhibit 1006 was 15 introduced and retained by Counsel.) 16 Q I'm going to hand you what has previously 17 been marked as Meta Exhibit 1006. 18 A Thank you, sir. 19 Q Zhao describes a dynamic human body model, 20 correct? 21 A Well, Zhao describes the dressed human 22 modeling, detection and parts localizations.	415 1 the proper, you know, contributions that Zhao has 2 contributed. 3 Q Does Zhao describe a human body model? 4 A So if you look at, for instance, the -- 5 the table of contents of Zhao. So Zhao describes 6 Chapter 2, you see dressed human modeling. 7 So he has -- if you look at 2.3, Zhao 8 describes the shape decomposition; 2.4 describes 9 the human body model that's based on, you know, 10 the TRS invariant body model. 11 Q So does Zhao describe a human body model? 12 A Zhao describes in Section 2.4 a human body 13 model that's based on that TRS -- translation, 14 rotation and scaling -- invariant body model. 15 Q Is Zhao's body model dynamic? 16 ATTORNEY EKLEM: Objection to form. 17 A I don't know what you mean by dynamic. 18 Q Let's go to Page 3. 19 A Page? 20 Q Page 3 of Exhibit 1006, using the bottom 21 right corner page numbering. 22 A Yes, sir.

Conducted on August 13, 2024

416 1 Q Does Zhao describe dressed human modeling 2 and dynamic model assembling? 3 (Reporter clarification.) 4 A Yeah. You read that sentence correctly. 5 Q Does Zhao describe a human body -- a 6 dynamic human body model? 7 ATTORNEY EKLEM: Objection to form. 8 A Zhao describes a dressed human modeling 9 and dynamic model assembling model. 10 Q Would a POSA understand that to be a 11 dynamic human body model? 12 ATTORNEY EKLEM: Objection to form. 13 A Well, you have to read the rest of the 14 paragraph to -- to a POSITA to understand what's 15 being described. And obviously when you read the 16 thesis that Zhao provides, you understand that 17 Zhao is providing a human body model that's within 18 the image. There's no -- there's no temporal 19 element to it. 20 Q Is it dynamic? Is the dressed human body 21 model dynamic? 22 ATTORNEY EKLEM: Objection to form.	418 1 step from which he's assembling his human model. 2 He's dynamically assembling his human model. 3 Q What does he use to assemble the human 4 model? What parts? 5 ATTORNEY EKLEM: Objection to form. 6 A The model parts. 7 Q Okay. And is this done on a frame by 8 frame basis? Is the model dynamically assembled 9 for each frame? 10 A Well, Zhao's work is within a frame, 11 within an image. So Zhao doesn't -- doesn't have 12 a temporal model in the sense across images, that 13 is probabilistic like he is describing in the '980 14 patent. 15 Q My question is: When Zhao assembles his 16 model, is that done on a frame by frame basis? 17 ATTORNEY EKLEM: Objection to form. 18 A That model -- so the concept of frame is 19 introduced later in Zhao. So you have to 20 distinguish Zhao's initial work. 21 So if you look at, for instance, 22 Chapter 2, Dressed Human Model; Chapter 3,
417 1 A Well, dynamic could mean a lot of things, 2 so I want to make sure that we're not talking 3 about different semantics. 4 Q What does it mean to be dynamically 5 assembled? 6 A So if you look at the description on 7 Page 3 for Paragraph 1 that you pointed to, do you 8 see where it says: Unlike previous work that 9 employs a fixed human body model or global 10 deformable template to perform human detection, 11 Zhao referring in this dissertation, merged body 12 parts are introduced to represent the deformations 13 caused by clothing and segmentation headers. 14 So that's the dynamics that he's talking 15 about, that Zhao is talking about. 16 Q What does it mean to be dynamically 17 assembled? 18 A So if you look at the next sentence there, 19 it says: Addressed human model is dynamically 20 assembled from the model parts in the recognition 21 step. 22 So he has model parts in his recognition	419 1 Bayesian Similarity Measure; Chapter 4, Recursive 2 Context Reasoning; all that's done is on a given 3 image. So Zhao's model is applied to a given 4 image. 5 In the applications -- and we talked about 6 this last time -- Zhao talks about deterministic 7 motion information across frames. That has no 8 probabilistic instruction. It's completely 9 different context than the '980 patent. I think 10 we went over this last time, multiple times. 11 Q But my question was whether or not Zhao 12 assembles the model dynamically on a frame by 13 frame basis? That's the question. 14 A And what I'm explaining to you is -- 15 Q It has nothing to do with the '980. I'm 16 just asking about what Zhao does. 17 A Right. And what I'm explaining to you is 18 Zhao -- when you talk about Zhao Chapters 1 19 through Chapter 4, it's done within an image, in 20 the image frame. It doesn't have a video 21 description. It's just all the modeling, the 22 probabilities, the equations, have no temporal

Conducted on August 13, 2024

420 1 element at all. It's strictly within an image. 2 It's strictly spatial. No temporal. 3 Q I'll repeat. Does Zhao teach assembling 4 its dynamic model on a frame by frame basis, yes 5 or no? Please provide an explanation afterwards 6 if you'd like. 7 A I think I've answered your question. 8 Q You're not. 9 A Zhao's Chapter 1 through 4 describe a 10 process applied to images. It's not a frame by 11 frame basis supplied to images. The equations 12 that you see there are strictly image-based – 13 spatially based. There's no temporal element 14 whatsoever. 15 All the probability equations – and I 16 pointed those out to you last time in the 17 deposition – they're strictly on an image-based 18 set-up scenario, formulation, framework. There's 19 no temporal in it whatsoever. 20 Q Does the model change from frame to frame 21 in the video experiments conducted at the end of 22 Zhao?	422 1 Q We are not talking about the '980. I'm 2 asking in the context of Zhao. Just look at Zhao. 3 A Yes. 4 Q He proposes a dynamically assembled human 5 body model, correct? 6 A I think I explained this already to you 7 multiple times, but you keep – 8 Q So was the answer yes or no? 9 A I've explained this to you. It's not a 10 yes or no answer. 11 Q It's not? 12 A It's not a yes or no answer. 13 Q Whether or not he assembles a 14 dynamically -- 15 A Zhao proposes a body model, in a sense, 16 within an image. The equations of Zhao are 17 strictly image spatial-related. There are no 18 temporal elements whatsoever to those probability 19 equations in Chapter 2 through 4 that you see 20 there. I can walk you through any one of those 21 equations you like. 22 Q Let's go to 5 in the experiments.
421 1 ATTORNEY EKLEM: Objection to form. 2 A So as I explained last time, and as I said 3 earlier in this deposition, when you get to 4 Chapter 5, Zhao introduces deterministic motion, 5 to say: Okay. I have some deterministic motion 6 I've computed from the prior frame to the next 7 frame. There's no probabilistic discussion there 8 whatsoever. 9 Q I asked whether the body model changes 10 frame by frame in the experimental testing. 11 A Well, the body model does change – the 12 body changes frame by frame. But the model – 13 Q As a single -- frame by frame. 14 A Well, you have to distinguish between the 15 two. The object changes frame by frame. 16 Q Uh-huh. 17 A The modeling of Zhao is strictly spatial. 18 The only difference is in Chapter 5, Zhao brings 19 in deterministic motion estimation. It doesn't 20 have any probabilistic modeling. There's no 21 probabilistic spatio-temporal as described in 22 the '980.	423 1 A When you go to Chapter 5, Zhao introduces 2 deterministic motion information from a prior 3 frame to the next frame. There's no probabilistic 4 modeling whatsoever. 5 Q Does the body model in the Chapter 5 6 discussions, is it dynamically assembled on a 7 frame by frame basis? 8 ATTORNEY EKLEM: Objection to form. 9 A So if you look at -- for instance, if you 10 look at Figure 5.6. I think we're talking 11 probably about different things. 12 If you look at Figure 5.6 of Zhao, it's on 13 Page 80. You see the body is changing. The 14 object that Zhao is modeling is changing from the 15 frames. So within each frame, Zhao has a 16 probabilistic model. From frame to frame, it's 17 the deterministic motion estimation. It has no 18 probabilistic model. There's no dynamic 19 probabilistic modeling from frame to frame as 20 described in the '980. 21 Q So using Dr. Bajaj's definition of a 22 temporal model, does Zhao describe a temporal

Conducted on August 13, 2024

424 1 model? 2 ATTORNEY EKLEM: Objection to form. 3 A Zhao describes -- again, I think we have 4 to be very, very careful and specific. Zhao 5 describes a probabilistic spatial model. There's 6 no probabilistic temporal model as in the context 7 or as described in the '980. 8 So the only thing that Zhao does in 9 Chapter 5 is introduces motion, deterministic 10 motion estimation. There's no probabilistic 11 discussion whatsoever. So that temporal -- that 12 temporal motion estimation in Zhao in Chapter 5 is 13 totally deterministic. There's no probabilistic 14 discussion whatsoever. So it's completely 15 different from what's being discussed in the '980. 16 Q That wasn't my question. 17 So using Dr. Bajaj's definition of the 18 temporal model, one where the model changes 19 configuration and time, does Zhao teach a temporal 20 body model that's in Dr. Bajaj's interpretation? 21 ATTORNEY EKLEM: Objection to form. 22 A Well, I think Dr. Bajaj's temporal	426 1 probabilistic modeling is done strictly spatially 2 within the frame. That's completely and 3 distinctively different from the '980. 4 Q For the sake of argument, if we apply 5 Dr. Bajaj's understanding of what a temporal model 6 is, which is a model which changes configuration 7 in time -- 8 A I don't know what that means. 9 Q -- does Zhao teach a temporal body model? 10 ATTORNEY EKLEM: Objection to form. 11 A See, I don't know what you mean by model 12 that changes configuration over time. That's why 13 Dr. Bajaj is incorrect in his -- in his 14 definition. 15 This model in Zhao, yes, the human is 16 moving from frame to frame so that the human is 17 changing from frame to frame. The probabilistic 18 modeling that Zhao does on a given frame, he does 19 that -- Zhao does that spatially. 20 There's deterministic motion estimation 21 from frame to frame. There's no probabilistic 22 modeling. There's no temporal model as in the
425 1 definition is incorrect is what I'm telling you. 2 So I think we've gone over this a few times. 3 So Zhao -- I want to be specific and 4 accurate. Zhao provides a spatial model, the 5 object in Zhao, as I showed you in Chapter 5. 6 Yes. The object is changing from frame to 7 frame. The person is walking. There's a change 8 from frame to frame. But the modeling that Zhao 9 is doing probabilistically is within the frame. 10 And if you go to the next frame, it does 11 probabilistic modeling. 12 Q It assembles a new model for each frame, 13 correct? 14 A So a model for each frame in Zhao is done 15 spatially. There's no temporal probabilistic 16 modeling. The only difference in Zhao in 17 Chapter 5 is he introduces motion estimation, 18 which is deterministic motion estimation from 19 prior frame to current frame. There's no later 20 frame. 21 So it's -- so it's a deterministic motion 22 estimation from frame to frame, but the	427 1 context of the '980. His model is strictly motion 2 deterministic motion model. 3 So his temporal modeling is deterministic 4 motion modeling. There's no probabilistic 5 modeling at all there. There's no compatibility 6 functions and there's no probabilistic modeling. 7 Q Is a deterministic motion model a temporal 8 model? 9 A It could be looked at as a temporal model 10 but that's not what's being discussed in the '980 11 and that's not the context of the '980. MPEG-1 12 has a motion estimation model that's temporal. 13 That's not the same as the '980. 14 Q What do you mean by deterministic motion 15 model? What does that mean? 16 A You compute a motion vector. So I have an 17 object here. I have -- the object is in the next 18 frame here. So I compute a motion vector. The 19 object moves 10 pixels to the right and 6 pixels 20 up, one vector. 21 Q Does that require constant velocity? 22 A Well, you can assume the constant velocity

Conducted on August 13, 2024

428 1 if you want. But typically, you do like a block 2 match. So you look at the object in Frame 1. You 3 look at the object location in Frame 2. And 4 essentially what you do is you search for the 5 object from Frame 1 into Frame 2. 6 When you find it in Frame 2, you have the 7 rotations. You define a motion vector that 8 basically says the object moved 10 pixels to the 9 right and 5 pixels up. That's a deterministic 10 model. There's no probability. No probability 11 estimation. 12 Q What if you use motion information from a 13 prior frame to predict that motion? 14 A It's still a deterministic model. 15 ATTORNEY EKLEM: Objection to the form of 16 the question. 17 You can answer. 18 THE WITNESS: Sorry for being quick. 19 A But it's still a deterministic model. So 20 you can have an object that you have computed, 21 let's say, looked over the last five frames and 22 you've seen that the object is moving so many	430 1 ATTORNEY EKLEM: Objection to form. 2 A What model are you talking about? The 3 motion model? The spatial model? What model are 4 you talking about? 5 Q The spatial model. 6 A So the spatial model is just within the 7 frame. It does not involve the next frame. 8 Q And the next frame? 9 A That would be a motion vector. So you 10 have a motion vector that predicts where the 11 object is going to be in the next frame. 12 Q Without -- just based on the original 13 model, the motion vector predicts where the object 14 is going to be? 15 A Based on the current frame and prior 16 frames. So when you observe the current frame and 17 the prior frames, you determine, for instance, 18 that the object is moving at, you know, 5 pixels 19 every second or whatever. You make a 20 determination of, you know, the speed of the 21 object or how the object is moving. 22 If you assume constant velocity, you can
429 1 pixels, right? So you can predict where it's 2 going to be in the next frames. You have a motion 3 vector prediction. I think it's going to be over 4 here. You go look over there and then you update 5 your prediction and you're done. That's not a 6 probabilistic model. 7 Q Does the model change based on the 8 prediction? Does it change configurations based 9 on that prediction? 10 A Well, you make a prediction. The 11 prediction is based on the past. 12 Q Uh-huh. 13 A You go to the next frame. You predicted 14 the object is going to be here. If it is here, 15 then you correct that. Now you make a correction. 16 So your motion vector isn't 10/15. It should be 17 10/5. 18 Q What role does the model play in what you 19 just described? 20 A What model are you talking about? 21 Q There's no model involved in anything 22 you're saying?	431 1 say I think the object is going to be here in the 2 next frame. That's a deterministic motion model, 3 and compression algorithms use that. 4 Q Let's turn to Page 93 of Zhao. 5 A Page 93 of Zhao? 6 Q Yes. Exhibit 1006. 7 A Yes. 8 Q Do you see the sentence where it says: 9 The results shown in Figure 5.7 demonstrate that 10 even if the skaters are in various postures and 11 wear skirts flying in the air, the covered body 12 parts can still be located accurately using the 13 dynamically assembled human model. 14 Do you see that sentence? 15 A Yes. You read that correctly up to that 16 comma. 17 Q And Figure 5.7 illustrates various frames 18 in the video; is that correct? 19 A Yes. So Figure 5 point -- yeah. 20 So Figure 5.7 illustrates various frames, 21 yes. 22 Q Does Figure 5.7 illustrate the body model?

Conducted on August 13, 2024

432 1 ATTORNEY EKLEM: Objection to form. 2 A So Figure 5.7, according to Zhao, it 3 illustrates the results – see, if you read the 4 results carefully, it says: The results shown in 5 Figure 5.7 demonstrate that even if the skaters 6 are in various postures and wear skirts flying in 7 the air. 8 So if you look at 5.7, you see obviously 9 figure skaters. The covered body parts can still 10 be located accurately using the dynamically 11 assembled human model that he has discussed 12 previously in the chapters, the Bayesian 13 similarity measure and of course defined 14 localization approach. 15 So he has assembled a dynamically human 16 model. He's got a Bayesian similarity measure 17 that applies within the frame only, no temporal 18 Bayesian at all, and he has a course to find 19 localization because you got to have like a little 20 hierarchy within the frame. So his model is 21 strictly a spatial model within the frame, just 22 applied on the next frame, and applied on the next	434 1 spatially within the frame. 2 Q I'm just asking if the configuration of 3 the model changed frame to frame in Zhao. 4 ATTORNEY EKLEM: Objection to form. 5 A And the configuration doesn't change. The 6 values that you compute change. The model is the 7 same, right? It's the same – you know, 8 probability – it's the same model structure. 9 The values that you compute for Frame 1 10 will be Alpha, Beta, Gamma. The models that you 11 compute from Frame 2 might be Alpha 2, Beta 2, 12 Gamma 2. They're different. But the model 13 equation is the same. It's just applied to 14 different frames. Just like the '980 has the same 15 joint distribution applied to different frames. 16 Q Does Column 3 of Figure 5.7 identify the 17 human body model for each frame? 18 A Yes. So you have a human body model that 19 is obviously based on the joint localization. 20 Yes. So the configuration changes because 21 the body is -- has changed. But the essentials, 22 the models remain the same. It's just they have
433 1 frame. So there's no temporal element. 2 Q When it's applied on the next frame, does 3 it change configuration? 4 ATTORNEY EKLEM: Objection to form. 5 A When it's applied on the next frame, it 6 changes according to the next frame. But it's not 7 a temporal element is what I'm saying. 8 Q Does the model change configuration from 9 frame to frame? 10 A The model is the same equations. It's the 11 different frame. You get different values for 12 that equation. So it's the same equation applied 13 on the next frame. It's just the values of that 14 equation are different because the body in that 15 frame has a different configuration. 16 Q The change in values reflects the change 17 in configuration of the model? 18 A So the change in values in the equation 19 that are applied spatially, those are changing 20 from frame to frame. But there's no temporal 21 connectivity between them. There's no temporal 22 probabilistic part. This is strictly done	435 1 different values now. 2 Q So one frame has an image of a skater in 3 one configuration, and the model attempts to match 4 that? 5 A Yes. 6 Q Another frame has the skater in a 7 different configuration and the model changes to 8 match that? 9 A Correct. 10 Q So the model is changing over time? 11 A Well, the point is your over time thing is 12 something that has to be clearly qualified. So 13 the model is applied spatially. Because the frame 14 changed, the application on the frame changed. 15 But it's still a spatial model. Because 16 it changed -- it changed frames, you apply on 17 another frame. But the application of a model is 18 strictly in a spatial sense. There's no temporal 19 part to it besides the deterministic motion that 20 we discussed earlier. 21 Q Would you agree that Zhao describes that 22 model as being a dynamic model? Could you make

Conducted on August 13, 2024

436 1 that simple acknowledgment? 2 ATTORNEY EKLEM: Objection to form. 3 (Reporter clarification.) 4 Q Simple acknowledgement, that Zhao 5 describes its model as being dynamic? 6 ATTORNEY EKLEM: Objection to form. 7 A Well, Zhao refers to its model as dynamic, 8 but you have to understand what -- dynamic could 9 mean a lot of things. Dynamic could be in a 10 spatial domain. Dynamic could be in a temporal 11 domain. Dynamic could be in a spatio-temporal 12 domain. 13 The context of dynamic is important to 14 understand, and Zhao is strictly a spatial 15 probabilistic model. There's no temporal element 16 to it at all, with the exception of the motion -- 17 deterministic motion estimation that we discussed 18 earlier. 19 Q Could Zhao be described as a linear 20 dynamic model? 21 A I don't know what you mean by linear. 22 Q Does that term have a meaning, linear	438 1 Bayesian model in the spatial domain. 2 Q One more set of questions on this topic. 3 I'm going to hand you what's been 4 previously marked as Exhibit 1016. 5 (Previously marked Meta Exhibit 1016 was 6 introduced and retained by Counsel.) 7 Q Are you familiar with that document? 8 A Yes. I haven't looked at it recently, but 9 yes. 10 Q One of the authors is Michael Black, 11 correct? 12 A That is correct. 13 Q And Michael Black appeared also as an 14 author on TLP; is that correct? 15 A If my memory serves me right, I believe -- 16 I don't have TLP... 17 Q Did I give you TLP already? 18 A Yes. Yes. You are correct. 19 Q Can you turn to Page 3 of Exhibit 1016? 20 A Yes. 21 Q Do you see the subsection titled: 22 Temporal Models?
437 1 dynamic model? Does that have a meaning to a 2 POSA? 3 A I mean, Zhao is a spatial probabilistic 4 model. You can linearize it if you want, but -- 5 Q What does it mean to linearize it? 6 (Reporter clarification.) 7 ATTORNEY EKLEM: Objection to form and 8 scope. 9 A So first of all, I mean, let's say I have 10 a parabola. Okay. So as you are well aware, a 11 parabola is a quadratic, right? 12 (Reporter clarification.) 13 A If I wanted to linearize and say that 14 that's particular quadratic entity, I may look at 15 a certain section of it and fit a linear model. I 16 may say well, I'm not going to look at the whole 17 thing. I'm just going to look at a small section 18 of it, and fit a linear -- an approximate linear 19 model because I want to simplify my calculations. 20 So you can potentially do that if you 21 wanted to, to simplify things in this particular 22 case. But Zhao's model is the probabilistic	439 1 A Yes. 2 Q Can you read the first sentence to 3 yourself, please? 4 A Yes. I have read that sentence. 5 Q Do you agree that temporal models of body 6 limb or joint motion -- 7 (Reporter clarification.) 8 Q Do you agree that temporal models of body 9 limb or joint motion also vary in complexity. 10 They include smooth motion, linear dynamic models, 11 non-linear models learned from training data using 12 dimensionality reduction and probabilistic Hidden 13 Markon Models? 14 A You read that correctly. 15 Q Do you agree with that statement? 16 A Yeah. 17 Q And do you agree that that statement was 18 true in the 2004/2005 time frame? 19 ATTORNEY EKLEM: Objection to form. 20 A Yeah. 21 Q So there's more than one type of temporal 22 model for object detection, correct?

Conducted on August 13, 2024

440 1 ATTORNEY EKLEM: Objection to form. 2 A [No verbal response]. 3 Q Using that definition, why would you not 4 agree that Zhao describes a temporal model? 5 ATTORNEY EKLEM: Objection to form and 6 scope. 7 A As I described to you already multiple 8 times, so Zhao – what we are talking about here 9 is the '980 patent, the context of the '980 10 patent. What's the spatio-temporal model in the 11 context of the '980? That context is important. 12 So when you read Zhao, Zhao's model is 13 strictly a spatial Bayesian model. It has no 14 temporal probabilistic element to it whatsoever. 15 There are no Hidden Markov Models. There are 16 no – no discussions of probabilistic temporal 17 models whatsoever in Zhao. 18 The only piece that Zhao does to bring in 19 some type of temporal is a deterministic motion 20 estimation section. There is no probabilistic 21 temporal determination at all with Zhao. 22 Q So your opinion is that the dynamic	442 1 So you have a temporal deterministic 2 motion estimation. But there's no probabilistic 3 framework whatsoever. There's no joint 4 probabilistic framework whatsoever. It's 5 distinctively different from what is being done in 6 the '980. 7 Q Okay. Thank you. One more line of 8 questions and then let's do lunch. 9 You have the provisional. Have I given 10 that to you already? 11 A I think you have. 12 Q And can you also confirm having your 13 supplemental declaration? 14 A Yes, sir. 15 Q Can you focus on Paragraph 33 of your 16 supplemental? 17 You state in the first sentence of 18 Paragraph 33 that: As also explained in my 19 initial declaration, the provisional application 20 further states that, quote, object detection and 21 tracking are formulated as inference in a 22 two-layer graphical model, correct?
441 1 assembly of the model on a frame by frame basis 2 does not render to be a temporal model, correct? 3 A The dynamic assembly on a frame by frame 4 basis combined with the – even the deterministic 5 motion estimation, does not render it as a 6 spatio-temporal model as described in the context 7 of the '980 patent, which is a probabilistic 8 spatio-temporal model. So Zhao's model is 9 completely and distinctively different temporally 10 from the '980, and spatially, temporally 11 completely different from the '980. 12 Q Would you describe Zhao as a temporal 13 model within the scope of the definition provided 14 on Page 3 of Exhibit 1016? 15 ATTORNEY EKLEM: Objection to form and 16 scope. 17 A So again, as I mentioned, Zhao has a 18 spatial model that has a probabilistic Bayesian, 19 you know, framework to it. The temporal part is a 20 deterministic motion estimation. So you can say 21 that it includes smooth motion, like reference 7 22 that you saw on that sentence.	443 1 A You read that correctly. And that's a 2 quote from the provisional. 3 Q Are you relying upon that passage from the 4 provisional application for support that the 5 provisional revised written description for 6 limitation 1D? 7 ATTORNEY EKLEM: Objection to form. 8 A Well, I'm relying on not just that, but 9 when you read the provisional, you obviously read 10 the entire thing, not just one sentence. So when 11 I read the provisional as a POSITA, as I described 12 in my initial declaration – and there are several 13 pages on that – you clearly come to the 14 conclusion that the inventors have possession of 15 what's being described in Claim 1. And I outlined 16 that in the declaration for every element. 17 (Reporter clarification.) 18 A And every claim. 19 Do you have a copy of the initial 20 declaration? 21 Q I do. For now, let's focus on the 22 supplemental.

Conducted on August 13, 2024

444 1 For argument's sake, if Claims 1 and 9 are 2 not limited to a two-layer graphical model, what 3 support does the provisional have for limitations 4 1[e] and 9[e]? 5 ATTORNEY EKLEM: Objection to form and 6 scope. 7 A I'm not sure what you're asking me. 8 Q Does the provisional teach how to detect 9 the object in any image upon comparing the 10 probabilities for each image for a threshold for 11 detecting the object absent in two-layer graphical 12 model? Does it teach how to do that for a dynamic 13 body model such as Zhao? 14 A I don't understand. 15 ATTORNEY EKLEM: Objection to form and 16 scope. 17 A First of all, I don't understand what 18 you're asking. 19 (Reporter clarification.) 20 A Second of all, the support for the claims 21 is in my initial declaration, and I don't have it 22 memorized. But if you provide me a copy with	446 1 What's the first thing you cite? 2 A So you see it says: In addition to the 3 disclosures for Element 1/9[d]. 4 So obviously it builds on the previous 5 description there. 6 The provisional application further states 7 in the abstract that this -- that object 8 detection, and this is a quote. 9 Quote: Object detection and tracking is 10 then formulated as an inference over directed 11 loopy graph and is solved with non-parametric 12 belief propagation that uses a variation of 13 particle filtering. 14 And that quote continues. This type of an 15 object model, et cetera, et cetera. And that's 16 from Exhibit 3, which is the provisional, on 17 Page 3 from that provisional. 18 And then it goes on to describe the 19 introduction where the support is in the 20 introduction, and there are a series of quotes 21 there that you see in section -- I'm looking at 22 Page 23 now, second sentence. You see in
445 1 that, I can show you where 1[e] has support in the 2 provisional. I don't have that document 3 memorized -- 4 Q I'm handing you what's been previously 5 marked as Exhibit 2004. 6 (Previously marked VL Collective Exhibit 7 2004 was introduced and retained by Counsel.) 8 Q And let's focus on 1[e] and 9[e], 9 provisional support. And if you can tell me what 10 paragraph you're on, I'd appreciate it. 11 A Yes. So I am in the original declaration, 12 in Paragraph 36 of that original declaration, 13 which goes on -- so basically it talks about -- so 14 the paragraph begins by stating that the 15 provisional application conveys to a POSITA that 16 the inventors had possession of Element 1/9[e], 17 and it quotes that element. 18 Q So let's go through what you cite in the 19 provisional for support for -- 20 (Reporter clarification.) 21 Q Let's go through what you cite in the 22 provisional for support for limitation 1/9[e].	447 1 Section 2.3, it talks about -- describes where 2 support is in Section 2.3. 3 Q Can we pause there? 4 A Sure. 5 Q Section 2.3 is all non-parametric belief 6 propagation as taught by PAMPAS, correct? 7 ATTORNEY EKLEM: Objection to form. 8 (Reporter clarification.) 9 A No. It's not as taught by PAMPAS. It's 10 just -- it says, see in -- so if you look at 11 Section 2.3, it says: Inferring the state of the 12 object and its components in our framework is 13 defined as estimating belief in a graphical model. 14 Q Uh-huh. 15 A We use a form of non-parametric belief 16 propagation PAMPAS to deal with this task. And 17 he -- the authors say that this approach is 18 generalization of particle filtering, and then 19 they describe what they do. 20 Q Uh-huh. 21 A So they build or they -- you know, they 22 build on that form in a sense. They add to that

Conducted on August 13, 2024

448 1 form. They utilize that form, and they add to it, 2 you know, their description. 3 Q What can you tell me is on Page 23 of your 4 first declaration that's not directly taught by 5 PAMPAS? 6 (Reporter clarification.) 7 Q Is there anything at all on Page 23 that's 8 not directly from PAMPAS? 9 ATTORNEY EKLEM: Objection to form. 10 Q Starting at Line 2. 11 ATTORNEY EKLEM: Objection to form and to 12 scope. 13 A So you see -- if you look on Page 8 of the 14 provisional, in that section, the third line, you 15 see the approach is a generalization of particle 16 filtering. So their approach -- the approach that 17 their authors are proposing is a generalization 18 which allows interference over an arbitrary 19 graphs, rather than a simple chain. So you would 20 have an arbitrary graph instead of a simple chain. 21 In this generalization, the message used in the 22 standard belief propagation is approximated with a	450 1 graph rather than a simple chain. 2 Q Uh-huh. 3 A So their approach that they're proposing 4 doesn't just deal with a simple chain. Because a 5 simple chain is just looking at the prior type 6 thing. It's got an arbitrary graph. So you have 7 the ability to move, you know, in various ways in 8 the graph. 9 In this generalization -- this is what the 10 authors are contributing. The message used in the 11 standard belief propagation is approximated with a 12 kernel density, and you have a parentheses there. 13 And the conditional distribution used in standard 14 particle filtering is replaced by a product of 15 incoming messages. So that's their contribution. 16 Most of the complexity in this algorithm 17 lays in the sampling from a product of kernel 18 densities and requires for message passing and 19 belief estimation. We use sequential multi-scale 20 Gibbs sampling. So again, that's part of their 21 contributions. 22 And they continue on the next paragraph.
449 1 kernel density. 2 So these are their contributions, right? 3 And the conditional distribution used in standard 4 particle filtering is replaced by product of 5 incoming messages, and they basically describe 6 their contribution. 7 Q What is their contribution relative to 8 PAMPAS? What is that again? 9 ATTORNEY EKLEM: Objection to form. 10 A Well, I just read those sentences to you. 11 So you see the authors say, it says: We use a 12 form -- I'm looking at the second sentence. 13 We use a form of non-parametric belief 14 propagation. They cite 19, PAMPAS -- 15 Q Uh-huh. 16 A -- to deal with the stats. The approach 17 is a generalization of particle filtering. So the 18 approach that the authors are proposing is a 19 generalization of particle filtering, and they 20 cite that at 15. 21 Q Uh-huh. 22 A Which allows inference over an arbitrary	451 1 Individual messages may not constrain a node. 2 Well, however the product of all incoming messages 3 tends to produce a very tight distribution. 4 So that's their contributions. That's 5 what -- how they've modeled essentially their 6 non-parametric Bayesian belief -- Bayesian 7 propagation. 8 Q Do you believe that the '980 inventors 9 first proposed windowed smoothing in the '980 10 specification, or had they discussed that -- 11 (Reporter clarification.) 12 Q -- '980 specification, or had they 13 proposed that in an earlier paper? 14 ATTORNEY EKLEM: Objection to form. 15 A So I'm not sure I understand your question 16 properly, but if you look on Page 23 of my 17 original declaration, most of the way down, four 18 lines from the bottom, you see: The provisional 19 application further states that -- 20 (Reporter clarification.) 21 A So I'm on Page 23 of my original 22 declaration. And I'm four lines from the bottom.

Conducted on August 13, 2024

452 1 So the -- there, it states: The 2 provisional application further states that, 3 quote: We use w-frame windowed smoothing 4 algorithm for out tracking and object detection. 5 I think that might be a typo. 6 Q I'm sorry. What's the typo? 7 A Hang on a second. I'm going to check 8 something. 9 All right. So that's a typo. So -- 10 excuse me. 11 The quote says, so if you go to the 12 provisional, Page 9, second paragraph, top of 13 second paragraph. So you see that's the quote 14 that's in my declaration. See: We use w-frame 15 windowed smoothing algorithm for -- instead of 16 out, it should be our. 17 Q Got it. 18 A Tracking and object detection. So that 19 should be an our. Where W is an odd integer 20 greater or equal to 1, see Fig. 2cd. 21 And the quote continues. It says: 22 Essentially the paragraph -- the quote you see	454 1 you're referring to? 2 Q Page 5, left column, halfway down. 3 The paragraph starts with: The basic algorithm? 4 A So he has that same sentence there, but 5 obviously the model in the TLP is distinctively 6 different than what we're talking about here in 7 the provisional and the '980. 8 So he has a sentence there that says: We 9 use a 3-frame windowed smoothing algorithm for our 10 tracking results, where the estimates at time T 11 are based on observations that times T minus 1 T 12 and T plus 1. 13 So yes, he is talking about a use of the 14 3-frame windowed smoothing algorithm. But the 15 model that's described in TLP is distinctively 16 different from the provisional and the 9[e]. Many 17 applications use windowed smoothing algorithms. 18 It doesn't mean they're all the same thing. 19 Q Many applications in the 2004/2005 time 20 frame use windowed smoothing? 21 A I mean -- 22 ATTORNEY EKLEM: Objection. Objection to
453 1 here is the paragraph that is in the provisional 2 on Page 9. It's the second paragraph from the 3 top. 4 Q Did earlier contributions from the '980 5 inventors discuss using windowed smoothing 6 algorithm? 7 ATTORNEY EKLEM: Objection to form. 8 A Well, the provisional obviously discusses 9 that in this paragraph. 10 Q No. I'm asking: Did the earlier paper 11 from these inventors also discuss windowed 12 smoothing algorithm? 13 ATTORNEY EKLEM: Objection to form. 14 A I would have to look at something 15 specific. I don't remember off the top of my head 16 everything that's disclosed in every paper. 17 Q And this is the last line, and then we'll 18 take a lunch break. 19 Does TLP teach using a 3-frame windowed 20 smoothing algorithm? 21 ATTORNEY EKLEM: Objection to form. 22 A Is there a specific place in the TLP that	455 1 form. 2 A There are applications that obviously use 3 windowed smoothings for a variety of things. 4 Common filters or whatever are being used. But 5 it's the specifics. The devil is in the details. 6 The TLP discusses a model that is distinctively 7 different from the provisional and the '980 as 8 we've discussed earlier. 9 Q But using windowed smoothing, based on a 10 frame before and a frame after a current frame was 11 known for object detection in the 2004/2005 time 12 frame? 13 ATTORNEY EKLEM: Objection to form. 14 A No. We use in windowed smoothing in the 15 particular model that TLP was discussing for that 16 particular model. Now, if you want to use it in a 17 different model, you would have to structure your 18 smoothing differently for the different model. 19 It's not the same structures. 20 Q Applying it to a model -- I'll give you 21 that -- a generic spatio-temporal model using 22 smoothing based on a frame before and a frame

Conducted on August 13, 2024

456 1 after, was known in the 2004 and 2005 time frame? 2 ATTORNEY EKLEM: Objection to form. 3 A The generic idea of applying smoothing 4 would be known. The details of how to apply it 5 are distinctively different depending on the 6 models that you're using. 7 Q Okay. Fair enough. 8 Are you relying on any other portions of 9 the provisional, other than the passages you've 10 identified in Paragraph 33, to support your 11 conclusion that a POSITA would understand that the 12 inventors were in possession of element 1[e]/9[e]? 13 ATTORNEY EKLEM: Objection to form. 14 A Well, obviously I'm relying on a POSITA 15 reading the entire provisionals. So you're not 16 just looking at one sentence. You read the whole 17 thing, you understand what's being discussed. You 18 rely on the entire thing, and I then just quoted 19 here a few passages for you to provide support. 20 But you're relying on the understanding of the 21 whole provisional. It's not just one sentence in 22 a vacuum.	458 1 So while ideally, theoretically that's 2 possible, practically it would take a lot of 3 offline processing. So then the authors say, well 4 okay. A w-frame windowed smoothing algorithm is 5 used. Where W is an odd integer greater or equal 6 to 1. There are two ways one can do windowed 7 smoothing, and he continues on. 8 So the windowed smoothing is introduced 9 essentially to limit the offline or the processing 10 to so many frames. Because theoretically, it 11 would take a long time to do that. So you have to 12 limit it to so many frames. And in their results, 13 they talk about obviously using three frames. 14 But so that's what the smoothing has done, 15 still using the spatio-temporal probabilistic 16 model that they developed, but over a window of 17 frames instead of the entire sequence where you 18 can do that ideally for, you know, practical 19 considerations. 20 Q But my question is: What's being smoothed 21 using this window? 22 ATTORNEY EKLEM: Objection to form.
457 1 Q One more line of questioning on the 2 smoothing. It will be short I hope. 3 According to the '980, what is being 4 smoothed? What does the smoothing operate on 5 smooth? 6 ATTORNEY EKLEM: Objection to form. 7 A So if you look at the '980, I'm looking at 8 Column 7, and I'm starting on Line 6. 9 See where it says: While it is possible 10 to perform inference over the spatio-temporal 11 model defined for the entire image sequence. 12 (Reporter clarification.) 13 A There are many applications for which this 14 is not an option due to the lengthy offline 15 processing needed. 16 So you see, in the '980 he's defined a 17 spatio-temporal model that we've been talking all 18 morning. And theoretically speaking, you can 19 define that for the entire inner sequence. You 20 have a probabilistic model that covers spatial and 21 temporal for the entire image sequence, and there 22 could be a million frames.	459 1 A So if you continue on Line 11, Column 7, 2 there are two ways one can do windowed smoothing: 3 In an object detection centric way or tracking 4 centric way. And then he discusses that. So you 5 have an object detection centric way that's where 6 the smoothing is applied; and a tracking centric 7 way, where the smoothing is applied. 8 So in the former, the object detection 9 centric way, all those are reinitialized every 10 time a window is shifted, and so on and so forth. 11 You have a temporal integration is only applied 12 within the window instead of the entire sequence. 13 So that's where the smoothing is taking place. 14 Q So I'm not asking how it's applied. I'm 15 asking what's being smoothed. 16 A All the things that you are computing are 17 being done over the window instead of -- your 18 compatibilities that we talked about earlier, 19 those are now being done over window instead of, 20 you know, the entire sequence. 21 Q So what are you computing? 22 A Well, you have to compute the

Conducted on August 13, 2024

460 1 compatibility functions. You have to compute the 2 likelihoods. You know, all the pieces of, say, 3 that equation that's what we described earlier. 4 You've got to compute, you know, the component 5 stuff. You've got to compute the object stuff. 6 You got to figure out where the new nodes are. 7 And all that has to be computed. 8 Q And that's in each image, correct? Those 9 computations? 10 A The computations are done temporally and 11 spatially. So you have to temporally connect 12 things and spatially connect things. So instead 13 of doing that over the entire sequence, which 14 would take a long time, we would do that over a 15 window of limited frames, a number of frames. 16 Q And that's in each image for the video, 17 right? 18 ATTORNEY EKLEM: Objection to form. 19 A That's in the window of frames that you 20 selected. So you have a window of five. You're 21 going to be doing -- you're going to be working in 22 that window of five, and then you move over one	462 1 You have to compute these compatibility functions 2 within the frame and across frames. You have to 3 compute the likelihoods within frames for the 4 object and the components. 5 So those have to be computed. So you have 6 to compute all that so you don't apply -- to be 7 able to say what is the probability to detect that 8 object in a given frame. So you have to update 9 these joint distributions as you progress in the 10 frames. 11 Q So what you're discussing works for W 12 equals 1, correct? 13 (Reporter clarification.) 14 Q So what you're proposing works when W is 15 set to 1? 16 ATTORNEY EKLEM: Objection to form. 17 A W set to 1 is a special case. It's an 18 exception. Once you set W to 1, it's essentially 19 saying I'm not applying any temporal stuff. I'm 20 just working on a single frame by frame basis. So 21 W equal to 1 is essentially the author's way of 22 explaining to you that if you bring it to W
461 1 frame, and then you work in that window of five 2 using the prior results as, you know, your 3 initialization in a sense. So you're not 4 searching randomly in space. And then you move 5 again, and you do the same thing. 6 Q But the computations are done for each 7 image, correct? 8 ATTORNEY EKLEM: Objection to form. 9 Q And the smoothing is across frames? 10 A The computations are done both temporally 11 and spatially. Because you have a temporal model. 12 So you have a spatio-temporal model. You have to 13 do both. Otherwise you wouldn't perform what's 14 being done. 15 (Reporter clarification.) 16 A You wouldn't be able to perform what's 17 being proposed. 18 Q When smoothing is done across frames, what 19 are the computations? 20 ATTORNEY EKLEM: Objection to form. 21 A Well, again, I think we've gone over this. 22 So if you look at say Equation 8, for instance.	463 1 equal 1, you get -- you remove the temporal aspect 2 and you're just doing spatial. 3 But that's not what's claimed. What's 4 claimed is a window of X frames, two or more. For 5 you to be temporal, you have to have multiple, you 6 know, two or more frames. So it doesn't -- W 7 equal 1 does not fit the temporal model. 8 Q So let me ask it this way for the W 9 equals 1 embodiment. I can use the '980 graphical 10 model in determining this configuration for a 11 frame for W equals 1, and you call that using 12 simple fusion; is that correct? 13 (Reporter clarification.) 14 Q That's what you call simple fusion, right? 15 You can do that for W equals 1 in a frame? 16 ATTORNEY EKLEM: Objection to form. 17 A So if you go for W equals 1 -- 18 Q Uh-huh. 19 A -- you essentially lose the temporal 20 compatibility, right? So your model simplifies. 21 So essentially exactly what they say, note that 22 with W equal 1, the algorithm resembles single

Conducted on August 13, 2024

464 1 frame component-based fusion. 2 Q Uh-huh. 3 A So you no longer have a temporal model. 4 Q But that graphical model has a 5 configuration for W equals 1, correct? 6 ATTORNEY EKLEM: Objection. 7 A Yes. Instead of -- 8 ATTORNEY EKLEM: Sorry. Objection to 9 form. 10 A It's got a spatial configuration for W 11 equals 1. 12 Q And for the next frame -- 13 A Again -- 14 Q -- has a configuration for W equals 1, 15 correct? 16 ATTORNEY EKLEM: Objection to form. 17 A Yes. 18 Q Has that configuration for the model 19 changed from the first frame to the second frame 20 for W equal 1? 21 ATTORNEY EKLEM: Objection to form. 22 A Yes. I mean, models -- you don't have a	466 1 Q Is W equal 1 an option according to the 2 inventors? 3 ATTORNEY EKLEM: Objection to form. 4 A W equal 1 is you look at their sentence 5 carefully and note that with W equal 1 the 6 algorithm resembles single frame component-based 7 fusions. Single frame. You've lost all the 8 temporal stuff. That's all they're telling you 9 here is if you consider W equal 1, they're not 10 telling you to do that. They're just saying if 11 you bring it to that point, because they're trying 12 to explain to you what they're doing, you would 13 lose the temporal part. But that's not what 14 they're claiming. 15 Q Does that graphical model have a 16 configuration when the W is equal to 1? 17 A It's got a limited configuration 18 because -- 19 Q Does it have a configuration -- 20 (Reporter clarification.) 21 A It's got a limited configuration because 22 you've ripped off all the temporal aspect of it,
465 1 temporal model at this point. You're not 2 practicing what the '980 is describing. You 3 essentially lift -- ripped off all the temporal 4 parts of his model and all you're doing is just 5 the spatial part. That's not what they're 6 proposing. That's just a special case of it. 7 Q But I think you would agree that using W 8 equals 1, the '980 graphical model has a 9 configuration, which is calculated based on 10 measurements of the components for a frame. And 11 then for the next frame, W equals 1, the 12 configuration of that graphical model has changed? 13 ATTORNEY EKLEM: Objection to form. 14 A I think you're mixing apples and oranges. 15 Q I am not. 16 A Yes, you are. 17 Q I am not. 18 A You are mixing apples and oranges and 19 trying to convolute patent claim terms with the W 20 equal 1 to try to get some kind of a sound bite. 21 Q Is W equal 1 -- 22 (Reporter clarification.)	467 1 which is not what they're claiming. They're 2 claiming a spatio-temporal model. If you go to W 3 equal 1, you lose all the temporal stuff. 4 Q And the next frame has the configuration 5 of the '980 graphical model, will it have changed? 6 ATTORNEY EKLEM: Objection to form. 7 A That's not the configuration that's being 8 claimed here. So you've lost the temporal 9 compatibility. 10 Q That's not my question. 11 A The model has simplified. You're not -- 12 Q Has it changed -- has the configuration of 13 the model changed from frame to frame for W 14 equals 1? 15 ATTORNEY EKLEM: Objection to form. 16 A For W equals 1, you have a frame. You 17 have a model for that frame. That model has now 18 been reduced to just a spatial model. You have no 19 temporal elements. Your formulation here, you've 20 just ripped off a section of that formulation. 21 Q How -- 22 A Let me finish. You go to the next frame,

Conducted on August 13, 2024

468 1 you again have a spatial model. You ripped off 2 the temporal. That's not what's being practiced 3 in the '980. 4 Q Are those two spatial models you just 5 mentioned, do they have different configurations? 6 A Well, they have to -- they have to model 7 what's in the frame. So they potentially could be 8 slightly different, but that's not what's being 9 claimed. You've lost the temporal element of that 10 model. It's just like saying I'm just going to 11 remove from the equation a third of the equation 12 and only practice the two-thirds. But you're not 13 practicing what's being claimed here. Claim 1 14 does not claim W equal 1. 15 Q Does Claim 1 recite -- strike that. 16 Does Claim 1 recite providing a temporal 17 window defining a plurality of images? 18 (Reporter clarification.) 19 ATTORNEY EKLEM: Objection to form. 20 A Claim 1 strictly calls for providing -- it 21 clearly calls for providing a spatio-temporal 22 model. So you would have to have a	470 1 A Yes, sir. 2 Q You indicated in Paragraph 37 of your 3 supplemental declaration that you disagree with 4 the argument that Zhao is directed to much more 5 than a simple fusion scheme. 6 What do you -- why do you disagree that 7 Zhao is much more than a simple fusion scheme? 8 A Well, if you look at the Paragraph 37, so 9 the first sentence says exactly what you just 10 said. Then the next sentences explain why I 11 disagree. 12 So you see, my next sentence says: Zhao's 13 RCR algorithm does not fuse or combine object 14 probabilities from multiple from frames. 15 So as I explained earlier before lunch, 16 Zhao is strictly within the frame. It doesn't 17 have any probability modeling across frames. The 18 probabilistic analysis is confined to a single 19 frame under consideration, as I've explained in my 20 previous declaration and earlier this morning from 21 our conversations. 22 Q And the probabilistic analysis is
469 1 spatio-temporal model for an object to be 2 detected. It's got to be spatial. It's got to be 3 temporal. It's got to have both. 4 Then you provide a video comprising a 5 plurality of images. So you have a video that has 6 a plurality images which we typically refer to as 7 frames, that include those -- those plurality of 8 images include the object. So you have to have a 9 spatio-temporal model, and that model has to be 10 probabilistic so you can practice C, D and E. 11 I think we've gone over this many times 12 now. 13 ATTORNEY BAKER: Let's take a break. If 14 your answer is finished, let's take a break for 15 lunch. 16 THE WITNESS: I'm good. 17 (Recess from 12:46 p.m. until 1:52 p.m.) 18 BY ATTORNEY BAKER: 19 Q Dr. Saber, I have given you a copy of Zhao 20 already? 21 A Yes. You have. 22 Q Can you put that in front of you, please?	471 1 conducted on a single frame, and then it's 2 conducted on the next frame, and then it's 3 conducted on the next frame; is that correct? 4 A So if you look at Zhao Page 54 -- and just 5 to give you context, we are in Chapter 3 of Zhao 6 talking about the Bayesian similarity measure. 7 And the section I'm referring to is Bayesian 8 similarity measure and body part identification. 9 (Reporter clarification.) 10 A So you see when you look at the 11 formulation there? 12 Q Uh-huh. 13 A There's no temporal at all. This is just 14 strictly within a given image. You look at the 15 Bayesian formulation, the probabilities that are 16 formulated there -- the maximum a posteriori 17 hypothesis and so on -- is all within a single 18 image or frame. It doesn't go across multiple 19 images. 20 Q What doesn't go across multiple images? 21 A There's no probabilistic modeling across 22 multiple images, across frames. It's just within

Conducted on August 13, 2024

472 1 the frame. 2 Q And how about the motion information it 3 discusses with regards to the experimental 4 results? 5 ATTORNEY EKLEM: Objection to form. 6 A Well, we discussed that earlier this 7 morning as well. So the motion information that's 8 talked about, we are now experimental results on 9 Page 91, 92, 93. That motion information is 10 deterministic. It's just past to present. It's a 11 deterministic motion vector. It has no 12 probabilistic modeling whatsoever. 13 Q Does Zhao teach updating shapes and 14 locations of the body parts as part of this 15 algorithm? 16 A So Zhao teaches, as I mentioned, model 17 within the frame. So as you go to next frame, the 18 model updates within the frame. But there's no 19 probabilistic model across frames. The only thing 20 that's across frames is the deterministic motion 21 vector. And that's all that's discussed in Zhao. 22 Q Can we turn to Page 56 in Zhao?	474 1 A Yes. 2 Q About three lines down, first paragraph. 3 A Yes. Again, those are within the frame. 4 They're not talking about across frames. It's 5 all within the frame. Everything Zhao is doing is 6 within the frame. 7 Q So how do you dynamically assemble within 8 the frame? Each frame is different, correct? 9 ATTORNEY EKLEM: Objection to form. 10 A Yeah. But you're -- the object within the 11 frame has moved so you have to do something to 12 accommodate the object within the frame, and it 13 moves and you have to do something to accommodate 14 within the frame. There's nothing that 15 accommodates from frame to frame in a 16 probabilistic modeling. 17 Q So you want some type of connectivity, 18 temporal connectivity between the frames? Is that 19 what you're looking for? 20 ATTORNEY EKLEM: Objection to form. 21 A There is no temporal connectivity. There 22 is no probabilistic temporal modeling in Zhao from
473 1 A Yes, sir. 2 Q Does Zhao teach how to calculate the 3 conditional probability that an object is in an 4 image? 5 A Within the frame. Within the image. See, 6 that likelihood that you see on the first 7 paragraph on Page 56: P C, given H, person, 8 that's all within the frame. That's the 9 formulation I was talking about from the previous 10 page. It's all within the frame. There's 11 nothing -- there's no probabilistic formulation 12 from frame to frame. Therefore, there's no 13 temporal model, probabilistic temporal model in 14 Zhao. 15 Q How is Zhao teaching that the model 16 parameters are not fixed, but are dynamically 17 assembled based on the match hypothesis on 18 Page 56? 19 A Where are you reading that? 20 Q Page 56. Same page we were on. 21 A Yes. But which... 22 Q Starts with the word note.	475 1 frame to frame as described, you know, in the 2 context of the '980. None of that exists in Zhao. 3 Zhao is not concerned with temporal probabilistic 4 modeling at all. 5 Q There's no temporal connectivity in 6 Claim 1 though, correct, of '980? 7 ATTORNEY EKLEM: Objection to form. 8 A I don't know how you come to that 9 conclusion. You see, providing a spatio-temporal 10 model in Claim 1. The first element. You have a 11 spatial and you have a temporal. You have a 12 spatial model. You have a temporal model for an 13 object to be detected. So you have a 14 spatio-temporal model. That's what's claimed. 15 Q You agree Zhao also has a spatio-temporal 16 model, correct? 17 ATTORNEY EKLEM: Objection to form. 18 A I think we went over that a few times now. 19 Zhao has a spatial probabilistic model. There is 20 no temporal probabilistic modeling in Zhao at all. 21 Q Would you agree that Zhao has a spatial 22 model that changes configuration from frame to

Conducted on August 13, 2024

476 1 frame? Would you agree with that? 2 A Zhao has a spatial model that is 3 configured on each frame separately. There is no 4 temporal connectivity from frame to frame from the 5 probabilistic sense. So every frame Zhao updates 6 the model. 7 For the next frame, Zhao updates the 8 model. There is no probabilistic compatibility. 9 There is no probabilistic modeling between frames. 10 It's strictly within the frame. So it's strictly 11 a spatial model. 12 Q Let's go to Page 92 of Zhao, please? 13 A Yes, sir. 14 Q So doesn't Zhao teach here that object 15 detection in Frames 31 to 190 is based on motion 16 information from Frames 1 to 30? 17 A Deterministic from motion information. 18 We've been over this before. 19 Q So is that yes or no, what I asked? 20 A As I mentioned to you before -- I think 21 I've said it a few times now -- Zhao determines 22 deterministic -- computes deterministic motion	478 1 Q Bayesian. Okay. 2 A Bayesian inference spatially. And only 3 spatially. 4 Q Okay. 5 A That's what's described in the page I 6 showed you earlier, 56 or whatever. 54. Yeah. 7 Bayesian similarity measure and discusses all 8 that, et cetera. 9 Q And it does that using Zhao's dynamic 10 model across frames, correct? 11 ATTORNEY EKLEM: Objection to form. 12 A I think we've been over that a few times. 13 It's strictly spatial. It's applied to this 14 frame spatially. I go to the next frame 15 spatially. Go to the next frame spatially. There 16 is no temporal connectivity between the frames in 17 a probabilistic sense in Zhao whatsoever. 18 Q And how is the body model in Zhao 19 assembled from one frame to the next? 20 A Spatially. 21 Q And changes in configurations? 22 A Spatially. And only spatially.
477 1 information from frame to frame. There is no 2 probabilistic modeling whatsoever from frame to 3 frame in Zhao as you see in the context of the 4 '80. That doesn't exist in Zhao at all. 5 Q What do you mean by deterministic? 6 A I explained that this morning as well. 7 It's -- you have a frame. You have an object in 8 this frame. I find the object has moved over here 9 in the next frame. So I have a motion vector: 10 10 pixels that way; 6 pixels that way. 11 Deterministic. 12 There's no probability computation. 13 There's no probabilistic modeling. There's no 14 compatibility of objects and components. None of 15 that exists in Zhao temporally. It's strictly 16 deterministic motion. 17 Q And you agree that Zhao uses Bayesian 18 inference? 19 A Spatially, and only spatially. 20 Q How do you say it? How do you say the 21 term, Bayesian? 22 A Bayesian inference.	479 1 Q Can you go to Paragraph 39 of the 2 supplemental declaration? 3 A Yes, sir. 4 Q Is there any requirement in Claims 4 5 and 12 that the prior and later frames are 6 adjacent to the current frame? 7 A There's got to be a prior image and a 8 later image relative to the current image. 9 Q Can it be based on a frame that's three 10 frames before the current image? 11 A It can potentially be, but practically you 12 wouldn't do that because you -- you are more 13 likely to be erroneous if you did that. You're 14 more accurate by looking at the previous frame and 15 the later -- the previous frame, immediately 16 previous, and later frame immediately because 17 frames are taken in the video at 1/30th of a 18 second typically. So a previous frame and later 19 frame are the closest it's going to be to the 20 current frame versus, let's say, 20 frames back 21 where things have changed significantly. 22 So technically you could do that.

Conducted on August 13, 2024

480 1 Practically, you probably would not do that 2 because you'd have too much error. 3 Q Can I turn your attention to Section 4.4 4 of Zhao? 5 A Okay. Section, you said 4.4 or 3.4? 6 Q 4.4. Example Runs of the RCR Algorithm. 7 A Okay. 8 Q So doesn't Zhao teach using the Bayesian 9 similarity measure to identify the probability 10 that the human model is matched? 11 (Reporter clarification.) 12 ATTORNEY EKLEM: Objection to form. 13 A So if you go back to Page 70, and that's 14 Exhibit Page 70, not thesis Page 70. If you go 15 back to Exhibit Page 70, which describes the 16 outline of the RCR algorithm, Section 4.2 in Zhao. 17 Q Thesis Page 70? 18 A No. Exhibit Page 70. I will always refer 19 to the exhibit pages because this way it's easier 20 to find. 21 ATTORNEY EKLEM: Sorry. Was that 7-0? 22 THE WITNESS: 7-0.	482 1 What does that mean to you? 2 A So I'll give you the analogy that I gave 3 you this morning about motion JPEG. So I have 4 frames of video. Say I have a hundred frames of 5 videos on this table. I'm going to apply JPEG to 6 Frame 1. Then I'm going to apply JPEG to Frame 2. 7 Then I'm going to apply JPEG to Frame 3. Just one 8 at a time, then compress. 9 Yes. I've compressed a sequence of the 10 video, but I didn't utilize any temporal 11 knowledge. All I did is spatial knowledge. 12 Q How do you keep going to a compression -- 13 A Well, I -- 14 Q Why didn't you use an object detection? 15 A So let me get to that. 16 So in Zhao, you have essentially an 17 algorithm. Let's say the RCR algorithm that 18 you're talking about. And again, I have a 19 sequence of video, a hundred frames on this table. 20 Zhao applies his algorithm to Frame 1, 21 independently applies the algorithm to Frame 2, 22 independently applies the algorithm to Frame 3,
481 1 A So you see there's an outline for the RCR 2 algorithm? 3 Q Yes. 4 A And that RCR algorithm outline that's 5 outlined here, is being example run in Section 4.4 6 as you see there, the section you're pointing to. 7 Q Okay. 8 A So if you walk through the steps of that 9 algorithm in 4.2, there's nothing in there about 10 temporal. The formulation doesn't show any 11 temporal probabilistic models whatsoever. 12 So if you look on page -- Exhibit Page 70, 13 Exhibit Page 71 which describes the steps of the 14 RCR algorithm. 15 Q Uh-huh. 16 A There's nothing in here that talks about 17 any kind of temporal models. This is strictly 18 spatial. 19 Q What about Figure 5 when you apply the RCR 20 algorithm to video? 21 A Strictly spatial. Strictly spatial. 22 Q What do you mean by strictly spatial?	483 1 and does so spatially across the frames. 2 Q And there's no inferencing between frames? 3 A There's no temporal probabilistic -- let 4 me finish. There's no temporal probabilistic 5 modeling in Zhao between the frames. 6 Q Is there inference -- any inferencing 7 between frames? 8 A Not probabilistically done. 9 Q I said: Is there any inferencing between 10 frames? 11 A The only thing between the frames is the 12 deterministic motion estimation. 13 Q Is that for each inference then between 14 frames? 15 A That's used to just predict the motion 16 from Frame 1 to Frame 2, or Frame 2 to Frame 3, et 17 cetera. 18 Q And the other thing that's changing from 19 frame to frame is the configuration of the body 20 model, correct? 21 ATTORNEY EKLEM: Objection to form. 22 A Well, the body is changing. The person is

Conducted on August 13, 2024

484 1 walking, right? 2 Q Uh-huh. 3 A So the person is walking. The person is 4 going to look different in every frame. Zhao's 5 model looks at Frame 1, does the Bayesian thing 6 spatially. Looks at Frame 2, does the Bayesian 7 thing spatially. 8 Q What's it doing to the model there when it 9 gets to Frame 2? It's assembling it again, right? 10 A It's just spatially. Spatially. 11 Q But it's reassembling the model in each 12 frame, right? 13 A Applying it spatially to the frame. 14 Q How is it -- what's it doing with its 15 assembly? 16 A It's looking at the frame content and 17 doing its Bayesian modeling, just like it would do 18 on any frame. The only difference in Zhao, in the 19 later part of it, is Zhao introduces deterministic 20 motion estimation. So basically Zhao says: I 21 know the object at Frame 3 is here and has this 22 motion. I expect it to be here in Frame 4.	486 1 motion estimation to predict the next one and 2 applies it spatially again. There's no 3 probabilistic temporal model at all. 4 Q Does JPEG use -- I mean does MPEG use 5 inferencing between frames? 6 A No. MPEG inferencing is typically a term 7 used with probabilistic-type model. It's not used 8 when you're doing deterministic motion estimation. 9 MPEG -- MPEG does motion estimation using block 10 matching. 11 (Reporter clarification.) 12 A So typically, MPEG does block matching 13 like using some of absolute differences, and 14 computes the motion from Frame 1 to Frame 2. 15 That's a deterministic model. No probabilistic 16 modeling whatsoever. There's none in Zhao. 17 Q Let's get back to the RCR algorithm. 18 How is the RCR algorithm updating 19 temporally across frames according to Zhao? 20 ATTORNEY EKLEM: Objection to form. 21 A I think we've been over that multiple 22 times. Zhao does deterministic motion estimation.
485 1 That's the only thing, and it's a deterministic 2 motion model. That's not an inference by, you 3 know, calculation or, you know, framework. 4 Q In Zhao's examples in Figure 5, he 5 discusses -- 6 A Figure what? 7 Q I'm sorry. Chapter 5. 8 A Chapter 5. Okay. 9 Q He models a human walking. Isn't that a 10 spatio-temporal model? 11 A I think we went over that a few times now. 12 I believe I've answered your question a few times 13 now. 14 Q How can the RCR algorithm be used to 15 analyze motions if it's not using any 16 spatio-temporal model? 17 ATTORNEY EKLEM: Objection to form. 18 A How does motion JPEG compress a video if 19 it's not using a spatio-temporal model? It does. 20 It just doesn't use the connectivity temporally. 21 It doesn't have a probabilistic model. It just 22 applies it spatially on every frame, and does	487 1 He does basically motion estimation, Frame 1 and 2 Frame 2, deterministic, finds the vector. He 3 says: Here's the object in Frame 1. Here's the 4 motion vector. Therefore, it should be here in 5 Frame 2. Does this spatial thing again in 6 Frame 2, agrees or disagrees, and moves it. There 7 is no probabilistic model across the frames. 8 Q Let's turn your attention to Page 91 of 9 Zhao. 10 A Exhibit Page 91? 11 Q Yes. 12 A Yes, sir. 13 Q The bottom sentence, it says: Figure 5.6 14 presents a full cycle of a walking person, 15 correct? 16 A That is correct. You read that correctly. 17 And you can see Figure 5.6 is two pages there. 18 Q And Zhao teaches that during the first 19 half cycle, no motion information is used to 20 resolve ambiguity with limbs' orientations, 21 correct? 22 A You read that correctly.

Conducted on August 13, 2024

488 1 Q While in the second half of the cycle, the 2 prediction from previous frames, constant angular 3 velocity is assumed, is used to get better results 4 of body part localization, correct? 5 A Deterministic motion estimation, yes. 6 We've been over that. 7 Q So isn't Zhao using motion information 8 obtained from previous frames to predict the 9 orientations of the limbs and to solve ambiguity? 10 A Deterministic motion estimation, yes. 11 Q Is that a yes or no to my question? 12 A Yes. Deterministic motion estimation. 13 Yes. We've been over that a few times. 14 Q You would agree though that in each frame, 15 Zhao determines whether an object is in that frame 16 probabilistically? 17 A The spatial Bayesian model is applied to 18 each frame spatially. 19 Q And in Zhao, the object is measured as a 20 collection of components, correct? 21 A In Zhao, the object is modeled by 22 contours, not components.	490 1 Let me ask again. 2 Can contours represent components? 3 A Contours are contours. So the contour of 4 this cup is not the same as the interior region of 5 that cup. So the contour is the contour. That's 6 what is being modeled in -- that's what Zhao 7 relies on. 8 The '980 looks at the object as a series 9 of components. The component represents the 10 interior part of the object like a region, versus 11 in Zhao you're looking at the contour. So they're 12 not the same thing. 13 Q So that cup has two components? 14 A What do you mean? 15 Q A top and a bottom? 16 A So, you can, for instance, look at this 17 cup and say: Well, I have the white -- assume 18 there's no writing on here. I have the white 19 part, this whole region as component one; and the 20 lid is the black part. If I'm using color. 21 Q Let's use shape, please. 22 A As component two.
489 1 (Reporter clarification.) 2 Q So it's not modeled by body parts? 3 A The body parts are modeled by contours 4 within the spatial frame, spatially within the 5 frame. There's no temporal modeling or 6 probabilistic whatsoever. 7 Q And contours can't be components, correct? 8 A Well, contours are contours. Components 9 are kind of like a region-based approach. 10 Contours are -- the contour of the region. So 11 they're not essentially the same thing. So '980 12 is a region-based approach, so it looks at the 13 components as a region, like you see in Figure 3 14 of the patent. 15 So you see there's -- these are regions, 16 versus Zhao looks at the object as a series of 17 contours, not really region-based. It doesn't 18 look at the region. It just looks at the 19 contours. So it's essentially a very different 20 process. And it's nonspatial. There's no 21 temporal probabilistic model. 22 Q So your answer wasn't very clear to me.	491 1 Q Let's use shape. 2 A Well, if you're using shape, I can look 3 at, you know, for instance, the cup and look at 4 the shape in the bottom. But that's the region 5 that I'm looking at. 6 In '980, they're looking at the region, 7 the whole region itself. And modeling that, 8 versus in Zhao, they're looking at the contour. 9 Q So Zhao could model the contour of the 10 cup? 11 A So Zhao is modeling the contour of the 12 cup. 13 Q But also the components? 14 A That's not really the same components in 15 the context of what's being discussed in the '980. 16 Q I did not ask anything about the '980. 17 We're talking about Zhao and how Zhao builds in 18 its human body model, and we're trying to apply 19 that to building a model of two components for 20 that cup. 21 A Right. 22 Q Doesn't it use -- couldn't it use contours

Conducted on August 13, 2024

492 1 to detect the top of the cup and the base of the 2 cup? 3 A So, again as I've explained to you, Zhao, 4 if you look at the figures of Zhao, throughout 5 this place, throughout this thesis, Zhao is 6 looking at the contours. That's not the same 7 thing as components. I don't even think -- I 8 mean, I haven't done this, but if you do a search 9 of the word component in Zhao, you probably would 10 not find Zhao describing its contours by 11 components. They're contours. 12 Q Let's go to Figure 3.3. 13 A Yes, sir. 14 Q Doesn't Zhao use the contours to identify 15 components of the human body model? 16 A Yes. Zhao uses contours. 17 Q To do what? 18 A To identify the components. But these 19 are -- you see, these are contours. The inside of 20 them is like a hollow. There's no -- you're only 21 looking at the contour itself. You're not looking 22 at the structure inside these contours. That's	494 1 Q A component of the human body? 2 A But that's not the same component as being 3 described in the '980. 4 Q That's fine. 5 A That's -- do you see what I'm saying? 6 Q No. 7 A So these are just contours. You're not 8 looking at the internal piece of that calf. 9 What's inside the contour, Zhao doesn't look at. 10 Zhao -- 11 Q If I can use a contour to find an arm, why 12 do I need to define the bicep if I'm looking for 13 the arm? What do I need inside of the contour? 14 What else do I need? 15 A Well, that's where -- that's what I'm 16 trying to explain to you. In Zhao, all he uses is 17 the contour. 18 Q To do what? 19 A To identify the arm. 20 Q Thank you. 21 A In the '980, you're using that entire 22 inside pattern on your coat, that pattern on your
493 1 not the same as the '980 and what's being 2 described there. You're mixing apples and 3 oranges. 4 Q I am not mixing apples and oranges. 5 A You are. You're trying to fit a square 6 peg in a round hole. Zhao does -- works with 7 contours. It doesn't work with the inside of the 8 region. 9 Q It doesn't use contours to identify 10 components of the human body? Is that your 11 position? 12 A That's not what I'm saying. 13 Q What are you saying then? 14 A What I'm telling you is it's using the 15 contour. 16 Q To do what? 17 A This is the contour, right? Look at the 18 figure that you're pointing to, Figure 3.3, right? 19 Q Uh-huh. 20 A It's using the contour to define the calf. 21 Q Which is what? 22 A A piece of the human body.	495 1 coat also can define the arm. So the '980 uses a 2 different style and methodology, and that's why 3 it's called components and not contours. You're 4 mixing apples and oranges and trying to fit a 5 square peg in a round hole. 6 Q So the plain and ordinary meaning of 7 component is what you just said? 8 A Well, component by itself could mean a lot 9 of things. You have to read the spec and the '980 10 specification to determine what the authors are -- 11 mean what they're saying. 12 Q Does component have a plain and ordinary 13 meaning in the field of object detection? 14 A In the context of what it's describing. 15 So you're going to have to read the context. Just 16 like the word bank has a plain and ordinary 17 meaning. It could be a bank of a river or it 18 could be an institution where you deposit money. 19 If you just said to me bank, it could be a 20 plane banking. So it depends on the context of 21 what's being described. So you have to read 22 what's being described. It's not just a word, you

Conducted on August 13, 2024

496 1 know, by itself. It has a meaning and description 2 of what's being described. 3 Q What are the components of a car? 4 A I mean, I'm not an automotive expert. 5 Q Give me three examples. 6 A Tires. I don't know. Body. Glass. I'm 7 not an automotive expert. 8 Q Does the tire have a contour? 9 A It has a contour. 10 Q Could Zhao use its method to identify a 11 tire on a car using contours? 12 A You can look at the contour of a car to 13 identify -- the contour of a tire to identify the 14 tire. That's what Zhao does. But you could also 15 look at the inside of the contour. That's kind of 16 like the color and texture to also identify it, 17 and other people have done that. The '980 uses 18 that kind of analysis. That's what I'm trying to 19 explain to you. 20 Q All right. Let's go to Exhibit 1011. 21 A Are we done with Zhao? 22 Q I hope so, but no promises.	498 1 A So the abstract of this method -- well, 2 the title is: Generating Spatiotemporal Models 3 From Examples. 4 And if we look at the abstract, and I'm 5 looking at the third sentence. The abstract 6 teaches: We present a method for automatically 7 generating an equivalent physically based model 8 using a training set of examples of the object 9 deforming, tuning the elastic properties of the 10 object to reflect how the object actually deforms. 11 That's what it's presenting. 12 Q And the resulting model? 13 A The resulting model provides a low 14 dimensional shape description that allows accurate 15 temporal extrapolation based on the training 16 motions. This is a kinematic kind of model 17 essentially. 18 Q And do you know what temporal 19 extrapolation means? 20 A Yes. 21 Q What does it mean? 22 A So I'm here in this frame. I'm going to
497 1 I'm going to hand you what's been 2 previously marked as Exhibit 1011. 3 (Previously marked Meta Exhibit 1011 was 4 introduced and retained by Counsel.) 5 Q Let me know when you've got it open. 6 A Yeah. I do have it. 7 Q Exhibit 1011, doesn't the abstract teach 8 that this model allows accurate temporal 9 extrapolation based on training motions? 10 ATTORNEY EKLEM: Objection to form. 11 A So this is talking about object 12 deformations, elastic properties of objects and 13 essentially kinematic models. 14 (Reporter clarification.) 15 A And this is talking about finite elements. 16 This is completely different from what's being 17 described in... 18 Q My question was: Does the abstract teach 19 a model which allows accurate temporal 20 extrapolation based on training motions? 21 That was my question. I didn't ask for an 22 overview of the reference.	499 1 extrapolate a frame that -- the next frame or the 2 frame after that, where I think the object might 3 be or what the formation the object might take. 4 So that's temporal extrapolation. This is a 5 kinematic model. It's a deformation model. 6 Q Does Exhibit 1011 teach using information 7 from a future frame as part of the extrapolation? 8 A This is, again, a deterministic kinematic 9 model. This is -- there's no probabilistic 10 discussions here. This is essentially you're 11 modeling the object kinematically using 12 potentially finite elements. And as the object 13 deforms, so you're modeling these deformations 14 from frame to frame. 15 And if I model the deformation up to here, 16 I can say, well I think in the next frame, the 17 object is going to look like this. Because it's a 18 deformable object. This is a kinematic model. 19 There's no probability here. 20 Q Yes or no, does Exhibit 1011 teach using 21 information from a future frame as part of its 22 extrapolation?

Conducted on August 13, 2024

500 1 ATTORNEY EKLEM: Objection to form. 2 A No. It doesn't teach information from a 3 future frame. 4 Q What does it teach? 5 A It teaches -- it says: The resulting 6 model provides a low dimensional shape 7 description. 8 So it provides a low dimensional shape 9 description. So a low dimensional shape 10 description that allows accurate temporal 11 extrapolation based on the training motions. 12 Q Okay. 13 A So it allows for temporal extrapolation 14 based on this low dimensional shape description of 15 the object. Because the objects could have a very 16 high non-linear shape. What they're trying to do 17 is they're modeling the shape with a low dimension 18 shape description. Like you would model, for 19 instance, without ellipse instead of having them 20 model it with some very non-linear surface. 21 Q How is the prior frame used? I'm sorry. 22 How is the future frame used as part of	502 1 thing? 2 Q Yes. Furthermore, the purely spatial 3 model cannot discriminate between similar shaped 4 objects that deform in different ways. 5 Do you have an understanding of what that 6 sentence means? 7 A Generally speaking, yes. I mean... 8 Q So what does it mean? 9 A So if you have a purely spatial model, so 10 I have an object that deforms. I have a different 11 object that deforms in a different way. Unless 12 you have temporal understanding essentially -- if 13 you just have a spatial model for the object, you 14 can't predict the deformations. You've got to 15 have some temporal knowledge to see the 16 deformation, right? 17 You have to see the object in State 1. 18 You have to see the object in State 2. Then you 19 can define, okay. This is a deformation. 20 So you can see, for instance, if you look 21 at Equation 1. Do you see in Section 2, first of 22 all, they're doing modal analysis here. So the
501 1 this process? 2 A Well, what you would -- 3 ATTORNEY EKLEM: Objection to form. 4 A What you would do is you would model the 5 object looking at frame by frame. You have a low 6 dimensional shape description. Now you can 7 extrapolate to the next frame and say okay. I 8 think in the next frame this object is going to 9 look like this. So you'll make a prediction to 10 the next frame and then you can look at the next 11 frame and say: Is it true or not, and then 12 reconcile your prediction. 13 There's no probability discussion here. 14 This is just a kinematic kind of model. And you 15 can see the model formulation in Equation 1. This 16 is even finite elements. It's not even in the 17 same context. This is typically more in the 18 mechanical engineering type of things. 19 Q On Page 2 of Exhibit 1011, top paragraph, 20 do you see the sentence that begins with: 21 Furthermore? 22 A Yes. Halfway down the paragraph kind of	503 1 finite element method, the FEM, represent object 2 deformations in terms of the discreet -- of a set 3 of discrete nodal points was displacement U. 4 So you have nodal points across the 5 object. Each point has a displacement, so you 6 model the object like, as a series of finite 7 elements, series of points across the object where 8 each point has a certain displacement to it. 9 And then what they've done is they've 10 created this kinematic model, which is essentially 11 a second order of differential equation. U dot 12 dot means second derivative. So this is just a 13 kinematic model. There's no probabilities here at 14 all. And this is typical in modal analysis type 15 modeling. 16 (Reporter clarification.) 17 Q Dr. Saber, have I already given you 18 Dr. Bajaj's supplemental dec, 1052? 19 A I don't believe I have such a dec. 20 ATTORNEY BAKER: Do you have 1052? Have I 21 handed that had out? 22 ATTORNEY EKLEM: I don't think so. I

Conducted on August 13, 2024

504 1 don't have it. 2 THE WITNESS: Yeah. I don't have it. 3 BY ATTORNEY BAKER: 4 Q I'm going to hand you what's been 5 previously marked as Exhibit 1052. 6 (Previously marked Meta Exhibit 1052 was 7 introduced and retained by Counsel.) 8 Q Are you familiar with this document? 9 A I am, sir. 10 Q Did you review this as part of your 11 preparation for today's deposition? 12 A I have. 13 Q During lunch or during any of the breaks 14 today, did you discuss the substance of your 15 testimony with counsel? 16 A No. I didn't. 17 Q Can you take a look at Dr. Bajaj's 18 Paragraph 39 in Exhibit 1052 and read it to 19 yourself, please? 20 A Yes, sir. 21 Q Do you agree with Dr. Bajaj's conclusions 22 in Paragraph 39?	506 1 That's what's described in Figure 8. 2 Q So I asked: Do you agree with Dr. Bajaj's 3 conclusions from Paragraph 38? 39, I'm sorry. 4 A Well, I would prefer to say this is what 5 the authors exactly describe. What you've 6 described here isn't what the authors are 7 describing exactly. 8 Q So you aren't able to glean anything 9 additional beyond exactly what is stated in the 10 references? 11 A Well, this is not the spatio-temporal 12 model that we're talking about. You know, 13 spatio-temporal models have meanings in the 14 context of different things. 15 Q Uh-huh. 16 A This is a kinematic model that has -- that 17 describes modal analysis. I think if you were to 18 search this whole thing, you probably wouldn't 19 find the word spatio-temporal in it at all. 20 Q Besides the title? 21 A Besides the title. But this is a 22 kinematic-type of model. So this is a modal
505 1 ATTORNEY EKLEM: Objection to form. 2 A Well, generally speaking, I mean, 3 Dr. Bajaj is essentially -- see, this is the 4 Figure 5 from Exhibit 1011. 5 (Reporter clarification.) 6 A So let's go -- so if you'll go to 7 Exhibit 1011, and you go to Meta Page 8, and right 8 at the top of that page, it discusses Figure 5. 9 So the exhibit states what the figure is 10 exacting. 11 So you see the exhibit says: Figure 5, 12 which is the figure we're talking about here, 13 shows another input sequence and the approximated 14 sequence using the generic model that they 15 described earlier. 16 The nodal errors -- because this is a 17 nodal-based model, as I explained earlier with the 18 finite elements -- were minimized over the first 19 eight frames and the subsequent frames are purely 20 extrapolations. As before, the amplitude and 21 phase of each vibration mode is fixed over the 22 approximated sequence.	507 1 analysis. It uses finite elements. And 2 essentially it's looking -- it's modeled the 3 shape, but with a series of finite elements. If 4 you look at the equations, this is a 5 vibration-type modeling. 6 If you look at the Equation 1, you have a 7 second order differential equation. And if you 8 look at Equation 2, essentially you have an item 9 value problem decomposition. And you've modeled 10 the displacement, and now you -- you train the 11 model parameters over a series of seven or eight 12 frames. 13 And now what the authors have done here in 14 Figure 5, they've extrapolated -- they've traded 15 over eight frames and they've extrapolated for the 16 next series of frames. 17 So what you see in the figure, you see 18 what they've done is they said: Okay. Here's 19 your first eight frames, and then I'm going to 20 extrapolate over the remaining frames to see how 21 well my model predicts the reality, which is A. A 22 is reality. B is the model portion of it. So

Conducted on August 13, 2024

508 1 that's what's being described here. It's a 2 kinematic model using differential equations, 3 compositions and finite elements. 4 This is completely different from -- not 5 even the same domain as the '980. It's a totally 6 different thing here. There's no probabilistic 7 descriptions at all. There's no probability 8 modeling whatsoever. There's no temporal 9 probability modeling whatsoever. This is apples 10 and oranges. 11 Q So you agree that the paper is directed to 12 spatio-temporal models, correct? 13 ATTORNEY EKLEM: Objection to form. 14 A In the context of modal analysis, 15 vibrations, finite elements and displacements. 16 This is essential -- this is an analysis approach. 17 It's finite elements. 18 Q Does it teach temporal extrapolation? 19 A In that -- in the context of what it's 20 talking about here, which is completely different 21 from what we're talking about. 22 Q Does it teach temporal extrapolation using	510 1 in that sentence. 2 This is essentially more paraphrasing than 3 what the authors have described there in Figure 5. 4 What Dr. Bajaj should have done is quoted Figure 5 5 and put it there in the paragraph and then 6 elaborate instead of trying to paraphrase what's 7 being done. 8 Q There would be no need for experts if all 9 we're going to do is quote references and put it 10 on the paper without any insights from an expert. 11 You would not have money. You would not have 12 these 10 IPRs that you have depositions for. The 13 reason we have you is to try to provide insights 14 on what the teachings mean to a POSA. 15 So he's provided his understanding of what 16 a POSA, how they would understand Exhibit 1011, 17 and I'm asking you: Do you agree with it? 18 A I -- 19 ATTORNEY EKLEM: Objection to form, scope 20 and argumentative. 21 A And again, as I described to you is, this 22 is -- this does not accurately represent properly
509 1 future frames? 2 ATTORNEY EKLEM: Objection to form. 3 A In the context of what it's doing. In the 4 context of modal analysis, displacement analysis, 5 kinematic modeling, deterministic here, it teaches 6 extrapolating future frames using these kinematic 7 models. This is completely different from the 8 '980. 9 Q Did you disagree with anything stated by 10 Dr. Bajaj in Paragraph 39, and if so, can you 11 precisely identify what you disagree with? 12 A Well, I mean it's not quite an accurate 13 description of what's being done here. This is -- 14 Q What's inaccurate? 15 A Well, so you have a generic model that's 16 based on modal analysis, finite elements, 17 displacement, second order of kinematics. None of 18 that is being discussed there in that sentence. 19 Then you have nodal errors were minimized. None 20 of that is discussed there in that sentence. And 21 he talks about amplitude and phase of each 22 vibration mode. None of that is discussed there	511 1 what's being discussed in this paper. This paper 2 talks about modal analysis, finite element 3 modeling, displacement, kinematic models and that 4 nodal errors. 5 So this is essentially what the authors -- 6 you know, Figure 5 is the -- the results of what 7 their models are doing. This is completely 8 different from the '980 and the probabilistic 9 models that we're talking about. There's not even 10 a probability in here. 11 Q Let's take it step by step. Does Figure 5 12 of Exhibit 1011 show the approximation of a 13 spatio-temporal shaped model walking sequence, in 14 the bottom Row B, yes or no? 15 A Figure 5, as the authors tell, you shows 16 an input sequence -- they refer to it as another 17 because they've done a previous one -- and the 18 approximated sequence. So 5A is an input walk 19 sequence that they have essentially -- this is a 20 real sequence that they have determined the shape 21 for. And Figure 5B is the approximate sequence 22 using the generic model that they have used

Conducted on August 13, 2024

512 1 essentially modal analysis, finite elements and 2 displacement, the second order of differential 3 equations, analysis, and to compute the AMC U and 4 R, the elements of the model. 5 And using those, they have said: Okay. 6 In Figure 8 -- it's 5B, I'm sorry -- the first 7 eight frames were used essentially to train the 8 model, and the next series of frames were used to 9 predict from those frames to show you how well 10 their predictions matched reality. But this is 11 strictly a kinematic model that has modal analysis 12 and finite elements. This has nothing to do with 13 what we're talking about. 14 Q So your challenge with Exhibit 1011 is 15 that it is not the precise model that the '980 16 uses? Is that your challenge with it? 17 ATTORNEY EKLEM: Objection to form. 18 A The 1011 is a completely different ball 19 game. This is a modal analysis. This is a 20 kinematic model. This is using finite elements. 21 None of this is in the '980. This is a totally 22 different ball game.	514 1 model, correct? 2 ATTORNEY EKLEM: Objection. Objection to 3 form. 4 A Again, a spatio-temporal model has a 5 context. It means something different depending 6 on what you're reading, what the application 7 that's being described. These are apples and 8 oranges. It couldn't be any farther on this by 9 using this 1011. 10 Q Would a POSA looking to apply temporal 11 extrapolation to a spatio-temporal model look to 12 Exhibit 1011? 13 ATTORNEY EKLEM: Objection to form. 14 Scope. 15 A A POSA doing what? 16 Q A POSA looking to apply temporal 17 extrapolation to their spatio-temporal model. 18 A If their spatio-temporal model is a 19 kinematic model that uses modal analysis and 20 finite elements and displacements, and they want 21 to add a temporal element to it, then a POSA might 22 look at this.
513 1 Q And, again, you think it's a different 2 ball game because the model is different? 3 A Completely different. 4 Q It's not about the temporal extrapolation? 5 That's not what's different. The difference is 6 the model? 7 ATTORNEY EKLEM: Objection to form. 8 A The model is different. The way it's 9 extrapolated is different. The way the shapes are 10 modeled are different. It's apples and oranges. 11 Q The temporal extrapolation is apples and 12 oranges? 13 A Completely. 14 Q Why? 15 A This is done based on deterministic 16 models. This is a kinematic model. This has 17 nothing to do with -- 18 Q It's a spatio-temporal model, is it not? 19 A Yes. There's a bank too, and airplane has 20 banked. Does that mean that I can deposit money 21 on an airplane wing? 22 Q Claim 1 uses what, a spatio-temporal	515 1 Q So their temporal model is limited to 2 having all of the other things you discussed. It 3 has to have that precise model with those 4 characteristics, otherwise the discussion 5 regarding the extrapolation is inapplicable; is 6 that what you're saying? 7 A I mean, look at the formulas. You know, 8 it's just like saying, you know -- 9 Q The formulas for what? 10 A Look at Exhibit 1011. Go to Page 2 of 11 Exhibit 1011. So you see in Equation 1, it's got 12 a second order differential equation. 13 Q What's it's describing? What's the 14 equation for? 15 A It's probably easier to have the exhibit 16 in front of you, so if you want to use mine? 17 Q No. You keep talking, please. 18 A I'll wait until you have the exhibit. 19 Q We're on the record. You can continue. I 20 have the realtime. Please just answer the 21 question. 22 A Okay. So if you look Exhibit 1011, and

Conducted on August 13, 2024

516 1 I'll put it down here so you can see mine in case 2 you're not finding yours. So if you look at 3 Exhibit 1011, and you look at Equation 1 of 4 Exhibit 1011, which is on page -- Exhibit 5 Page 2, you see that equation has: MU double dot, 6 plus CU dot, plus KU equals R. 7 So, and then when you read below it, it 8 says U is vector of nodal displacements. So 9 because this is a modal analysis model, U 10 represents the displacement of the nodes that you 11 placed on the model. 12 M is mass. C is damping. And a K is 13 material stiffness. I mean, this is a kinematic 14 model. This is, like, a physics based model, 15 right? 16 Q Is the kinematic model a spatio-temporal 17 model? 18 ATTORNEY EKLEM: Objection. 19 Q That's the only question I have before we 20 move on. 21 ATTORNEY EKLEM: Objection to form. 22 A So let me finish my point.	518 1 Q Yes or no? 2 ATTORNEY EKLEM: Same objection. 3 A I mean, you can see when you look at this 4 Figure 5 that he's done some modeling of the walk 5 sequence using, you know, modal analysis and 6 vectors and so on. This is a deterministic 7 kinematic model. 8 Q I just asked could it be used to track an 9 object? I'm sorry. Detect an object? 10 A Well, he's using it to obviously do a 11 sequence of tracking, but this is completely 12 different from the probabilistic model that we're 13 talking about in the '980. This is a totally 14 different ball game. 15 Q All right. Let's go to Exhibit 1015. 16 A Which one is it? 17 Q 1015. 18 ATTORNEY EKLEM: We've been going for a 19 little over an hour. 20 ATTORNEY BAKER: Yup. Let's take a break. 21 (Recess from 3:01 p.m. until 3:12 p.m.) 22 ATTORNEY BAKER: All right. I'm going to
517 1 Q I have a very straightforward question. 2 We're running out of time. 3 Is the kinematic model described in 4 Exhibit 1011 a spatio-temporal model, yes or no? 5 ATTORNEY EKLEM: Objection to form. 6 A So the kinematic model that's described 7 here utilizes modal analysis, finite elements, 8 differential equations, mass damping material 9 stiffness, to create its spatio-temporal 10 extrapolations. So this is a completely different 11 model, apples and oranges different from the '980 12 spatio-temporal model. This is a totally 13 different ball game here. This is a -- this is a 14 physics-based, modal-based approach, vastly 15 different from the '980, much further than even 16 Zhao. 17 (Reporter clarification.) 18 A I mean, this has no probability at all. 19 This is completely kinematics and physics based. 20 Q Could this spatio-temporal model be used 21 to track objects? 22 ATTORNEY EKLEM: Objection to form.	519 1 hand the witness what's been previously marked as 2 Exhibit 1015. Dr. Saber is anxious to look at 3 this one. 4 (Previously marked Meta Exhibit 1015 was 5 introduced and retained by Counsel.) 6 BY ATTORNEY BAKER: 7 Q Are you familiar with Exhibit 1015? 8 A I am. 9 Q And this paper was coauthored by a couple 10 of the '980 inventors, correct? 11 A That is correct. 12 Q Did you review Exhibit 1015 as part of 13 your preparation for today? 14 A I have. 15 Q And doesn't Exhibit 1015 teach the use of 16 the PAMPAS algorithm to perform non-parametric 17 belief propagation? 18 ATTORNEY EKLEM: Objection to form. 19 A Well, it's -- obviously the title is 20 Attractive People Assembling Loose-Limbed Models 21 using Non-Parametric Belief Propagation. That's 22 essentially what the title is of this particular

Conducted on August 13, 2024

520 1 paper. 2 Q And it uses the PAMPAS version of NBP, 3 non-parametric belief propagation; is that 4 correct? 5 ATTORNEY EKLEM: Objection to form. 6 A Generally speaking, I think, you know, 7 that is correct. 8 Q And do you still have the provisional, 9 Exhibit 1003? 10 A Somewhere. Yes. 11 Q And the provisional also uses NBP as 12 taught by PAMPAS, correct? 13 ATTORNEY EKLEM: Objection to form. 14 A Well, I mean there are many papers that 15 use -- that doesn't mean they use them in the same 16 exact way and the same exact reason. So just 17 because you're using one algorithm, that doesn't 18 mean you're doing the exact same thing. So the 19 devil's in the details. 20 Q Do you think that the provisional and the 21 Attractive People paper are using the NBP 22 algorithm in different ways for belief	522 1 Q So my question was: Do you think that the 2 provisional and the Attractive People paper, 3 Exhibit 1015, use non-belief propagation -- let me 4 say that again -- use non-parametric belief 5 propagation in the same way? 6 ATTORNEY EKLEM: Objection to form. 7 A No. They do not. 8 Q What is the difference between the way 9 it's used by the provisional and the way it's used 10 by 1015. 11 ATTORNEY EKLEM: Objection to form and 12 scope. 13 A So TLP and 1015 have kind of a 14 single-layer model. They have a model of the 15 components in a sense. Their model uses these 16 paper cylinders as you see in the figures, right? 17 And they've constructed their model based on that. 18 '980 and the provisional have a two-layer, 19 essentially, kind of model. They don't use the 20 paper cylinders. They use a different modeling 21 approach. So just like -- just because two 22 examples, two algorithms use calculus, it doesn't
521 1 propagation? 2 ATTORNEY EKLEM: Objection to form and 3 scope. 4 A So if you go to my Paragraph 42 in my 5 supplemental declaration, I talk about this 6 particular exhibit, the Attractive People 1015. 7 So this is essentially very similar to TLP in the 8 way -- as you see, you look at the figures, 9 there's a lot of similarities. 10 So if you look, for instance, at Figure 1 11 of the Attractive People, and you look at Figure 1 12 of TLP -- or, I'm sorry, figure -- so if you look 13 at Figure 1 of the Attractive People and you look 14 at Figure 1 of TLP, you see it's kind of the same 15 model. 16 And you look at Figure 2 of TLP and you 17 look at Figure 1C of the Attractive People, you 18 kind of see the same model. So there's a high 19 degree of similarity in the way the things are 20 modeled between those -- between Attractive People 21 and TLP, and that's distinctively different from 22 '980 and the provisional.	523 1 mean they do the same thing. This is a totally 2 different approach here in the '980 and in the 3 provisional than we are talking about in the TLP 4 and the Attractive People. 5 Q So the difference is, in your opinion, the 6 models -- the model used in the provisional and 7 the model used in Attractive People is different. 8 But the way NBP is applied is precisely the same, 9 isn't it? 10 A No. 11 ATTORNEY EKLEM: Objection to -- 12 A No. No. 13 ATTORNEY EKLEM: Objection to form. 14 A It's also different. 15 ATTORNEY EKLEM: Hold on. 16 Q How is NBP -- 17 ATTORNEY EKLEM: You've got to slow down. 18 Objection to form. 19 Re-ask your question. 20 A Could you please re-ask the question? 21 Q How is -- NBP, as taught by PAMPAS, 22 applied differently in Attractive People than it

Conducted on August 13, 2024

524 1 is applied to the provisional? 2 ATTORNEY EKLEM: Objection to scope. 3 A So first of all, in the TLP and Attractive 4 People, you have kind of a single-layer model. 5 You don't have a two-layer model. You have a 6 single-layer model. That's the first difference. 7 You're not detecting the probability of an 8 object and components. You're just looking at 9 components in the Attractive and TLP. So your 10 non-parametric models and everything else works 11 with just components. 12 In the provisional and in the '980, you 13 have an object and components. You have a 14 two-layer model. So your parametric models and 15 non-parametric models and the probabilities 16 have – work with objects and components. So 17 these are substantial differences. 18 Q So the belief propagation is the same 19 according to PAMPAS and how it's applied. You're 20 just saying for the provisional, there's is node 21 for the object and for Attractive People, there is 22 no node that corresponds to the object. That's	526 1 way. 2 Does 1015 teach temporal connectivity 3 between a Frame I and Frame J for nodes? 4 ATTORNEY EKLEM: Objection to scope and 5 form. 6 A So for instance, look at 1015. Okay. I'm 7 looking at Page 3 just to give you an example. 8 And I'm looking at the third paragraph down. 9 You see where it says: Each directed edge 10 between parts I and J as an associated conditional 11 distribution Ψ_{IJ, X_i, X_j}, that encodes the 12 compatibility between pairs of part 13 configurations? 14 Q Uh-huh. 15 A Do you see that? 16 Q Yes. 17 A Okay. It models the probability of 18 configuration X_j of parts J, conditioned on X_i of 19 part I. 20 Q Uh-huh. 21 A Okay. Now go to the '980, and go to the 22 formula that we've been looking at all day on
525 1 the difference? 2 ATTORNEY EKLEM: Objection to form. 3 Q Is that correct? 4 ATTORNEY EKLEM: Objection to form and 5 scope. 6 A Well, that difference propagates – like, 7 for instance, in the provisional you have – or in 8 the '980, you have likelihoods for the object. 9 You have likelihoods for the components. 10 In TLP and Attractive, you don't have a 11 likelihood for the object because you're just 12 dealing with components. So these calculations 13 are different. So the models applied underneath 14 them would be different. 15 Q So the models you're saying are different. 16 But the algorithm is the same; am I not correct? 17 A No. You are not correct. They are not 18 the same. 19 Q How is NBP different? 20 ATTORNEY EKLEM: Objection to scope. 21 Q How is it being used different? They're 22 all being treated as nodes. Let me ask it another	527 1 Column 3, Line 60. 2 Do you see where it says: Ψ_{IJ} on the 3 second line there? 4 Q Uh-huh. 5 A That Ψ_{IJ} is across frames, not across 6 components. 7 Q And I'm asking: Does 1015 teach going 8 across Frame IJ for any node? 9 A And you don't – there is no formulation 10 here described like you would see in the '980. So 11 even though it's talking about – it's only 12 looking at components, it has essentially kind of 13 a spatial compatibility modeling, it doesn't show 14 cross-temporal compatibility modeling like you 15 would see in the '980. 16 Q All right. Let's go to Page 7 of 17 Exhibit 1015. 18 A Yes. 19 Q Doesn't that teach that there are several 20 advantages of this approach, including forward 21 backward smoothing? Is that a temporal component? 22 A Where are you looking at?

Conducted on August 13, 2024

528 1 Q I'm looking at Page 7, Exhibit 1015, first 2 paragraph. There are several advantages of this 3 approach, and they list them, including 4 forward-backward smoothing, either over a time 5 window or an entire sequence. 6 Is that not temporal connectivity? 7 A Well, you are looking at forward-backward 8 smoothing because obviously you have some motion 9 knowledge of the parts. But that's completely 10 different from the temporal compatibility that 11 we're talking about in the '980 that I explained 12 to you this morning. 13 Q Why is that? Doesn't PAMPAS -- 14 A I mean, look at the equations. 15 Q Let me ask, doesn't PAMPAS and 16 Loose-Limbed teach temporal connectivity between 17 nodes from Frame I to Frame J? 18 ATTORNEY EKLEM: Objection to form. 19 A I think you're conflating things. You're 20 mixing apples and oranges. 21 Q I am not. 22 A And you're desperately doing it --	530 1 Just like if you look at Zhao. Zhao has 2 Frame X or Frame I, that has an object there. In 3 Frame J, the object has changed. 4 So yes. You can see a difference between 5 them. Zhao has motion estimation to do that. 6 They do similar things in TLP, but you don't have 7 the temporal compatibility that you have in the 8 '980. That's why the formulation in the '980 is 9 different from your formulation is TLP, as well as 10 Attractive People. 11 They're -- I mean, they don't have that. 12 Look at the formulation in TLP. You don't see 13 anything that looks like that equation. 14 Q Do you see Figure 1 and do you see the red 15 lines connecting the two models from the head for 16 Node 9? Does that not convey a temporal 10-pound 17 dependancy between the nodes? 18 A That just shows you where the nodes have 19 gone from frame to frame. That's not the temporal 20 compatibility that we're talking about in the '980 21 where you have a probabilistic model that models 22 that, for the object and across components.
529 1 Q I am not. 2 A -- continuously. Continuously all day 3 you've been doing it. 4 Q I am not. 5 A I mean, just look at the formulations. If 6 I look at the formula on page -- on Column 3 of 7 the '980, you have a temporal compatibility of 8 object between frames. That doesn't exist in 9 these other ones because there is no object level. 10 It's just strictly components. So you're mixing 11 apples and oranges. 12 Q Let's go to Exhibit 1009. 13 A Which is what? 14 Q TLP. 15 A Yes. 16 Q Figure 1. 17 A Yes. 18 Q Does it not show temporal connectivity 19 between Frame I and Frame J for a node? 20 A Well, yes. You have the object in 21 different frames, but you don't have the temporal 22 compatibility that you have in -- in the '980.	531 1 You're mixing apples and oranges. 2 Q I'm not. 3 A Absolutely you are. 4 Q So you don't think that TLP, in the same 5 manner as the '980, uses PAMPAS to message between 6 frames? 7 ATTORNEY EKLEM: Objection to form. 8 A TLP is -- first of all, doesn't have an 9 object and a component layer like we have in '980. 10 Q That wasn't my question. 11 A That's step one. So every time you have a 12 difference that -- these algorithms change. There 13 is no temporal compatibility in TLP across frames 14 like you have in '980 when you look at the 15 formulation. Their formulation is strictly on a 16 spatial-type compatibility and going across 17 frames. So it's apples and oranges. 18 Q And the inventors of the '980 don't 19 acknowledge that TLP is the framework which they 20 are presenting their paper for the '980? 21 ATTORNEY EKLEM: Objection. Form. 22 A Where do you see...

Conducted on August 13, 2024

532 1 Q In the provisional. 2 A I mean, obviously the inventors build on 3 their ideas. But what's in the provisional and 4 what's in the '980 is distinctively different from 5 what you see in TLP and Attractive People. 6 Q And what is that distinctive difference? 7 A I've already said that several times. 8 Q How many distinctive differences are 9 there? 10 ATTORNEY EKLEM: Objection to form and 11 scope. 12 A Well, you have two different layers in 13 '980. You don't have an object layer in TLP and 14 Attractive People. You have a temporal 15 compatibility side function in '980. You don't 16 have that in TLP and Attractive People. 17 So these are substantial differences. You 18 have a likelihood for the object in '980. You 19 don't have that in TLP and Attractive People. So 20 these are distinctive, big differences. So the 21 messaging would have to change. Yes. You use an 22 algorithm, a Bayesian-type algorithm, but the	534 1 correspondence between the frames. 2 Q Temporally. Temporal dependance? 3 A Correspondence between the frames that 4 shows where the part has moved from frame to 5 frame. That's not the temporal probabilistic 6 modeling like it's done in the '980. 7 Q For my clarification, we agree that the 8 provisional doesn't expressly recite the joint 9 probability distribution that's in the '980 spec, 10 correct? 11 A Let's -- for my understanding, let's be 12 sure we're saying the same thing. You're talking 13 about formula Column 3, Line 55 to 65 of the '980? 14 Q Yes. 15 A So that formula isn't printed in the 16 provisional, but it's understood when you read 17 what's being described in the provisional and that 18 analysis is done in my original declaration under 19 column -- under Claim 8. 20 Q Where does the provisional explain that 21 first product -- 22 ATTORNEY EKLEM: Objection.
533 1 devil is in the details and the changes are 2 substantial. 3 Q Can you look at Figure 1 of TLP? 4 A Yes. 5 Q Do you see the last sentence in the 6 caption for Figure 1: In our model, each part I 7 at time T is connected by edge to part I at times 8 T minus 1 and T plus 1. 9 What does that mean to you? 10 A Just what it says. You have a part here 11 and you connect it to T plus 1, and you connect it 12 to T minus 1. 13 Q What's the edge? What's the edge 14 communicate? 15 A That this part used to be here. It's now 16 here. And it used to be here, it's now here and 17 it's now here. 18 So you're basically just correcting -- 19 providing like a correspondence. You know, the 20 object has moved from frame to frame. The part 21 used to be here. It used to be here, and now it's 22 here, and now it's here. They're just providing a	535 1 Q -- in the equation? 2 ATTORNEY EKLEM: Objection to form. 3 A So if you go to my original declaration 4 and you look at Section 6 under the '980 patent 5 starting at Page 36, it describes for each element 6 and each claim where support is in the 7 provisional. 8 Q So let's do it for Claim 8. 9 And my question is: Where does the 10 provisional explain the first product in Claim 8? 11 A So if you go to my original declaration 12 starting on Paragraph 51 on Page 40, I describe 13 where in the provisional the support for this 14 essentially joint probability distribution is 15 described. 16 (Reporter clarification.) 17 Q Okay. I've got Exhibit 1003 in front of 18 me. What does it describe for Claim 8, in 19 particular, that first product? 20 A So you see -- so starting in Paragraph 52, 21 it's describing obviously the joint probability 22 equation, and Paragraph 53 describes the temporal

Conducted on August 13, 2024

536 1 compatibility. And all those terminologies are 2 essentially described in the provisional. So if 3 you go through the provisional, you would find all 4 that terminology basically described there. 5 Q Okay. Point to me where there's a 6 discussion or a teaching regarding the first 7 product of the joint probability distribution? 8 A Well I mean, if you look at the 9 provisional, for instance, Figure 2, you see that 10 the exact same figure is Figure 2A and 2B in the 11 '980 patent. If you look at the graphical object 12 models, Page 5 of the provisional, you see that 13 description pretty much mimics what's being 14 described in the '980 patent starting under the 15 section graphical object models. 16 Q Are you in Section 2? 17 A I'm in Section 2 of the provisional and 18 I'm comparing to Column 3, Lines 47 of the 19 graphical object models of the '980. So you'll 20 see the wording is almost exactly the same. So 21 you see it's talking about all this wording and 22 it's talking about the compatibility Psi functions	538 1 model. So the first thing is you see -- before 2 that even, so you see you have -- on Page 5, it 3 starts with a graphical object model. So when you 4 read that last paragraph, when you read the 5 graphical object model paragraph in the '980, 6 they're essentially identical. You know, minor 7 paraphrasing but essentially identical. 8 And obviously it says in the provisional: 9 Finding and tracking of an object is formulated as 10 in inference over this graphical model. Finding 11 and tracking of an object, not just a collection 12 of components. 13 Then you get into the next page, 6, you 14 see each directed edge between Component I and J 15 has an associated potential function. You get the 16 size that encodes the compatibility between pairs 17 of node states. That's model is mixture of 18 Gaussian. Same thing with the patent on '980, 19 Column 4, Lines 55 to 60. So you see that mixture 20 of Gaussian. 21 Q Is all that in PAMPAS? 22 (Reporter clarification.)
537 1 and how they are modeled. They're just, you know, 2 slightly different of where they put them and how 3 they describe them between the patent and the 4 paper, and the order the things are described. 5 But you still see the graphical model 6 that's being described. You see where it says: 7 Learning spatial and temporal constraints. 8 Section 2.2 talks about learning spatial and 9 temporal constraints. Then you go into 2.3, 10 non-parametric BP; and then 2.4, AdaBoost image 11 likelihoods. 12 So it's essentially describing the same 13 process. So a POSITA reading that would 14 understand that the authors had possession of 15 what's being described in the provisional, what's 16 being described in '980 in the provisional. 17 Now, that equation isn't exactly 18 explicitly printed there, but it's understood from 19 the description. 20 Q What description in particular supports 21 the first product in Claim 8? 22 A Well, you look at building the graphical	539 1 Q Is all that in PAMPAS? 2 ATTORNEY EKLEM: Objection to form. 3 A You're mixing -- 4 Q I'm just asking a question. Is it all in 5 PAMPAS? You can say no if you like. 6 A I think you're mixing apples and oranges. 7 We're talking about the provisional. We're 8 talking about the '980. What PAMPAS are we 9 talking about? 10 Q The provisional heavily relies upon 11 PAMPAS. TLP heavily relies upon PAMPAS. Loose 12 Limbs heavily relies upon PAMPAS. 13 And I'm just asking you, the passage 14 you're reading, is that based on PAMPAS NBP? 15 That's all I'm asking. 16 ATTORNEY EKLEM: Objection to form. 17 Q You can tell me no. 18 ATTORNEY EKLEM: Objection to form, 19 argumentative and scope. 20 A As I've described to you earlier, you 21 know, I can have calculus being applied to 22 different things. It's just, the devil's in the

Conducted on August 13, 2024

540 1 details in the way you're applying it. 2 Q So I'm asking for the detail -- 3 A The detail is -- 4 Q -- on the first product of the joint 5 probability distribution. Where is that -- that 6 devil, that detail, where is that in the 7 provisional? 8 A And I've explained to you where, as a 9 POSITA reading the provisional and looking at the 10 descriptions, the graphical models, I come to the 11 conclusion that the authors possessed the 12 knowledge of these joint distributions when they 13 were built in their provisional -- provisional 14 patent. 15 Q What tickles me -- 16 A That's not the same as the TLP or the 17 Attractive People that we're talking about. 18 Q What tickles me is when we read the 19 provisional and we read '980, there's all this 20 knowledge and synergy that you can bring to bear 21 to what is taught. But when we read the 22 references, it's well, what does it say precisely?	542 1 between them. 2 Q Okay. 3 A So this is clear to me. 4 Q Let's go to Paragraph 33 of your 5 supplemental declaration. 6 All right. So in Paragraph 33, you're 7 discussing the provisional, correct? 8 A You are correct. 9 Q And you're indicating that you can look or 10 send messages between a set of neighbors in 11 Node I, and you say as well as between frames in 12 the parentheticals. 13 Do you see that? 14 A I do. 15 Q And you state that the potential 16 designating, the compatibility between the states 17 of Node I and J, which can mean different frames, 18 correct? 19 A Correct. 20 Q Where does the provisional teach as well 21 as between frames or between the different frames, 22 aren't you adding that to the discussion?
541 1 You know, the approach to the understanding of a 2 POSA and what is understood to me, is quite 3 bright. So here you're saying for the provisional 4 you can't tell me the devil in the detail for how 5 you can formulate the first product and joint 6 probability distribution, where is that taught in 7 the provisional? 8 ATTORNEY EKLEM: Objection to form, scope 9 and argumentative. 10 A And I mean, you have to -- you have to 11 understand what -- I mean, you have to understand 12 this area. This is not -- it's not like you match 13 sentences to sentence. You have to understand 14 technically what's being described. 15 So as a POSITA reading this provisional, I 16 understand what's being described in this 17 provisional patent. 18 Q So long as you apply that approach when 19 we're looking at the prior art, let's go for it. 20 A And the same thing. I mean, as I read the 21 prior art, I understand what's being described 22 there and can explain to you the differences	543 1 ATTORNEY EKLEM: Objection to form. 2 A Well, that's -- you see the reference 3 there of Page 8 and 9 of the provisional. 4 Q Uh-huh. 5 A You see the citation. So you can -- when 6 you read that description there, you, as a POSITA, 7 come to that conclusion. 8 Q So what are you reading and what 9 conclusion? How do you reach your conclusion? 10 Tell me what lines are you reading and how you 11 reach the conclusion that's also between frames. 12 A So you see the discussion essentially 13 starts -- I mean, the context for it is obviously 14 earlier. But the discussion, like when you look 15 at Section 2.3, it starts to get into the 16 discussion of the details. But you obviously have 17 the context from earlier. 18 Like you can see just above 2.3, you can 19 see the paragraph: While this is not strictly 20 necessary, for the ease of the formulation, we 21 assume that the constraints are stationary in 22 time, so i.e., the relative position of the

Conducted on August 13, 2024

544 1 Component I and J is statistically the same for 2 any given frame in our spatio-temporal window. 3 So we're talking about a spatio-temporal 4 window and a given component in that window. 5 Examples of a learned conditional distribution can 6 be seen in Figure 3 CDE, which we can't see very 7 well here. 8 Now, you get into the next section. It 9 starts to talk about the state of the object and 10 its components and their framework, which is 11 obviously a graphical model. It gets into the 12 non-parametric belief. They state that as a 13 generalization of particle filtering where the 14 inference is done over arbitrary graphs. 15 This generalization, the message used in a 16 standard belief propagation is approximated by 17 kernel. You have a conditional distribution. You 18 have a sequential multiscale Gibbs sampling. 19 Individual messages may not constrain the node, so 20 you have product of all incoming messages into the 21 node. 22 And obviously those incoming messages are	546 1 language as in the '980, just done in a different 2 way. 3 So you have the object centric tracking 4 and you have the temporal integration, right? So 5 you have that temporal integration. 6 Q Where are you reading? 7 A I am in -- 8 Q Because the window is moving? I see it. 9 A Yeah. On Page 9, like six or seven lines 10 down, maybe eight lines down. 11 So you see, in an object detection centric 12 way, we reinitialize all nodes every time we shift 13 a window. Hence, the temporal integration is only 14 applied in the window of size W. 15 So you have a temporal integration. And 16 you attract in a centric way, you look at the, you 17 know, the window before and the window after. And 18 then in the same sentence as we've said before, if 19 W is equaling 1, you have essentially the single 20 frame. 21 And then it continues. So you obviously 22 come to this conclusion that, you know, the
545 1 spatially and temporally. Because into the node, 2 you have temporal messaging, just to say: Okay. 3 This node used to be here. It's now here. 4 Q Where is that taught, the temporal 5 messaging? 6 A Well, it's basically saying, you know, 7 however the product of all incoming -- so if you 8 look at the Page 8, pretty much the last 9 paragraph: Individual messages may not constrain 10 the node well. However, the product of all 11 incoming messages into the node -- so these are in 12 the spatio-temporal framework that they have. 13 Now, if you go to the next page, you see 14 they're talking about the local evidence, the 15 likelihood that we've been talking about, you've 16 got the Psi compatibility. And then you get into 17 the next paragraph, which talks about a window 18 frame. 19 So now you're looking at the window for 20 tracking and object detection, where W is an odd 21 integer, and it talks about object detection 22 centric way. So this is essentially the same	547 1 authors possessed the knowledge of this, you know, 2 joint modeling in their two-level graphical model 3 with the likelihoods and the compatibilities that 4 we've been talking about all day. 5 Q TLP has all of that, right? 6 A No. TLP does not have that. 7 Q Does not have compatibilities? 8 A TLP doesn't have an object layer and a 9 component layer. We've gone through this before. 10 Q But everything else you've discussed, TLP 11 doesn't have? 12 A No. TLP does not have an object 13 compatibility across frames. It only has 14 components. It doesn't have the compatibility 15 across frames that we've been talking about. 16 Q For nodes? 17 A Has -- has a different type of model. 18 Q But the NBP, the non-parametric belief 19 propagation, is the same? 20 A No. It's not. 21 Q Applied to the model of TLP, and applied 22 to the model, whatever the model may be, for the

Conducted on August 13, 2024

548 1 '980? 2 ATTORNEY EKLEM: Objection to form. 3 A I think we -- 4 Q We have. Let's continue. 5 A No. It is not the same. 6 Q Aren't the components in Exhibit 1015 7 associated with a node? 8 A 1015. Did you move on to something else? 9 Q Attractive People. I'm sorry. 1015. 10 A I lost where... 11 Oh. 1015. Yes, sir. 12 What was your question? 13 Q Aren't the components in 1015 associated 14 with the node? 15 A So I think we've gone over this a few 16 times now. 17 Q For 1015 we have? 18 A For 1015, you have essentially components 19 model. You don't have a two-layer model. You 20 have a single-layer model. You have tapered type 21 of cylinders that model these components. 22 Q That's my question. Aren't nodes	550 1 A It's completely different in the way it's 2 teaching it than in the '980. You're trying to 3 mix -- it's a square peg -- 4 Q I asked a very simple question. 5 A I'm answering your question. You're 6 trying to fit a square peg in a round hole. It's 7 not the same model. 8 Q I didn't ask if it was the same model. 9 There was nothing about a model in my question at 10 all. 11 I said: Does Exhibit 1015 teach messaging 12 between nodes using NBP and forward-backward 13 smoothing? That's my question. 14 ATTORNEY EKLEM: Objection to form. 15 A And what's being taught there is 16 distinctively different from the '980. That's 17 what I'm trying -- so yes. You're using 18 sentencing here, trying to fit these wordings in 19 the '980, but these are different type of the way 20 they're computed. 21 ATTORNEY BAKER: Objection to strike. 22 Non-responsive.
549 1 associated with components? That's 1015. That's 2 precisely what I asked you. 3 ATTORNEY EKLEM: Objection to form. 4 A So you do have components in -- I mean, 5 you have nodes represent limbs, like he describes 6 in Figure 1. 7 Q Are those components -- 8 A So those would be components. But you 9 don't have a two-layer graphical model. 10 Q So I was asking in Exhibit 1015, does it 11 teach messaging between nodes using NBP and 12 forward-backward smoothing? 13 A And as I explained to you earlier, the 14 devil's in the details of how that's done. When 15 you have a single layer, a component-type model 16 versus a two-layer model, there are difference in 17 the way these probabilities and these likelihoods 18 and these compatibilities are created, modeled and 19 combined. 20 Q I'm asking, yes or no: In Exhibit 1015, 21 does it teach messaging between nodes using NBP 22 and forward-backward smoothing, yes or no?	551 1 Let's go to the next question. 2 BY ATTORNEY BAKER: 3 Q On Paragraph 44 of your declaration. 4 A Supplemental? 5 Q Supplemental. 6 A Yes, sir. 7 Q I'll find the precise line. Maybe you can 8 find it first. 9 You say that: The detection techniques in 10 1015 are beyond the scope of this paper. 11 Let me see if I can find the line for you. 12 So my apologies. It's Paragraph 42. 13 Do you see that that sentence? 14 A No. I'm not sure what sentence you're 15 referring to. 16 Q About halfway down, the sentence starts: 17 The author's proposed a loose-limbed body model. 18 Do you see that? 19 A Yes. Yes. 20 Q Could you read the rest of that? 21 A You mean read it out loud, or... 22 Q Read it to yourself.

Conducted on August 13, 2024

552 1 A Yeah. I think the paragraph itself is 2 explanatory. That's what I've been saying all 3 along. 4 Q Tell me where in Exhibit 1015 it indicates 5 that tracking techniques are beyond the scope of 6 this paper? 7 A You would have to do a Control F to 8 find... 9 Q You cite Page 4. 10 A It's on... 11 Q I think it's in Section 4. It says Id. 12 at 4, but I think that's Section 4. And I think 13 it's the second line, the development... 14 A Yes. 15 Q Does that mean that, that statement, do 16 you equate that to the admission that detection 17 techniques are beyond the scope of this paper? 18 A Well, the development of bottoms-up 19 detectors, I'd say -- explain it, as it's saying 20 here is beyond the scope of this paper. 21 Q Other detectors wouldn't be useable? 22 ATTORNEY EKLEM: Objection to form and	554 1 So you see in the next sentence in my 2 declaration says: This loose-limbed body model 3 does not teach or suggest determining the 4 probability that an object is in an image or doing 5 so by detecting the object in the current image 6 using measurements of the object in prior and 7 later images. So the 1015 isn't talking about 8 that. 9 Q All right. Let's turn to Exhibit 1009, 10 the TLP. 11 A Yes. 12 Q All right. Let's look at Figure 1 again. 13 A Yes. 14 Q Do you agree that node zero corresponds to 15 the torso? 16 A Yes. 17 Q And does the TLP teach that the head, 18 upper arms and upper legs can send messages to the 19 torso? 20 A These are all components. Again, it's 21 not -- it's not -- the whole object is not modeled 22 separately from the components in the TLP, as I've
553 1 scope. 2 A Well, they're basically saying, we've 3 used -- you know, we've used basically bottoms-up 4 information, and the development of these 5 bottoms-up detectors is beyond the scope of this 6 paper. 7 Q And that to you means that they indicated 8 that detection techniques are beyond the scope of 9 this paper? 10 A Well, obviously when you're -- you're 11 doing a bottoms-up detector, so essentially you're 12 looking at the components to try to detect these 13 components. What they're saying is that's beyond 14 the scope of the paper, because in the paper, 15 they're addressing essentially assembling 16 loose-limbed models using that or a method belief 17 propagation. 18 So they're not really concerned with the 19 detection part, as much as they're concerned with 20 the model assembly that they are talking about in 21 here. And you see that essentially in Figure 1, 22 and so on. That's what's meant for this.	555 1 been describing to you all day, compared to what 2 the '980. You have a single-layer model in the 3 TLP and that just addresses components. 4 Q I asked: Does TLP teach that the head, 5 arm and upper legs send messages to the torso? 6 That's my question. Yes or no? 7 A Generally speaking, yes. I mean, you 8 have -- 9 Q Thank you. 10 A They're interconnected. But these are all 11 components. The torso is a component. 12 Q Is a torso the largest component on a 13 human? 14 ATTORNEY EKLEM: Objection to form and 15 scope. 16 A Well, I mean I'm not a medical doctor but 17 that's generally the case. Yes. 18 Q With reference to Figure 4, does TLP 19 explain that protocol, any single message 20 represents uncertain information about the torso 21 pose, the product of these messages tightly 22 constrain the torso position and orientation?

Conducted on August 13, 2024

556 1 ATTORNEY EKLEM: Objection to scope. 2 A I mean, yes. In a sense, you're looking 3 at the different components. But again, TLP is 4 looking at components. A single-layer component 5 model doesn't have the two-layer object models in 6 '980. You can see, if you look on the next page, 7 TLP uses multi-view spaces to do bottoms-up 8 detectors. None of that is in the '980. They're 9 different techniques. 10 Q I was just asking whether or not TLP 11 explains that a single message represents 12 uncertain information about the torso pose, the 13 product of these messages tightly constrains the 14 torso position and orientation. 15 Is that taught, yes or no? 16 A Where are you reading in the TLP? 17 Q Figure 4. 18 A Are you reading the caption? 19 Q Caption. 20 A What are you reading? 21 So the last three sentences -- I think 22 that's what you're reading is the last three	558 1 here. I see the arms here. This must be so you 2 can improve the accuracy by using the products of 3 these messages in this single-layer model that 4 they have. 5 So that essentially makes sense for the 6 single-layer model. That's distinctively 7 different from the '980 and the two-layer model. 8 Q So let's look at Column 6 of the '980. 9 A Yes. 10 Q Lines 42 to 44. Can you read them to 11 yourself? 12 A Yes. 13 Q So it's saying the same thing, isn't it, 14 as we just discussed in TLP? 15 ATTORNEY EKLEM: Objection to form. 16 A Well, again this is a general message. 17 This is a general sentence. But in this case, 18 it's being applied to two-layer models. So you 19 have messages that are components on the object, 20 which is distinctively different from what is done 21 with TLP. 22 You're mixing apples and oranges. We've
557 1 sentences of the caption of Figure 4. 2 Q Do you agree with that statement? 3 A I mean, that's what the author is saying. 4 You read it correctly. 5 Q Can you breathe any life into it from a 6 POSA's perspective? 7 ATTORNEY EKLEM: Objection to form and 8 scope. 9 A Yes. Whatever it says, it says. 10 Q It's what it says? 11 A Yes. 12 Q But for the provisional and the '980, it's 13 whatever it says, plus whatever else you can glean 14 from it from the perspective of a POSA, correct? 15 ATTORNEY EKLEM: Objection to form and 16 scope. Argumentative. 17 A You have a single message because 18 obviously a single message is representing a given 19 node, represents uncertain information about the 20 torso post. The product of these messages, 21 because you have things coming from different 22 places, you obviously know, okay. I see the head	559 1 been doing this all day. 2 Q All right. Can you put in front of you 3 PAMPAS Exhibit 1019, and let's also look at 4 Dr. Bajaj's supplemental dec. 5 A I don't know. Where is that... 6 Q And actually before we go there, you 7 didn't answer my last question. 8 I was asking whether or not the passage 9 from the '980, Lines 42 to 44 says the same thing 10 as the caption of Figure 4 at TLP; is that 11 correct? 12 ATTORNEY EKLEM: Objection to form. 13 A And I answered your question. 14 Q No. You didn't. 15 A Yes. I said to you that even though the 16 wording reads similar, this is -- this wording is 17 being applied to a two-layer model. This wording 18 is just like if I said to you I have an 19 integration, I can have a double integral. I 20 could have a single integral. It doesn't mean 21 they're the same things. 22 This is being applied in the '980 to a

Conducted on August 13, 2024

560 1 two-layer model. Over in the TLP, it's being 2 applied to a single-layer model. They're totally 3 different things. 4 Q Okay. So the PAMPAS, Exhibit 1019. 5 A I guess I'm missing that. 6 Q We haven't done PAMPAS yet? 7 ATTORNEY EKLEM: I don't think we have. 8 A I don't think I have that here. 9 Q I'm going to hand you what's been 10 previously marked as PAMPAS Exhibit 1019. 11 (Previously marked Meta Exhibit 1019 was 12 introduced and retained by Counsel.) 13 Q And do you have Dr. Bajaj's supplemental 14 dec? 15 A I do. 16 Q Let's go to Paragraph 75 of Dr. Bajaj's 17 supplemental dec. 18 A Yes. 19 Q Go ahead and read that to yourself, 20 Paragraph 75. 21 A Okay. 22 Q Do you agree with his conclusions?	562 1 You don't do that. You don't take on the 2 component and say that's the layer and let's fit 3 all the other components. That's not how 4 graphical object models work. 5 Q How about the example in Section 3.3 in 6 PAMPAS? 7 ATTORNEY EKLEM: Objection to form and 8 scope. 9 A So that's just talking about jointed 10 object and clutter. 11 Q So isn't the circle node the object? 12 ATTORNEY EKLEM: Objection to form. 13 A So it's not -- it's not that the object, 14 it's just the way it's modeled. See, the 15 difference between these things and the '980 like 16 TLP. This Figure 1 in TLP, you have these 17 components that are -- 18 Q I'm asking about PAMPAS in Section 3.3. 19 A I understand. 20 ATTORNEY EKLEM: Let him finish his 21 question -- or, his answer before you ask your 22 start your question.
561 1 ATTORNEY EKLEM: Objection to form. 2 A No. 3 Q Can you explain why? 4 ATTORNEY EKLEM: Objection to form and 5 scope. 6 A A POSITA would have understood from 7 PAMPAS, to select a component of the object, the 8 torso, to be representative of the object node X1, 9 the first layer and to conditionally link -- 10 that's not the case. 11 I mean, you're manufacturing things. So 12 that is not the case in PAMPAS. You don't -- 13 PAMPAS has, as I've explained to you earlier. 14 This is a totally different model than the 15 two-layer model here. You don't take a component 16 and make it a layer and make the other ones a 17 second layer. That's not how it works. 18 You're just trying to fit basically a 19 square peg in a round hole. It's not -- that's 20 not it. It's incorrect. 21 Q And what about it is incorrect? 22 A It doesn't -- that's not how it's done.	563 1 A So just like in TLP where you have a 2 series of components that you connect together to 3 essentially create the object. This is a 4 single-layer model. 5 Same thing with PAMPAS. You have a 6 single-layer model that you are essentially 7 connecting these components. That's distinctively 8 different from the two-layer model that we're 9 talking about in '980. You're mixing apples and 10 oranges here. 11 Q You agree that the '980 refers to PAMPAS 12 as its primary teaching for NBP, correct? 13 ATTORNEY EKLEM: Objection to form. 14 A Where do you -- I mean, yeah. The '980 in 15 Column 6, a form of the non-parametric belief 16 propagation PAMPAS proposed by Isard -- and I'm 17 assuming that's the paper we're talking about 18 here -- is implemented to deal with the stats. 19 That doesn't mean it's going to be exactly 20 this. It's just saying I'm going to take this 21 idea from here and import it over to the '980. 22 But it's got to be modeled properly for what I'm

Conducted on August 13, 2024

564 1 doing in the '980. You just don't -- don't bring 2 an integral and say: Oh, it's going to work here. 3 You have to customize it to what you're doing. 4 Q What's the model on 3.3 of PAMPAS? 5 ATTORNEY EKLEM: Objection to form. 6 A So you see in 3.3, we construct a graph 7 representing a jointed object and apply the PAMPAS 8 on it. It doesn't say it's a two-layer graph. It 9 just says graph. You have a single graph. 10 To locating the object in a cluttered 11 scene. The model consists of nine nodes; a 12 central circle with four jointed arms made up of 13 blah, blah. The circle node X1 encodes a position 14 and radius -- each arm, XI. 15 These are totally different than what's 16 described in the '980. 17 Q I'm going to ask you what's the model 18 in 3.3. 19 ATTORNEY EKLEM: Objection to form and 20 scope. 21 A So you're modeling circle node X1 with X0, 22 Y0, R0. So you have the position and you have the	566 1 A It is not. 2 Q Explain why it is not. 3 A Because it's not. You've looked at the 4 equations. You've looked at the figures. It is 5 not. It's like saying would the POSITA look at a 6 Volkswagon and think it's a Lamborghini. 7 Q You would explain the differences, 8 wouldn't you? You would say: Oh. It's round. A 9 Lamborghini is low profile. It's got better 10 tires. 11 So I'm asking you to explain why this is 12 not a -- 13 A Because it's not. It's a single-layer 14 model. There's no second layer description. 15 There's no components and object. There's no 16 compatibility between components and object. 17 There's no multi-layers described. There's no 18 layers described. There's no layer indicators 19 described. There's no layer indices described. 20 It's not a two-layer model. 21 ATTORNEY BAKER: Let's take a quick break. 22 (Recess from 4:22 p.m. until 4:34 p.m.)
565 1 radius. Now, each arm XI has XI, YI, Alpha I, WI, 2 and HI that correspond essentially to the... 3 So Alpha I -- XI and YI are obviously the 4 image coordinate. Alpha I is an orientation 5 angle. And Lambda I is the distance between 6 adjacent edgels, small edgels. 7 (Reporter clarification.) 8 A Now, you see where it says in PAMPAS -- so 9 this is PAMPAS? Yes. 10 The circle node at -- or, each arm node XI 11 equals XI, small xi, YI, Alpha I, WI, HI, and it 12 goes the position that's the XI and YI angle, 13 Alpha I, width and height, WI and HI. 14 So that's how he's modeling each node. So 15 it's location and it's angle and so on. Height 16 and width. 17 Q Would a POSITA have understood this model 18 to be a two-layer model? 19 A No. 20 Q Why not? 21 A It isn't. 22 (Reporter clarification.)	567 1 BY ATTORNEY BAKER: 2 Q Dr. Saber, are you a librarian? 3 A No. 4 Q Have you ever been a librarian? 5 A No. I have not. 6 Q Are you testifying today as an expert 7 regarding the authenticity and public availability 8 of TLP? 9 ATTORNEY EKLEM: Objection to form. 10 A No. I'm not -- that's defined -- I wasn't 11 asked to talk about the authenticity of it. 12 (Reporter clarification.) 13 A I'm not testifying about the authenticity 14 of it. I can talk about the process of how things 15 are sent or the process to accomplish. 16 Q Do you have any personal knowledge 17 regarding the circumstances of the Exhibits 2009 18 and 2010, which I'm going to hand to you now. 19 (Previously marked VL Collective Exhibit 20 2009 was introduced and retained by Counsel.) 21 (Previously marked VL Collective Exhibit 22 2010 was introduced and retained by Counsel.)

Conducted on August 13, 2024

568 1 A What do you mean, personal knowledge? 2 Q Did you receive them in the 2000 time 3 frame? 4 A No. I -- 5 Q Were you CC'd? 6 A No. I wasn't. No. I don't mean -- I've 7 seen these in the confines of this case. 8 Q So the first time you saw them is after 9 you'd been retained as an expert in this case? 10 A That's correct. 11 Q You testified in your declaration that a 12 draft submission of TLP appears to have been 13 submitted directly to official CVPR personnel that 14 were responsible for facilitating confidential 15 peer review under double-blind conditions. 16 Do you recall that testimony? 17 (Reporter clarification.) 18 A Yes. That's typically what happens. 19 CVPR, by the way, is Computer Vision and 20 Patent Recognition. So that's typically the 21 process that happens in many conferences. Some 22 conferences have a double-blind process, like CVPR	570 1 knowledge. 2 Q Were you aware at the time, did you 3 personally see, do you have a personal 4 understanding how TLP was submitted to the 5 conference? 6 A Well, I wasn't sitting with the authors 7 when they submit it, but I have an understanding 8 of the process. 9 Q Do you have an understanding of the 10 process for the particular meeting where TLP was 11 submitted? 12 ATTORNEY EKLEM: Objection to form. 13 A Well, I mean the process is very similar 14 with most well-recognizable conferences or 15 well-recognized conferences. It's a very similar 16 process. You submit your paper to the conference. 17 That submission is held in confidence. It's 18 peer-reviewed. 19 So your submission, an area chair and/or a 20 technical program chair will see your submission, 21 will assign it to reviewers that review your paper 22 in confidence, so you don't know who they are.
569 1 does. 2 Other conferences have non-double-blind 3 process, like when you submit your paper, the 4 author's names are on the paper. They're not 5 deleted from the paper or removed from the paper. 6 But the process similarities are very, very 7 similar. 8 Q When did you first become familiar with 9 CVPR processes? 10 A I don't remember off the top of my head. 11 Q Roughly? 12 A I don't remember. I've been working on 13 conferences since the late '90's. I've served in 14 many different chairs positions, from tutorial 15 chairs to special sections to technical programs 16 chairs, area chairs, reviewer, many, many times, 17 to general chair. I have served in many roles at 18 conferences. 19 Q Do you have any personal knowledge how TLP 20 was submitted? 21 ATTORNEY EKLEM: Objection to form. 22 A I don't know what you mean by personal	571 1 They review the paper and they provide their 2 feedback on your paper, as I have done many times 3 on many papers. And that's essentially what you 4 see when you look at one of these exhibits here, 5 the reviewers commenting back on the paper. 6 Q TLP was submitted to a specific 7 conference, correct? 8 A Correct. CVPR. 9 Q Do you have an understanding of the 10 process for that particular reading where TLP was 11 submitted to CVPR? 12 A I understand the process of CVPR. Yes. 13 Q I'm asking: Do you have knowledge of that 14 year, yes or no? 15 A I don't what you mean, do you have 16 knowledge of that year. I mean, the process is 17 pretty much the same year over year. So yeah. I 18 understand generally the process. 19 Q Has the process ever changed in 20 years? 20 A I mean, there may be some minute changes 21 on things have happened. But the general -- the 22 general umbrella of the process is pretty much the

Conducted on August 13, 2024

572 1 same. 2 Q So I asked a specific question. I hope 3 you give me a specific answer. 4 Do you have specific knowledge of the 5 procedure the year that TLP was submitted to the 6 CVPR? 7 A As I mentioned to you, I understand -- I 8 understand the process of how things are submitted 9 to the conference. That specific year, I wasn't 10 sitting there looking at exactly the process. But 11 the general steps of the process are essentially 12 the same, and they are pretty much the same in 13 many of the conferences. And you can you see that 14 from just looking at the exhibits here. 15 Q What exhibits are you referring to? 16 A The ones you just gave me. 17 Q So are you referring to the exhibits and 18 using them for what day and indicate what happened 19 for the truth of what they say -- 20 ATTORNEY EKLEM: Objection. 21 Q -- relying upon them? 22 ATTORNEY EKLEM: Objection to form.	574 1 CVPR, correct? 2 A I did not submit a paper to CVPR but I'm 3 aware of the process, the general process that 4 conferences utilize. And I was a general chair 5 where I had obviously set the process for the 6 conference. So I'm very well aware of the 7 processes for how conferences are conducted, you 8 know, peer-review process is conducted. 9 Q I'm going to hand you what's been 10 previously marked as Exhibit 1007. 11 (Previously marked Meta Exhibit 1007 was 12 introduced and retained by Counsel.) 13 Q Do you still have the Bajaj supplemental? 14 A I think I do, yes. Yes. 15 Q And also your own supplemental dec? 16 (Reporter clarification.) 17 Q Your own supplemental dec. Put that in 18 front of you as well. 19 A All right. 20 Q All right. Paragraph 48 of your own dec? 21 A Yes, sir. 22 Q You opine that: The key error in
573 1 A Well, I mean you can -- if you look at 2 this exhibit over here obviously the paper was 3 submitted to the conference. The conference area 4 chairs or the person that's handling the review 5 process is replying back to let you know that your 6 review is completed and here is the details. So 7 that's typically what happens in most review -- 8 peer-reviewed conferences. 9 ATTORNEY BAKER: So I'm going to object to 10 that answer is being hearsay as being directed to 11 the truth of what that paper means and what was 12 intended by the author of the... 13 Q Let's go to Steffens. 14 And actually, that's a great question. 15 Were you personally at the 2004 CVPR? Did you 16 attend that one? 17 A No. I did not. 18 Q Did you submit a paper to that conference? 19 A I don't believe so. I don't remember. I 20 don't believe so. 21 Q So you don't have personal knowledge of 22 the process for submitting a paper in 2004 to	575 1 Dr. Bajaj's analysis is that he incorrectly 2 characterizes the normalized scalar products of 3 the amplitude vector of two jets in Steffens as a 4 probability. 5 That's your opinion? 6 A That's correct. And I could prove that to 7 you. 8 Q Does the term scalar product and dot 9 product have the same meaning? 10 (Reporter clarification.) 11 A Generally speaking, yes. 12 Q And doesn't Dr. Bajaj explain in 13 Paragraph 52 of his supplemental declaration that 14 the value range from a dot product of two 15 normalized vectors between 01 -- let me start over 16 and strike the original question. 17 As explained by Dr. Bajaj in Paragraph 52 18 of his supplemental declaration, isn't the value 19 range from a dot product of two normalized vectors 20 between 0 and 1, with 0 being not similar and 1 21 being exactly similar, in real values between them 22 giving the continuous measure of function of

Conducted on August 13, 2024

576 1 similarity; is that accurate? 2 A Of a dot – 3 ATTORNEY EKLEM: Objection to form. 4 Q Yes. 5 A That is incorrect. And I'll tell you why. 6 Q Please. 7 A I want you to write down two vectors in 8 front of you. I want you to write down Vector 1, 9 V1, 3I plus 2J. 10 Q Uh-huh. 11 A And Vector 2, let's make it easy. Vector 12 1 is 3 – again, 3I plus 2J. 13 Vector 2 is minus I plus J. So Vector 1 14 is 3I plus 2J; Vector 2 is minus I plus J. 15 When you compute the dot product between 16 those two vectors, then you multiply the I 17 components and the J components and add that 18 together. So Vector 1 was 3I plus 2J. Vector 2 19 was minus I plus J. So minus I times 3 is minus 20 3, plus 1 times 2 is plus 2. That makes it a 21 minus 1. 22 (Reporter clarification.)	578 1 between minus 1 and 1. 2 Q Isn't the dot product the magnitude? 3 A No. The dot product – the scalar product 4 it's necessarily a magnitude. Just, this is a dot 5 product. Just open your linear algebra book and 6 look at the dot product. The dot product isn't 7 necessarily a product of magnitudes. It's just a 8 scalar product of two vectors. 9 (Reporter clarification.) 10 Q But the dot product is the magnitude and 11 it cannot be negative, correct? 12 A dot product can normalized vectors is a 13 magnitude which is not negative, correct? 14 A A dot product is not a magnitude. A dot 15 product is a scalar product. 16 So I gave you two examples of vector, V1 17 10I plus 2J. It's one vector. 10 in the X 18 direction, 2 in the Y direction. Write it on the 19 piece of paper. 20 Vector 2. Minus I – minus in the X 21 direction, plus J in the Y direction. You compute 22 the dot product between those two, you're going to
577 1 Q So they're pointing in opposite 2 directions? These are totally opposite. 3 A Well, they're not opposite. They're 4 just – they're not 180 degree opposites. They're 5 just pointing in different directions, not 6 opposite directions. But the dot product can be 7 negative, as well as positive. Depends on how the 8 vectors are pointing. 9 Q So to your 0 to minus 1, or 0 to plus 1, 10 or is it minus 1 and 1? 11 A That – well, it can be more. So let's 12 just say V1 is 10I plus 3J, and V2 is minus I, 13 plus J. Two vectors, 10I plus 3J, minus I plus J. 14 So minus I times 10 would make it a minus 15 10. And the plus J, 1J times 2J will make it a 16 plus 2. Minus 10 plus 2 is minus 8. The dot 17 product is minus 8, because that's not normalized. 18 Q I said normalized. That was part of the 19 hypothetical. 20 A So if you're going to normalize it now, 21 you can say divide by the maximum possible value. 22 The value is still negative. It's just normalized	579 1 get minus 1 times 10, plus 1 times 2, which makes 2 it a minus 8. That's the dot product. 3 Q Those weren't normalized vectors? 4 A Okay. Now, if you normalize the two 5 vectors, you take the first vector and divide by 6 norm, right, that vector is still pointing in that 7 direction. 8 You take the second vector normalized by 9 its norm. It's still pointing in that direction. 10 That value would still be negative. It would just 11 be between 0 and 1, and the negative – with a 12 negative number. It's not necessarily a positive. 13 Compute that on the calculator right now. 14 Q Would you agree that the dot product for 15 vectors normalized is a similarity measure? 16 (Reporter clarification.) 17 ATTORNEY EKLEM: Objection to form. 18 A A dot product between two vectors. Open 19 your algebra book. 20 Q Normalized vectors. 21 A Whether it's normalized or not, it doesn't 22 matter. The dot product between two vectors is

Conducted on August 13, 2024

580 1 essentially how much of Vector 1 is represented or 2 rides along Vector 2. So it provides a sense of 3 similarity between the vectors. 4 Q And the higher the similarity, then what 5 does that mean to a POSA? 6 A The closer the two vectors are aligned, 7 the higher the number is going to be. 8 Q And what does that convey to a POSA, the 9 higher a number is? 10 A So when the two vectors are completely -- 11 I would say parallel or they're in the same 12 direction, then you have a maximum value for the 13 dot product. When the two vectors are total 14 opposite, you have a negative value, and that 15 would be the minimum value dot product. 16 Q So the maximum value is a hundred percent 17 similarity? 18 A When they're completely aligned. The two 19 vectors are in the same direction. They don't 20 have to have the same magnitude, just have the 21 same direction. They're completely aligned, you 22 would get the maximum similarity -- the maximum	582 1 likely the probability of that component being in 2 existence? 3 A No. 4 ATTORNEY EKLEM: Objection. Excuse me. 5 Q Why not? 6 ATTORNEY EKLEM: Hold on a second. 7 Objection to form and scope. 8 A No. 9 Q Why not? 10 A A POSA that understands linear algebra 11 will understand that when the dot product is 12 maximum, the two vectors are completely aligned. 13 Q Meaning what? 14 A It means they're in the same direction. 15 They have the same -- if I plot them on the XY or 16 whatever coordinate you're using -- on whatever 17 dimension you're using, it doesn't matter -- 18 they're completely in alignment. 19 Q Why is Steffens using the similarity 20 measure? For what purpose? 21 A Huh? 22 Q Why is Steffens using the similarity
581 1 dot product value. Get a book on linear algebra 2 and look at it. 3 Q And you don't think there's a relationship 4 between the degree of similarity and probability? 5 ATTORNEY EKLEM: Objection to form and 6 scope. 7 A Totally different concepts. 8 Q So the closer to similarity is not the 9 higher probability? 10 A There's no probability in dot products. 11 Q I asked: Is the higher the similarity 12 measure the more likely the probability of the 13 existence of that component. 14 ATTORNEY EKLEM: Objection to scope and 15 form. 16 A And what I'm telling you is, you go to 17 your library tonight and open -- grab a book on 18 linear algebra, open it up, look up a dot product 19 and there is no discussion of probability in dot 20 product. They're completely different concepts. 21 Q My question is: Would a POSA understand 22 that the higher the similarity measure, the more	583 1 measure? For what purpose? 2 ATTORNEY EKLEM: Objection to form and 3 scope. 4 A To see how well Image 1 is aligned with 5 the features from Image 1 that he computes using 6 the wavelet transforms are aligned with the 7 features of Image 2. Just like you would align 8 two vectors. If I wanted to know is vector V1 9 aligned with vector V2, I would compute a dot 10 product to see how well they're aligned and I 11 would look at their angle to see the alignment. 12 That has nothing to do with probability. 13 Q Does it have anything to do with object 14 detection, the similarity measure? 15 ATTORNEY EKLEM: Objection to form. 16 A I mean, it depends on the context of what 17 you're doing. 18 Q In the context of Steffens. 19 A So I'm doing -- if I'm doing face 20 recognition, then the similarity measure has to do 21 whether my face matches this face in a particular 22 image. If I'm doing a skin detection, the

Conducted on August 13, 2024

584 1 similarity measure is going to be how well does 2 this skin color matches that color. 3 If I'm doing -- in Steffens, Steffens is 4 doing a wavelet transforms. It's capturing the 5 coefficients that transform and doing similarity 6 to another image wavelet transforms, and seeing 7 how well the two are similar. It has nothing do 8 with probability. 9 Q But it's to see how similar the two -- 10 A Computing similarity. Now, I'm going to 11 point you to something also important in Steffens. 12 So you notice the -- go to Column 10 in Steffens 13 and let me know when you're there. 14 Q I was going to ask you questions about it 15 but I'll give you a couple seconds. 16 A So you notice those two equations on 17 similarity in Steffens. Do you see that on 18 Column -- Column 9 in the bottom? 19 Q Uh-huh. 20 A Look at the second equation. Do you see 21 there's an AJ AJ cosine in Column 9. 22 Q I think I'm --	586 1 has features to see how the two -- how well the 2 two are similar in this multidimensional space. 3 Q How does Zhao use its Bayesian similarity 4 measure? For what purpose? 5 (Reporter clarification.) 6 ATTORNEY EKLEM: Objection. Form. 7 A You're mixing -- 8 Q I'm asking for -- we talked about 9 similarity measures, first step, and you explained 10 to me how it's used. I'm now asking: Zhao does 11 use a Bayesian similarity measure, yes or no? 12 (Reporter clarification.) 13 A So Zhao's process is a probabilistic 14 process, right, computed probability, essentially. 15 Computes a posterioric probability for these 16 contours, and it's a probabilistic approach. 17 Q To determine what? What's the point of 18 similarity measure? 19 A To determine, you know, how similar this 20 contour is to something else, you know, in his 21 image. 22 Q Okay.
585 1 A Column 9, Line 62. 2 Q Uh-huh. 3 A Do you see that cosine there? 4 Q Uh-huh. 5 A So cosine or an angle can be positive or 6 negative depending on where the angle is. So a 7 cosine can be negative, as you know, and can be 8 positive. 9 So cosine goes between minus 1 and 1. 10 Grab your calculator on your way home tonight and 11 do a cosine. So when the cosine is negative, that 12 number is going to be negative. 13 Q But wasn't my question: Why was Steffens 14 using similarity measures? What was the purpose? 15 A I explained to you is because Steffens is 16 computing a wavelet transforms of, say, Image X. 17 Image X computes a wavelet transforms this region. 18 How is this region similar to that region? 19 Computes a wavelet transforms to that region and 20 then looks at the similarity between the 21 coefficients to see -- because using the 22 coefficients of the wavelet transforms essentially	587 1 A So it's a probability measure. This is a 2 completely different thing here. This is a 3 similarity dot product. This is not a 4 probability. You're mixing different concepts. 5 Q I'm comparing similarity measures versus 6 similarity measures I believe. 7 A I don't think so. I think you're mixing 8 different concepts. 9 ATTORNEY EKLEM: Objection to form. 10 Argumentative. 11 Q Let's be precise. Page 25 of Zhao. 12 A Meta Page 25 or thesis Page 25? 13 Q Meta. 14 A Yes. 15 Q Doesn't Zhao teach that is uses the 16 Bayesian similarity measure -- 17 A Yes. 18 Q -- to evaluate the degree of resemblance 19 between a contour and the assembled human model? 20 A Yes. 21 Q Okay. 22 A It states that. But that's -- this

Conducted on August 13, 2024

588 1 description of similarity is completely different 2 from what you're talking about in Steffens. So 3 this is a probabilistic-based thing. They're 4 completely different concepts. 5 Q Does Steffens use a spatio-temporal model? 6 ATTORNEY EKLEM: Objection to form. 7 A Steffens does not have a probabilistic 8 spatio-temporal model. 9 Q I just asked whether it has a 10 spatio-temporal model, yes or no? 11 A So it's just a face recognition from video 12 images. It doesn't appear to have a 13 spatio-temporal model, you know, probabilistic 14 model as described in the -- 15 Q Does the term spatio-temporal model occur 16 in Steffens? 17 ATTORNEY EKLEM: Objection to form. 18 A I have not -- don't remember off the top 19 of my head. I would have to look. You can you do 20 a search, and I don't believe that's the case, but 21 I would have to look. I don't believe so but... 22 Q Does Steffens use a video?	590 1 similarity. Those are totally different than 2 what's described in the '980. Apples and oranges. 3 Q All right. Is it your opinion that a 4 feature of Steffens is different than a component 5 as recited in the claim? Are those different 6 things in your opinion? 7 (Reporter clarification.) 8 A Yes, sir. 9 Q Why? 10 A A feature, like edge for instance or a 11 corner, when you see in Steffens, you have these 12 different landmarks, for instance, or points. I 13 mean, that's not the same thing as the component 14 that you're looking at from a region-based type of 15 approach like you have in the '980. 16 Q Is a landmark different than a component? 17 A I mean, the landmark would be something 18 like a corner. Like, say I have a corner on the 19 car is a landmark, versus a component would be 20 like the tire on the car. It's not -- 21 Q Did Steffens say that a nose could be a 22 landmark?
589 1 ATTORNEY EKLEM: Objection to form. 2 A Well, it's face recognition from video 3 images. So it looks at the video frames, because 4 the frames are coming in, and it does -- and 5 analyze them on a frame by frame basis. It's not 6 a spatio-temporal model like you would -- like is 7 described -- it's certainly not a probabilistic 8 model that's described in the '980. 9 Q Does Steffens use -- does Steffens measure 10 the object as a collection of components? 11 ATTORNEY EKLEM: Objection to form. 12 A Steffens has a totally different approach. 13 Steffens is talking about -- you've got regions. 14 He's doing a wavelet transforms. He's -- it's 15 not -- the components in the '980 is a completely 16 different description than the landmarks and 17 components that we're talking about here in 18 Steffens. 19 Q Are you saying a nose is not a component? 20 A No. These are totality different 21 concepts. You're looking at landmarks and 22 features here and wavelet transforms and	591 1 A Well, Steffens approach is based on, you 2 know, you have essentially facial recognition 3 capturing video images, you're doing landmarks and 4 then you're computing the wavelet transforms. 5 You're doing matching to, you know, database and 6 you're saying: Okay. This is jetting. 7 Q My question is: Is a landmark the same 8 thing as a component? 9 A The landmark with Steffens, I explained to 10 you would like, you know, for instance, look at 11 Column 9 of Steffens. 12 You see where it says: The model graph 13 168, and this is talking -- it looks like around 14 Figure 13. 15 So you see it says: That it's 16 particularly designed for finding the human face 17 in an image is shown in Figure 12. 18 So they're talking about Figure 12. 19 Q If you could go to Column 9, Line 1, I 20 would appreciate it. 21 A Yeah. That's what I'm looking at. 22 Column 9, Line 1.

Conducted on August 13, 2024

592 1 So you see the numbered nodes of the graph 2 of the following locations: Right eye pupil, left 3 eye pupil, top of the nose, right corner. 4 So these are kinds of landmarks. 5 Q Those are not components of the face? 6 A Those are not -- those are not components 7 in the sense of the '980 components that we're 8 talking about. Those are described as landmarks. 9 These are typically what we refer to as features 10 or landmarks, not reading components. 11 Q So you're distinguishes between the tip of 12 the nose of a face would not be a component of the 13 face if the face were the object? Is that your 14 position? 15 (Reporter clarification.) 16 Q If the face were considered the object, 17 are you saying the tip of the nose would not be a 18 component of the face? 19 A So component has a certain meaning in the 20 '980. In the context of the '980, component has a 21 certain meaning. The word component, these things 22 in the Steffens are all landmarks and features.	594 1 Q All right. Let's go on to Ozer. 2 A How much time do we have left here? 3 (Reporter clarification.) 4 ATTORNEY BAKER: We can pause the record 5 for a second. 6 (Recess from 5:08 p.m. until 5:08 p.m.) 7 BY ATTORNEY BAKER: 8 Q I've just handed you what's been 9 previously marked as Exhibit 1008. 10 (Previously marked Meta Exhibit 1008 was 11 introduced and retained by Counsel.) 12 Q That's the Ozer reference, correct? 13 A Yes, sir. 14 Q So Paragraph 58 of your supplemental 15 declaration, is it your opinion that Dr. Bajaj is 16 incorrect when he concludes that Ozer's detection 17 process uses Ozer's motion classification process 18 to detect objects? 19 A Ozer is talking about activity 20 recognition. So if you look at Figure 4 of Ozer, 21 you see he's got a video input, the -- 22 (Reporter clarification.)
593 1 They would not be described as components of the 2 face. 3 And because the word component in the '980 4 has a certain context features. Steffens 5 describes these as features and landmarks. The 6 word component doesn't show up in Steffens in his 7 description. 8 Q So I have to have precise words in the 9 prior art in order for the prior art to read only 10 claims? Is that your position? 11 A Well, you have to understand what the 12 prior art is the doing and what is happening in 13 the prior art, you don't just randomly fit things 14 and say: Okay. I'm looking to work a component. 15 Let me just fit whatever I can grab. 16 Q Is it your position that the tip of the 17 nose is not a component of the face? 18 A That is correct. The tip of the nose is 19 not a component of the face in the context of what 20 component is being described in the '980. That's 21 important to understand that. The context is 22 important.	595 1 A So Ozer has Figure 4. You can see in Ozer 2 you have a video input. Then Ozer performs a 3 background elimination and color transformation, 4 performs a segmentation, then performs a contour 5 generation. 6 All that is now done on the single frame, 7 does ellipse fitting, still on the single frame; 8 does object modeling, still on the single frame; 9 does graph matching, still on the single frame; 10 and then does multiple frame classification 11 because it's applying frame to frame to frame. 12 What Ozer goes after is the activity 13 recognize that -- obviously as I mentioned. So 14 there is no spatio-temporal model in the context 15 of the '980 with a probabilistic modeling like we 16 described in '980, with the two-level graphical 17 models as described in '980, in Ozer at all. 18 Q All right. Let's go to Column 7, Line 33, 19 the section titled: Classifying Over Multiple 20 Frames. 21 Are you there? 22 A Yes, sir.

Conducted on August 13, 2024

596 1 Q Okay. So the output of the graph matching 2 algorithm is the classified object parts, correct? 3 A Which are done frame by frame, not 4 temporally across frames. Yes. 5 Q The movements of the object parts are 6 described as a spatio-temporal sequence of feature 7 vectors that consist of the direction of the 8 object part movement, correct? 9 A Yes. 10 Q What does that mean to you? 11 A Okay. So that's exactly what I was trying 12 to say. 13 So you see, the first sentence that you 14 read, it says: Output of the graph matching 15 algorithm is the classified object parts. 16 That's done on a frame by frame basis. 17 The second sentence says: The movement of 18 the object parts are described as a 19 spatio-temporal sequence of feature vectors. 20 So here you have the object parts. You 21 complete feature vectors, and you look at this 22 feature, and you say: This feature used to be	598 1 configuration in the next frame? 2 ATTORNEY EKLEM: Objection to form. 3 A So as I described to you in Figure 4 of 4 Ozer, so you see all that is happening, all that 5 is done is on a single frame with the exception of 6 the last piece, which is 408. So everything else 7 up to 408 is strictly on a frame by frame basis. 8 There's no probabilities and any kind of 9 compatibility between frames. 10 When you get to multiple frame 11 classification, you see when you read that 12 sentence that essentially says: Okay. Now, 13 classified over multiple frames, I'm going to find 14 this feature in this frame, which is over here in 15 the other frame, and I have to define a motion 16 vector. So I have a motion vector that's 17 deterministic. There's no probability here 18 whatsoever in that particular computation, 19 completely different from '980. 20 Q That wasn't the question. 21 Does the model have one configuration in a 22 frame and a change configuration in the next frame
597 1 here. It's now here in the next frame. So you 2 have a deterministic motion vector that describes 3 this movement of this feature vector. And that 4 essentially is going to say to you: Well, the 5 object used to be here. It's now moved over here. 6 This is a deterministic motion estimation 7 just like Zhao does. It's a deterministic motion 8 estimation. There's no -- 9 Q Is it a spatio-temporal model being used? 10 A spatio-temporal model? 11 A It's a -- well, first of all, the word 12 spatio-temporal model doesn't exist in Ozer. Ozer 13 only references -- talks about a spatio-temporal 14 sequence and that only appears once, and that's a 15 deterministic motion essentially of feature 16 vector. This has no probability in it. No 17 compatibility in it. No description of these 18 whatsoever when it comes to the spatio-temporal 19 sequence of the feature vectors that are being 20 described in this. 21 Q In Ozer, does the model have one 22 configuration and one frame, and then a changed	599 1 as part of the classification? 2 A I don't know what you mean by model 3 configuration in a frame -- 4 Q Does Ozer use a model? 5 A Ozer doesn't -- doesn't use a model. Ozer 6 takes a video frame -- look at Figure 4 -- takes a 7 video frame, does a background illumination so you 8 can focus on the foreground region, does a color 9 transformation to make it easier to find, does a 10 segmentation. 11 Q And then what does it do? 12 A That does -- that's all part of 13 essentially working on the frame. 14 Q What's step 406? 15 A Then goes to contour generation, still on 16 this frame; ellipse fitting, still on the frame; 17 object modeling, still on the frame. 18 Q It's a video input, right? 19 A But it's analyzing them frame by frame. 20 It doesn't have compatibility across frames. 21 Q So when it does an object model in 406, on 22 a frame of the video, it has some model. For the

Conducted on August 13, 2024

600 1 next frame of that video, has that model changed 2 configuration? 3 A Well, if that frame has changed – so if I 4 had a frame that has a human in it, and then the 5 next frame has a cat in it, the model is obviously 6 going to change from frame to frame. 7 Q What if it's the same human in one frame 8 but the human has moved in the next frame? Will 9 the model change configuration? 10 A So the model in the second frame would 11 model what has changed in that particular frame. 12 The point is that model doesn't comprehend cross 13 frames. The only thing that's cross frames is the 14 feature motion that I described to you earlier 15 from that section you're pointing to. There's no 16 probability here. There's no spatio-temporal 17 models with probability. 18 Q Is it correct that Ozer checks the 19 direction of the movements of the object parts for 20 a number of frames? 21 ATTORNEY EKLEM: Objection to form. 22 A Where are you reading?	602 1 understood that Ozer's activity classification 2 encompasses object motion tracking over multiple 3 frames to classify or discriminate between various 4 motion trajectories. 5 Isn't that accurate? 6 ATTORNEY EKLEM: Objection to form. 7 A It's – it's not said exactly accurate. 8 Because the object motion tracking over multiple 9 frames is essentially not done in a probabilistic 10 way. This is just – the object detection is done 11 on a frame by frame basis. The feature tracking 12 is done using the motion vectors I just described 13 to you, and that's essentially how you connect the 14 frames by using deterministic motion and define 15 the trajectory. But there's no probability here 16 at all in this type of spatio-temporal modeling 17 that you have here. 18 Q So you agree that the object motion 19 tracking occurs over multiple frames. What you're 20 saying is that it's not done in a probabilistic 21 way? Is that a fair assessment of what you just 22 said?
601 1 Q Column 7, Lines 33 to 45. 2 Would it be correct to say that Ozer's 3 system checks the direction of the movements of 4 the object parts for a number of frames? 5 A Yeah. Obviously it says that sentence. 6 You read that sentence correctly. 7 Q What does that sentence mean? 8 A I've described that to you already. So 9 you have an object part. You have this feature 10 here. Corner. It's moved over here. 11 You have a motion vector. It's moved over 12 here in the next frame. You have another motion 13 vector. It's moved over here in the next frame. 14 You have another motion vector. So this is a 15 deterministic motion vector that's showing you 16 where the part has moved. 17 It's as simple as that. There's no 18 probabilistic discussions here. There's no 19 probabilistic modeling. There's no compatibility 20 modeling. None of that is this... 21 Q Paragraph 60 of Bajaj's supplemental. 22 Dr. Bajaj opines that a POSITA would have	603 1 ATTORNEY EKLEM: Objection. Form. 2 A Yes. The motion – the object detection 3 is done on a frame by frame basis in Ozer. There 4 is no probability there. It's completely frame 5 dependent with no probabilistic model. 6 Q But the motion tracking itself is over 7 multiple frames, correct? 8 A The tracking from frame to frame is 9 tracking the features from the frame to the next 10 frame using deterministic motion. There's no 11 probability. There's no compatibility. There's 12 no graphical modeling. None of that exists here. 13 And then he gets to the activity, which 14 basically says: I see a human walking with a 15 suitcase. That's the activity that also is trying 16 to get that. But the underlying algorithms don't 17 utilize the probabilistic modeling as described in 18 the context of the '980. 19 Q And doesn't Ozer use Hidden Markov Models 20 for his inference of the motion, for example, the 21 walking activity? 22 (Reporter clarification.)

Conducted on August 13, 2024

604 1 A But that's for the probabilities of the 2 activities with the known activities. You have a 3 known activity. This is what I expect to see 4 when a car is driving down the road. This is what 5 I expect to see when somebody is walking with a 6 suitcase or walking with a dog. 7 So you have an activity. That activity, 8 we have a known activity using Hidden Markov 9 Models essentially and it chooses the pattern of 10 the highest probability. That's distinctively 11 different from the '980. The '980 is not using 12 Hidden Markov Models. 13 Q Does Ozer describe those Markov models -- 14 Hidden Markov Models as being probabilistic? 15 A You're mixing apples and oranges. 16 Q I'm asking: Are the Markov models 17 probabilistic? 18 A You're computing a probability from the 19 Hidden Markov Model. There's no Hidden Markov 20 Models in the '980 at all, description. 21 Q I asked you whether Ozer uses 22 probabilistic Hidden Markov Models for inference?	606 1 the highest probabilities. 2 Because I'm comparing the one in the 3 frames to activity one in my database. I'm 4 comparing the second one, my frame to activity two 5 in the database. I'm comparing one of my frames 6 to activity three in the database. And I'm 7 choosing the one with the highest probability. 8 That is totally different stuff than what you're 9 talking about in the '980. So yes, you're using 10 probability. But this is a completely different 11 context. 12 Q Are you using probabilities to infer 13 motion? 14 ATTORNEY EKLEM: Objection to form. 15 A No. He's using probability -- he's 16 calculating, he's finding -- you have a database 17 of activities. I have a hundred activities in my 18 database -- walking the dog, driving the car, 19 playing tennis, whatever. I have a hundred 20 activities in my database. 21 I took a frame of video. I defined the 22 activity, and now I have a set -- you know, I've
605 1 ATTORNEY EKLEM: Objection to form. 2 A So he's using Hidden Markov Models and 3 he's choosing the pattern with the highest 4 probability as a recognized activity. 5 So Markov models have states. Hidden 6 Markov Models means you're not able to observe the 7 state. You're just observing the outcome. I see 8 somebody walking in this door with a wet -- soggy, 9 wet shirt. I think it's raining outside but I'm 10 not able to see directly the state. I can look at 11 the outcome and try to infer what the state is. 12 So these Hidden Markov Models go after these type 13 of things you can't see. 14 Q Is it probabilistic? 15 A So he's computing. He's choosing the 16 pattern with the highest probability. So he's 17 using Hidden Markov Models to define the activity 18 in the frames. He's got an activity in his 19 database that says: This is what I'm expecting to 20 see when someone's walking their dog, and he's 21 comparing the activity in the database to what 22 he's seen in the frames and choosing to run with	607 1 done some work in my video, and now I'm comparing 2 to these hundred activities to see which one. Are 3 they playing tennis or am I walking the dog? So 4 I'm doing the probabilistic comparison there to 5 pick the one with the highest probability, like 6 you would do in maximum likelihood. 7 (Reporter clarification.) 8 A So this is distinctively different from 9 what we're talking about in the '980. 10 Q Can you turn to Column 4, Lines 35 to 37 11 in the Ozer? That passage teaches that Ozer -- 12 let me just read it. 13 After the detection of the object parts, 14 the system is ready to recognize the activities of 15 each object part and the overall activity of the 16 object, correct? 17 A Yes. 18 Q So its tracking each object part and it's 19 also tracking the object as a whole, correct? 20 ATTORNEY EKLEM: Objection to form. 21 A I think we discussed that already. 22 Q I don't think we have.

Conducted on August 13, 2024

608 1 A So if you look at Figure 4 of Ozer, which 2 I've pointed to you several times now, you have a 3 video input. You've done your segmentation, your 4 contour, the ellipse, the object model, your graph 5 match. You're essentially within the frame. You 6 define the object. Here's my object. Here's the 7 features. 8 Q You find the object and you find the 9 features? 10 A I found the object in my frame, so I know 11 where -- you know, here's the corners of the 12 object. I see -- I have another frame. I see the 13 object. I see this corner is now here, so I have 14 a motion vector. 15 As I look at the motion of how the object 16 has moved from frame to frame in a deterministic 17 motion model, I define and I potentially have an 18 activity. I compare that to my database of a 19 series of canned hundred activities and I 20 determine which one from that database has the 21 highest probability of being what's in this video. 22 Totally different from the '980.	610 1 not objects of interest. 2 I have a deer walking in the backyard. 3 I'm not interested in deer. I just want to know 4 if somebody's walking around my backyard for 5 security purposes. 6 ATTORNEY BAKER: Ten minutes, five 7 minutes? What do I have left? 8 THE COURT REPORTER: 6:44. 9 ATTORNEY BAKER: Okay. I'm not going to 10 use all 16. 11 All right. I'm going to ask you a couple 12 of questions regarding the TLP, take a five-minute 13 break, check my notes, and we should be done. 14 ATTORNEY EKLEM: Are we taking a break 15 right now? 16 ATTORNEY BAKER: No. I'm going to ask a 17 couple of questions about TLP, and I mean a 18 couple, take a break and then I'll be done. 19 BY ATTORNEY BAKER: 20 Q So TLP, if we could turn our attention to 21 Page 2,1? 22 A Yes.
609 1 Q Can you go to Column 6 of Ozer, please? 2 A Okay. 3 Q Do you agree that Ozer teaches there that 4 it tracks on the objects that fit the model of the 5 user defined subject, such as human, any rigid 6 object, dog? 7 (Reporter clarification.) 8 A You are reading where in Column 6? 9 Q 23 to 24. It tracks. 10 A Yeah. You read that correctly. 11 Q So what does that mean, that those are 12 tracked objects? 13 A Tracks only objects that fit the model of 14 the user defined subject. So it's not going to 15 track -- for instance, if I'm interested in humans 16 and humans walking their dog, I'm not going to 17 track a car driving down the road. 18 So I'm tracking objects that I'm 19 specifically interested in. You know, that's why 20 the next sentence says: This makes the system 21 more accurate because it easily rejects many 22 elements in the scene that may be moving but are	611 1 Q Doesn't TLP teach that its loose-limbed 2 body model requires a specification of the 3 probabilistic relationships between joints at a 4 given time instant and over time? 5 ATTORNEY EKLEM: Objection. Form. 6 A Yes. You read that correctly. 7 Q What does that mean to you? 8 A The loose-limbed body model, just like you 9 see in Figure 1, you have a loose-limbed body 10 model requires a specification of the 11 probabilistic relationship between joints. So you 12 have the probabilistic relationship between joints 13 at a given time instant. So at a given time 14 instant, you have a probabilistic relationship 15 between these joints and over time. 16 But this is a single-layer model. We've 17 been over this now many times. This is a 18 single-layer model. There's no object in 19 components. There's no compatibility between 20 object to object, object to components. Those are 21 completely missing from this model. This is just 22 nodes to nodes, and that's it.

Conducted on August 13, 2024

612 1 Q Over time? 2 A Within and over time. But there's no 3 second layer to this. There's no object or 4 component layer. This is just a... 5 Q There's temporal connectivity between 6 nodes and over time? 7 ATTORNEY EKLEM: Objection to form. 8 A Between the joints, this is a joint -- 9 you're not looking at the component. You're 10 looking at the joint at a given time instant and 11 over time. There's no object level and component 12 level. There's no compatibility between the 13 object and the component. There's no object to 14 object. 15 You know, you're comparing apples and 16 oranges. We've been over this a hundred times 17 today. 18 Q And doesn't the TLP conclusion state that 19 TLP presents a probabilistic method for fully 20 automatic 3D human detection and tracking? 21 ATTORNEY EKLEM: Objection to form. 22 A You read that sentence correctly.	614 1 A Column 3, Line? 2 Q 60. 3 A Yes, sir. 4 Q Okay. Do you remember being asked 5 questions today about the joint probability 6 distribution between Lines 55 and 65 in Column 3? 7 A Multiple times, yes. 8 Q Okay. Do you remember being asked about 9 the first multiplier, which is approximately at 10 Line 60? 11 A Yes, sir. 12 Q Okay. So that first multiplier, we have 13 the Psi IJ (X superscript 0 sub I, X superscript 0 14 sub J). 15 Do you see that? 16 A I do. 17 Q Can you explain what that is? 18 A Yes. So if you go to Column 4, first 19 line, you see it's, you know, obviously it's -- 20 there's a typo there. It should say -- as I 21 mentioned earlier, Psi I -- the K should be J. 22 Other than that, it's a temporal
613 1 Q Do you agree with it? 2 A Well, they provide a probabilistic method 3 for fully automatic 3D human detection and 4 tracking. Generally speaking, that's what they're 5 doing. And the devil's in the details, as we have 6 been over this I think a hundred times today. 7 ATTORNEY BAKER: All right. We can take a 8 five or 10-minute break, and we should be done. 9 (Recess from 5:34 p.m. until 5:39 p.m.) 10 ATTORNEY BAKER: Thank you. 11 No further questions. 12 THE WITNESS: You're very welcome. It's 13 good to see you. 14 ATTORNEY EKLEM: Okay. Let me see here. 15 One second here. 16 EXAMINATION 17 BY ATTORNEY EKLEM: 18 Q Dr. Saber, could you get the '980 patent 19 and put that in front of you please, Exhibit 1001? 20 A Yes, sir. 21 Q And could you turn to Column 3, please, 22 around Line 60?	615 1 compatibility of objects stayed between Frame I 2 and Frame J. 3 So if you look at Figure 2A, for instance, 4 you have an object OTE and then you have the 5 object in another frame. So that's the temporal 6 compatibility of object states between Frame I and 7 Frame J. 8 Q Okay. Is the temporal compatibility 9 represented by anything in Figure 2A, or 2B for 10 that matter? 11 A So as I just mentioned, so you see the 12 object layer in Figure 2A that's labeled 2 or 3? 13 So that object layer, you have the object at time 14 Index T. You have the object at time index that 15 say T plus 1 and T plus 2. So the compatibility 16 between the object and across frames is 17 represented by that Psi IJ. 18 Q Okay. In Column 4 between Lines 9 and 17, 19 there's a paragraph. It's a long sentence, but I 20 guess I better, for the record, read this whole 21 thing. I'm going to ask you a question about this 22 sentence.

Conducted on August 13, 2024

616 1 It says: According to an embodiment of 2 the present disclosure, a system comprises the 3 following modules: The graphical modules, an 4 inference module providing the ability to infer 5 the state of each node in the graph, a local 6 evidence distribution or image likelihood module, 7 a proposal process module for some or all nodes in 8 a graphical model, and module comprising a set of 9 spatial and/or temporal constraints corresponding 10 to the edges in a graph. 11 Do you see that? 12 A I do. 13 Q Okay. I want to ask you about that very 14 last part. Where it says: Set in spatial and/or 15 temporal constraints corresponding to the edges in 16 a graph? 17 A Yes, sir. 18 Q Are there edges in the Figures 1 and 2 -- 19 I'm sorry -- Figures 2A and 2B that you were just 20 describing? Are there edges in those figures? 21 A Yes. So if you look at the figure, you'll 22 see the components are interconnected, and then	618 1 Q Okay. Could you take the provisional and 2 put that in front of you. That's Exhibit 1003. 3 A Yes, sir. 4 Q And go to Meta Page 6? 5 A Yes, sir. 6 Q Okay. There's -- I want to say that the 7 second full paragraph near the top half of the 8 page, the first sentence of the paragraph is: The 9 framework presented here. 10 Do you see that? 11 A Yes. 12 Q Okay. Again, let me just read it in. 13 It's kind of a long one. 14 The framework presented here can be viewed 15 as having five distinct components. 16 (Reporter clarification.) 17 Q The framework presented here can be viewed 18 as having five distinct components: A graphical 19 model; an inference algorithm that provides 20 ability to infer a state of each node in a graph; 21 a local evidence distribution or image likelihood; 22 a proposal process for some or all nodes in a
617 1 there's a connection between the object layer and 2 the component layer. So those are essentially 3 considered edges. 4 Q Okay. Are there edges that correspond to 5 temporal constraints? 6 A Yes. So if you go from the object to the 7 next frame object, those will be your temporal 8 constraints. 9 Q Okay. Are you looking at those lines with 10 the ellipses in them? Are those the things you're 11 talking about? 12 A Yeah. So you go -- like say, on the 13 object layer, you go from object to object. You 14 have a temporal connectivity. Those are your 15 temporal connectivity and constraints. 16 Q Okay. So the temporal connectivity 17 constraints for the temporal compatibility, as you 18 said just before, we're talking about the edges 19 connecting the object nodes across time; is that 20 correct? 21 A That is correct. 22 (Reporter clarification.)	619 1 graphical model; and a set of spatial and/or 2 temporal constraints corresponding to the edges in 3 a graph. 4 Do you see that? 5 A I do. 6 Q Okay. The last part of that sentence is 7 marked by -- I didn't read it out -- by Roman 8 numeral V, which is Roman five? 9 A Yes. 10 Q Spatial and/or temporal constraints 11 corresponding to the edges in a graph. 12 Do you see that? 13 A That's correct. Yes. 14 Q Okay. On the next page, Meta Page 7, are 15 Figures 2A through 2D. Do you see those? 16 A I do. 17 Q And Figures 2C and 2D, do you see edges? 18 A Yes. They're the same figures as the 19 '980. 20 Q Okay. Are there any edges that correspond 21 to temporal constraints? 22 A Yes. Same as the '980.

Conducted on August 13, 2024

620 1 Q Okay. So specifically, can you tell us 2 which edges correspond to the temporal 3 constraints? 4 A Yes. So if I go to Figure 2D, for 5 instance as an example, you look at the object 6 layer there. You have OT and you have the next 7 object. Those edges correspond to the temporal 8 constraints. 9 Q Those edges connect to the object notes; 10 is that correct? 11 A That is correct. 12 Q In the caption for Figure 2, which is 13 still on Page 7, it comprises two sentences. 14 The second sentence says: Spatio-temporal 15 models are obtained by replicating a spatial model 16 along the temporal domain to a W length window and 17 then connecting the second layer nodes across 18 time. 19 A Yeah. 20 Q Do you see that? 21 A Yes. I do. 22 Q Okay. Could you explain or identify which	622 1 Q And the edges, you identified the edges in 2 Figure 2A between the object nodes as 3 corresponding to those temporal compatibilities, 4 right? 5 A Yes, sir. 6 ATTORNEY BAKER: Objection. 7 I've let it go on for a little bit, but 8 these are leading questions. 9 A Well, I described earlier Psi IJ, multiple 10 times now, as the temporal compatibility of object 11 state between Frame I and J. I've said that 50 12 times today. 13 ATTORNEY EKLEM: Okay. No further 14 questions. 15 ATTORNEY BAKER: Thank you. I appreciate 16 your time, sir. 17 THE WITNESS: Thank you. 18 (The deposition of ELI SABER, PH.D. was 19 adjourned at 5:50 p.m.) 20 21 22
621 1 are the nodes that are connected across time in 2 Figure 2? 3 A Well, you're connecting the second layer 4 nodes. You see the second layer is like you've 5 got the object layer. You've got a component 6 layer. So you're connecting those across time. 7 Q Okay. And so those are the -- the 8 connection across time is what we were just 9 talking about, the edges in the graph, right? 10 A Correct. 11 Q Okay. So before we picked up the 12 provisional, we were talking about the '980 patent 13 in Column 3, the joint probability distribution. 14 Do you remember that? 15 A Yes, sir. 16 Q And you described the first multiplier we 17 were discussing, Psi IJ? 18 A Yes, sir. 19 Q And you said that that represents the 20 temporal compatibility of the object state between 21 the Frames I and J, right? 22 A Yes, sir.	623 1 CERTIFICATE OF SHORTHAND REPORTER 2 3 I, Kadi A. Harmon, the officer before whom the 4 foregoing deposition was taken, do hereby certify 5 that the foregoing transcript is a true and 6 correct record of the testimony given; that said 7 testimony was taken by me stenographically and 8 thereafter reduced to typewriting under my 9 direction; that reading and signing was not 10 requested; and that I am neither counsel for, 11 related to, nor employed by any of the parties to 12 this case and have no interest, financial or 13 otherwise, in its outcome. 14 15 I further certify that the adverse party 16 was represented by counsel at the deposition. 17 18 I further certify that the deposition of 19 Eli Saber, Ph.D. occurred at the Hilton Garden 20 Inn, 155 East Main Street, Rochester, New York 21 14604 on Tuesday, August 13th, 2024, commencing 22 at 8:49 a.m. to 5:50 p.m.

Conducted on August 13, 2024

624

1 IN WITNESS WHEREOF, I have hereunto set my hand
2 and affixed my notarial seal this 23rd day of
3 August, 2024.

4
5 My commission expires:
6 December 18, 2026

7
8 *Kadi A. Hamm*
9

10 -----
11 NOTARY PUBLIC IN AND FOR THE
12 STATE OF NEW YORK

13
14
15
16
17
18
19
20
21
22

A			
abilities	432:2, 433:6,	599:20, 615:16,	addressed
343:14	457:3, 466:1,	617:19, 620:17,	417:19
ability	486:19, 524:19,	621:1, 621:6,	addresses
338:10, 343:3,	616:1	621:8	555:3
343:16, 361:1,	account	activities	addressing
365:11, 410:16,	411:7, 413:6	604:2, 606:17,	553:15
450:7, 616:4,	accuracy	606:20, 607:2,	adjacent
618:20	339:16, 339:19,	607:14, 608:19	479:6, 565:6
able	391:4, 393:21,	activity	adjourned
323:22, 324:5,	394:1, 558:2	594:19, 595:12,	622:19
331:9, 331:10,	accurate	602:1, 603:13,	admission
335:2, 335:3,	344:4, 389:18,	603:15, 603:21,	552:16
337:13, 338:14,	414:11, 414:22,	604:3, 604:7,	advantages
340:19, 340:20,	425:4, 479:14,	604:8, 605:4,	527:20, 528:2
342:2, 342:5,	497:8, 497:19,	605:17, 605:18,	adverse
342:21, 343:15,	498:14, 500:10,	605:21, 606:3,	623:15
343:18, 349:2,	509:12, 576:1,	606:4, 606:6,	affirm
461:16, 462:7,	602:5, 602:7,	606:22, 607:15,	305:4
506:8, 605:6,	609:21	608:18	affixed
605:10	accurately	actually	624:2
above	431:12, 432:10,	362:13, 498:10,	after
410:9, 543:18	510:22	559:6, 573:14	322:17, 455:10,
absent	achieve	adaboost	456:1, 499:2,
444:11	324:11	378:6, 379:7,	546:17, 568:8,
absolute	acknowledge	379:11, 379:19,	595:12, 605:12,
486:13	531:19	379:21, 380:8,	607:13
absolutely	acknowledgement	380:16, 381:16,	afterwards
531:3	436:4	381:18, 385:5,	311:17, 420:5
abstract	acknowledgment	385:10, 385:16,	again
378:4, 378:6,	436:1	385:17, 386:17,	312:7, 314:1,
378:10, 387:2,	across	387:8, 388:3,	321:19, 322:17,
389:22, 390:10,	314:12, 339:17,	388:6, 388:7,	322:20, 326:3,
414:4, 414:20,	381:13, 383:1,	388:8, 388:18,	327:20, 328:5,
446:7, 497:7,	384:15, 384:19,	390:3, 390:22,	329:7, 332:15,
497:18, 498:1,	412:11, 418:12,	393:2, 393:11,	356:2, 360:22,
498:4, 498:5	419:7, 461:9,	393:15, 394:2,	372:15, 372:22,
accommodate	461:18, 462:2,	394:4, 394:17,	374:20, 376:3,
474:12, 474:13	470:17, 471:18,	537:10	386:8, 386:16,
accommodates	471:20, 471:21,	adaptive	393:8, 395:13,
474:15	471:22, 472:19,	385:18, 393:15	412:1, 412:18,
accomplish	472:20, 474:4,	add	414:7, 424:3,
567:15	478:10, 483:1,	447:22, 448:1,	441:17, 449:8,
according	486:19, 487:7,	514:21, 576:17	450:20, 461:5,
341:20, 363:3,	503:4, 503:7,	adding	461:21, 464:13,
364:3, 364:8,	527:5, 527:8,	542:22	468:1, 474:3,
364:15, 378:5,	530:22, 531:13,	addition	482:18, 484:9,
	531:16, 547:13,	446:2	486:2, 487:5,
	547:15, 596:4,	additional	490:1, 492:3,
		506:9	

499:8, 510:21, 513:1, 514:4, 522:4, 554:12, 554:20, 556:3, 558:16, 576:12, 618:12 against 355:15 ago 377:4 agree 308:21, 309:16, 311:14, 318:11, 320:11, 320:13, 329:22, 330:16, 435:21, 439:5, 439:8, 439:15, 439:17, 440:4, 465:7, 475:15, 475:21, 476:1, 477:17, 488:14, 504:21, 506:2, 508:11, 510:17, 534:7, 554:14, 557:2, 560:22, 563:11, 579:14, 602:18, 609:3, 613:1 agreed 351:18 agrees 487:6 ahead 308:16, 357:22, 560:19 air 431:11, 432:7 airplane 513:19, 513:21 aj 584:21 al 303:12, 303:16, 304:13, 304:14 algebra 578:5, 579:19, 581:1, 581:18, 582:10	algorithm 339:16, 369:15, 370:7, 375:10, 375:14, 375:15, 385:16, 388:4, 388:8, 389:11, 389:14, 393:16, 450:16, 452:4, 452:15, 453:6, 453:12, 453:20, 454:3, 454:9, 454:14, 458:4, 463:22, 466:6, 470:13, 472:15, 480:6, 480:16, 481:2, 481:4, 481:9, 481:14, 481:20, 482:17, 482:20, 482:21, 482:22, 485:14, 486:17, 486:18, 519:16, 520:17, 520:22, 525:16, 532:22, 596:2, 596:15, 618:19 algorithms 431:3, 454:17, 522:22, 531:12, 603:16 align 583:7 aligned 580:6, 580:18, 580:21, 582:12, 583:4, 583:6, 583:9, 583:10 alignment 582:18, 583:11 allow 365:6, 368:15 allows 378:15, 387:4, 390:14, 448:18, 449:22, 497:8, 497:19, 498:14, 500:10, 500:13 almost 354:15, 536:20	along 552:3, 580:2, 620:16 alpha 434:10, 434:11, 565:1, 565:3, 565:4, 565:11, 565:13 already 329:19, 340:8, 348:11, 356:3, 357:1, 361:21, 396:4, 422:6, 438:17, 440:7, 442:10, 469:20, 503:17, 532:7, 601:8, 607:21 also 302:19, 324:18, 331:20, 336:21, 346:19, 347:1, 347:9, 348:22, 349:15, 351:22, 360:10, 369:16, 386:22, 387:10, 388:13, 389:12, 394:20, 404:22, 406:18, 409:9, 438:13, 439:9, 442:12, 442:18, 453:11, 475:15, 491:13, 495:1, 496:14, 496:16, 520:11, 523:14, 543:11, 559:3, 574:15, 584:11, 603:15, 607:19 alternate 345:8, 346:16 alternative 395:12, 395:15, 397:7, 397:9 alternatively 345:5, 396:17, 397:18, 397:19 although 410:11 always 366:14, 412:1,	480:18 ambiguity 487:20, 488:9 amc 512:3 amplitude 505:20, 509:21, 575:3 analogy 482:2 analysis 362:16, 382:15, 384:5, 411:6, 411:10, 412:12, 470:18, 470:22, 496:18, 502:22, 503:14, 506:17, 507:1, 508:14, 508:16, 509:4, 509:16, 511:2, 512:1, 512:3, 512:11, 512:19, 514:19, 516:9, 517:7, 518:5, 534:18, 575:1 analyze 485:15, 589:5 analyzing 599:19 angle 565:5, 565:12, 565:15, 583:11, 585:5, 585:6 angular 488:2 another 347:1, 405:3, 435:6, 435:17, 505:13, 511:16, 525:22, 584:6, 601:12, 601:14, 608:12, 615:5 answer 307:11, 307:12, 311:15, 311:20, 314:2, 348:7, 349:2, 355:22, 356:1, 357:6,
--	--	---	--

372:18, 374:13, 375:12, 375:17, 377:19, 392:6, 392:7, 392:18, 412:22, 413:10, 422:8, 422:10, 422:12, 428:17, 469:14, 489:22, 515:20, 559:7, 562:21, 572:3, 573:10 answered 340:8, 361:21, 367:13, 396:4, 412:21, 420:7, 485:12, 559:13 answering 550:5 answers 306:14, 349:8 anxious 519:2 any 306:13, 308:9, 311:2, 321:6, 323:13, 324:6, 324:9, 326:1, 328:6, 343:7, 347:21, 348:5, 353:5, 356:7, 361:8, 369:19, 376:9, 376:18, 401:2, 421:20, 422:20, 444:9, 456:8, 462:19, 470:17, 479:4, 481:10, 481:17, 482:10, 483:6, 483:9, 484:18, 485:15, 504:13, 510:10, 514:8, 527:8, 544:2, 555:19, 557:5, 567:16, 569:19, 598:8, 609:5, 619:20, 623:11 anything 340:6, 354:1,	355:8, 356:11, 367:14, 429:21, 448:7, 491:16, 506:8, 509:9, 530:13, 583:13, 615:9 anywhere 353:5, 392:1 apologies 551:12 appeal 300:2 appear 337:21, 343:7, 588:12 appearance 391:11 appeared 438:13 appears 568:12, 597:14 apples 465:14, 465:18, 493:2, 493:4, 495:4, 508:9, 513:10, 513:11, 514:7, 517:11, 528:20, 529:11, 531:1, 531:17, 539:6, 558:22, 563:9, 590:2, 604:15, 612:15 application 303:15, 435:14, 435:17, 442:19, 443:4, 445:15, 446:6, 451:19, 452:2, 514:6 applications 419:5, 454:17, 454:19, 455:2, 457:13 applied 318:2, 318:20, 370:3, 371:21, 375:1, 375:6, 375:11, 379:19, 379:22, 381:16,	389:11, 393:10, 393:12, 394:4, 394:20, 411:5, 411:15, 412:13, 419:3, 420:10, 432:22, 433:2, 433:5, 433:12, 433:19, 434:13, 434:15, 435:13, 459:6, 459:7, 459:11, 459:14, 478:13, 488:17, 523:8, 523:22, 524:1, 524:19, 525:13, 539:21, 546:14, 547:21, 558:18, 559:17, 559:22, 560:2 applies 432:17, 482:20, 482:21, 482:22, 485:22, 486:2 apply 314:19, 374:2, 388:11, 388:17, 389:6, 390:3, 390:22, 394:17, 426:4, 435:16, 456:4, 462:6, 481:19, 482:5, 482:6, 482:7, 491:18, 514:10, 514:16, 541:18, 564:7 applying 411:13, 455:20, 456:3, 462:19, 484:13, 540:1, 595:11 appreciate 445:10, 591:20, 622:15 approach 311:13, 346:16, 391:1, 397:9, 432:14, 447:17, 448:15, 448:16, 449:16, 449:18,	450:3, 489:9, 489:12, 508:16, 517:14, 522:21, 523:2, 527:20, 528:3, 541:1, 541:18, 586:16, 589:12, 590:15, 591:1 approximate 437:18, 511:21 approximated 448:22, 450:11, 505:13, 505:22, 511:18, 544:16 approximately 614:9 approximation 511:12 arbitrary 448:18, 448:20, 449:22, 450:6, 544:14 area 541:12, 569:16, 570:19, 573:3 aren't 341:12, 343:9, 506:8, 542:22, 548:6, 548:13, 548:22 argument 426:4, 470:4 argument's 388:16, 389:1, 444:1 argumentative 371:2, 371:13, 384:8, 510:20, 539:19, 541:9, 557:16, 587:10 argumentatively 389:3 arm 494:11, 494:13, 494:19, 495:1, 555:5, 564:14, 565:1, 565:10 arms 554:18, 558:1,
--	---	--	---

564:12 around 384:11, 591:13, 610:4, 613:22 art 320:16, 541:19, 541:21, 593:9, 593:12, 593:13 asked 321:2, 336:8, 339:5, 349:10, 350:4, 350:18, 367:12, 384:4, 384:9, 421:9, 476:19, 506:2, 518:8, 549:2, 550:4, 555:4, 567:11, 572:2, 581:11, 588:9, 604:21, 614:4, 614:8 asking 311:21, 317:6, 319:21, 327:9, 365:3, 374:18, 376:16, 386:4, 397:14, 419:16, 422:2, 434:2, 444:7, 444:18, 453:10, 459:14, 459:15, 510:17, 527:7, 539:4, 539:13, 539:15, 540:2, 549:10, 549:20, 556:10, 559:8, 562:18, 566:11, 571:13, 586:8, 586:10, 604:16 aspect 409:10, 411:19, 411:22, 463:1, 466:22 assemble 418:3, 474:7 assembled 417:5, 417:17, 417:20, 418:8, 422:4, 423:6, 431:13, 432:11, 432:15, 473:17, 478:19, 587:19 assembles 418:15, 419:12, 422:13, 425:12 assembling 416:2, 416:9, 418:1, 418:2, 420:3, 484:9, 519:20, 553:15 assembly 441:1, 441:3, 484:15, 553:20 assessment 602:21 assign 570:21 associated 526:10, 538:15, 548:7, 548:13, 549:1 assume 317:15, 391:18, 392:19, 395:1, 395:3, 427:22, 430:22, 490:17, 543:21 assumed 391:14, 488:3 assuming 563:17 assumption 391:22, 392:22 assumptions 392:14, 393:9, 408:5 attempts 435:3 attend 573:16 attention 344:19, 380:3, 480:3, 487:8, 610:20 attract 546:16	attractive 304:7, 519:20, 520:21, 521:6, 521:11, 521:13, 521:17, 521:20, 522:2, 523:4, 523:7, 523:22, 524:3, 524:9, 524:21, 525:10, 530:10, 532:5, 532:14, 532:16, 532:19, 540:17, 548:9 august 300:20, 623:21, 624:3 authenticity 567:7, 567:11, 567:13 author 375:16, 438:14, 557:3, 573:12 author's 462:21, 551:17, 569:4 authors 313:3, 327:3, 352:22, 353:22, 355:5, 358:22, 360:13, 370:5, 390:13, 392:2, 394:12, 394:22, 397:7, 438:10, 447:17, 448:17, 449:11, 449:18, 450:10, 458:3, 495:10, 506:5, 506:6, 507:13, 510:3, 511:5, 511:15, 537:14, 540:11, 547:1, 570:6 automatic 612:20, 613:3 automatically 498:6 automobile 321:3, 321:5, 321:11, 321:12, 347:14 automobiles 321:10 automotive 496:4, 496:7 availability 567:7 avenue 302:6, 302:14 aware 347:21, 359:10, 363:18, 369:13, 369:16, 376:8, 376:17, 437:10, 570:2, 574:3, 574:6	B b-a-j-a-j 305:13 back 333:16, 362:1, 380:19, 384:11, 385:3, 387:2, 479:20, 480:13, 480:15, 486:17, 571:5, 573:5 background 595:3, 599:7 backward 527:21 backyard 610:2, 610:4 bajaj 302:20, 304:6, 305:12, 337:21, 410:2, 426:13, 505:3, 509:10, 510:4, 574:13, 575:12, 575:17, 594:15, 601:22 bajaj's 409:9, 409:15, 410:11, 411:2, 423:21, 424:17, 424:20, 424:22, 426:5, 503:18,
---	--	--

504:17, 504:21, 506:2, 559:4, 560:13, 560:16, 575:1, 601:21 baker 302:4, 303:3, 305:9, 305:10, 305:19, 308:1, 348:18, 362:6, 362:9, 409:1, 409:4, 413:12, 469:13, 469:18, 503:20, 504:3, 518:20, 518:22, 519:6, 550:21, 551:2, 566:21, 567:1, 573:9, 594:4, 594:7, 610:6, 610:9, 610:16, 610:19, 613:7, 613:10, 622:6, 622:15 ball 512:18, 512:22, 513:2, 517:13, 518:14 bank 352:13, 352:14, 352:16, 495:16, 495:17, 495:19, 513:19 banked 513:20 banking 495:20 base 492:1 based 322:14, 323:11, 345:11, 349:14, 362:16, 365:16, 405:22, 406:5, 415:9, 415:13, 420:13, 429:7, 429:8, 429:11, 430:12, 430:15, 434:19, 454:11, 455:9, 455:22,	465:9, 473:17, 476:15, 479:9, 497:9, 497:20, 498:7, 498:15, 500:11, 500:14, 509:16, 513:15, 516:14, 517:19, 522:17, 539:14, 591:1 basic 454:3 basically 327:17, 410:2, 428:8, 445:13, 449:5, 484:20, 487:1, 533:18, 536:4, 545:6, 553:2, 553:3, 561:18, 603:14 basis 379:18, 409:14, 418:8, 418:16, 419:13, 420:4, 420:11, 423:7, 441:1, 441:4, 462:20, 589:5, 596:16, 598:7, 602:11, 603:3 bayesian 419:1, 432:12, 432:16, 432:18, 438:1, 440:13, 441:18, 451:6, 471:6, 471:7, 471:15, 477:17, 477:21, 477:22, 478:1, 478:2, 478:7, 480:8, 484:5, 484:6, 484:17, 488:17, 586:3, 586:11, 587:16 bayesian-type 532:22 bear 540:20 because 308:15, 320:18,	334:13, 334:15, 336:21, 338:8, 360:10, 363:22, 366:8, 369:4, 370:1, 384:14, 386:22, 387:11, 388:2, 389:13, 391:3, 391:4, 392:8, 394:8, 398:7, 398:9, 398:18, 402:9, 405:3, 405:17, 406:18, 408:15, 432:19, 433:14, 434:20, 435:13, 435:15, 437:19, 450:4, 458:10, 461:11, 466:11, 466:18, 466:21, 479:12, 479:16, 480:2, 480:19, 499:17, 500:15, 505:16, 511:17, 513:2, 516:9, 520:17, 522:21, 525:11, 528:8, 529:9, 545:1, 546:8, 553:14, 557:17, 557:21, 566:3, 566:13, 577:17, 585:15, 585:21, 589:3, 593:3, 595:11, 602:8, 606:2, 609:21 become 569:8 been 306:4, 308:17, 315:2, 317:2, 348:19, 349:4, 367:20, 368:18, 377:21, 392:5, 399:16, 400:4, 408:21, 412:4, 412:18, 413:17, 438:3, 445:4, 457:17, 467:18,	476:18, 478:12, 486:21, 488:6, 488:13, 497:1, 504:4, 518:18, 519:1, 526:22, 529:3, 545:15, 547:4, 547:15, 552:2, 555:1, 559:1, 560:9, 567:4, 568:9, 568:12, 569:12, 574:9, 594:8, 611:17, 612:16, 613:6 before 300:2, 301:10, 306:17, 315:10, 317:16, 348:11, 354:4, 376:7, 378:13, 455:10, 455:22, 470:15, 476:18, 476:20, 479:10, 505:20, 516:19, 538:1, 546:17, 546:18, 547:9, 559:6, 562:21, 617:18, 621:11, 623:3 begins 445:14, 501:20 behalf 302:3, 302:11, 305:10, 305:15 belief 356:15, 446:12, 447:5, 447:13, 447:15, 448:22, 449:13, 450:11, 450:19, 451:6, 519:17, 519:21, 520:3, 520:22, 522:4, 524:18, 544:12, 544:16, 547:18, 553:16, 563:15 believe 349:3, 354:9, 410:20, 438:15,
---	--	--	---

451:8, 485:12, 503:19, 573:19, 573:20, 587:6, 588:20, 588:21 below 359:6, 516:7 benefit 339:21 besides 343:8, 435:19, 506:20, 506:21 best 312:1 beta 434:10, 434:11 better 488:3, 566:9, 615:20 between 309:1, 309:3, 328:7, 352:1, 353:7, 360:5, 369:22, 382:22, 383:7, 383:13, 400:22, 402:13, 404:14, 410:13, 412:10, 421:14, 433:21, 474:18, 476:9, 478:16, 483:2, 483:5, 483:7, 483:9, 483:11, 483:13, 486:5, 502:3, 521:20, 522:8, 526:3, 526:10, 526:12, 528:16, 529:8, 529:19, 530:4, 530:17, 531:5, 534:1, 534:3, 537:3, 538:14, 538:16, 542:1, 542:10, 542:11, 542:16, 542:21, 543:11, 549:11, 549:21, 550:12, 562:15, 565:5, 566:16, 575:15, 575:20,	575:21, 576:15, 578:1, 578:22, 579:11, 579:18, 579:22, 580:3, 581:4, 585:9, 585:20, 587:19, 592:11, 598:9, 602:3, 611:3, 611:11, 611:12, 611:15, 611:19, 612:5, 612:8, 612:12, 614:6, 615:1, 615:6, 615:16, 615:18, 617:1, 621:20, 622:2, 622:11 beyond 506:9, 551:10, 552:5, 552:17, 552:20, 553:5, 553:8, 553:13 bi-directional 345:4, 345:7, 346:12, 395:16, 396:18, 397:21 bicep 494:12 big 344:16, 359:7, 380:21, 532:20 bird 327:17, 328:1 birds 327:14, 327:18, 327:19, 327:20 bit 306:17, 622:7 bite 465:20 black 438:10, 438:13, 490:20 blah 564:13 block 428:1, 486:9, 486:12 board 300:2	body 413:19, 414:8, 415:3, 415:9, 415:10, 415:11, 415:12, 415:14, 415:15, 416:5, 416:6, 416:11, 416:17, 416:20, 417:9, 417:11, 421:9, 421:11, 421:12, 422:5, 422:15, 423:5, 423:13, 424:20, 426:9, 431:11, 431:22, 432:9, 433:14, 434:17, 434:18, 434:21, 439:5, 439:8, 444:13, 471:8, 472:14, 478:18, 483:19, 483:22, 488:4, 489:2, 489:3, 491:18, 492:15, 493:10, 493:22, 494:1, 496:6, 551:17, 554:2, 611:2, 611:8, 611:9 book 401:15, 401:18, 578:5, 579:19, 581:1, 581:17 boosting 385:18, 393:16 both 331:18, 461:10, 461:13, 469:3 bottom 346:21, 358:9, 382:10, 382:12, 383:4, 384:3, 384:5, 397:12, 397:16, 398:5, 398:15, 415:20, 451:18, 451:22, 487:13, 490:15, 491:4, 511:14, 584:18	bottoms-up 391:1, 552:18, 553:3, 553:5, 553:11, 556:7 bp 537:10 break 362:4, 362:7, 408:22, 409:2, 453:18, 469:13, 469:14, 518:20, 566:21, 610:13, 610:14, 610:18, 613:8 breaks 504:13 breathe 557:5 briefly 343:20, 399:19, 399:22 bright 541:3 bring 384:11, 384:20, 440:18, 462:22, 466:11, 540:20, 564:1 brings 365:13, 369:21, 369:22, 421:18 broad 317:20, 318:5, 318:12 build 342:16, 447:21, 447:22, 532:2 building 342:17, 491:19, 537:22 builds 446:4, 491:17 built 345:2, 345:6, 346:11, 395:8, 396:18, 397:20, 540:13 C c-h-a-n-d-r-a 305:12
---	---	---	---

c0 344:17	caption 533:6, 556:18,	355:19	406:3
c1 358:16	556:19, 557:1,	cc'd 568:5	chandra 302:20, 305:12
calculate 473:2	559:10, 620:12	cde 544:6	chandrajit 304:6
calculated 465:9	capture 403:2	central 564:12	change 314:2, 409:12,
calculating 606:16	capturing 584:4, 591:3	centric 459:3, 459:4,	410:17, 412:22,
calculation 485:3	car 321:6, 327:6,	459:5, 459:6,	420:20, 421:11,
calculations 437:19, 525:12	401:11, 401:12,	459:9, 545:22,	425:7, 429:7,
calculator 579:13, 585:10	403:2, 403:10,	546:3, 546:11,	429:8, 433:3,
calculus 522:22, 539:21	403:17, 403:21,	546:16	433:8, 433:16,
calf 493:20, 494:8	407:18, 407:19,	certain 322:14, 382:2,	433:18, 434:5,
call 373:19, 463:11,	407:22, 496:3,	394:4, 437:15,	434:6, 531:12,
463:14	496:11, 496:12,	503:8, 592:19,	532:21, 598:22,
called 375:18, 402:4,	590:19, 590:20,	592:21, 593:4	600:6, 600:9
495:3	604:4, 606:18,	certainly 326:21, 589:7	changed 434:3, 434:21,
calls 468:20, 468:21	609:17	certificate 623:1	435:14, 435:16,
can't 306:14, 362:11,	careful 424:4	certify 623:4, 623:15,	464:19, 465:12,
372:18, 375:12,	carefully 318:6, 322:3,	623:18	467:5, 467:12,
377:1, 489:7,	377:18, 432:4,	cetera 314:12, 357:17,	467:13, 479:21,
502:14, 541:4,	466:5	393:9, 446:15,	530:3, 571:19,
544:6, 605:13	cartoon 401:15, 401:16,	478:8, 483:17	597:22, 600:1,
canned 608:19	401:18	chain 448:19, 448:20,	600:3, 600:11
cannot 324:11, 391:18,	case 300:10, 327:16,	450:1, 450:4,	changes 319:17, 319:20,
502:3, 578:11	347:20, 370:13,	450:5	411:17, 421:9,
capabilities 324:7, 343:14	388:11, 388:22,	chair 328:13, 329:4,	421:12, 421:15,
capability 341:9, 365:6	389:4, 389:7,	329:8, 569:17,	424:18, 426:6,
capable 324:4	389:8, 395:14,	570:19, 570:20,	426:12, 433:6,
capital 358:10, 358:12,	404:4, 437:22,	574:4	434:20, 435:7,
359:4	462:17, 465:6,	chairs 569:14, 569:15,	475:22, 478:21,
	516:1, 555:17,	569:16, 573:4	533:1, 571:20
	558:17, 561:10,	challenge 512:14, 512:16	changing 372:12, 373:9,
	561:12, 568:7,	cham 303:16, 399:19,	373:11, 373:16,
	568:9, 588:20,	399:22, 400:1,	409:2, 423:13,
	623:12	400:11, 400:18,	423:14, 425:6,
	cat 600:5	400:21, 405:21,	426:17, 433:19,
	caused 417:13		435:10, 483:18,
	caution 307:8, 308:12,		483:22
	355:10, 355:15,		chapter 415:6, 418:22,

424:9, 424:12, 425:5, 425:17, 471:5, 485:7, 485:8 chapters 419:18, 432:12 characteristics 515:4 characterizes 575:2 check 452:7, 610:13 checks 600:18, 601:3 chooses 604:9 choosing 605:3, 605:15, 605:22, 606:7 chop 397:15, 397:16 circle 562:11, 564:12, 564:13, 564:21, 565:10 circumstances 567:17 citation 543:5 citations 316:21, 322:5 cite 316:22, 445:18, 445:21, 446:1, 449:14, 449:20, 552:9 cites 351:13 claimed 312:14, 314:8, 354:21, 354:22, 395:19, 398:7, 398:9, 399:14, 399:17, 463:3, 463:4, 467:8, 468:9, 468:13, 475:14 claiming 352:22, 397:8,	466:14, 467:1, 467:2 claims 309:13, 309:17, 309:19, 309:20, 311:2, 311:6, 311:8, 311:10, 312:15, 313:1, 313:22, 314:4, 314:7, 314:15, 314:19, 315:2, 315:3, 316:6, 316:20, 317:12, 318:6, 319:14, 321:1, 322:2, 326:7, 343:8, 343:10, 343:15, 353:6, 354:3, 354:9, 354:12, 354:16, 354:19, 355:1, 355:12, 355:17, 356:9, 357:9, 357:18, 360:22, 362:15, 367:5, 367:10, 367:14, 367:17, 367:22, 371:14, 399:18, 409:18, 413:2, 444:1, 444:20, 479:4, 593:10 clarification 307:5, 310:10, 314:21, 315:19, 319:5, 326:20, 337:16, 344:3, 350:10, 355:14, 385:19, 386:20, 388:20, 394:16, 404:18, 405:20, 416:3, 436:3, 437:6, 437:12, 439:7, 443:17, 444:19, 445:20, 447:8, 448:6, 451:11, 451:20, 457:12, 461:15, 462:13, 463:13,	465:22, 466:20, 468:18, 471:9, 480:11, 486:11, 489:1, 497:14, 503:16, 505:5, 517:17, 534:7, 535:16, 538:22, 565:7, 565:22, 567:12, 568:17, 574:16, 575:10, 576:22, 578:9, 579:16, 586:5, 586:12, 590:7, 592:15, 594:3, 594:22, 603:22, 607:7, 609:7, 617:22, 618:16 class 361:11 classification 393:21, 594:17, 595:10, 598:11, 599:1, 602:1 classified 596:2, 596:15, 598:13 classify 393:18, 393:19, 602:3 classifying 595:19 classroom 370:10 clear 331:3, 338:1, 338:15, 353:14, 353:20, 354:10, 355:4, 356:10, 364:19, 366:16, 366:18, 367:1, 367:6, 368:2, 382:19, 384:13, 413:4, 489:22, 542:3 clearer 380:20 clearly 352:2, 352:21,	353:1, 353:11, 353:12, 355:7, 360:13, 363:15, 365:3, 378:20, 378:22, 389:9, 389:10, 390:13, 390:16, 392:4, 395:18, 409:16, 435:12, 443:13, 468:21 closer 580:6, 581:8 closest 479:19 clothing 417:13 clutter 562:10 cluttered 564:10 cn 344:17, 358:16, 358:19 coat 494:22, 495:1 coauthored 519:9 coefficient 408:14 coefficients 584:5, 585:21, 585:22 coffee 328:14 collected 330:14, 341:17 collection 326:9, 326:11, 328:3, 328:11, 328:15, 328:19, 328:22, 329:5, 329:9, 329:12, 329:14, 329:15, 329:16, 330:10, 330:11, 330:17, 330:21, 331:2, 331:11, 331:14, 332:7, 332:17,
---	--	---	--

332:19, 332:21, 333:3, 333:13, 335:5, 335:9, 335:14, 335:22, 336:2, 336:16, 337:15, 337:18, 337:20, 338:1, 338:5, 338:12, 340:21, 341:21, 342:13, 343:17, 345:12, 347:6, 347:22, 348:2, 348:14, 348:15, 349:15, 350:5, 350:20, 351:3, 351:7, 351:14, 351:19, 352:3, 352:4, 353:2, 353:21, 355:6, 356:17, 357:13, 359:1, 360:7, 360:14, 361:2, 361:5, 361:19, 363:4, 364:4, 364:10, 364:16, 365:11, 366:2, 366:8, 366:12, 366:13, 366:15, 367:4, 368:16, 389:5, 396:9, 396:13, 398:3, 398:13, 399:9, 413:9, 488:20, 538:11, 589:10 collective 300:12, 303:10, 304:1, 304:11, 304:12, 305:16, 306:6, 445:6, 567:19, 567:21 color 401:16, 401:19, 404:2, 490:20, 496:16, 584:2, 595:3, 599:8 column 329:20, 329:21, 329:22, 333:16,	344:19, 344:21, 345:10, 347:10, 357:21, 358:2, 360:2, 370:5, 380:20, 381:2, 381:20, 382:4, 382:19, 385:12, 391:7, 391:8, 391:9, 391:10, 395:7, 395:12, 400:9, 400:10, 400:11, 406:4, 406:13, 412:5, 412:8, 434:16, 454:2, 457:8, 459:1, 527:1, 529:6, 534:13, 534:19, 536:18, 538:19, 558:8, 563:15, 584:12, 584:18, 584:21, 585:1, 591:11, 591:19, 591:22, 595:18, 601:1, 607:10, 609:1, 609:8, 613:21, 614:1, 614:6, 614:18, 615:18, 621:13 columns 314:13 combine 470:13 combined 441:4, 549:19 come 316:15, 317:3, 317:13, 318:22, 320:6, 320:20, 322:3, 336:19, 361:9, 361:12, 361:14, 361:17, 366:21, 397:21, 398:18, 409:16, 411:3, 443:13, 475:8, 540:10, 543:7, 546:22 comes 597:18	coming 557:21, 589:4 comma 431:16 commencing 623:21 commenting 571:5 commission 624:5 common 455:4 communicate 533:14 communications 307:9, 355:20 compare 387:17, 608:18 compared 386:1, 555:1 comparing 357:17, 406:8, 444:9, 536:18, 587:5, 605:21, 606:2, 606:4, 606:5, 607:1, 612:15 comparison 405:22, 406:6, 607:4 compatibilities 384:16, 459:18, 547:3, 547:7, 549:18, 622:3 compatibility 360:4, 381:12, 382:21, 383:5, 383:6, 383:13, 384:19, 412:9, 412:11, 412:15, 413:8, 427:5, 460:1, 462:1, 463:20, 467:9, 476:8, 477:14, 526:12, 527:13, 527:14, 528:10, 529:7, 529:22, 530:7, 530:20,	531:13, 531:16, 532:15, 536:1, 536:22, 538:16, 542:16, 545:16, 547:13, 547:14, 566:16, 597:17, 598:9, 599:20, 601:19, 603:11, 611:19, 612:12, 615:1, 615:6, 615:8, 615:15, 617:17, 621:20, 622:10 complete 306:14, 392:9, 583:9, 596:21 completed 573:6 completely 419:8, 424:14, 426:2, 441:9, 441:11, 497:16, 508:4, 508:20, 509:7, 511:7, 512:18, 513:3, 513:13, 517:10, 517:19, 518:11, 528:9, 550:1, 580:10, 580:18, 580:21, 581:20, 582:12, 582:18, 587:2, 588:1, 588:4, 589:15, 598:19, 603:4, 606:10, 611:21 complex 396:6 complexity 439:9, 450:16 complicated 391:12, 391:17, 394:22 component 327:19, 330:2, 331:4, 331:6, 334:1, 334:6, 360:12, 380:7, 380:12, 382:1,
--	---	--	---

383:4, 383:14, 383:15, 385:22, 387:17, 388:1, 393:10, 393:18, 394:3, 394:6, 397:2, 397:4, 398:1, 399:9, 460:4, 490:9, 490:19, 490:22, 492:9, 494:1, 494:2, 495:7, 495:8, 495:12, 527:21, 531:9, 538:14, 544:1, 544:4, 547:9, 555:11, 555:12, 556:4, 561:7, 561:15, 562:2, 581:13, 582:1, 589:19, 590:4, 590:13, 590:16, 590:19, 591:8, 592:12, 592:18, 592:19, 592:20, 592:21, 593:3, 593:6, 593:14, 593:17, 593:19, 593:20, 612:4, 612:9, 612:11, 612:13, 617:2, 621:5 component-based 370:7, 370:8, 464:1, 466:6 component-type 549:15 compositions 508:3 comprehend 600:12 comprehends 384:22 compress 482:8, 485:18 compressed 482:9 compresses 369:18	compression 369:15, 375:9, 431:3, 482:12 comprised 342:20 comprises 332:16, 332:20, 333:2, 333:10, 333:12, 335:8, 336:16, 338:7, 338:11, 341:17, 342:4, 363:10, 363:22, 364:14, 616:2, 620:13 comprising 325:15, 356:16, 469:4, 616:8 computation 477:12, 598:18 computations 460:9, 460:10, 461:6, 461:10, 461:19 compute 365:12, 368:17, 395:3, 405:9, 407:7, 427:16, 427:18, 434:6, 434:9, 434:11, 459:22, 460:1, 460:4, 460:5, 462:1, 462:3, 462:6, 512:3, 576:15, 578:21, 579:13 computed 385:16, 385:21, 387:16, 421:6, 428:20, 460:7, 462:5, 550:20, 586:14 computer 304:10, 313:10, 325:7, 332:9, 344:6, 568:19 computes 476:22, 486:14, 583:5, 585:17,	585:19, 586:15 computing 374:16, 395:1, 459:16, 459:21, 584:10, 585:16, 591:4, 604:18, 605:15 concept 418:18 concepts 581:7, 581:20, 587:4, 587:8, 588:4, 589:21 concerned 475:3, 553:18, 553:19 concludes 594:16 conclusion 318:22, 320:6, 361:10, 361:13, 361:14, 361:17, 366:21, 368:2, 398:18, 409:17, 411:3, 443:14, 456:11, 475:9, 540:11, 543:7, 543:9, 543:11, 546:22, 612:18 conclusions 322:3, 504:21, 506:3, 560:22 conditional 449:3, 450:13, 473:3, 526:10, 544:5, 544:17 conditionally 561:9 conditioned 526:18 conditions 568:15 conducted 420:21, 471:1, 471:2, 471:3, 574:7, 574:8 conference 570:5, 570:16,	571:7, 572:9, 573:3, 573:18, 574:6 conferences 568:21, 568:22, 569:2, 569:13, 569:18, 570:14, 570:15, 572:13, 573:8, 574:4, 574:7 confidence 570:17, 570:22 confident 308:15 confidential 568:14 configuration 402:5, 402:9, 409:12, 410:17, 411:17, 424:19, 426:6, 426:12, 433:3, 433:8, 433:15, 433:17, 434:2, 434:5, 434:20, 435:3, 435:7, 463:10, 464:5, 464:10, 464:14, 464:18, 465:9, 465:12, 466:16, 466:17, 466:19, 466:21, 467:4, 467:7, 467:12, 475:22, 483:19, 526:18, 597:22, 598:1, 598:21, 598:22, 599:3, 600:2, 600:9 configurations 429:8, 468:5, 478:21, 526:13 configured 476:3 confined 470:18 confines 568:7 confirm 306:10, 442:12
---	--	---	---

conflate 414:15 conflating 528:19 connect 460:11, 460:12, 533:11, 563:2, 602:13, 620:9 connected 326:1, 397:13, 533:7, 621:1 connecting 530:15, 563:7, 617:19, 620:17, 621:3, 621:6 connection 617:1, 621:8 connectivity 328:6, 411:12, 411:13, 412:15, 413:7, 433:21, 474:17, 474:18, 474:21, 475:5, 476:4, 478:16, 485:20, 526:2, 528:6, 528:16, 529:18, 612:5, 617:14, 617:15, 617:16 consider 466:9 consideration 470:19 considerations 458:19 considered 376:19, 592:16, 617:3 consist 596:7 consists 564:11 constant 427:21, 427:22, 430:22, 488:2 constrain 451:1, 544:19, 545:9, 555:22	constrains 556:13 constraint 345:7, 396:2 constraints 345:4, 346:12, 346:15, 392:10, 393:9, 395:17, 396:1, 396:18, 397:21, 537:7, 537:9, 543:21, 616:9, 616:15, 617:5, 617:8, 617:15, 617:17, 619:2, 619:10, 619:21, 620:3, 620:8 construct 564:6 constructed 343:2, 365:6, 522:17 construction 308:22, 315:1, 315:17, 315:20, 316:2, 316:3, 316:10, 317:10, 319:3, 409:9, 410:10, 410:12, 411:1, 411:4 constructions 309:3, 315:15 contains 333:11 content 484:16 contents 415:5 context 316:4, 317:5, 318:1, 318:8, 318:17, 318:19, 319:2, 319:16, 320:12, 320:17, 320:20, 320:21, 321:4, 321:12, 321:13, 321:16, 352:12, 352:17, 352:18, 352:20, 373:8, 379:4, 379:6, 390:11, 398:2, 401:4, 401:6, 412:1, 412:2, 412:3, 412:16, 419:2, 419:9, 422:2, 424:6, 427:1, 427:11, 436:13, 440:9, 440:11, 441:6, 471:5, 475:2, 477:3, 491:15, 495:14, 495:15, 495:20, 501:17, 506:14, 508:14, 508:19, 509:3, 509:4, 514:5, 543:13, 543:17, 583:16, 583:18, 592:20, 593:4, 593:19, 593:21, 595:14, 603:18, 606:11 continue 306:2, 365:16, 393:14, 450:22, 459:1, 515:19, 548:4 continues 446:14, 452:21, 458:7, 546:21 continuous 575:22 continuously 529:2 contour 401:19, 489:10, 490:3, 490:5, 490:11, 491:8, 491:9, 491:11, 492:21, 493:15, 493:17, 493:20, 494:9, 494:11, 494:13, 494:17, 496:8, 496:9, 496:12, 496:13, 496:15, 586:20, 587:19, 595:4, 599:15, 608:4 contours 488:22, 489:3, 489:7, 489:8, 489:10, 489:17, 489:19, 490:2, 490:3, 491:22, 492:6, 492:10, 492:11, 492:14, 492:16, 492:19, 492:22, 493:7, 493:9, 494:7, 495:3, 496:11, 586:16 contributed 415:2 contributing 450:10 contribution 449:6, 449:7, 450:15 contributions 415:1, 449:2, 450:21, 451:4, 453:4 control 552:7 conversations 306:3, 470:21 convey 530:16, 580:8 conveys 445:15 convolute 414:15, 465:19 coordinate 406:22, 407:4, 565:4, 582:16 coordinates 406:18, 406:20 copy 348:16, 348:22, 443:19, 444:22, 469:19 corner 401:10, 401:11, 402:2, 402:7,
---	--

402:8, 403:13, 408:1, 408:2, 408:3, 408:7, 408:8, 408:9, 415:21, 590:11, 590:18, 592:3, 601:10, 608:13 corners 402:9, 403:13, 407:18, 407:19, 407:21, 407:22, 408:12, 608:11 correcting 533:18 correction 429:15 correctly 313:7, 313:12, 329:3, 330:5, 357:5, 357:6, 362:21, 363:11, 409:13, 416:4, 431:15, 439:14, 443:1, 487:16, 487:22, 557:4, 601:6, 609:10, 611:6, 612:22 correspond 407:5, 408:11, 565:2, 617:4, 619:20, 620:2, 620:7 correspondence 407:3, 408:7, 533:19, 534:1, 534:3 correspondences 405:17, 406:10, 407:6 corresponding 356:16, 380:7, 388:17, 390:6, 404:12, 616:9, 616:15, 619:2, 619:11, 622:3 corresponds 330:1, 333:19, 333:22, 334:5,	335:5, 405:8, 408:8, 524:22, 554:14 corvette 321:6 cosine 584:21, 585:3, 585:5, 585:7, 585:9, 585:11 cost 402:13, 404:16, 405:19, 406:10, 406:13, 408:16 could 318:16, 320:19, 321:5, 321:6, 321:7, 321:9, 323:13, 326:19, 327:6, 327:14, 327:19, 345:2, 346:19, 348:11, 348:13, 353:18, 369:2, 372:17, 373:9, 373:22, 375:10, 392:1, 393:4, 398:16, 404:2, 406:20, 417:1, 427:9, 435:22, 436:8, 436:9, 436:10, 436:11, 436:19, 457:22, 468:7, 479:22, 491:9, 495:8, 495:17, 495:18, 495:19, 496:10, 496:14, 500:15, 517:20, 518:8, 523:20, 551:20, 559:20, 575:6, 590:21, 591:19, 610:20, 613:18, 613:21, 618:1, 620:22 couldn't 323:14, 395:22, 491:22, 514:8 counsel 303:8, 306:7,	307:10, 308:20, 348:21, 354:13, 354:16, 355:10, 355:15, 355:21, 367:21, 378:1, 400:7, 413:15, 438:6, 445:7, 497:4, 504:7, 504:15, 519:5, 560:12, 567:20, 567:22, 574:12, 594:11, 623:10, 623:16 couple 325:20, 519:9, 584:15, 610:11, 610:17, 610:18 course 432:13, 432:18 court 301:11, 305:2, 305:8, 610:8 covered 431:11, 432:9 covers 457:20 create 517:9, 563:3 created 503:10, 549:18 cross 600:12, 600:13 cross-examination 410:16 cross-temporal 527:14 crossed 352:13 crystal 331:3, 353:14, 353:20, 355:4, 356:10, 366:16, 367:1 cu 516:6 cup 328:13, 490:4, 490:5, 490:13,	490:17, 491:3, 491:10, 491:12, 491:20, 492:1, 492:2 current 341:18, 341:20, 342:3, 342:5, 343:5, 362:19, 363:3, 363:6, 363:14, 364:1, 364:6, 364:8, 364:14, 364:18, 365:15, 365:19, 368:22, 425:19, 430:15, 430:16, 455:10, 479:6, 479:8, 479:10, 479:20, 554:5 cushion 329:4, 329:7 customize 564:3 cvpr 568:13, 568:19, 568:22, 569:9, 571:8, 571:11, 571:12, 572:6, 573:15, 574:1, 574:2 cycle 487:14, 487:19, 488:1 cylinders 522:16, 522:20, 548:21 D damping 516:12, 517:8 data 439:11 database 591:5, 605:19, 605:21, 606:3, 606:5, 606:6, 606:16, 606:18, 606:20, 608:18, 608:20
--	--	--	---

day 308:16, 311:13, 317:16, 413:1, 526:22, 529:2, 547:4, 555:1, 559:1, 572:18, 624:2 dc 302:7 deal 447:16, 449:16, 450:4, 563:18 dealing 525:12 debating 366:17 dec 503:18, 503:19, 559:4, 560:14, 560:17, 574:15, 574:17, 574:20 december 624:6 decide 314:14 decided 397:15 declaration 303:10, 304:1, 304:5, 307:14, 307:18, 309:8, 315:7, 315:8, 316:11, 322:4, 349:1, 349:6, 349:10, 349:18, 351:11, 362:11, 409:6, 410:1, 442:13, 442:19, 443:12, 443:16, 443:20, 444:21, 445:11, 445:12, 448:4, 451:17, 451:22, 452:14, 470:3, 470:20, 479:2, 521:5, 534:18, 535:3, 535:11, 542:5, 551:3, 554:2,	568:11, 575:13, 575:18, 594:15 declarations 307:15 decomposed 401:8 decomposition 415:8, 507:9 deer 610:2, 610:3 define 316:17, 324:5, 326:12, 326:13, 326:15, 328:4, 328:9, 328:11, 328:16, 328:20, 329:10, 329:12, 329:17, 330:12, 331:2, 331:12, 336:1, 336:22, 356:19, 378:7, 379:8, 379:12, 381:22, 385:5, 386:17, 387:8, 394:6, 405:12, 405:14, 412:19, 428:7, 457:19, 493:20, 494:12, 495:1, 502:19, 598:15, 602:14, 605:17, 608:6, 608:17 defined 317:2, 323:12, 323:22, 337:3, 337:8, 337:10, 342:11, 342:14, 343:11, 368:13, 368:15, 374:15, 402:12, 403:17, 432:13, 447:13, 457:11, 457:16, 567:10, 606:21, 609:5, 609:14 defines 316:3, 321:14, 334:19, 343:1 defining 374:17, 468:17	definitely 339:4 definition 411:5, 423:21, 424:17, 425:1, 426:14, 440:3, 441:13 deform 502:4 deformable 417:10, 499:18 deformation 499:5, 499:15, 502:16, 502:19 deformations 417:12, 497:12, 499:13, 502:14, 503:2 deforming 498:9 deforms 498:10, 499:13, 502:10, 502:11 degree 521:19, 577:4, 581:4, 587:18 deleted 569:5 demonstrate 431:9, 432:5 densities 450:18 density 336:22, 449:1, 450:12 depend 321:13, 343:12, 368:8, 368:10 dependance 534:2 dependancy 530:17 dependant 390:4 dependent 332:11, 603:5 depending 456:5, 514:5,	585:6 depends 342:10, 343:13, 344:5, 363:18, 368:6, 368:7, 368:11, 368:14, 495:20, 577:7, 583:16 deposit 495:18, 513:20 deposition 300:16, 301:1, 305:22, 306:19, 308:3, 308:11, 388:9, 409:16, 409:20, 411:3, 413:11, 420:17, 421:3, 504:11, 622:18, 623:4, 623:16, 623:18 depositions 510:12 derivative 503:12 describe 371:9, 388:5, 401:12, 402:2, 415:3, 415:11, 416:1, 416:5, 420:9, 423:22, 441:12, 446:18, 447:19, 449:5, 506:5, 535:12, 535:18, 537:3, 604:13 described 317:2, 343:19, 350:2, 352:12, 353:16, 354:2, 356:13, 387:14, 389:9, 389:20, 395:6, 395:7, 395:18, 412:3, 414:5, 414:21, 416:15, 421:21, 423:20, 424:7, 429:19, 436:19, 440:7, 441:6,
--	---	--	---

443:11, 443:15, 454:15, 460:3, 475:1, 478:5, 493:2, 494:3, 495:21, 495:22, 496:2, 497:17, 505:15, 506:1, 506:6, 508:1, 510:3, 510:21, 514:7, 517:3, 517:6, 527:10, 534:17, 535:15, 536:2, 536:4, 536:14, 537:4, 537:6, 537:15, 537:16, 539:20, 541:14, 541:16, 541:21, 564:16, 566:17, 566:18, 566:19, 588:14, 589:7, 589:8, 590:2, 592:8, 593:1, 593:20, 595:16, 595:17, 596:6, 596:18, 597:20, 598:3, 600:14, 601:8, 602:12, 603:17, 621:16, 622:9 describes 317:9, 413:19, 413:21, 414:1, 414:3, 414:7, 415:5, 415:8, 415:12, 416:8, 424:3, 424:5, 435:21, 436:5, 440:4, 447:1, 480:15, 481:13, 506:17, 535:5, 535:22, 549:5, 593:5, 597:2 describing 374:11, 378:22, 381:22, 412:17, 418:13, 465:2, 492:10, 495:14, 506:7, 515:13,	535:21, 537:12, 555:1, 616:20 description 320:4, 347:9, 347:12, 367:9, 380:14, 388:2, 417:6, 419:21, 443:5, 446:5, 448:2, 496:1, 498:14, 500:7, 500:9, 500:10, 500:14, 500:18, 501:6, 509:13, 536:13, 537:19, 537:20, 543:6, 566:14, 588:1, 589:16, 593:7, 597:17, 604:20 descriptions 376:14, 508:7, 540:10 design 377:13, 385:2 designating 542:16 designed 591:16 desperately 528:22 detail 349:9, 540:2, 540:3, 540:6, 541:4 details 310:1, 319:22, 355:4, 374:21, 375:14, 376:3, 376:8, 376:15, 377:15, 380:2, 414:4, 414:6, 455:5, 456:4, 520:19, 533:1, 540:1, 543:16, 549:14, 573:6, 613:5 detect 327:13, 335:4, 336:20, 336:21,	341:4, 341:7, 343:3, 357:16, 444:8, 462:7, 492:1, 518:9, 553:12, 594:18 detected 322:11, 325:11, 325:13, 332:15, 342:14, 349:14, 365:5, 469:2, 475:13 detecting 341:17, 341:18, 342:4, 342:20, 349:19, 350:12, 362:16, 363:2, 363:22, 364:7, 364:14, 444:11, 524:7, 554:5 detection 303:18, 309:17, 310:22, 311:8, 311:9, 312:10, 312:13, 313:5, 313:11, 313:13, 313:17, 313:18, 314:4, 314:11, 321:16, 325:8, 350:19, 363:10, 374:19, 375:8, 375:10, 413:22, 414:19, 417:10, 439:22, 442:20, 446:8, 446:9, 452:4, 452:18, 455:11, 459:3, 459:5, 459:8, 476:15, 482:14, 495:13, 545:20, 545:21, 546:11, 551:9, 552:16, 553:8, 553:19, 583:14, 583:22, 594:16, 602:10, 603:2, 607:13, 612:20, 613:3 detections 321:22	detector 333:1, 333:8, 334:21, 335:15, 336:11, 338:9, 392:21, 394:14, 553:11 detectors 332:6, 332:16, 332:18, 332:20, 333:3, 333:13, 335:9, 336:3, 336:5, 336:9, 338:4, 338:8, 338:12, 338:14, 378:6, 379:7, 379:11, 380:8, 385:5, 386:17, 387:8, 390:3, 392:19, 393:3, 552:19, 552:21, 553:5, 556:8 detects 349:21 determination 430:20, 440:21 determine 307:6, 323:10, 341:6, 357:14, 363:16, 374:22, 393:4, 404:11, 430:17, 495:10, 586:17, 586:19, 608:20 determined 341:22, 363:5, 364:4, 511:20 determines 476:21, 488:15 determining 341:14, 342:18, 349:20, 363:8, 463:10, 554:3 deterministic 419:6, 421:4, 421:5, 421:19, 423:2, 423:17, 424:9, 424:13, 425:18, 425:21,
---	--	---	---

426:20, 427:2, 427:3, 427:7, 427:14, 428:9, 428:14, 428:19, 431:2, 435:19, 436:17, 440:19, 441:4, 441:20, 442:1, 472:10, 472:11, 472:20, 476:17, 476:22, 477:5, 477:11, 477:16, 483:12, 484:19, 485:1, 486:8, 486:15, 486:22, 487:2, 488:5, 488:10, 488:12, 499:8, 509:5, 513:15, 518:6, 597:2, 597:6, 597:7, 597:15, 598:17, 601:15, 602:14, 603:10, 608:16 developed 458:16 development 552:13, 552:18, 553:4 devil 374:21, 376:15, 377:14, 455:5, 533:1, 540:6, 541:4 devil's 520:19, 539:22, 549:14, 613:5 diagrams 355:3 difference 352:2, 410:13, 421:18, 425:16, 484:18, 513:5, 522:8, 523:5, 524:6, 525:1, 525:6, 530:4, 531:12, 532:6, 549:16, 562:15 differences 486:13, 524:17,	532:8, 532:17, 532:20, 541:22, 566:7 differential 503:11, 507:7, 508:2, 512:2, 515:12, 517:8 differently 356:14, 455:18, 523:22 difficult 392:12 dimension 500:17, 582:17 dimensional 498:14, 500:6, 500:8, 500:9, 500:14, 501:6 dimensionality 439:12 direct 310:16, 409:8 directed 446:10, 470:4, 508:11, 526:9, 538:14, 573:10 direction 578:18, 578:21, 579:7, 579:9, 580:12, 580:19, 580:21, 582:14, 596:7, 600:19, 601:3, 623:9 directions 577:2, 577:5, 577:6 directly 448:4, 448:8, 568:13, 605:10 disagree 351:21, 470:3, 470:6, 470:11, 509:9, 509:11 disagreeing 390:1 disagrees 487:6 disclose 349:19	disclosed 314:5, 453:16 discloses 310:11, 310:12, 310:13 disclosure 397:19, 616:2 disclosures 446:3 discreet 503:2 discrete 503:3 discriminate 502:3, 602:3 discuss 307:1, 414:20, 453:5, 453:11, 504:14 discussed 308:10, 340:1, 345:10, 346:18, 392:15, 424:15, 427:10, 432:11, 435:20, 436:17, 451:10, 455:8, 456:17, 472:6, 472:21, 491:15, 509:18, 509:20, 509:22, 511:1, 515:2, 547:10, 558:14, 607:21 discusses 310:8, 310:21, 312:10, 453:8, 455:6, 459:4, 472:3, 478:7, 485:5, 505:8 discussing 327:3, 348:5, 348:6, 360:19, 385:15, 392:5, 455:15, 462:11, 542:7, 621:17 discussion 316:14, 373:6, 386:5, 407:10, 421:7, 424:11,	424:14, 501:13, 515:4, 536:6, 542:22, 543:12, 543:14, 543:16, 581:19 discussions 310:2, 423:6, 440:16, 499:10, 601:18 displacement 503:3, 503:5, 503:8, 507:10, 509:4, 509:17, 511:3, 512:2, 516:10 displacements 508:15, 514:20, 516:8 dispute 309:1, 309:3 dissertation 417:11 distance 565:5 distinct 349:22, 353:1, 618:15, 618:18 distinctive 532:6, 532:8, 532:20 distinctively 350:16, 351:5, 351:9, 426:3, 441:9, 442:5, 454:5, 454:15, 455:6, 456:5, 521:21, 532:4, 550:16, 558:6, 558:20, 563:7, 604:10, 607:8 distinguish 418:20, 421:14 distinguished 390:16 distinguishes 592:11 distribution 337:7, 344:8,
---	--	--	---

345:11, 353:17, 353:19, 360:16, 360:19, 362:2, 368:13, 380:7, 382:7, 384:21, 385:21, 387:16, 391:19, 395:2, 412:20, 434:15, 449:3, 450:13, 451:3, 526:11, 534:9, 535:14, 536:7, 540:5, 541:6, 544:5, 544:17, 614:6, 616:6, 618:21, 621:13 distributions 378:8, 379:9, 379:13, 385:6, 386:18, 387:9, 462:9, 540:12 divide 327:21, 328:1, 577:21, 579:5 divulge 307:9, 355:20 doctor 555:16 document 306:8, 378:2, 438:7, 445:2, 504:8 documents 306:21, 307:1, 307:3, 307:6, 308:9 dodge 321:6 dog 604:6, 605:20, 606:18, 607:3, 609:6, 609:16 doing 307:12, 313:3, 321:21, 355:22, 369:19, 373:13, 373:15, 373:17, 374:18, 375:5,	386:21, 386:22, 387:5, 404:4, 405:3, 406:19, 411:9, 411:11, 412:16, 425:9, 460:13, 460:21, 463:2, 465:4, 466:12, 474:5, 484:8, 484:14, 484:17, 486:8, 502:22, 509:3, 511:7, 514:15, 520:18, 528:22, 529:3, 553:11, 554:4, 559:1, 564:1, 564:3, 583:17, 583:19, 583:22, 584:3, 584:4, 584:5, 589:14, 591:3, 591:5, 593:12, 607:4, 613:5 dollars 352:15 domain 436:10, 436:11, 436:12, 438:1, 508:5, 620:16 done 322:14, 326:7, 337:1, 351:6, 355:9, 356:4, 361:3, 373:22, 377:17, 399:16, 418:7, 418:16, 419:2, 419:19, 425:14, 426:1, 429:5, 433:22, 442:5, 458:14, 459:17, 459:19, 460:10, 461:6, 461:10, 461:14, 461:18, 483:8, 492:8, 496:17, 496:21, 503:9, 507:13, 507:18, 509:13, 510:4, 510:7, 511:17,	513:15, 518:4, 534:6, 534:18, 544:14, 546:1, 549:14, 558:20, 560:6, 561:22, 571:2, 595:6, 596:3, 596:16, 598:5, 602:9, 602:10, 602:12, 602:20, 603:3, 607:1, 608:3, 610:13, 610:18, 613:8 door 605:8 dot 358:10, 503:11, 503:12, 516:5, 516:6, 575:8, 575:14, 575:19, 576:2, 576:15, 577:6, 577:16, 578:2, 578:3, 578:4, 578:6, 578:10, 578:12, 578:14, 578:22, 579:2, 579:14, 579:18, 579:22, 580:13, 580:15, 581:1, 581:10, 581:18, 581:19, 582:11, 583:9, 587:3 double 516:5, 559:19 double-blind 568:15, 568:22 down 359:6, 372:15, 378:11, 397:1, 399:15, 412:18, 451:17, 454:2, 474:2, 501:22, 516:1, 523:17, 526:8, 546:10, 551:16, 576:7, 576:8, 604:4, 609:17	downtown 301:4 dr 302:20, 305:12, 305:20, 308:21, 337:21, 409:5, 409:9, 409:15, 410:2, 410:11, 411:2, 423:21, 424:17, 424:20, 424:22, 426:5, 426:13, 469:19, 503:17, 503:18, 504:17, 504:21, 505:3, 506:2, 509:10, 510:4, 519:2, 559:4, 560:13, 560:16, 567:2, 575:1, 575:12, 575:17, 594:15, 601:22, 613:18 draft 568:12 dressed 303:17, 413:21, 414:18, 415:6, 416:1, 416:8, 416:20, 418:22 driving 604:4, 606:18, 609:17 due 457:14 during 307:10, 410:15, 487:18, 504:13 dynamic 372:1, 372:6, 372:11, 372:16, 372:20, 373:3, 373:9, 373:19, 374:2, 375:1, 375:22, 376:9, 376:18, 377:9, 413:19, 414:8, 415:15, 415:17, 416:2, 416:6,
---	---	--	--

416:9, 416:11, 416:20, 416:21, 417:1, 420:4, 423:18, 435:22, 436:5, 436:7, 436:8, 436:9, 436:10, 436:11, 436:13, 436:20, 437:1, 439:10, 440:22, 441:3, 444:12, 478:9 dynamically 373:12, 373:16, 400:20, 417:4, 417:16, 417:19, 418:2, 418:8, 419:12, 422:4, 422:14, 423:6, 431:13, 432:10, 432:15, 473:16, 474:7 dynamics 417:14	382:14, 385:22, 387:16, 388:18, 392:20, 393:3, 403:13, 408:1, 418:9, 423:15, 425:12, 425:14, 434:17, 444:10, 460:8, 460:16, 461:6, 474:8, 476:3, 483:13, 484:11, 488:14, 488:18, 503:5, 503:8, 505:21, 509:21, 526:9, 533:6, 535:5, 535:6, 538:14, 564:14, 565:1, 565:10, 565:14, 607:15, 607:18, 616:5, 618:20 earlier 311:5, 312:7, 314:1, 328:5, 333:17, 337:17, 356:11, 366:19, 368:2, 395:11, 421:3, 435:20, 436:18, 451:13, 453:4, 453:10, 455:8, 459:18, 460:3, 470:15, 470:20, 472:6, 478:6, 505:15, 505:17, 539:20, 543:14, 543:17, 549:13, 561:13, 600:14, 614:21, 622:9 ease 543:20 easier 480:19, 515:15, 599:9 easiest 345:21 easily 609:21 east 301:5, 623:20	eastern 300:21 easy 576:11 edge 401:10, 402:1, 404:19, 404:21, 404:22, 405:5, 526:9, 533:7, 533:13, 538:14, 590:10 edgels 565:6 edges 403:21, 616:10, 616:15, 616:18, 616:20, 617:3, 617:4, 617:18, 619:2, 619:11, 619:17, 619:20, 620:2, 620:7, 620:9, 621:9, 622:1 eight 314:13, 505:19, 507:11, 507:15, 507:19, 512:7, 546:10 either 334:18, 395:3, 528:4 elaborate 510:6 elastic 497:12, 498:9 element 315:12, 324:17, 324:19, 325:5, 410:18, 411:14, 416:19, 420:1, 420:13, 433:1, 433:7, 436:15, 440:14, 443:16, 445:16, 445:17, 446:3, 456:12, 468:9, 475:10, 503:1, 511:2, 514:21, 535:5	elements 324:1, 324:8, 324:9, 325:3, 422:18, 467:19, 497:15, 499:12, 501:16, 503:7, 505:18, 507:1, 507:3, 508:3, 508:15, 508:17, 509:16, 512:1, 512:4, 512:12, 512:20, 514:20, 517:7, 609:22 eli 300:17, 301:1, 303:2, 303:11, 304:1, 622:18, 623:19 elimination 595:3 ellipse 500:19, 595:7, 599:16, 608:4 ellipses 617:10 ellis 302:5, 305:10 else 373:18, 414:17, 494:14, 524:10, 547:10, 548:8, 557:13, 586:20, 598:6 eluding 359:2 emails 304:11, 304:12 embodiment 346:17, 463:9, 616:1 embodiments 395:18 employed 623:11 employs 417:9 encode 402:8
---	---	---	--

encodes 402:5, 402:7, 526:11, 538:16, 564:13	466:1, 466:4, 466:5, 466:9, 466:16, 467:3, 468:14	566:4, 584:16	563:3, 563:6, 565:2, 571:3, 572:11, 580:1, 585:22, 586:14, 591:2, 597:4, 597:15, 598:12, 599:13, 602:9, 602:13, 604:9, 608:5, 617:2
encompasses 602:2	equaling 546:19	erroneous 479:13	essentials 434:21
end 420:21	equally 392:1, 395:2	error 480:2, 574:22	estimates 454:10
engineering 501:18	equals 462:12, 463:9, 463:11, 463:15, 463:17, 464:5, 464:11, 464:14, 465:8, 465:11, 467:14, 467:16, 516:6, 565:11	errors 505:16, 509:19, 511:4	estimating 447:13
english 318:16	equate 552:16	esquire 302:4, 302:12	estimation 369:21, 370:2, 421:19, 423:17, 424:10, 424:12, 425:17, 425:18, 425:22, 426:20, 427:12, 428:11, 436:17, 440:20, 441:5, 441:20, 442:2, 450:19, 483:12, 484:20, 486:1, 486:8, 486:9, 486:22, 487:1, 488:5, 488:10, 488:12, 530:5, 597:6, 597:8
enough 407:6, 456:7	equation 344:8, 344:15, 368:1, 368:5, 380:21, 381:5, 382:3, 382:19, 383:3, 384:21, 412:4, 433:12, 433:14, 433:18, 434:13, 460:3, 461:22, 468:11, 501:15, 502:21, 503:11, 507:6, 507:7, 507:8, 515:11, 515:12, 515:14, 516:3, 516:5, 530:13, 535:1, 535:22, 537:17, 584:20	essential 319:10, 508:16	estimations 369:20
entire 347:13, 347:16, 378:15, 378:20, 385:22, 387:4, 387:6, 387:17, 390:15, 390:17, 390:19, 390:21, 413:11, 443:10, 456:15, 456:18, 457:11, 457:19, 457:21, 458:17, 459:12, 459:20, 460:13, 494:21, 528:5	equations 366:19, 372:9, 374:16, 375:14, 392:4, 394:9, 405:15, 405:16, 408:10, 408:13, 419:22, 420:11, 420:15, 422:16, 422:19, 422:21, 433:10, 507:4, 508:2, 512:3, 517:8, 528:14,	essentially 316:1, 316:5, 317:8, 317:19, 318:21, 328:1, 328:4, 329:8, 342:17, 346:10, 358:11, 365:18, 369:17, 370:13, 385:17, 393:15, 393:16, 394:2, 401:22, 402:6, 408:10, 410:11, 411:9, 411:16, 428:4, 451:5, 452:22, 458:9, 462:18, 462:21, 463:19, 463:21, 465:3, 482:16, 489:11, 489:19, 497:13, 498:17, 499:10, 502:12, 503:10, 505:3, 507:2, 507:8, 510:2, 511:5, 511:19, 512:1, 512:7, 519:22, 521:7, 522:19, 527:12, 535:14, 536:2, 537:12, 538:6, 538:7, 543:12, 545:22, 546:19, 548:18, 553:11, 553:15, 553:21, 558:5,	et 303:12, 303:16, 304:13, 304:14, 314:12, 357:17, 393:9, 446:15, 478:8, 483:16
entities 331:15, 349:22, 357:14			evaluate 587:18
entity 319:11, 353:3, 360:14, 369:19, 437:14			even 431:10, 432:5, 441:4, 492:7, 501:16, 508:5, 511:9, 517:15, 527:11, 538:2,
equal 337:19, 359:6, 365:18, 365:19, 368:21, 370:4, 370:6, 370:12, 370:16, 370:18, 370:21, 371:8, 371:9, 395:13, 409:11, 452:20, 458:5, 462:21, 463:1, 463:7, 463:22, 464:20, 465:20, 465:21,			

559:15 eventually 385:13 ever 354:4, 399:8, 567:4, 571:19 every 353:19, 354:15, 388:1, 430:19, 443:16, 443:18, 453:16, 459:9, 476:5, 484:4, 485:22, 531:11, 546:12 everything 392:14, 453:16, 474:5, 524:10, 547:10, 598:6 evidence 545:14, 616:6, 618:21 exact 366:6, 381:19, 407:2, 520:16, 520:18, 536:10 exacting 505:10 exactly 372:8, 373:22, 392:9, 392:11, 463:21, 470:9, 506:5, 506:7, 506:9, 536:20, 537:17, 563:19, 572:10, 575:21, 596:11, 602:7 examination 303:2 examine 377:18 example 327:2, 329:4, 369:12, 391:10, 391:11, 480:6, 481:5, 526:7, 562:5, 603:20, 620:5 examples 304:4, 485:4,	496:5, 498:3, 498:8, 522:22, 544:5, 578:16 exception 436:16, 462:18, 598:5 exclude 335:10, 338:13 excuse 411:7, 452:10, 582:4 exhibit 303:9, 306:5, 306:6, 306:22, 307:17, 308:18, 308:19, 348:9, 348:19, 348:20, 376:6, 377:21, 377:22, 399:22, 400:5, 400:6, 409:7, 413:14, 413:17, 415:20, 431:6, 438:4, 438:5, 438:19, 441:14, 445:5, 445:6, 446:16, 480:14, 480:15, 480:18, 480:19, 481:12, 481:13, 487:10, 496:20, 497:2, 497:3, 497:7, 499:6, 499:20, 501:19, 504:5, 504:6, 504:18, 505:4, 505:7, 505:9, 505:11, 510:16, 511:12, 512:14, 514:12, 515:10, 515:11, 515:15, 515:18, 515:22, 516:3, 516:4, 517:4, 518:15, 519:2, 519:4, 519:7, 519:12, 519:15, 520:9, 521:6, 522:3, 527:17, 528:1,	529:12, 535:17, 548:6, 549:10, 549:20, 550:11, 552:4, 554:9, 559:3, 560:4, 560:10, 560:11, 567:19, 567:21, 573:2, 574:10, 574:11, 594:9, 594:10, 613:19, 618:2 exhibits 303:7, 307:15, 567:17, 571:4, 572:14, 572:15, 572:17 exist 359:4, 376:13, 376:16, 395:4, 477:4, 529:8, 597:12 existence 581:13, 582:2 exists 475:2, 477:15, 603:12 expect 484:22, 604:3, 604:5 expecting 605:19 experimental 421:10, 472:3, 472:8 experiments 420:21, 422:22 expert 354:6, 356:2, 356:7, 356:8, 361:8, 367:17, 496:4, 496:7, 510:10, 567:6, 568:9 experts 510:8 expires 624:5 explain 311:19, 312:4,	345:22, 374:1, 393:11, 397:10, 400:17, 410:21, 466:12, 470:10, 494:16, 496:19, 534:20, 535:10, 541:22, 552:19, 555:19, 561:3, 566:2, 566:7, 566:11, 575:12, 614:17, 620:22 explained 338:22, 349:4, 349:9, 349:17, 351:10, 352:2, 354:11, 356:11, 388:8, 421:2, 422:6, 422:9, 442:18, 470:15, 470:19, 477:6, 492:3, 505:17, 528:11, 540:8, 549:13, 561:13, 575:17, 585:15, 586:9, 591:9 explaining 353:13, 354:6, 356:8, 403:6, 419:14, 419:17, 462:22 explains 556:11 explanation 311:17, 420:5 explanatory 552:2 explicitly 313:13, 313:18, 313:21, 351:13, 410:15, 537:18 expressly 362:15, 534:8 extent 307:11, 329:18, 355:22 extrapolate 499:1, 501:7, 507:20
--	--	--	---

extrapolated 507:14, 507:15, 513:9 extrapolating 509:6 extrapolation 497:9, 497:20, 498:15, 498:19, 499:4, 499:7, 499:22, 500:11, 500:13, 508:18, 508:22, 513:4, 513:11, 514:11, 514:17, 515:5 extrapolations 505:20, 517:10 eye 592:2, 592:3 eyes 356:9, 367:18 F face 583:19, 583:21, 588:11, 589:2, 591:16, 592:5, 592:12, 592:13, 592:16, 592:18, 593:2, 593:17, 593:19 facial 591:2 facilitating 568:14 fact 390:2, 402:3 fair 311:19, 456:7, 602:21 fairly 388:3, 388:10 familiar 306:8, 378:2, 438:7, 504:8, 519:7, 569:8 farther 514:8 faster 312:4	feature 393:17, 393:19, 400:15, 402:15, 402:16, 403:4, 403:15, 403:20, 404:22, 406:15, 406:21, 407:1, 407:3, 408:6, 590:4, 590:10, 596:6, 596:19, 596:21, 596:22, 597:3, 597:15, 597:19, 598:14, 600:14, 601:9, 602:11 features 393:17, 393:20, 393:22, 400:21, 401:9, 401:10, 401:12, 402:1, 402:2, 402:5, 402:14, 403:17, 403:21, 404:3, 404:11, 404:12, 404:19, 404:20, 404:21, 406:16, 406:17, 406:20, 406:22, 407:17, 407:18, 583:5, 583:7, 586:1, 589:22, 592:9, 592:22, 593:4, 593:5, 603:9, 608:7, 608:9 feedback 571:2 feet 328:2 feldberg 302:13, 305:15 fem 503:1 few 361:22, 425:2, 456:19, 475:18, 476:21, 478:12, 485:11, 485:12, 488:13, 548:15	field 495:13 fig 452:20 figure 326:22, 327:1, 327:4, 327:7, 328:18, 333:22, 334:4, 334:7, 334:9, 334:10, 345:22, 346:3, 346:13, 346:19, 347:2, 347:7, 360:15, 379:1, 389:11, 396:19, 396:20, 398:5, 398:15, 423:10, 423:12, 431:9, 431:17, 431:19, 431:20, 431:22, 432:2, 432:5, 432:9, 434:16, 460:6, 481:19, 485:4, 485:6, 487:13, 487:17, 489:13, 492:12, 493:18, 505:4, 505:8, 505:9, 505:11, 505:12, 506:1, 507:14, 507:17, 510:3, 510:4, 511:6, 511:11, 511:15, 511:21, 512:6, 518:4, 521:10, 521:11, 521:12, 521:13, 521:14, 521:16, 521:17, 529:16, 530:14, 533:3, 533:6, 536:9, 536:10, 544:6, 549:6, 553:21, 554:12, 555:18, 556:17, 557:1, 559:10, 562:16, 591:14, 591:17, 591:18, 594:20, 595:1,	598:3, 599:6, 608:1, 611:9, 615:3, 615:9, 615:12, 616:21, 620:4, 620:12, 621:2, 622:2 figures 303:21, 338:2, 338:16, 339:12, 353:14, 366:18, 368:1, 389:10, 492:4, 521:8, 522:16, 566:4, 616:18, 616:19, 616:20, 619:15, 619:17, 619:18 filed 317:16 filtering 446:13, 447:18, 448:16, 449:4, 449:17, 449:19, 450:14, 544:13 filters 455:4 financial 352:15, 623:12 find 362:12, 404:12, 404:13, 405:4, 405:15, 408:6, 408:11, 408:13, 408:15, 428:6, 432:18, 477:8, 480:20, 492:10, 494:11, 506:19, 536:3, 551:7, 551:8, 551:11, 552:8, 598:13, 599:9, 608:8 finding 516:2, 538:9, 538:10, 591:16, 606:16 finds 487:2 fine 307:20, 311:22,
--	--	--	---

405:10, 405:11, 494:4 finish 348:7, 467:22, 483:4, 516:22, 562:20 finished 469:14 finite 497:15, 499:12, 501:16, 503:1, 503:6, 505:18, 507:1, 507:3, 508:3, 508:15, 508:17, 509:16, 511:2, 512:1, 512:12, 512:20, 514:20, 517:7 first 308:3, 328:17, 360:2, 360:9, 373:5, 374:14, 382:20, 383:3, 384:18, 396:22, 400:18, 405:6, 405:7, 412:8, 437:9, 439:2, 442:17, 444:17, 446:1, 448:4, 451:9, 464:19, 470:9, 473:6, 474:2, 475:10, 487:18, 502:21, 505:18, 507:19, 512:6, 524:3, 524:6, 528:1, 531:8, 534:21, 535:10, 535:19, 536:6, 537:21, 538:1, 540:4, 541:5, 551:8, 561:9, 568:8, 569:8, 579:5, 586:9, 596:13, 597:11, 614:9, 614:12, 614:18, 618:8, 621:16 fit 311:20, 437:15,	437:18, 463:7, 493:5, 495:4, 550:6, 550:18, 561:18, 562:2, 593:13, 593:15, 609:4, 609:13 fitting 595:7, 599:16 five 382:8, 382:9, 403:12, 428:21, 460:20, 460:22, 461:1, 610:6, 613:8, 618:15, 618:18, 619:8 five-minute 610:12 fixed 417:9, 473:16, 505:21 flock 327:14 flying 431:11, 432:6 focus 442:15, 443:21, 445:8, 599:8 focuses 349:21 following 315:14, 592:2, 616:3 foregoing 623:4, 623:5 foreground 599:8 formal 410:12 formation 499:3 former 459:8 formula 526:22, 529:6, 534:13, 534:15 formulas 353:16, 515:7, 515:9	formulate 541:5 formulated 442:21, 446:10, 471:16, 538:9 formulation 370:11, 420:18, 467:19, 467:20, 471:11, 471:15, 473:9, 473:11, 481:10, 501:15, 527:9, 530:8, 530:9, 530:12, 531:15, 543:20 formulations 355:3, 355:7, 529:5 forth 315:14, 459:10 forward 527:20 forward-backward 528:4, 528:7, 549:12, 549:22, 550:12 found 403:12, 406:14, 608:10 four 382:6, 382:10, 382:12, 384:2, 384:4, 405:12, 407:19, 451:17, 451:22, 564:12 framework 413:6, 420:18, 441:19, 442:3, 442:4, 447:12, 485:3, 531:19, 544:10, 545:12, 618:9, 618:14, 618:17 front 329:19, 361:9, 361:11, 366:20, 377:7, 469:22, 515:16, 535:17, 559:2, 574:18,	576:8, 613:19, 618:2 full 306:14, 487:14, 618:7 fully 612:19, 613:3 function 337:3, 402:13, 404:16, 405:19, 405:22, 406:6, 406:13, 408:17, 532:15, 538:15, 575:22 functions 336:22, 427:6, 460:1, 462:1, 536:22 further 322:22, 324:20, 401:8, 442:20, 446:6, 451:19, 452:2, 517:15, 613:11, 622:13, 623:15, 623:18 furthermore 501:21, 502:2 fuse 470:13 fusion 370:8, 463:12, 463:14, 464:1, 470:5, 470:7 fusions 466:7 future 499:7, 499:21, 500:3, 500:22, 509:1, 509:6
G			
game 354:3, 512:19, 512:22, 513:2, 517:13, 518:14 gamma 434:10, 434:12 garden 301:4, 623:19			

gaussian 538:18, 538:20	438:17, 455:20, 471:5, 482:2, 496:5, 526:7, 572:3, 584:15	429:13, 445:18, 445:21, 452:11, 463:17, 467:2, 467:22, 471:18, 471:20, 472:17, 476:12, 478:14, 478:15, 479:1, 480:13, 480:14, 492:12, 496:20, 505:6, 505:7, 515:10, 518:15, 521:4, 526:21, 527:16, 529:12, 535:3, 535:11, 536:3, 537:9, 541:19, 542:4, 545:13, 551:1, 559:6, 560:16, 560:19, 573:13, 581:16, 584:12, 591:19, 594:1, 595:18, 605:12, 609:1, 614:18, 617:6, 617:12, 617:13, 618:4, 620:4, 622:7	479:19, 482:5, 482:6, 482:7, 482:12, 484:4, 495:15, 497:1, 498:22, 499:17, 501:8, 504:4, 507:19, 510:9, 518:18, 518:22, 527:7, 531:16, 560:9, 563:19, 563:20, 564:2, 564:17, 567:18, 573:9, 574:9, 577:20, 578:22, 580:7, 584:1, 584:10, 584:14, 585:12, 597:4, 598:13, 600:6, 609:14, 609:16, 610:9, 610:11, 610:16, 615:21
gave 371:3, 482:2, 572:16, 578:16	given 330:3, 334:10, 334:12, 334:14, 334:15, 394:3, 419:2, 419:3, 426:18, 442:9, 462:8, 469:19, 471:14, 473:7, 503:17, 544:2, 544:4, 557:18, 611:4, 611:13, 612:10, 623:6	going 306:4, 308:16, 311:12, 311:13, 314:2, 346:20, 355:19, 365:13, 369:12, 370:15, 377:20, 387:22, 391:20, 391:21, 392:11, 400:2, 405:7, 408:21, 412:22, 413:16, 429:2, 429:3, 429:14, 430:11, 430:14, 431:1, 437:16, 437:17, 438:3, 452:7, 460:21, 468:10,	gone 425:2, 461:21, 469:11, 530:19, 547:9, 548:15
general 319:1, 319:13, 319:21, 320:3, 370:11, 372:18, 373:2, 558:16, 558:17, 569:17, 571:21, 571:22, 572:11, 574:3, 574:4	giving 370:10, 575:22	goes 312:2, 445:13, 446:18, 565:12, 585:9, 595:12, 599:15	good 305:9, 305:20, 305:21, 408:22, 409:1, 469:16, 613:13
generalization 447:18, 448:15, 448:17, 448:21, 449:17, 449:19, 450:9, 544:13, 544:15	glass 496:6	go 308:16, 311:12, 312:4, 315:16, 325:14, 328:19, 333:16, 341:3, 357:21, 357:22, 360:1, 360:8, 362:1, 362:13, 370:4, 370:5, 376:7, 379:22, 380:1, 380:19, 383:20, 384:3, 385:3, 387:1, 388:1, 391:2, 391:7, 399:2, 399:3, 399:5, 401:19, 405:3, 405:4, 406:11, 406:12, 407:2, 408:2, 408:19, 412:5, 412:8, 414:20, 415:18, 422:22, 423:1, 425:10, 429:4,	grab 581:17, 585:10, 593:15
generally 372:22, 502:7, 505:2, 520:6, 555:7, 555:17, 571:18, 575:11, 613:4	glean 506:8, 557:13	global 417:9	graduate 361:11, 366:20
generating 304:3, 498:2, 498:7			graph 446:11, 448:20, 450:1, 450:6, 450:8, 564:6, 564:8, 564:9, 591:12, 592:1, 595:9, 596:1, 596:14, 608:4, 616:5, 616:10, 616:16, 618:20, 619:3, 619:11, 621:9
generation 595:5, 599:15			graphical 304:9, 311:7,
generic 337:11, 361:15, 388:2, 455:21, 456:3, 505:14, 509:15, 511:22			
generically 324:10, 339:5			
getting 379:3, 402:21			
gibbs 450:20, 544:18			
giphy 300:8			
give 306:14, 369:12, 370:11, 371:6, 388:2, 414:22,			

312:5, 312:8, 312:10, 312:13, 312:17, 312:19, 312:21, 313:5, 314:3, 323:4, 323:6, 323:8, 327:4, 330:1, 333:19, 333:21, 334:3, 334:5, 334:17, 341:11, 341:12, 342:7, 342:8, 343:7, 343:9, 356:16, 357:7, 357:19, 373:10, 378:15, 387:3, 389:17, 390:5, 390:12, 390:14, 442:22, 444:2, 444:11, 447:13, 463:9, 464:4, 465:8, 465:12, 466:15, 467:5, 536:11, 536:15, 536:19, 537:5, 537:22, 538:3, 538:5, 538:10, 540:10, 544:11, 547:2, 549:9, 562:4, 595:16, 603:12, 616:3, 616:8, 618:18, 619:1	guys 372:14	557:22, 569:10, 588:19	606:7, 607:5, 608:21
	H	headers	hilton
	half	417:13	301:4, 623:19
	346:21, 487:19, 488:1, 618:7	heard	hold
	halfway	354:4	523:15, 582:6
	454:2, 501:22, 551:16	hearsay	hole
	hand	573:10	493:6, 495:5, 550:6, 561:19
	305:3, 306:4, 308:17, 377:20, 400:2, 413:16, 438:3, 497:1, 504:4, 519:1, 560:9, 567:18, 574:9, 624:1	heavily	hollow
	handed	539:10, 539:11, 539:12	492:20
	503:21, 594:8	height	home
	handing	565:13, 565:15	585:10
	348:18, 400:4, 445:4	held	hope
	handling	301:1, 570:17	457:2, 496:22, 572:2
	573:4	helps	hour
	hang	339:15, 405:9	408:22, 518:19
	452:7	hence	however
	happen	546:13	343:2, 361:2, 451:2, 545:7, 545:10
	342:6	here's	huh
	happened	390:17, 407:18, 487:3, 507:18, 608:6, 608:11	582:21
	571:21, 572:18	hereby	human
	happening	623:4	303:17, 303:21, 326:19, 327:22, 352:13, 413:19, 413:21, 414:8, 414:18, 415:3, 415:6, 415:9, 415:11, 415:12, 416:1, 416:5, 416:6, 416:8, 416:11, 416:17, 416:20, 417:9, 417:10, 417:19, 418:1, 418:2, 418:3, 418:22, 422:4, 426:15, 426:16, 431:13, 432:11, 432:15, 434:17, 434:18, 480:10, 485:9, 491:18, 492:15, 493:10, 493:22, 494:1, 555:13, 587:19, 591:16,
graphs	593:12, 598:4	hereunto	
448:19, 544:14	happens	624:1	
great	568:18, 568:21, 573:7	hi	
362:5, 573:14	happy	565:2, 565:11, 565:13	
greater	311:16, 377:18, 380:1	hidden	
370:21, 371:7, 371:9, 452:20, 458:5	hard	439:12, 440:15, 603:19, 604:8, 604:12, 604:14, 604:19, 604:22, 605:2, 605:5, 605:12, 605:17	
greek	392:8, 393:8	hierarchy	
359:16, 381:6	harmon	432:20	
guarantee	300:25, 301:10, 623:3	high	
361:10	head	500:16, 521:18	
guess	308:14, 328:2, 453:15, 530:15, 554:17, 555:4,	higher	
366:8, 560:5, 615:20		580:4, 580:7, 580:9, 581:9, 581:11, 581:22	
guidelines		highest	
367:11		604:10, 605:3, 605:16, 606:1,	

600:4, 600:7, 600:8, 603:14, 609:5, 612:20, 613:3 humans 609:15, 609:16 hundred 366:17, 369:1, 482:4, 482:19, 580:16, 606:17, 606:19, 607:2, 608:19, 612:16, 613:6 hypothesis 471:17, 473:17 hypothetical 372:19, 392:9, 393:7, 394:13, 577:19 hypothetically 375:13 hypotheticals 320:3, 392:6, 392:8, 392:12, 393:8	496:10, 496:13, 496:16, 509:11, 620:22 ignore 391:16 ij 359:12, 359:17, 382:20, 412:7, 412:8, 526:11, 527:2, 527:5, 527:8, 614:13, 615:17, 621:17, 622:9 ik 383:2, 384:14 ikl 384:14 illumination 599:7 illustrate 431:22 illustrates 431:17, 431:20, 432:3 image-based 420:12, 420:17 images 310:12, 325:15, 325:17, 330:13, 330:14, 341:16, 357:12, 400:22, 411:14, 411:15, 418:12, 420:10, 420:11, 468:17, 469:5, 469:6, 469:8, 471:19, 471:20, 471:22, 554:7, 588:12, 589:3, 591:3 immediately 479:15, 479:16 implement 398:16 implemented 313:10, 325:7, 332:10, 344:6, 398:17, 563:18 import 314:14, 563:21	important 380:12, 436:13, 440:11, 584:11, 593:21, 593:22 importing 314:17, 355:11, 355:16 improve 558:2 improves 339:10, 339:19 improving 339:15 inaccurate 409:21, 509:14 inapplicable 515:5 inc 300:5, 300:6, 300:8 include 325:18, 330:15, 392:13, 439:10, 469:7, 469:8 includes 362:17, 441:21 including 325:15, 527:20, 528:3 incoming 449:5, 450:15, 451:2, 544:20, 544:22, 545:7, 545:11 incomplete 393:7 incorporating 355:11 incorrect 347:12, 351:17, 410:20, 425:1, 426:13, 561:20, 561:21, 576:5, 594:16 incorrectly 409:9, 575:1 increase 394:1	increases 391:3 independently 371:19, 482:21, 482:22 index 615:14 indicate 344:22, 385:21, 409:8, 572:18 indicated 313:4, 470:2, 553:7 indicates 405:21, 552:4 indicating 542:9 indicators 566:18 indices 566:19 individual 378:16, 378:21, 387:5, 387:7, 390:15, 390:18, 390:22, 451:1, 544:19, 545:9 individually 393:5 infer 605:11, 606:12, 616:4, 618:20 inference 378:15, 387:4, 387:6, 390:14, 442:21, 446:10, 449:22, 457:10, 477:18, 477:22, 478:2, 483:6, 483:13, 485:2, 538:10, 544:14, 603:20, 604:22, 616:4, 618:19 inferencing 483:2, 483:6, 483:9, 486:5, 486:6 inferring 447:11
I			
id 552:11 idea 362:5, 456:3, 563:21 ideally 406:11, 408:12, 458:1, 458:18 ideas 532:3 identical 538:6, 538:7 identification 471:8 identified 306:21, 456:10, 622:1 identify 434:16, 480:9, 492:14, 492:18, 493:9, 494:19,			

information 365:22, 411:7, 419:7, 423:2, 428:12, 472:2, 472:7, 472:9, 476:16, 476:17, 477:1, 487:19, 488:7, 499:6, 499:21, 500:2, 553:4, 555:20, 556:12, 557:19 initial 418:20, 442:19, 443:12, 443:19, 444:21 initialization 461:3 initially 316:1 inn 301:4, 623:20 inner 457:19 input 505:13, 511:16, 511:18, 594:21, 595:2, 599:18, 608:3 inside 492:19, 492:22, 493:7, 494:9, 494:13, 494:22, 496:15 insights 510:10, 510:13 instagram 300:6 instance 312:16, 325:5, 326:22, 328:18, 333:22, 373:10, 380:19, 390:9, 406:7, 415:4, 418:21, 423:9, 430:17, 461:22, 490:16, 491:3, 500:19, 502:20, 521:10, 525:7,	526:6, 536:9, 590:10, 590:12, 591:10, 609:15, 615:3, 620:5 instant 330:3, 334:11, 334:12, 334:14, 334:15, 611:4, 611:13, 611:14, 612:10 instead 349:21, 394:22, 448:20, 452:15, 458:17, 459:12, 459:17, 459:19, 460:12, 464:7, 500:19, 510:6 institution 495:18 instructed 354:13, 354:15, 367:20 instruction 419:8 integer 452:19, 458:5, 545:21 integral 559:19, 559:20, 564:2 integration 459:11, 546:4, 546:5, 546:13, 546:15, 559:19 intended 355:5, 358:22, 360:13, 367:7, 367:9, 390:13, 392:2, 573:12 intending 353:22, 375:16 interconnected 555:10, 616:22 interest 610:1, 623:12 interested 609:15, 609:19, 610:3	interference 448:18 interior 490:4, 490:10 internal 494:8 interpretation 351:21, 352:1, 410:15, 424:20 interprets 409:10 introduced 306:7, 308:20, 348:21, 378:1, 400:7, 413:15, 417:12, 418:19, 438:6, 445:7, 458:8, 497:4, 504:7, 519:5, 560:12, 567:20, 567:22, 574:12, 594:11 introduces 421:4, 423:1, 424:9, 425:17, 484:19 introduction 446:19, 446:20 invariant 415:10, 415:14 invention 310:14, 310:22, 311:7, 311:9, 312:9, 312:12, 313:1, 314:3, 314:5, 354:21, 356:19, 371:7, 371:11, 371:14, 377:16, 394:19, 399:18 inventors 316:16, 367:6, 367:8, 443:14, 445:16, 451:8, 453:5, 453:11, 456:12, 466:2, 519:10, 531:18, 532:2	involve 430:7 involved 429:21 ip 300:12, 305:16 ipr 300:10, 306:1 iprs 354:14, 367:21, 510:12 isard 563:16 ish 391:8, 391:10, 406:13 item 507:8 iterating 373:12 itself 329:11, 340:2, 342:20, 359:20, 380:22, 394:8, 399:10, 402:15, 491:7, 492:21, 495:8, 496:1, 552:1, 603:6 J j 614:14 jets 575:3 jetting 591:6 job 300:23 joint 336:22, 337:3, 337:7, 344:7, 345:10, 353:17, 360:16, 360:18, 362:1, 368:12, 382:7, 384:21, 412:19, 434:15, 434:19, 439:6, 439:9, 442:3,
---	--	--	--

462:9, 534:8, 535:14, 535:21, 536:7, 540:4, 540:12, 541:5, 547:2, 612:8, 612:10, 614:5, 621:13 jointed 562:9, 564:7, 564:12 joints 611:3, 611:11, 611:12, 611:15, 612:8 jorgensen 302:13, 305:15 jpeg 369:13, 369:15, 369:17, 370:2, 371:20, 371:21, 375:6, 375:9, 482:3, 482:5, 482:6, 482:7, 485:18, 486:4 jump 306:17	395:14, 401:22, 465:20, 481:17, 489:9, 496:15, 496:18, 498:16, 501:14, 501:22, 521:14, 521:18, 522:13, 522:19, 524:4, 527:12, 598:8, 618:13 kinds 592:4 kinematic 375:18, 497:13, 498:16, 499:5, 499:8, 499:18, 501:14, 503:10, 503:13, 506:16, 508:2, 509:5, 509:6, 511:3, 512:11, 512:20, 513:16, 514:19, 516:13, 516:16, 517:3, 517:6, 518:7 kinematic-type 506:22 kinematically 499:11 kinematics 509:17, 517:19 kirkland 302:5, 305:10 knowledge 482:11, 502:15, 528:9, 540:12, 540:20, 547:1, 567:16, 568:1, 569:19, 570:1, 571:13, 571:16, 572:4, 573:21 known 350:19, 455:11, 456:1, 456:4, 604:2, 604:3, 604:8 ku 516:6	615:12 lambda 565:5 lamborghini 398:8, 566:6, 566:9 landmark 590:16, 590:17, 590:19, 590:22, 591:7, 591:9 landmarks 589:16, 589:21, 590:12, 591:3, 592:4, 592:8, 592:10, 592:22, 593:5 language 318:16, 385:10, 414:12, 414:13, 414:15, 414:17, 546:1 largest 555:12 last 419:6, 419:10, 420:16, 421:2, 428:21, 453:17, 533:5, 538:4, 545:8, 556:21, 556:22, 559:7, 598:6, 616:14, 619:6 late 569:13 later 342:1, 342:3, 342:6, 343:4, 362:18, 363:6, 363:13, 364:5, 364:17, 365:14, 365:19, 368:21, 418:19, 425:19, 479:5, 479:8, 479:15, 479:16, 479:18, 484:19, 554:7 latter 364:22	layer 339:13, 339:14, 345:2, 345:6, 346:6, 346:8, 346:11, 346:21, 347:8, 347:16, 347:19, 359:20, 383:8, 395:8, 395:16, 396:8, 396:12, 396:17, 396:22, 397:1, 397:2, 397:5, 397:11, 397:12, 397:16, 397:17, 397:20, 398:1, 398:5, 398:15, 398:16, 398:19, 398:21, 398:22, 399:2, 399:4, 399:5, 531:9, 532:13, 547:8, 547:9, 549:15, 561:9, 561:16, 561:17, 562:2, 566:14, 566:18, 566:19, 612:3, 612:4, 615:12, 615:13, 617:1, 617:2, 617:13, 620:6, 620:17, 621:3, 621:4, 621:5, 621:6 layers 355:6, 368:4, 397:15, 532:12, 566:18 lays 450:17 ld 310:12 lead 406:8, 406:9 leading 622:8 learned 439:11, 544:5 learning 537:7, 537:8
K			
kadi 300:25, 301:10, 623:3 keep 322:19, 353:4, 359:2, 366:3, 366:5, 366:6, 367:15, 390:20, 422:7, 482:12, 515:17 keeping 397:12 kernel 449:1, 450:12, 450:17, 544:17 key 574:22 kid's 401:15 kind 319:21, 349:18,			
	L		
	labeled 334:7, 334:9,		

least 404:16, 406:7, 408:16 leave 367:10 lecture 370:10 left 383:4, 454:2, 592:2, 594:2, 610:7 legal 354:8, 356:2, 356:7, 367:19, 371:6 legs 554:18, 555:5 lehman 302:13, 305:15 length 620:16 lengthy 457:14 let's 317:15, 343:6, 343:20, 344:19, 346:14, 362:1, 362:6, 362:10, 362:22, 373:13, 376:5, 378:4, 382:3, 385:3, 392:17, 392:19, 393:19, 399:19, 399:21, 404:9, 404:19, 407:18, 408:19, 409:2, 409:21, 412:5, 413:12, 415:18, 422:22, 428:21, 431:4, 437:9, 442:8, 443:21, 445:8, 445:18, 445:21, 469:13, 469:14, 476:12, 479:20, 482:17, 486:17, 487:8, 490:21, 491:1, 492:12, 496:20,	505:6, 511:11, 518:15, 518:20, 527:16, 529:12, 534:11, 535:8, 541:19, 542:4, 548:4, 551:1, 554:9, 554:12, 558:8, 559:3, 560:16, 562:2, 566:21, 573:13, 576:11, 577:11, 587:11, 594:1, 595:18 letter 358:15, 359:16, 381:7, 381:8 letters 381:6, 381:10, 381:12, 381:15 level 328:17, 391:3, 394:1, 529:9, 612:11, 612:12 liang 303:19 librarian 567:2, 567:4 library 581:17 lid 490:20 lieu 345:1 life 557:5 lift 465:3 light 311:11, 312:15, 313:2, 314:7, 315:3, 316:20, 317:13, 318:7, 326:4, 352:21, 354:16, 354:20, 355:1, 356:10, 367:5, 367:20, 367:22, 413:3 likelihood 378:7, 379:8,	379:12, 380:18, 381:10, 381:15, 381:18, 382:1, 385:5, 386:8, 386:14, 386:18, 387:9, 387:11, 387:13, 388:14, 388:15, 389:13, 389:15, 391:14, 391:21, 392:2, 393:4, 394:5, 394:8, 394:18, 395:1, 473:6, 525:11, 532:18, 545:15, 607:6, 616:6, 618:21 likelihoods 380:16, 383:21, 384:16, 385:11, 385:15, 392:3, 394:6, 460:2, 462:3, 525:8, 525:9, 537:11, 547:3, 549:17 likely 392:1, 395:2, 479:13, 581:12, 582:1 limb 439:6, 439:9 limbs 487:20, 488:9, 539:12, 549:5 limit 322:7, 340:2, 392:13, 393:9, 458:9, 458:12 limitation 309:5, 309:7, 309:10, 323:15, 324:20, 356:20, 443:6, 445:22 limitations 309:20, 322:22, 324:1, 355:11, 355:16, 444:3 limited 309:17, 414:1,	444:2, 460:15, 466:17, 466:21, 515:1 line 329:20, 329:21, 329:22, 333:16, 357:21, 360:2, 370:5, 380:21, 381:2, 381:20, 384:19, 385:12, 386:6, 391:8, 391:10, 401:6, 406:4, 406:13, 412:5, 412:9, 442:7, 448:10, 448:14, 453:17, 457:1, 457:8, 459:1, 527:1, 527:3, 534:13, 551:7, 551:11, 552:13, 585:1, 591:19, 591:22, 595:18, 613:22, 614:1, 614:10, 614:19 linear 372:20, 373:3, 373:17, 373:19, 374:2, 375:1, 376:9, 376:18, 377:9, 436:19, 436:21, 436:22, 437:15, 437:18, 439:10, 578:5, 581:1, 581:18, 582:10 linearize 437:4, 437:5, 437:13 lines 344:22, 345:5, 347:10, 395:7, 395:12, 400:9, 400:10, 400:11, 402:11, 451:18, 451:22, 474:2, 530:15, 536:18, 538:19, 543:10,
--	---	---	---

546:9, 546:10, 558:10, 559:9, 601:1, 607:10, 614:6, 615:18, 617:9 link 561:9 list 306:21, 325:3, 528:3 listed 307:15, 322:4, 323:12, 325:18 literally 310:7, 310:20, 311:6, 312:8, 312:17, 312:22 little 306:17, 356:14, 358:16, 380:20, 432:19, 518:19, 622:7 llc 300:6, 300:8, 300:12, 305:16 llp 302:5 local 545:14, 616:5, 618:21 localization 303:19, 414:19, 432:14, 432:19, 434:19, 488:4 localizations 413:22 located 431:12, 432:10 locating 564:10 location 382:2, 403:13, 428:3, 565:15 locations 403:16, 472:14, 592:2 long 314:14, 400:3,	458:11, 460:14, 541:18, 615:19, 618:13 longer 464:3 looked 325:5, 348:11, 365:7, 365:8, 404:2, 427:9, 428:21, 438:8, 566:3, 566:4 looking 347:1, 357:21, 371:18, 374:12, 401:6, 412:5, 413:5, 446:21, 449:12, 450:5, 456:16, 457:7, 474:19, 479:14, 484:16, 490:11, 491:5, 491:6, 491:8, 492:6, 492:21, 494:8, 494:12, 498:5, 501:5, 507:2, 514:10, 514:16, 524:8, 526:7, 526:8, 526:22, 527:12, 527:22, 528:1, 528:7, 540:9, 541:19, 545:19, 553:12, 556:2, 556:4, 572:10, 572:14, 589:21, 590:14, 591:21, 593:14, 612:9, 612:10, 617:9 looks 320:1, 350:6, 372:9, 484:5, 484:6, 489:12, 489:16, 489:18, 490:8, 530:13, 585:20, 589:3, 591:13 loopy 446:11	loose 539:11 loose-limb 350:9 loose-limbed 303:13, 519:20, 528:16, 551:17, 553:16, 554:2, 611:1, 611:8, 611:9 lose 463:19, 466:13, 467:3 lost 466:7, 467:8, 468:9, 548:10 lot 311:13, 312:4, 417:1, 436:9, 458:2, 495:8, 521:9 loud 551:21 low 498:13, 500:6, 500:8, 500:9, 500:14, 500:17, 501:5, 566:9 lunch 442:8, 453:18, 469:15, 470:15, 504:13	337:21, 341:1, 342:6, 347:20, 353:4, 358:20, 384:12, 387:7, 390:20, 391:22, 399:7, 403:5, 408:5, 417:2, 429:10, 429:15, 430:19, 435:22, 501:9, 561:16, 576:11, 577:14, 577:15, 599:9 makes 558:5, 576:20, 579:1, 609:20 making 306:2 manner 375:11, 531:5 manufacturing 561:11 many 367:21, 396:4, 412:21, 428:22, 454:16, 454:19, 457:13, 458:10, 458:12, 469:11, 520:14, 532:8, 568:21, 569:14, 569:16, 569:17, 571:2, 571:3, 572:13, 609:21, 611:17 marked 303:7, 306:5, 306:6, 308:17, 308:19, 348:19, 348:20, 377:21, 377:22, 400:5, 400:6, 413:14, 413:17, 438:4, 438:5, 445:5, 445:6, 497:2, 497:3, 504:5, 504:6, 519:1, 519:4, 560:10, 560:11, 567:19, 567:21, 574:10,
--	---	--	---

574:11, 594:9, 594:10, 619:7 markon 439:13 markov 440:15, 603:19, 604:8, 604:12, 604:13, 604:14, 604:16, 604:19, 604:22, 605:2, 605:5, 605:6, 605:12, 605:17 mass 516:12, 517:8 match 316:10, 428:2, 435:3, 435:8, 473:17, 541:12, 608:5 matched 480:10, 512:10 matches 583:21, 584:2 matching 407:3, 486:10, 486:12, 591:5, 595:9, 596:1, 596:14 material 516:13, 517:8 matter 306:1, 306:18, 579:22, 582:17, 615:10 maximizing 405:22, 406:6 maximum 471:16, 577:21, 580:12, 580:16, 580:22, 582:12, 607:6 maybe 345:17, 391:17, 546:10, 551:7 meaning 308:21, 309:9, 314:19, 314:22, 315:4, 315:21,	316:9, 317:7, 317:18, 319:6, 320:9, 320:11, 320:15, 321:3, 352:6, 352:10, 436:22, 437:1, 495:6, 495:13, 495:17, 496:1, 575:9, 582:13, 592:19, 592:21 meanings 318:17, 320:19, 352:11, 506:13 means 320:8, 320:11, 324:21, 333:11, 335:3, 371:15, 398:22, 426:8, 498:19, 502:6, 503:12, 514:5, 553:7, 573:11, 582:14, 605:6 meant 553:22 measure 323:10, 331:9, 331:10, 335:2, 337:13, 338:10, 338:15, 338:18, 339:2, 339:6, 339:8, 347:5, 348:14, 350:20, 357:12, 390:2, 419:1, 432:13, 432:16, 471:6, 471:8, 478:7, 480:9, 575:22, 579:15, 581:12, 581:22, 582:20, 583:1, 583:14, 583:20, 584:1, 586:4, 586:11, 586:18, 587:1, 587:16, 589:9 measured 335:4, 338:9, 342:13, 347:22, 348:1, 366:13,	368:17, 488:19 measurement 330:6, 366:1 measurements 341:21, 363:4, 364:3, 364:8, 364:15, 465:10, 554:6 measures 350:4, 351:3, 585:14, 586:9, 587:5, 587:6 measuring 326:9, 328:21, 329:13, 330:9, 330:16, 330:20, 330:22, 331:4, 331:5, 331:7, 331:16, 331:17, 331:18, 335:1, 335:14, 335:18, 335:20, 350:22, 351:13, 351:18, 352:3, 352:4, 361:18, 366:7, 398:3, 398:12 mechanical 501:18 medical 555:16 meet 387:14 meeting 570:10 memorized 444:22, 445:3 memory 377:2, 438:15 mentioned 310:19, 312:7, 314:1, 337:17, 366:19, 397:19, 441:17, 468:5, 472:16, 476:20, 572:7, 595:13, 614:21, 615:11 merged 417:11	message 448:21, 450:10, 450:18, 531:5, 544:15, 555:19, 556:11, 557:17, 557:18, 558:16 messaged 364:21 messages 449:5, 450:15, 451:1, 451:2, 542:10, 544:19, 544:20, 544:22, 545:9, 545:11, 554:18, 555:5, 555:21, 556:13, 557:20, 558:3, 558:19 messaging 532:21, 545:2, 545:5, 549:11, 549:21, 550:11 meta 300:5, 300:7, 303:12, 303:13, 303:14, 303:16, 303:17, 303:20, 304:3, 304:5, 304:7, 304:8, 304:13, 304:14, 305:11, 308:17, 308:19, 348:20, 377:22, 400:6, 413:14, 413:17, 438:5, 497:3, 504:6, 505:7, 519:4, 560:11, 574:11, 587:12, 587:13, 594:10, 618:4, 619:14 method 310:8, 313:11, 325:7, 332:10, 344:7, 400:19, 496:10, 498:1, 498:6, 503:1, 553:16, 612:19, 613:2
--	---	--	---

methodology 495:2 michael 438:10, 438:13 middle 382:10, 382:21, 384:18, 412:7 might 434:11, 452:5, 499:2, 499:3, 514:21 million 457:22 mimics 536:13 mine 515:16, 516:1 minimize 406:9 minimized 505:18, 509:19 minimizes 402:13 minimum 405:15, 406:11, 580:15 minor 538:6 minus 346:14, 454:11, 533:8, 533:12, 576:13, 576:14, 576:19, 576:21, 577:9, 577:10, 577:12, 577:13, 577:14, 577:16, 577:17, 578:1, 578:20, 579:1, 579:2, 585:9 minute 571:20, 613:8 minutes 610:6, 610:7 mischaracterizes 356:22, 390:8 misinterpreting 409:17 misinterprets 410:2, 410:6,	410:7 misrepresentation 354:1, 355:8, 356:12 misrepresenting 323:18, 330:19, 399:18 missing 345:15, 345:16, 380:12, 380:13, 560:5, 611:21 misunderstanding 396:11 mix 550:3 mixing 465:14, 465:18, 493:2, 493:4, 495:4, 528:20, 529:10, 531:1, 539:3, 539:6, 558:22, 563:9, 586:7, 587:4, 587:7, 604:15 mixture 538:17, 538:19 modal 502:22, 503:14, 506:17, 506:22, 508:14, 509:4, 509:16, 511:2, 512:1, 512:11, 512:19, 514:19, 516:9, 517:7, 518:5 modal-based 517:14 mode 505:21, 509:22 modeled 385:16, 391:13, 396:7, 396:8, 396:12, 451:5, 488:21, 489:2, 489:3, 490:6, 507:2, 507:9, 513:10, 521:20, 537:1, 549:18,	554:21, 562:14, 563:22 modeling 303:17, 371:16, 395:5, 397:6, 398:10, 398:20, 399:1, 399:3, 399:4, 399:6, 399:10, 413:22, 414:19, 415:6, 416:1, 416:8, 419:21, 421:17, 421:20, 423:4, 423:14, 423:19, 425:8, 425:11, 425:16, 426:1, 426:18, 426:22, 427:3, 427:4, 427:5, 427:6, 470:17, 471:21, 472:12, 474:16, 474:22, 475:4, 475:20, 476:9, 477:2, 477:13, 483:5, 484:17, 486:16, 489:5, 491:7, 491:11, 499:11, 499:13, 500:17, 503:15, 507:5, 508:8, 508:9, 509:5, 511:3, 518:4, 522:20, 527:13, 527:14, 534:6, 547:2, 564:21, 565:14, 595:8, 595:15, 599:17, 601:19, 601:20, 602:16, 603:12, 603:17 models 304:4, 304:9, 311:7, 312:10, 312:13, 313:5, 314:4, 321:17, 321:21, 369:7, 376:9, 376:10, 376:18, 376:19,	400:20, 434:10, 434:22, 438:22, 439:5, 439:8, 439:10, 439:11, 439:13, 440:15, 440:17, 456:6, 464:22, 468:4, 481:11, 481:17, 485:9, 497:13, 498:2, 506:13, 508:12, 509:7, 511:3, 511:7, 511:9, 513:16, 519:20, 523:6, 524:10, 524:14, 524:15, 525:13, 525:15, 526:17, 530:15, 530:21, 536:12, 536:15, 536:19, 540:10, 553:16, 556:5, 558:18, 562:4, 595:17, 600:17, 603:19, 604:9, 604:12, 604:13, 604:14, 604:16, 604:20, 604:22, 605:2, 605:5, 605:6, 605:12, 605:17, 620:15 module 616:4, 616:6, 616:7, 616:8 modules 616:3 moment 412:6 money 495:18, 510:11, 513:20 more 349:9, 405:16, 405:17, 408:12, 408:15, 414:4, 438:2, 439:21, 442:7, 457:1, 463:4, 463:6, 470:4, 470:7,
--	---	--	---

479:12, 479:14, 501:17, 510:2, 577:11, 581:12, 581:22, 609:21 morning 305:9, 305:20, 305:21, 306:2, 457:18, 470:20, 472:7, 477:6, 482:3, 528:12 most 450:16, 451:17, 570:14, 573:7 motions 485:15, 497:9, 497:20, 498:16, 500:11 move 450:7, 460:22, 461:4, 516:20, 548:8 moved 407:5, 428:8, 474:11, 477:8, 533:20, 534:4, 597:5, 600:8, 601:10, 601:11, 601:13, 601:16, 608:16 movement 596:8, 596:17, 597:3 movements 596:5, 600:19, 601:3 moves 427:19, 474:13, 487:6 moving 371:21, 426:16, 428:22, 430:18, 430:21, 546:8, 609:22 mpeg 369:21, 369:22, 371:22, 486:4, 486:6, 486:9, 486:12	mpeg-1 318:3, 427:11 mu 516:5 much 385:9, 391:18, 399:20, 470:4, 470:7, 480:2, 517:15, 536:13, 545:8, 553:19, 571:17, 571:22, 572:12, 580:1, 594:2 multi-layers 566:17 multi-scale 450:19 multi-view 556:7 multidimensional 586:2 multiple 354:13, 354:14, 370:3, 393:22, 419:10, 422:7, 440:7, 463:5, 470:14, 471:18, 471:20, 471:22, 486:21, 595:10, 595:19, 598:10, 598:13, 602:2, 602:8, 602:19, 603:7, 614:7, 622:9 multiplication 359:9, 412:7 multiplier 614:9, 614:12, 621:16 multiply 576:16 multiscale 544:18 must 366:9, 558:1 N name 354:3	names 569:4 narrowing 324:21 nature 323:15 nbp 520:2, 520:11, 520:21, 523:8, 523:16, 523:21, 525:19, 539:14, 547:18, 549:11, 549:21, 550:12, 563:12 near 618:7 necessarily 578:4, 578:7, 579:12 necessary 543:20 need 320:5, 321:10, 326:6, 331:9, 331:10, 348:12, 352:18, 359:2, 360:7, 373:7, 373:21, 374:7, 374:9, 374:10, 374:20, 375:2, 375:4, 375:13, 376:3, 387:11, 404:11, 404:12, 404:13, 405:14, 494:12, 494:13, 494:14, 510:8 needed 307:4, 307:7, 307:16, 308:8, 457:15 negative 577:7, 577:22, 578:11, 578:13, 579:10, 579:11, 579:12, 580:14, 585:6, 585:7, 585:11, 585:12 neighbors 542:10	neither 623:10 never 406:11 new 300:19, 301:12, 302:15, 425:12, 460:6, 623:20, 624:12 next 326:8, 359:5, 366:1, 381:17, 383:11, 383:12, 383:20, 397:1, 402:7, 412:13, 417:18, 421:6, 423:3, 425:10, 427:17, 429:2, 429:13, 430:7, 430:8, 430:11, 431:2, 432:22, 433:2, 433:5, 433:6, 433:13, 450:22, 464:12, 465:11, 467:4, 467:22, 470:10, 470:12, 471:2, 471:3, 472:17, 476:7, 477:9, 478:14, 478:15, 478:19, 486:1, 499:1, 499:16, 501:7, 501:8, 501:10, 507:16, 512:8, 538:13, 544:8, 545:13, 545:17, 551:1, 554:1, 556:6, 597:1, 598:1, 598:22, 600:1, 600:5, 600:8, 601:12, 601:13, 603:9, 609:20, 617:7, 619:14, 620:6 nine 564:11 nodal 503:3, 503:4,
--	---	--	---

505:16, 509:19, 511:4, 516:8 nodal-based 505:17 node 330:1, 333:18, 333:20, 334:3, 334:18, 345:19, 388:17, 390:5, 394:8, 394:10, 394:13, 451:1, 524:20, 524:22, 527:8, 529:19, 530:16, 538:17, 542:11, 542:17, 544:19, 544:21, 545:1, 545:3, 545:10, 545:11, 548:7, 548:14, 554:14, 557:19, 561:8, 562:11, 564:13, 564:21, 565:10, 565:14, 616:5, 618:20 nodes 334:5, 356:16, 397:11, 460:6, 516:10, 525:22, 526:3, 528:17, 530:17, 530:18, 546:12, 547:16, 548:22, 549:5, 549:11, 549:21, 550:12, 564:11, 592:1, 611:22, 612:6, 616:7, 617:19, 618:22, 620:17, 621:1, 621:4, 622:2 noise 408:15 non-belief 522:3 non-double-blind 569:2 non-linear 439:11, 500:16, 500:20	non-parametric 446:11, 447:5, 447:15, 449:13, 451:6, 519:16, 519:21, 520:3, 522:4, 524:10, 524:15, 537:10, 544:12, 547:18, 563:15 non-responsive 550:22 none 475:2, 477:14, 486:16, 509:17, 509:19, 509:22, 512:21, 556:8, 601:20, 603:12 nonspatial 489:20 norm 579:6, 579:9 normalize 577:20, 579:4 normalized 575:2, 575:15, 575:19, 577:17, 577:18, 577:22, 578:12, 579:3, 579:8, 579:15, 579:20, 579:21 nose 589:19, 590:21, 592:3, 592:12, 592:17, 593:17, 593:18 notarial 624:2 notary 301:11, 624:11 note 370:6, 463:21, 466:5, 473:22 notes 610:13, 620:9 nothing 305:6, 419:15, 473:11, 474:14, 481:9, 481:16,	512:12, 513:17, 550:9, 583:12, 584:7 notice 301:10, 584:12, 584:16 number 307:17, 380:8, 460:15, 579:12, 580:7, 580:9, 585:12, 600:20, 601:4 numbered 592:1 numbering 415:21 numeral 619:8 numerous 349:4 nw 302:6 ny 301:6, 302:15 O objection 307:2, 309:18, 313:16, 314:16, 316:12, 318:14, 321:18, 323:17, 324:12, 325:1, 326:2, 327:15, 328:8, 329:6, 330:4, 330:18, 332:8, 336:4, 337:12, 338:6, 338:20, 339:22, 340:4, 342:9, 344:2, 345:14, 345:20, 346:22, 347:3, 347:11, 348:3, 350:21, 351:2, 351:16, 352:7, 353:10, 355:13, 355:18, 356:21, 357:3, 360:21, 361:16,	361:20, 365:1, 366:4, 367:12, 369:10, 371:1, 371:12, 372:2, 372:13, 373:4, 374:4, 375:20, 376:1, 376:11, 376:20, 377:11, 379:5, 379:15, 379:20, 382:17, 384:7, 386:2, 388:19, 388:21, 389:2, 389:19, 390:7, 393:6, 394:11, 395:10, 396:3, 396:10, 396:13, 398:6, 399:13, 402:20, 406:2, 407:11, 407:13, 414:9, 415:16, 416:7, 416:12, 416:22, 418:5, 418:17, 421:1, 423:8, 424:2, 424:21, 426:10, 428:15, 430:1, 432:1, 433:4, 434:4, 436:2, 436:6, 437:7, 439:19, 440:1, 440:5, 441:15, 443:7, 444:5, 444:15, 447:7, 448:9, 448:11, 449:9, 451:14, 453:7, 453:13, 453:21, 454:22, 455:13, 456:2, 456:13, 457:6, 458:22, 460:18, 461:8, 461:20, 462:16, 463:16, 464:6, 464:8, 464:16, 464:21, 465:13, 466:3, 467:6, 467:15, 468:19, 472:5, 474:9,
--	--	---	--

474:20, 475:7, 475:17, 478:11, 480:12, 483:21, 485:17, 486:20, 497:10, 500:1, 501:3, 505:1, 508:13, 509:2, 510:19, 512:17, 513:7, 514:2, 514:13, 516:18, 516:21, 517:5, 517:22, 518:2, 519:18, 520:5, 520:13, 521:2, 522:6, 522:11, 523:11, 523:13, 523:18, 524:2, 525:2, 525:4, 525:20, 526:4, 528:18, 531:7, 531:21, 532:10, 534:22, 535:2, 539:2, 539:16, 539:18, 541:8, 543:1, 548:2, 549:3, 550:14, 550:21, 552:22, 555:14, 556:1, 557:7, 557:15, 558:15, 559:12, 561:1, 561:4, 562:7, 562:12, 563:13, 564:5, 564:19, 567:9, 569:21, 570:12, 572:20, 572:22, 576:3, 579:17, 581:5, 581:14, 582:4, 582:7, 583:2, 583:15, 586:6, 587:9, 588:6, 588:17, 589:1, 589:11, 598:2, 600:21, 602:6, 603:1, 605:1, 606:14, 607:20, 611:5, 612:7, 612:21,	622:6 objects 339:2, 342:13, 350:11, 350:12, 360:5, 365:12, 395:20, 404:15, 407:8, 477:14, 497:12, 500:15, 502:4, 517:21, 524:16, 594:18, 609:4, 609:12, 609:13, 609:18, 610:1, 615:1 observations 454:11 observe 430:16, 605:6 observing 605:7 obtained 488:8, 620:15 obviously 310:8, 310:21, 311:8, 312:9, 314:10, 317:8, 327:2, 342:21, 346:17, 349:9, 349:22, 363:17, 375:9, 379:1, 407:4, 414:4, 416:15, 432:8, 434:19, 443:9, 446:4, 453:8, 454:5, 455:2, 456:14, 458:13, 518:10, 519:19, 528:8, 532:2, 535:21, 538:8, 543:13, 543:16, 544:11, 544:22, 546:21, 553:10, 557:18, 557:22, 565:3, 573:2, 574:5, 595:13, 600:5, 601:5, 614:19 occur 399:11, 588:15	occurred 623:19 occurs 602:19 odd 452:19, 458:5, 545:20 office 300:1 officer 623:3 offices 301:2 official 568:13 offline 457:14, 458:3, 458:9 oh 548:11, 564:2, 566:8 okay 305:2, 306:20, 308:9, 309:16, 309:22, 310:3, 324:3, 325:7, 325:20, 327:11, 332:5, 336:12, 340:19, 345:17, 347:15, 349:7, 357:8, 362:22, 363:21, 370:12, 373:14, 377:5, 379:10, 382:3, 393:1, 394:18, 402:22, 403:4, 403:7, 403:11, 403:18, 404:1, 404:5, 418:7, 421:5, 437:10, 442:7, 456:7, 458:4, 478:1, 478:4, 480:5, 480:7, 481:7, 485:8, 500:12, 501:7, 502:19, 507:18, 512:5, 515:22, 526:6,	526:17, 526:21, 535:17, 536:5, 542:2, 545:2, 557:22, 560:4, 560:21, 579:4, 586:22, 587:21, 591:6, 593:14, 596:1, 596:11, 598:12, 609:2, 610:9, 613:14, 614:4, 614:8, 614:12, 615:8, 615:18, 616:13, 617:4, 617:9, 617:16, 618:1, 618:6, 618:12, 619:6, 619:14, 619:20, 620:1, 620:22, 621:7, 621:11, 622:13 once 462:18, 597:14 one 309:5, 309:7, 314:14, 333:10, 333:16, 335:10, 335:12, 349:12, 354:15, 358:11, 360:11, 362:11, 365:22, 369:2, 369:3, 369:4, 369:8, 372:5, 382:9, 382:10, 382:20, 383:2, 383:3, 383:9, 383:16, 383:20, 384:18, 384:19, 384:21, 388:1, 392:17, 393:17, 403:22, 404:12, 408:2, 408:3, 408:7, 408:8, 422:20, 424:18, 427:20, 435:2, 435:3, 438:2, 438:10, 439:21, 442:7, 443:10, 456:16, 456:21,
---	--	--	--

457:1, 458:6, 459:2, 460:22, 478:19, 482:7, 486:1, 490:19, 511:17, 518:16, 519:3, 520:17, 531:11, 571:4, 573:16, 578:17, 597:21, 597:22, 598:21, 600:7, 606:2, 606:3, 606:4, 606:5, 606:7, 607:2, 607:5, 608:20, 613:15, 618:13 ones 308:10, 529:9, 561:16, 572:16 online 305:11 only 333:12, 338:4, 338:7, 391:13, 414:13, 421:18, 424:8, 425:16, 432:17, 440:18, 459:11, 468:12, 472:19, 477:19, 478:2, 478:22, 483:11, 484:18, 485:1, 492:20, 516:19, 527:11, 546:13, 547:13, 593:9, 597:13, 597:14, 600:13, 609:13 open 358:5, 401:15, 401:18, 497:5, 578:5, 579:18, 581:17, 581:18 operate 457:4 opine 348:8, 348:11, 348:13, 574:22 opines 601:22	opinion 309:9, 339:3, 409:14, 440:22, 523:5, 575:5, 590:3, 590:6, 594:15 opposite 366:6, 577:1, 577:2, 577:3, 577:6, 580:14 opposites 577:4 option 457:14, 466:1 oranges 465:14, 465:18, 493:3, 493:4, 495:4, 508:10, 513:10, 513:12, 514:8, 517:11, 528:20, 529:11, 531:1, 531:17, 539:6, 558:22, 563:10, 590:2, 604:15, 612:16 order 375:3, 503:11, 507:7, 509:17, 512:2, 515:12, 537:4, 593:9 ordered 400:20 ordinary 314:19, 314:22, 315:4, 315:21, 316:9, 317:7, 317:18, 319:6, 320:9, 320:14, 320:16, 320:19, 321:2, 352:5, 352:10, 352:11, 495:6, 495:12, 495:16 orientation 555:22, 556:14, 565:4 orientations 487:20, 488:9	original 307:13, 307:18, 385:3, 430:12, 445:11, 445:12, 451:17, 451:21, 534:18, 535:3, 535:11, 575:16 originals 303:8 ot 346:13, 346:14, 620:6 ote 615:4 other 324:6, 325:20, 343:10, 350:18, 372:14, 389:4, 456:8, 456:9, 483:18, 496:17, 515:2, 529:9, 552:21, 561:16, 562:3, 569:2, 598:15, 614:22 otherwise 326:6, 387:12, 388:14, 389:13, 394:9, 461:13, 515:4, 623:13 out 333:15, 367:10, 390:20, 397:22, 420:16, 452:4, 452:16, 460:6, 503:21, 517:2, 551:21, 619:7 outcome 605:7, 605:11, 623:13 outline 480:16, 481:1, 481:4 outlined 389:9, 443:15, 481:5 output 393:3, 596:1, 596:14	outside 308:9, 320:12, 354:1, 355:8, 356:12, 373:5, 605:9 over 319:17, 354:14, 359:7, 372:14, 378:15, 380:8, 385:22, 387:4, 387:6, 387:17, 388:1, 390:15, 391:14, 391:19, 395:2, 411:14, 411:15, 411:18, 414:20, 419:10, 425:2, 426:12, 428:21, 429:3, 429:4, 435:10, 435:11, 446:10, 448:18, 449:22, 457:10, 458:16, 459:17, 459:19, 460:13, 460:14, 460:22, 461:21, 469:11, 475:18, 476:18, 477:8, 478:12, 485:11, 486:21, 488:6, 488:13, 505:18, 505:21, 507:11, 507:15, 507:20, 518:19, 528:4, 538:10, 544:14, 548:15, 560:1, 563:21, 571:17, 573:2, 575:15, 595:19, 597:5, 598:13, 598:14, 601:10, 601:11, 601:13, 602:2, 602:8, 602:19, 603:6, 611:4, 611:15, 611:17, 612:1, 612:2, 612:6, 612:11, 612:16, 613:6 overall 339:19, 388:9,
---	---	---	--

607:15 overview 497:22 own 310:1, 369:19, 574:15, 574:17, 574:20 owner 300:13, 302:11, 305:16, 315:14, 315:17, 410:10 owner's 315:20, 316:10 ozer 304:14, 594:1, 594:12, 594:19, 594:20, 595:1, 595:2, 595:12, 595:17, 597:12, 597:21, 598:4, 599:4, 599:5, 600:18, 603:3, 603:19, 604:13, 604:21, 607:11, 608:1, 609:1, 609:3 ozer's 594:16, 594:17, 601:2, 602:1	471:4, 472:9, 472:22, 473:7, 473:10, 473:18, 473:20, 476:12, 478:5, 480:13, 480:14, 480:15, 480:17, 480:18, 481:12, 481:13, 487:8, 487:10, 501:19, 505:7, 505:8, 515:10, 516:4, 516:5, 526:7, 527:16, 528:1, 529:6, 535:5, 535:12, 536:12, 538:2, 538:13, 543:3, 545:8, 545:13, 546:9, 552:9, 556:6, 587:11, 587:12, 610:21, 618:4, 618:8, 619:14, 620:13 pages 300:24, 443:13, 480:19, 487:17 pairs 526:12, 538:16 pampas 304:8, 447:6, 447:9, 447:16, 448:5, 448:8, 449:8, 449:14, 519:16, 520:2, 520:12, 523:21, 524:19, 528:13, 528:15, 531:5, 538:21, 539:1, 539:5, 539:8, 539:11, 539:12, 539:14, 559:3, 560:4, 560:6, 560:10, 561:7, 561:12, 561:13, 562:6, 562:18, 563:5, 563:11, 563:16, 564:4, 564:7, 565:8,	565:9 paper 313:20, 370:9, 373:21, 374:10, 374:12, 451:13, 453:10, 453:16, 508:11, 510:10, 511:1, 519:9, 520:1, 520:21, 522:2, 522:16, 522:20, 531:20, 537:4, 551:10, 552:6, 552:17, 552:20, 553:6, 553:9, 553:14, 563:17, 569:3, 569:4, 569:5, 570:16, 570:21, 571:1, 571:2, 571:5, 573:2, 573:11, 573:18, 573:22, 574:2, 578:19 papers 370:10, 371:6, 520:14, 571:3 parabola 437:10, 437:11 paragraph 315:13, 316:13, 316:14, 322:6, 349:6, 349:8, 362:10, 362:13, 408:19, 409:6, 410:9, 416:14, 417:7, 442:15, 442:18, 445:10, 445:12, 445:14, 450:22, 452:12, 452:13, 452:22, 453:1, 453:2, 453:9, 454:3, 456:10, 470:2, 470:8, 473:7, 474:2, 479:1, 501:19, 501:22, 504:18, 504:22, 506:3, 509:10,	510:5, 521:4, 526:8, 528:2, 535:12, 535:20, 535:22, 538:4, 538:5, 542:4, 542:6, 543:19, 545:9, 545:17, 551:3, 551:12, 552:1, 560:16, 560:20, 574:20, 575:13, 575:17, 594:14, 601:21, 615:19, 618:7, 618:8 parallel 580:11 parameters 402:4, 402:6, 405:12, 405:13, 405:15, 473:16, 507:11 parametric 524:14 paraphrase 510:6 paraphrasing 510:2, 538:7 parentheses 358:6, 450:12 parentheticals 542:12 part 309:12, 329:8, 335:13, 360:18, 367:8, 371:10, 381:15, 386:14, 407:14, 433:22, 435:19, 441:19, 450:20, 465:5, 466:13, 471:8, 472:14, 484:19, 488:4, 490:10, 490:19, 490:20, 499:7, 499:21, 500:22, 504:10, 519:12, 526:12, 526:19, 533:6, 533:7, 533:10,
P			
page 303:2, 303:9, 306:11, 315:7, 315:9, 315:10, 315:16, 315:17, 316:11, 362:14, 381:17, 410:8, 415:18, 415:19, 415:20, 415:21, 417:7, 423:13, 431:4, 431:5, 438:19, 441:14, 446:17, 446:22, 448:3, 448:7, 448:13, 451:16, 451:21, 452:12, 453:2, 454:2,			

533:15, 533:20, 534:4, 553:19, 577:18, 596:8, 599:1, 599:12, 601:9, 601:16, 607:15, 607:18, 616:14, 619:6 particle 446:13, 447:18, 448:15, 449:4, 449:17, 449:19, 450:14, 544:13 particular 310:21, 315:9, 318:20, 320:12, 324:9, 327:5, 334:17, 360:8, 378:6, 403:17, 437:14, 437:21, 455:15, 455:16, 519:22, 521:6, 535:19, 537:20, 570:10, 571:10, 583:21, 598:18, 600:11 particularly 591:16 parties 309:1, 309:4, 623:11 parts 303:18, 367:10, 413:22, 414:19, 417:12, 417:20, 417:22, 418:4, 418:6, 431:12, 432:9, 465:4, 472:14, 489:2, 489:3, 526:10, 526:18, 528:9, 596:2, 596:5, 596:15, 596:18, 596:20, 600:19, 601:4, 607:13 party 623:15 passage 443:3, 539:13,	559:8, 607:11 passages 456:9, 456:19 passed 365:21, 365:22 passing 450:18 past 429:11, 472:10 patent 300:1, 300:2, 300:11, 300:13, 302:11, 303:14, 305:16, 313:5, 315:14, 315:17, 315:20, 316:10, 316:18, 320:4, 329:19, 346:1, 353:12, 353:15, 354:9, 370:20, 380:19, 380:21, 380:22, 381:2, 381:17, 385:9, 385:12, 391:8, 391:9, 410:10, 418:14, 419:9, 440:9, 440:10, 441:7, 465:19, 489:14, 535:4, 536:11, 536:14, 537:3, 538:18, 540:14, 541:17, 568:20, 613:18, 621:12 patents 316:4 pattern 494:22, 604:9, 605:3, 605:16 pause 447:3, 594:4 peer 568:15 peer-review 574:8 peer-reviewed 570:18, 573:8 peg 493:6, 495:5,	550:3, 550:6, 561:19 pennsylvania 302:6 people 303:13, 304:7, 317:20, 318:15, 319:1, 321:20, 350:9, 350:11, 350:12, 496:17, 519:20, 520:21, 521:6, 521:11, 521:13, 521:17, 521:20, 522:2, 523:4, 523:7, 523:22, 524:4, 524:21, 530:10, 532:5, 532:14, 532:16, 532:19, 540:17, 548:9 percent 366:17, 393:21, 580:16 perform 417:10, 457:10, 461:13, 461:16, 519:16 performs 595:2, 595:4 person 320:16, 347:14, 352:16, 353:11, 425:7, 473:7, 483:22, 484:3, 487:14, 573:4 personal 567:16, 568:1, 569:19, 569:22, 570:3, 573:21 personally 570:3, 573:15 personnel 568:13 perspective 557:6, 557:14 petitioner 300:9, 302:3, 305:11, 410:11	petitioner's 411:1 ph 300:17, 301:1, 303:2, 303:11, 304:2, 304:6, 373:14, 622:18, 623:19 phase 505:21, 509:21 phi 381:8, 381:10, 381:15 phil 305:14 philip 302:12 photograph 403:10 physically 343:10, 406:17, 498:7 physics 516:14, 517:19 physics-based 517:14 pi 359:7 pick 607:5 picked 621:11 picture 403:2 piece 313:19, 359:5, 440:18, 493:22, 494:8, 578:19, 598:6 pieces 328:12, 334:7, 460:2 pixels 404:3, 427:19, 428:8, 428:9, 429:1, 430:18, 477:10 place 329:18, 394:20,
--	--	---	--

395:6, 453:22, 459:13, 492:5 placed 516:11 places 316:22, 557:22 plain 314:19, 314:22, 315:4, 315:21, 316:8, 317:6, 317:17, 319:6, 320:9, 320:14, 320:18, 321:2, 352:5, 352:10, 495:6, 495:12, 495:16 plane 495:20 platforms 300:5, 300:7, 305:11 play 429:18 playing 606:19, 607:3 please 305:3, 334:4, 344:20, 400:17, 402:19, 420:5, 439:3, 469:22, 476:12, 490:21, 504:19, 515:17, 515:20, 523:20, 576:6, 609:1, 613:19, 613:21 plot 582:15 plurality 325:15, 325:17, 330:14, 357:12, 468:17, 469:5, 469:6, 469:7 plus 346:14, 454:12, 516:6, 533:8, 533:11, 557:13, 576:9, 576:12, 576:13, 576:14,	576:18, 576:19, 576:20, 577:9, 577:12, 577:13, 577:15, 577:16, 578:17, 578:21, 579:1, 615:15 point 329:9, 345:16, 355:7, 359:4, 372:11, 375:12, 376:15, 377:14, 431:19, 435:11, 465:1, 466:11, 503:5, 503:8, 516:22, 536:5, 584:11, 586:17, 600:12 pointed 333:15, 333:17, 387:2, 389:22, 390:10, 417:7, 420:16, 608:2 pointing 481:6, 493:18, 577:1, 577:5, 577:8, 579:6, 579:9, 600:15 points 407:5, 407:6, 503:3, 503:4, 503:7, 590:12 portion 507:22 portions 308:6, 308:7, 456:8 posa 416:10, 437:2, 510:14, 510:16, 514:10, 514:15, 514:16, 514:21, 541:2, 557:14, 580:5, 580:8, 581:21, 582:10 posa's 557:6 pose 555:21, 556:12	posita 314:18, 317:9, 317:10, 319:4, 322:3, 353:12, 354:6, 354:18, 356:9, 367:18, 397:18, 398:20, 413:4, 416:14, 443:11, 445:15, 456:11, 456:14, 537:13, 540:9, 541:15, 543:6, 561:6, 565:17, 566:5, 601:22 position 330:2, 330:7, 331:5, 334:1, 334:6, 334:19, 493:11, 543:22, 555:22, 556:14, 564:13, 564:22, 565:12, 592:14, 593:10, 593:16 positions 569:14 positive 577:7, 579:12, 585:5, 585:8 possessed 540:11, 547:1 possession 443:14, 445:16, 456:12, 537:14 possible 377:9, 457:9, 458:2, 577:21 post 557:20 posteriori 471:16 posterioric 586:15 postures 431:10, 432:6 potential 538:15, 542:15 potentially 392:1, 437:20,	468:7, 479:11, 499:12, 608:17 pound 530:16 practical 458:18 practically 458:2, 479:11, 480:1 practice 343:15, 468:12, 469:10 practiced 468:2 practicing 465:2, 468:13 preamble 313:8, 313:9, 325:6 precise 344:4, 409:21, 414:11, 414:21, 512:15, 515:3, 551:7, 587:11, 593:8 precisely 509:11, 523:8, 540:22, 549:2 predict 428:13, 429:1, 483:15, 486:1, 488:8, 502:14, 512:9 predicted 429:13 prediction 429:3, 429:5, 429:8, 429:9, 429:10, 429:11, 488:2, 501:9, 501:12 predictions 512:10 predicts 430:10, 430:13, 507:21 prefer 392:14, 506:4
---	--	---	--

preferably 405:21, 406:5	594:10	471:21, 472:12,	337:3, 337:7,
preferred 346:17	primary 563:12	472:19, 473:11,	341:5, 341:6,
preparation 306:19, 308:11, 504:11, 519:13	printed 310:7, 313:19, 343:10, 534:15, 537:18	473:13, 474:16, 474:22, 475:3, 475:19, 475:20, 476:5, 476:8, 476:9, 477:2, 477:13, 478:17, 481:11, 483:3, 483:4, 485:21, 486:3, 486:15, 487:7, 489:6, 489:21, 499:9, 508:6, 511:8, 518:12, 530:21, 534:5, 586:13, 586:16, 588:7, 588:13, 589:7, 595:15, 601:18, 601:19, 602:9, 602:20, 603:5, 603:17, 604:14, 604:17, 604:22, 605:14, 607:4, 611:3, 611:11, 611:12, 611:14, 612:19, 613:2	341:14, 341:15, 342:14, 342:18, 342:19, 344:7, 345:11, 345:12, 349:20, 353:17, 357:15, 360:19, 362:1, 363:9, 363:16, 364:9, 368:12, 382:7, 412:19, 420:15, 422:18, 428:10, 434:8, 462:7, 470:17, 473:3, 477:12, 480:9, 499:19, 501:13, 508:7, 508:9, 511:10, 517:18, 524:7, 526:17, 534:9, 535:14, 535:21, 536:7, 540:5, 541:6, 554:4, 575:4, 581:4, 581:9, 581:10, 581:12, 581:19, 582:1, 583:12, 584:8, 586:14, 586:15, 587:1, 587:4, 597:16, 598:17, 600:16, 600:17, 602:15, 603:4, 603:11, 604:10, 604:18, 605:4, 605:16, 606:7, 606:10, 606:15, 607:5, 608:21, 614:5, 621:13
preparations 307:10	prior 341:22, 342:2, 342:6, 343:4, 348:22, 349:10, 349:17, 351:11, 357:6, 362:18, 363:5, 363:13, 364:5, 364:17, 364:22, 365:14, 365:18, 368:21, 378:18, 390:11, 421:6, 423:2, 425:19, 428:13, 430:15, 430:17, 450:5, 461:2, 479:5, 479:7, 500:21, 541:19, 541:21, 554:6, 593:9, 593:12, 593:13	probabilistic 385:1, 413:6, 418:13, 419:8, 421:7, 421:20, 421:21, 423:3, 423:16, 423:18, 423:19, 424:5, 424:6, 424:10, 424:13, 425:11, 425:15, 426:1, 426:17, 426:21, 427:4, 427:6, 429:6, 433:22, 436:15, 437:3, 437:22, 439:12, 440:14, 440:16, 440:20, 441:7, 441:18, 442:2, 442:4, 457:20, 458:15, 469:10, 470:18, 470:22,	probably 311:12, 423:11, 480:1, 492:9, 506:18, 515:15
present 302:19, 472:10, 498:6, 616:2	presented 618:9, 618:14, 618:17	probabilistic-based 588:3	problem 507:9
presenting 498:11, 531:20	presents 487:14, 612:19	probabilistic-type 486:7	procedure 572:5
pretty 385:9, 536:13, 545:8, 571:17, 571:22, 572:12	previous 383:15, 388:9, 417:8, 446:4, 470:20, 473:9, 479:14, 479:15, 479:16, 479:18, 488:2, 488:8, 511:17	probabilistically 425:9, 483:8, 488:16	proceeding 411:8
previously 303:7, 306:5, 306:6, 308:17, 308:19, 348:19, 348:20, 349:17, 377:21, 377:22, 400:4, 400:6, 413:14, 413:16, 432:12, 438:4, 438:5, 445:4, 445:6, 497:2, 497:3, 504:5, 504:6, 519:1, 519:4, 560:10, 560:11, 567:19, 567:21, 574:10, 574:11, 594:9,		probabilities 310:13, 349:14, 362:17, 363:13, 364:21, 365:12, 368:18, 374:17, 419:22, 444:10, 470:14, 471:15, 503:13, 524:15, 549:17, 598:8, 604:1, 606:1, 606:12	
		probability 323:10, 336:22,	

process 306:19, 381:22, 387:20, 407:14, 420:10, 489:20, 501:1, 537:13, 567:14, 567:15, 568:21, 568:22, 569:3, 569:6, 570:8, 570:10, 570:13, 570:16, 571:10, 571:12, 571:16, 571:18, 571:19, 571:22, 572:8, 572:10, 572:11, 573:5, 573:22, 574:3, 574:5, 574:8, 586:13, 586:14, 594:17, 616:7, 618:22 processes 569:9, 574:7 processing 457:15, 458:3, 458:9 produce 451:3 product 359:11, 360:8, 360:9, 360:10, 383:11, 383:12, 384:15, 449:4, 450:14, 450:17, 451:2, 534:21, 535:10, 535:19, 536:7, 537:21, 540:4, 541:5, 544:20, 545:7, 545:10, 555:21, 556:13, 557:20, 575:8, 575:9, 575:14, 575:19, 576:15, 577:6, 577:17, 578:2, 578:3, 578:5, 578:6, 578:7, 578:8, 578:10, 578:12, 578:14,	578:15, 578:22, 579:2, 579:14, 579:18, 579:22, 580:13, 580:15, 581:1, 581:18, 581:20, 582:11, 583:10, 587:3 products 382:6, 382:8, 382:9, 382:14, 384:4, 384:13, 558:2, 575:2, 581:10 professorial 402:19 profile 566:9 program 570:20 programs 569:15 progress 462:9 project 404:20 projection 402:14 promise 399:19, 400:2 promises 496:22 propagates 525:6 propagation 446:12, 447:6, 447:16, 448:22, 449:14, 450:11, 451:7, 519:17, 519:21, 520:3, 521:1, 522:3, 522:5, 524:18, 544:16, 547:19, 553:17, 563:16 proper 342:22, 392:14, 395:17, 395:22, 396:2, 401:3, 415:1	properly 348:13, 404:14, 451:16, 510:22, 563:22 properties 497:12, 498:9 proposal 377:16, 378:7, 379:8, 379:12, 380:6, 385:6, 385:21, 386:18, 387:9, 387:16, 387:20, 616:7, 618:22 proposed 315:2, 410:12, 451:9, 451:13, 461:17, 551:17, 563:16 proposes 422:4, 422:15 proposing 448:17, 449:18, 450:3, 462:14, 465:6 protocol 555:19 prove 575:6 provide 305:5, 309:9, 311:16, 324:18, 333:10, 335:12, 335:13, 338:4, 340:21, 343:3, 343:14, 343:22, 349:12, 361:1, 363:12, 377:18, 411:18, 420:5, 444:22, 456:19, 469:4, 510:13, 571:1, 613:2 provided 306:15, 313:14, 323:1, 332:6, 332:18, 342:12, 407:10, 441:13, 510:15	provides 327:4, 334:18, 340:16, 357:11, 364:20, 410:17, 414:4, 414:6, 416:16, 425:4, 498:13, 500:6, 500:8, 580:2, 618:19 providing 322:9, 324:15, 325:10, 325:14, 332:12, 332:16, 332:20, 332:22, 333:2, 333:7, 333:13, 334:21, 335:8, 338:8, 338:11, 338:13, 416:17, 468:16, 468:20, 468:21, 475:9, 533:19, 533:22, 616:4 provisional 303:14, 317:16, 376:5, 378:5, 381:19, 385:4, 385:9, 385:14, 385:20, 386:12, 389:22, 442:9, 442:19, 443:2, 443:4, 443:5, 443:9, 443:11, 444:3, 444:8, 445:2, 445:9, 445:15, 445:19, 445:22, 446:6, 446:16, 446:17, 448:14, 451:18, 452:2, 452:12, 453:1, 453:8, 454:7, 454:16, 455:7, 456:9, 456:21, 520:8, 520:11, 520:20, 521:22, 522:2, 522:9, 522:18, 523:3, 523:6, 524:1, 524:12,
--	---	---	--

524:20, 525:7, 532:1, 532:3, 534:8, 534:16, 534:17, 534:20, 535:7, 535:10, 535:13, 536:2, 536:3, 536:9, 536:12, 536:17, 537:15, 537:16, 538:8, 539:7, 539:10, 540:7, 540:9, 540:13, 540:19, 541:3, 541:7, 541:15, 541:17, 542:7, 542:20, 543:3, 557:12, 618:1, 621:12 provisionals 456:15 psi 359:15, 359:16, 359:17, 360:2, 381:6, 381:12, 382:20, 383:2, 412:8, 526:11, 527:2, 527:5, 536:22, 545:16, 614:13, 614:21, 615:17, 621:17, 622:9 public 301:11, 567:7, 624:11 pupil 592:2, 592:3 purchase 398:8 purely 502:2, 502:9, 505:19 purpose 336:3, 336:9, 336:11, 582:20, 583:1, 585:14, 586:4 purposes 610:5	pursuant 301:10 put 352:15, 361:9, 361:11, 366:20, 377:6, 391:5, 393:22, 401:3, 403:16, 406:20, 410:1, 469:22, 510:5, 510:9, 516:1, 537:2, 559:2, 574:17, 613:19, 618:2 Q quadratic 373:18, 437:11, 437:14 qualified 435:12 quality 339:10 question 307:11, 311:4, 311:15, 311:21, 316:7, 316:8, 319:21, 324:14, 327:8, 327:9, 328:5, 334:20, 336:8, 337:6, 340:9, 340:11, 340:13, 340:15, 349:3, 349:8, 352:9, 356:1, 357:5, 375:17, 384:2, 384:6, 384:9, 384:11, 385:3, 386:16, 412:21, 418:15, 419:11, 419:13, 420:7, 424:16, 428:16, 451:15, 458:20, 467:10, 485:12, 488:11, 497:18, 497:21, 515:21, 516:19, 517:1, 522:1, 523:19, 523:20,	531:10, 535:9, 539:4, 548:12, 548:22, 550:4, 550:5, 550:9, 550:13, 551:1, 555:6, 559:7, 559:13, 562:21, 562:22, 572:2, 573:14, 575:16, 581:21, 585:13, 591:7, 598:20, 615:21 questioning 457:1 questions 306:15, 325:20, 374:13, 438:2, 442:8, 584:14, 610:12, 610:17, 613:11, 614:5, 622:8, 622:14 quick 428:18, 566:21 quite 509:12, 541:2 quote 362:17, 442:20, 443:2, 446:8, 446:9, 446:14, 452:3, 452:11, 452:13, 452:21, 452:22, 510:9 quoted 456:18, 510:4 quotes 445:17, 446:20 R r0 564:22 race 321:6, 321:11 radius 564:14, 565:1 raining 605:9 raise 305:3	ram 321:7 random 326:12, 328:12, 329:11, 341:1 randomly 402:9, 461:4, 593:13 range 371:18, 575:14, 575:19 rather 373:18, 397:11, 448:19, 450:1 rcr 470:13, 480:6, 480:16, 481:1, 481:4, 481:14, 481:19, 482:17, 485:14, 486:17, 486:18 rd 624:2 re-ask 523:19, 523:20 reach 543:9, 543:11 reader 370:14 reading 316:5, 347:9, 353:11, 354:18, 367:14, 367:16, 367:17, 378:9, 397:18, 406:3, 456:15, 473:19, 514:6, 537:13, 539:14, 540:9, 541:15, 543:8, 543:10, 546:6, 556:16, 556:18, 556:20, 556:22, 571:10, 592:10, 600:22, 609:8, 623:9 reads 329:22, 559:16 ready 607:14
---	---	--	---

real 511:20, 575:21 real-valued 304:8 reality 507:21, 507:22, 512:10 really 489:17, 491:14, 553:18 realtime 515:20 reason 306:13, 510:13, 520:16 reasoning 419:2 reassembling 484:11 recall 307:17, 308:14, 568:16 receive 568:2 recently 438:8 recess 362:8, 409:3, 469:17, 518:21, 566:22, 594:6, 613:9 recite 310:4, 310:17, 311:2, 312:5, 312:19, 323:5, 332:22, 333:7, 340:6, 340:12, 341:11, 341:13, 357:1, 362:16, 363:2, 468:15, 468:16, 534:8 recited 322:16, 590:5 recites 330:16, 340:14, 361:15 recognition 417:20, 417:22,	568:20, 583:20, 588:11, 589:2, 591:2, 594:20 recognize 595:13, 607:14 recognized 605:4 recollection 377:2 reconcile 501:12 record 515:19, 594:4, 615:20, 623:6 recursive 419:1 red 530:14 reduced 467:18, 623:8 reduction 439:12 refer 369:16, 469:6, 480:18, 511:16, 592:9 reference 388:6, 441:21, 497:22, 543:2, 555:18, 594:12 references 506:10, 510:9, 540:22, 597:13 referred 326:18, 341:14, 341:19 referring 308:15, 330:13, 363:17, 363:19, 368:5, 373:21, 402:1, 405:19, 406:12, 417:11, 454:1, 471:7, 551:15, 572:15, 572:17 refers 319:10, 319:12, 436:7, 563:11	reflect 498:10 reflects 433:16 regarding 309:9, 515:5, 536:6, 567:7, 567:17, 610:12 regards 472:3 region 407:9, 407:12, 489:10, 489:13, 489:18, 490:4, 490:10, 490:19, 491:4, 491:6, 491:7, 493:8, 585:17, 585:18, 585:19, 599:8 region-based 489:9, 489:12, 489:17, 590:14 regions 373:16, 406:14, 489:15, 589:13 register 404:8, 404:14, 407:7 registration 400:19, 400:22, 402:11, 404:4, 405:4, 406:19, 407:14 reichman 302:13, 305:15 reinitialize 546:12 reinitialized 459:9 rejects 609:21 related 623:11 relates 403:20 relationship 353:7, 581:3, 611:11, 611:12,	611:14 relationships 611:3 relative 342:3, 343:4, 362:18, 363:6, 363:14, 364:5, 364:18, 365:14, 449:7, 479:8, 543:22 relevant 308:7 relies 342:22, 490:7, 539:10, 539:11, 539:12 rely 456:18 relying 443:3, 443:8, 456:8, 456:14, 456:20, 572:21 remain 434:22 remaining 322:18, 322:21, 324:1, 324:8, 507:20 remember 384:10, 393:12, 401:14, 453:15, 569:10, 569:12, 573:19, 588:18, 614:4, 614:8, 621:14 remove 397:4, 397:11, 463:1, 468:11 removed 569:5 render 441:2, 441:5 repeat 420:3 repeatedly 316:16 rephrase 345:17
--	---	---	--

replaced 449:4, 450:14 replicating 620:15 replying 573:5 report 409:15, 411:2 reported 300:25 reporter 301:11, 305:2, 305:8, 307:5, 310:10, 314:21, 315:19, 319:5, 326:20, 337:16, 344:3, 350:10, 355:14, 385:19, 386:20, 388:20, 394:16, 404:18, 405:20, 416:3, 436:3, 437:6, 437:12, 439:7, 443:17, 444:19, 445:20, 447:8, 448:6, 451:11, 451:20, 457:12, 461:15, 462:13, 463:13, 465:22, 466:20, 468:18, 471:9, 480:11, 486:11, 489:1, 497:14, 503:16, 505:5, 517:17, 535:16, 538:22, 565:7, 565:22, 567:12, 568:17, 574:16, 575:10, 576:22, 578:9, 579:16, 586:5, 586:12, 590:7, 592:15, 594:3, 594:22, 603:22, 607:7, 609:7, 610:8, 617:22, 618:16, 623:1 represent 417:12, 490:2,	503:1, 510:22, 549:5 representative 561:8 represented 389:10, 580:1, 615:9, 615:17, 623:16 representing 557:18, 564:7 represents 358:18, 358:19, 490:9, 516:10, 555:20, 556:11, 557:19, 621:19 request 311:14 requested 623:10 require 330:6, 331:4, 331:5, 334:20, 335:15, 353:6, 427:21 required 339:20 requirement 325:22, 328:6, 479:4 requires 324:15, 324:22, 342:7, 342:10, 356:15, 356:18, 361:18, 450:18, 611:2, 611:10 resemblance 587:18 resembles 370:7, 463:22, 466:6 resolve 487:20 response 440:2 responsible 568:14 rest 357:17, 363:11,	414:5, 416:13, 551:20 resulting 498:12, 498:13, 500:5 results 431:9, 432:3, 432:4, 454:10, 458:12, 461:2, 472:4, 472:8, 488:3, 511:6 retained 303:8, 306:7, 308:20, 348:21, 378:1, 400:7, 413:15, 438:6, 445:7, 497:4, 504:7, 519:5, 560:12, 567:20, 567:22, 568:9, 574:12, 594:11 review 306:22, 307:4, 307:7, 308:2, 309:12, 504:10, 519:12, 568:15, 570:21, 571:1, 573:4, 573:6, 573:7 reviewed 307:3, 307:16, 308:10, 309:12 reviewer 569:16 reviewers 570:21, 571:5 reviewing 349:3 revised 443:5 rides 580:2 right 305:3, 305:20, 317:15, 319:9, 335:2, 342:11, 362:6, 377:4, 377:20, 382:6,	382:10, 382:15, 383:9, 383:17, 383:22, 385:10, 386:13, 393:2, 397:8, 403:13, 405:1, 406:10, 407:22, 408:4, 410:9, 415:21, 419:17, 427:19, 428:9, 429:1, 434:7, 437:11, 438:15, 449:2, 452:9, 460:17, 463:14, 463:20, 484:1, 484:9, 484:12, 491:21, 493:17, 493:18, 496:20, 502:16, 505:7, 516:15, 518:15, 518:22, 522:16, 527:16, 542:6, 546:4, 547:5, 554:9, 554:12, 559:2, 574:19, 574:20, 579:6, 579:13, 586:14, 590:3, 592:2, 592:3, 594:1, 595:18, 599:18, 610:11, 610:15, 613:7, 621:9, 621:21, 622:4 rigid 609:5 ripped 465:3, 466:22, 467:20, 468:1 river 352:13, 352:16, 495:17 road 412:18, 604:4, 609:17 rochester 300:19, 301:4, 301:6, 623:20 role 429:18
---	---	--	--

roles 569:17 roman 619:7, 619:8 rotation 405:13, 415:14 rotations 404:9, 428:7 roughly 569:11 round 493:6, 495:5, 550:6, 561:19, 566:8 row 383:4, 511:14 run 380:7, 481:5, 605:22 running 517:2 runs 480:6	617:18, 621:19, 622:11, 623:6 sake 388:16, 389:1, 426:4, 444:1 same 308:12, 322:19, 350:1, 353:3, 357:3, 366:5, 366:7, 367:15, 381:19, 385:10, 387:10, 387:20, 390:19, 400:22, 402:17, 407:2, 414:11, 427:13, 433:10, 433:12, 434:7, 434:8, 434:13, 434:14, 434:22, 454:4, 454:18, 455:19, 461:5, 473:20, 489:11, 490:4, 490:12, 491:14, 492:6, 493:1, 494:2, 501:17, 508:5, 518:2, 520:15, 520:16, 520:18, 521:14, 521:18, 522:5, 523:1, 523:8, 524:18, 525:16, 525:18, 531:4, 534:12, 536:10, 536:20, 537:12, 538:18, 540:16, 541:20, 544:1, 545:22, 546:18, 547:19, 548:5, 550:7, 550:8, 558:13, 559:9, 559:21, 563:5, 571:17, 572:1, 572:12, 575:9, 580:11, 580:19, 580:20, 580:21, 582:14, 582:15, 590:13, 591:7, 600:7, 619:18,	619:22 sampling 450:17, 450:20, 544:18 satisfied 409:11 saw 441:22, 568:8 say 307:21, 311:18, 311:19, 312:3, 320:8, 323:4, 333:9, 336:5, 346:14, 346:20, 360:3, 366:13, 370:11, 370:21, 372:7, 373:13, 373:18, 376:7, 387:22, 389:3, 393:19, 394:14, 398:19, 398:22, 404:3, 404:5, 404:9, 404:19, 405:7, 406:21, 407:19, 407:21, 408:3, 408:7, 421:5, 428:21, 431:1, 437:9, 437:13, 437:16, 441:20, 447:17, 449:11, 458:3, 460:2, 461:22, 462:7, 463:21, 477:20, 479:20, 482:4, 482:17, 490:17, 499:16, 501:7, 501:11, 506:4, 522:4, 539:5, 540:22, 542:11, 545:2, 551:9, 552:19, 562:2, 564:2, 564:8, 566:8, 572:19, 577:12, 577:21, 580:11, 585:16, 590:18, 590:21, 593:14, 596:12, 596:22,	597:4, 601:2, 614:20, 615:15, 617:12, 618:6 saying 322:19, 337:5, 339:6, 342:17, 353:6, 364:20, 366:5, 366:7, 367:15, 390:1, 429:22, 433:7, 462:19, 466:10, 468:10, 493:12, 493:13, 494:5, 495:11, 515:6, 515:8, 524:20, 525:15, 534:12, 541:3, 545:6, 552:2, 552:19, 553:2, 553:13, 557:3, 558:13, 563:20, 566:5, 589:19, 591:6, 592:17, 602:20 says 322:9, 325:14, 328:21, 330:20, 333:2, 333:10, 333:18, 338:7, 347:5, 358:5, 359:6, 359:12, 359:15, 359:17, 360:1, 360:2, 363:8, 368:20, 370:6, 380:15, 381:18, 385:8, 390:11, 391:9, 396:16, 398:10, 398:12, 401:5, 401:7, 402:11, 403:4, 410:15, 417:8, 417:19, 428:8, 431:8, 432:4, 446:2, 447:10, 447:11, 449:11, 452:11, 452:21, 454:8, 457:9, 470:9, 470:12, 484:20,
S			
saber 300:17, 301:1, 303:2, 303:11, 304:1, 305:20, 308:21, 409:5, 469:19, 503:17, 519:2, 567:2, 613:18, 622:18, 623:19 said 311:5, 312:21, 321:5, 372:5, 389:1, 389:16, 389:17, 391:17, 410:6, 421:2, 470:10, 476:21, 480:5, 483:9, 495:7, 495:19, 507:18, 512:5, 532:7, 546:18, 550:11, 559:15, 559:18, 577:18, 602:7, 602:22,			

487:3, 487:13, 500:5, 505:11, 516:8, 526:9, 527:2, 533:10, 537:6, 538:8, 552:11, 554:2, 557:9, 557:10, 557:13, 559:9, 564:9, 565:8, 591:12, 591:15, 596:14, 596:17, 598:12, 601:5, 603:14, 605:19, 609:20, 616:1, 616:14, 620:14 scalar 575:2, 575:8, 578:3, 578:8, 578:15 scale 330:2, 330:7, 331:6, 334:1, 334:6, 334:19, 405:13 scales 380:9 scaling 415:14 scenario 370:17, 395:13, 395:15, 397:7, 420:18 scene 564:11, 609:22 scheme 470:5, 470:7 scope 348:4, 369:11, 370:15, 373:4, 373:5, 374:5, 376:2, 376:12, 376:21, 377:12, 377:16, 392:9, 392:15, 437:8, 440:6, 441:13, 441:16, 444:6, 444:16, 448:12, 510:19, 514:14,	521:3, 522:12, 524:2, 525:5, 525:20, 526:4, 532:11, 539:19, 541:8, 551:10, 552:5, 552:17, 552:20, 553:1, 553:5, 553:8, 553:14, 555:15, 556:1, 557:8, 557:16, 561:5, 562:8, 564:20, 581:6, 581:14, 582:7, 583:3 seal 624:2 search 405:21, 406:5, 406:14, 407:9, 407:12, 408:5, 428:4, 492:8, 506:18, 588:20 searching 408:3, 461:4 second 305:22, 360:10, 362:11, 373:7, 383:2, 383:8, 384:19, 399:2, 405:4, 405:5, 405:8, 407:2, 408:2, 430:19, 444:20, 446:22, 449:12, 452:7, 452:12, 452:13, 453:2, 464:19, 479:18, 488:1, 503:11, 503:12, 507:7, 509:17, 512:2, 515:12, 527:3, 552:13, 561:17, 566:14, 579:8, 582:6, 584:20, 594:5, 596:17, 600:10, 606:4, 612:3, 613:15, 618:7, 620:14, 620:17,	621:3, 621:4 seconds 584:15 section 379:22, 380:2, 380:15, 385:11, 385:13, 385:20, 386:6, 387:15, 415:12, 437:15, 437:17, 440:20, 446:21, 447:1, 447:2, 447:5, 447:11, 448:14, 467:20, 471:7, 480:3, 480:5, 480:16, 481:5, 481:6, 502:21, 535:4, 536:15, 536:16, 536:17, 537:8, 543:15, 544:8, 552:11, 552:12, 562:5, 562:18, 595:19, 600:15 sections 569:15 security 610:5 seeing 584:6 seems 364:18 seen 428:22, 544:6, 568:7, 605:22 segmentation 373:13, 373:14, 373:15, 417:13, 595:4, 599:10, 608:3 segmenting 373:15 select 561:7 selected 460:20 selection 400:20	semantics 417:3 send 542:10, 554:18, 555:5 sense 337:20, 347:20, 365:20, 391:6, 395:15, 399:7, 406:8, 418:12, 422:15, 435:18, 447:22, 461:3, 476:5, 478:17, 522:15, 556:2, 558:5, 580:2, 592:7 sent 567:15 sentence 330:5, 362:21, 378:9, 378:13, 378:18, 400:15, 409:13, 416:4, 417:18, 431:8, 431:14, 439:2, 439:4, 441:22, 442:17, 443:10, 446:22, 449:12, 454:4, 454:8, 456:16, 456:21, 466:4, 470:9, 470:12, 487:13, 498:5, 501:20, 502:6, 509:18, 509:20, 510:1, 533:5, 541:13, 546:18, 551:13, 551:14, 551:16, 554:1, 558:17, 596:13, 596:17, 598:12, 601:5, 601:6, 601:7, 609:20, 612:22, 615:19, 615:22, 618:8, 619:6, 620:14 sentences 449:10, 470:10,
--	--	--	---

541:13, 556:21, 557:1, 620:13 sentencing 550:18 separate 331:14, 339:14, 340:22, 343:18, 344:15, 353:21, 355:5, 355:6, 357:14, 361:6, 368:4, 390:5, 392:3, 394:5, 395:20, 406:21, 413:9 separately 309:21, 337:22, 339:13, 349:15, 353:2, 356:19, 360:14, 364:13, 366:11, 366:15, 368:16, 369:18, 476:3, 554:22 sequence 319:11, 402:8, 457:11, 457:19, 457:21, 458:17, 459:12, 459:20, 460:13, 482:9, 482:19, 505:13, 505:14, 505:22, 511:13, 511:16, 511:18, 511:19, 511:20, 511:21, 518:5, 518:11, 528:5, 596:6, 596:19, 597:14, 597:19 sequential 450:19, 544:18 series 316:21, 319:11, 336:13, 336:14, 358:6, 371:18, 446:20, 489:16, 490:8, 503:6, 503:7, 507:3, 507:11, 507:16, 512:8, 563:2,	608:19 served 354:14, 569:13, 569:17 serves 438:15 set 326:12, 328:14, 401:9, 438:2, 462:15, 462:17, 462:18, 498:8, 503:2, 542:10, 574:5, 606:22, 616:8, 616:14, 619:1, 624:1 set-up 420:18 sets 315:14 setting 373:17 seven 507:11, 546:9 several 354:11, 443:12, 527:19, 528:2, 532:7, 608:2 shape 369:8, 369:9, 415:8, 490:21, 491:1, 491:2, 491:4, 498:14, 500:6, 500:8, 500:9, 500:14, 500:16, 500:17, 500:18, 501:6, 507:3, 511:20 shaped 502:3, 511:13 shapes 472:13, 513:9 sheer 405:13 shift 546:12 shifted 459:10 shirt 605:9	short 457:2 shorthand 623:1 should 336:5, 360:3, 406:11, 429:16, 452:16, 452:19, 487:4, 510:4, 610:13, 613:8, 614:20, 614:21 show 348:9, 357:20, 445:1, 481:10, 511:12, 512:9, 527:13, 529:18, 593:6 showed 368:2, 425:5, 478:6 showing 601:15 shown 431:9, 432:4, 591:17 shows 505:13, 511:15, 530:18, 534:4 side 532:15 sigal 303:12 signature 306:11, 401:13, 402:3 signature-plkal 624:8 significantly 479:21 signing 623:9 similar 375:11, 502:3, 521:7, 530:6, 559:16, 569:7, 570:13, 570:15, 575:20, 575:21, 584:7, 584:9,	585:18, 586:2, 586:19 similarities 521:9, 569:6 similarity 419:1, 432:13, 432:16, 471:6, 471:8, 478:7, 480:9, 521:19, 576:1, 579:15, 580:3, 580:4, 580:17, 580:22, 581:4, 581:8, 581:11, 581:22, 582:19, 582:22, 583:14, 583:20, 584:1, 584:5, 584:10, 584:17, 585:14, 585:20, 586:3, 586:9, 586:11, 586:18, 587:3, 587:5, 587:6, 587:16, 588:1, 590:1 similarly 334:10, 343:13, 362:15 simple 327:8, 327:9, 337:6, 436:1, 436:4, 448:19, 448:20, 450:1, 450:4, 450:5, 463:12, 463:14, 470:5, 470:7, 550:4, 601:17 simplified 467:11 simplifies 370:13, 463:20 simplify 343:6, 437:19, 437:21 since 382:4, 408:9, 569:13 single 345:1, 345:6,
---	---	---	---

346:6, 346:11, 346:21, 347:8, 347:16, 370:7, 370:8, 370:17, 372:16, 379:13, 379:16, 382:15, 384:5, 385:7, 395:8, 395:16, 396:8, 396:11, 396:12, 396:17, 397:20, 398:15, 398:19, 398:22, 421:13, 462:20, 463:22, 466:6, 466:7, 470:18, 471:1, 471:17, 546:19, 549:15, 555:19, 556:11, 557:17, 557:18, 559:20, 564:9, 595:6, 595:7, 595:8, 595:9, 598:5 single-layer 345:9, 345:18, 346:9, 398:14, 522:14, 524:4, 524:6, 548:20, 555:2, 556:4, 558:3, 558:6, 560:2, 563:4, 563:6, 566:13, 611:16, 611:18 sir 329:21, 343:21, 344:21, 354:5, 368:7, 372:6, 382:11, 382:13, 400:8, 406:3, 413:18, 415:22, 442:14, 470:1, 473:1, 476:13, 479:3, 487:12, 492:13, 504:9, 504:20, 548:11, 551:6, 574:21, 590:8, 594:13, 595:22, 613:20,	614:3, 614:11, 616:17, 618:3, 618:5, 621:15, 621:18, 621:22, 622:5, 622:16 sit 352:16, 399:15 sitting 329:7, 570:6, 572:10 situation 396:7 six 405:11, 405:15, 405:16, 405:17, 407:21, 407:22, 408:12, 408:13, 546:9 size 392:17, 538:16, 546:14 skater 435:2 skaters 431:10, 432:5, 432:9 skill 320:16 skin 583:22, 584:2 skip 360:9, 360:10 skirts 431:11, 432:6 sky 375:13 slight 401:14 slightly 320:20, 468:8, 537:2 slow 372:15, 523:17 small 437:17, 565:6, 565:11 smooth 439:10, 441:21,	457:5 smoothed 457:4, 458:20, 459:15 smoothing 451:9, 452:3, 452:15, 453:5, 453:12, 453:20, 454:9, 454:14, 454:17, 454:20, 455:9, 455:14, 455:18, 455:22, 456:3, 457:2, 457:4, 458:4, 458:7, 458:8, 458:14, 459:2, 459:6, 459:7, 459:13, 461:9, 461:18, 527:21, 528:4, 528:8, 549:12, 549:22, 550:13 smoothings 455:3 snippets 410:1 soggy 605:8 solve 408:13, 488:9 solved 446:11 some 364:21, 376:22, 389:4, 409:22, 421:5, 440:19, 465:20, 474:17, 486:13, 500:20, 502:15, 518:4, 528:8, 568:21, 571:20, 599:22, 607:1, 616:7, 618:22 somebody 604:5, 605:8 somebody's 610:4 someone's 605:20	something 319:12, 320:8, 348:8, 357:20, 373:18, 375:12, 375:18, 377:7, 393:22, 399:16, 414:16, 414:17, 435:12, 452:8, 453:14, 474:11, 474:13, 514:5, 548:8, 584:11, 586:20, 590:17 somewhere 378:9, 520:10 sorry 327:1, 332:1, 341:6, 365:16, 365:17, 368:9, 398:11, 428:18, 452:6, 464:8, 480:21, 485:7, 500:21, 506:3, 512:6, 518:9, 521:12, 548:9, 616:19 sound 465:20 space 391:15, 391:20, 395:3, 400:15, 402:15, 402:17, 403:1, 403:3, 403:4, 403:8, 403:15, 403:20, 406:15, 406:21, 461:4, 586:2 spaces 556:7 spatial 319:12, 349:13, 370:3, 370:19, 371:15, 371:20, 371:21, 383:4, 383:6, 383:13, 384:22, 411:6, 411:10, 411:13, 413:7, 420:2, 421:17, 424:5,
--	--	---	---

425:4, 430:3, 430:5, 430:6, 432:21, 435:15, 435:18, 436:10, 436:14, 437:3, 438:1, 440:13, 441:18, 457:20, 463:2, 464:10, 465:5, 467:18, 468:1, 468:4, 469:2, 475:11, 475:12, 475:19, 475:21, 476:2, 476:11, 478:13, 481:18, 481:21, 481:22, 482:11, 487:5, 488:17, 489:4, 502:2, 502:9, 502:13, 527:13, 537:7, 537:8, 616:9, 616:14, 619:1, 619:10, 620:15 spatial-related 422:17 spatial-type 531:16 spatially 319:13, 339:18, 365:7, 411:15, 420:13, 425:15, 426:1, 426:19, 433:19, 434:1, 435:13, 441:10, 460:11, 460:12, 461:11, 477:19, 478:2, 478:3, 478:14, 478:15, 478:20, 478:22, 483:1, 484:6, 484:7, 484:10, 484:13, 485:22, 486:2, 488:18, 489:4, 545:1 spatio 315:21 spatiotemporal 304:3, 498:2	speaking 372:22, 408:12, 457:18, 502:7, 505:2, 520:6, 555:7, 575:11, 613:4 spec 495:9, 534:9 special 395:14, 462:17, 465:6, 569:15 specific 377:7, 382:20, 388:11, 412:11, 414:10, 414:14, 424:4, 425:3, 453:15, 453:22, 571:6, 572:2, 572:3, 572:4, 572:9 specifically 320:2, 609:19, 620:1 specification 311:11, 314:6, 314:13, 314:15, 315:1, 315:3, 316:6, 316:21, 317:1, 317:3, 318:1, 318:7, 318:8, 318:19, 319:15, 320:22, 326:5, 326:6, 336:19, 338:3, 338:16, 352:21, 353:15, 354:17, 354:19, 354:20, 355:2, 355:12, 355:16, 356:10, 361:7, 361:8, 367:6, 367:20, 367:22, 413:4, 451:10, 451:12, 495:10, 611:2, 611:10 specifications 312:16, 313:2, 314:7, 314:18,	317:13, 320:6, 322:2, 337:2 specifics 372:18, 373:1, 373:20, 374:6, 374:8, 374:20, 375:2, 375:5, 376:22, 455:5 specified 323:19 speed 430:20 spend 399:20 square 406:8, 493:5, 495:5, 550:3, 550:6, 561:19 squares 404:17, 405:18, 406:7, 406:9, 408:16 standard 300:21, 448:22, 449:3, 450:11, 450:13, 544:16 stands 385:17 start 354:18, 359:3, 384:3, 391:2, 393:22, 562:22, 575:15 starting 315:10, 383:7, 385:12, 401:6, 448:10, 457:8, 535:5, 535:12, 535:20, 536:14 starts 454:3, 473:22, 538:3, 543:13, 543:15, 544:9, 551:16 state 301:12, 323:7, 323:9, 344:5, 391:15, 391:19,	402:4, 402:12, 404:10, 412:10, 442:17, 447:11, 502:17, 502:18, 542:15, 544:9, 544:12, 605:7, 605:10, 605:11, 612:18, 616:5, 618:20, 621:20, 622:11, 624:12 stated 325:6, 506:9, 509:9 statement 390:2, 439:15, 439:17, 552:15, 557:2 stater 435:6 states 300:1, 315:13, 325:9, 332:9, 335:7, 344:6, 363:15, 382:22, 442:20, 446:6, 451:19, 452:1, 452:2, 505:9, 538:17, 542:16, 587:22, 605:5, 615:6 stating 445:14 stationary 543:21 statistically 544:1 stats 449:16, 563:18 stayed 360:5, 615:1 steffens 304:13, 573:13, 575:3, 582:19, 582:22, 583:18, 584:3, 584:11, 584:12, 584:17, 585:13, 585:15, 588:2, 588:5,
---	--	---	--

588:7, 588:16, 588:22, 589:9, 589:12, 589:13, 589:18, 590:4, 590:11, 590:21, 591:1, 591:9, 591:11, 592:22, 593:4, 593:6 stenographically 623:7 step 322:17, 324:15, 325:14, 326:8, 328:21, 331:17, 332:1, 353:19, 417:21, 418:1, 511:11, 531:11, 586:9, 599:14 steps 314:9, 322:19, 322:21, 323:11, 324:6, 481:8, 481:13, 572:11 stick 382:3, 392:15, 397:5 stiffness 516:13, 517:9 still 320:16, 321:8, 383:22, 391:20, 393:12, 394:7, 428:14, 428:19, 431:12, 432:9, 435:15, 458:15, 520:8, 537:5, 574:13, 577:22, 579:6, 579:9, 579:10, 595:7, 595:8, 595:9, 599:15, 599:16, 599:17, 620:13 stochastic 303:20 stopping 384:10 straightforward 517:1	strain 392:13 street 301:5, 623:20 strictly 370:2, 420:1, 420:2, 420:12, 420:17, 421:17, 422:17, 426:1, 427:1, 432:21, 433:22, 435:18, 436:14, 440:13, 468:20, 470:16, 471:14, 476:10, 477:15, 478:13, 481:17, 481:21, 481:22, 512:11, 529:10, 531:15, 543:19, 598:7 strike 468:15, 550:21, 575:16 structure 378:14, 387:1, 387:3, 388:7, 388:10, 390:12, 390:14, 434:8, 455:17, 492:22 structured 375:16 structures 455:19 student 366:21, 370:14 students 361:12, 372:5 study 348:12, 392:11 stuff 460:5, 462:19, 466:8, 467:3, 606:8 style 495:2 sub 614:13, 614:14 subcomponents 399:4, 399:6	subject 609:5, 609:14 submission 568:12, 570:17, 570:19, 570:20 submit 569:3, 570:7, 570:16, 573:18, 574:2 submitted 568:13, 569:20, 570:4, 570:11, 571:6, 571:11, 572:5, 572:8, 573:3 submitting 573:22 subsection 438:21 subsequent 505:19 substance 306:18, 307:9, 355:20, 504:14 substantial 524:17, 532:17, 533:2 suggest 554:3 suitcase 603:15, 604:6 suite 302:14 summarized 351:11 summarizing 349:18 summations 384:15 sunbathe 352:17 superscript 344:16, 344:17, 358:13, 614:13 supplement 351:12 supplemental 303:10, 304:5,	307:14, 309:8, 315:8, 349:5, 362:11, 408:20, 409:6, 410:9, 442:13, 442:16, 443:22, 470:3, 479:2, 503:18, 521:5, 542:5, 551:4, 551:5, 559:4, 560:13, 560:17, 574:13, 574:15, 574:17, 575:13, 575:18, 594:14, 601:21 supplied 420:11 support 322:5, 323:22, 324:8, 340:20, 443:4, 444:3, 444:20, 445:1, 445:9, 445:19, 445:22, 446:19, 447:2, 456:10, 456:19, 535:6, 535:13 supporting 341:9 supports 537:20 sure 359:10, 369:13, 376:14, 382:5, 384:12, 403:5, 417:2, 444:7, 447:4, 451:15, 534:12, 551:14 surface 500:20 surge 402:12 swear 305:4 symbol 359:7, 359:9 synergy 540:20 synonymous 336:2, 337:20
--	--	--	--

system 601:3, 607:14, 609:20, 616:2 systems 350:19 T table 415:5, 482:5, 482:19 take 348:10, 361:10, 362:4, 362:6, 366:20, 377:7, 378:4, 392:10, 393:16, 393:17, 393:18, 395:6, 397:22, 400:3, 408:1, 409:2, 413:10, 413:12, 453:18, 458:2, 458:11, 460:14, 469:13, 469:14, 499:3, 504:17, 511:11, 518:20, 561:15, 562:1, 563:20, 566:21, 579:5, 579:8, 610:12, 610:18, 613:7, 618:1 taken 479:17, 623:4, 623:7 takes 369:17, 411:6, 413:6, 599:6 taking 391:18, 394:20, 459:13, 610:14 talk 306:17, 419:18, 458:13, 521:5, 544:9, 567:11, 567:14 talked 395:11, 401:4, 419:5, 459:18, 472:8, 586:8	talking 320:1, 320:3, 321:11, 321:12, 325:19, 332:13, 350:3, 359:19, 368:19, 372:14, 373:8, 376:4, 378:20, 380:22, 384:3, 386:3, 386:7, 386:8, 386:14, 387:19, 394:19, 400:18, 400:21, 412:2, 417:2, 417:14, 417:15, 422:1, 423:10, 429:20, 430:2, 430:4, 440:8, 454:6, 454:13, 457:17, 471:6, 473:9, 474:4, 482:18, 491:17, 497:11, 497:15, 505:12, 506:12, 508:20, 508:21, 511:9, 512:13, 515:17, 518:13, 523:3, 527:11, 528:11, 530:20, 534:12, 536:21, 536:22, 539:7, 539:8, 539:9, 540:17, 544:3, 545:14, 545:15, 547:4, 547:15, 553:20, 554:7, 562:9, 563:9, 563:17, 588:2, 589:13, 589:17, 591:13, 591:18, 592:8, 594:19, 606:9, 607:9, 617:11, 617:18, 621:9, 621:12 talks 314:10, 383:1, 419:6, 445:13, 447:1, 481:16, 509:21, 511:2, 537:8, 545:17, 545:21, 597:13 tapered 548:20 task 447:16 taught 396:15, 447:6, 447:9, 448:4, 520:12, 523:21, 540:21, 541:6, 545:4, 550:15, 556:15 teach 380:6, 387:15, 402:19, 420:3, 424:19, 426:9, 444:8, 444:12, 453:19, 472:13, 473:2, 476:14, 480:8, 497:7, 497:18, 499:6, 499:20, 500:2, 500:4, 508:18, 508:22, 519:15, 526:2, 527:7, 527:19, 528:16, 542:20, 549:11, 549:21, 550:11, 554:3, 554:17, 555:4, 587:15, 611:1 teaches 351:18, 385:4, 472:16, 487:18, 498:6, 500:5, 509:5, 607:11, 609:3 teaching 320:13, 473:15, 536:6, 550:2, 563:12 teachings 510:14 technical 356:8, 361:8, 367:17, 371:5, 569:15, 570:20 technically 354:7, 405:14, 479:22, 541:14 techniques 551:9, 552:5, 552:17, 553:8, 556:9 technologies 300:7 tell 321:4, 352:12, 371:10, 392:17, 445:9, 448:3, 511:15, 539:17, 541:4, 543:10, 552:4, 576:5, 620:1 telling 366:6, 367:16, 386:13, 394:22, 425:1, 466:8, 466:10, 493:14, 581:16 template 417:10 templates 401:9 temporally 339:19, 365:8, 441:9, 441:10, 460:10, 460:11, 461:10, 477:15, 485:20, 486:19, 534:2, 545:1, 596:4 ten 610:6 tends 451:3 tennis 606:19, 607:3 term 308:22, 310:4, 310:17, 311:2, 312:5, 312:19, 313:13, 313:17, 317:20, 318:5,
---	---

318:11, 318:12, 318:20, 319:1, 320:17, 322:16, 323:1, 436:22, 477:21, 486:6, 575:8, 588:15 terminologies 536:1 terminology 316:15, 321:14, 536:4 terms 309:6, 309:7, 314:22, 318:15, 318:16, 319:13, 319:16, 320:18, 391:13, 465:19, 503:2 testified 362:15, 568:11 testifying 567:6, 567:13 testimony 305:4, 356:22, 390:8, 409:8, 409:16, 409:20, 411:3, 504:15, 568:16, 623:6, 623:7 testing 421:10 text 382:18 texture 496:16 th 317:15, 479:17, 623:21 thank 305:8, 306:1, 344:12, 379:10, 400:8, 413:18, 442:7, 494:20, 555:9, 613:10, 622:15, 622:17 theoretically 457:18, 458:1, 458:10	thereafter 623:8 therefore 473:12, 487:4 thesis 414:5, 414:22, 416:16, 480:14, 480:17, 492:5, 587:12 thing 308:5, 333:12, 345:8, 350:1, 366:5, 366:7, 370:19, 372:19, 384:4, 387:10, 387:21, 390:19, 395:14, 400:22, 424:8, 435:11, 437:17, 443:10, 446:1, 450:6, 454:18, 456:17, 456:18, 461:5, 472:19, 483:11, 483:18, 484:5, 484:7, 485:1, 487:5, 489:11, 490:12, 492:7, 502:1, 506:18, 508:6, 520:18, 523:1, 534:12, 538:1, 538:18, 541:20, 558:13, 559:9, 563:5, 587:2, 588:3, 590:13, 591:8, 600:13, 615:21 things 310:14, 322:14, 326:13, 337:1, 342:8, 343:1, 343:19, 352:11, 367:15, 373:9, 377:13, 384:12, 417:1, 423:11, 436:9, 437:21, 455:3, 459:16, 460:12, 479:21, 495:9, 501:18,	506:14, 515:2, 521:19, 528:19, 530:6, 537:4, 539:22, 557:21, 559:21, 560:3, 561:11, 562:15, 567:14, 571:21, 572:8, 590:6, 592:21, 593:13, 605:13, 617:10 think 307:21, 312:4, 323:18, 324:10, 327:3, 327:7, 330:19, 336:7, 338:21, 339:7, 339:20, 340:5, 340:8, 345:15, 351:10, 353:11, 354:14, 357:4, 361:21, 362:5, 380:10, 380:13, 396:4, 396:11, 412:21, 419:9, 420:7, 422:6, 423:10, 424:3, 424:22, 425:2, 429:3, 431:1, 442:11, 452:5, 461:21, 465:7, 465:14, 469:11, 475:18, 476:20, 478:12, 485:11, 486:21, 492:7, 499:2, 499:16, 501:8, 503:22, 506:17, 513:1, 520:6, 520:20, 522:1, 528:19, 531:4, 539:6, 548:3, 548:15, 552:1, 552:11, 552:12, 556:21, 560:7, 560:8, 566:6, 574:14, 581:3, 584:22, 587:7, 605:9, 607:21, 607:22,	613:6 third 360:11, 399:3, 399:5, 448:14, 468:11, 498:5, 526:8 three 358:11, 381:7, 408:15, 458:13, 474:2, 479:9, 496:5, 556:21, 556:22, 606:6 threshold 386:1, 386:5, 387:18, 444:10 through 307:13, 309:14, 309:21, 311:12, 314:9, 316:19, 316:20, 322:13, 341:4, 344:17, 353:18, 358:19, 373:12, 379:22, 380:1, 414:18, 419:19, 420:9, 422:19, 422:20, 445:18, 445:21, 481:8, 536:3, 547:9, 619:15 throughout 308:16, 412:22, 492:4, 492:5 tickles 540:15, 540:18 tight 451:3 tightly 555:21, 556:13 time 300:21, 306:2, 318:13, 319:10, 319:11, 319:17, 330:3, 334:11, 334:12, 334:14, 334:15, 348:12, 376:17, 391:18, 392:11, 399:11, 399:20, 404:15,
--	--	---	--

408:22, 409:12, 410:17, 411:14, 411:15, 411:18, 419:6, 419:10, 420:16, 421:2, 424:19, 426:7, 426:12, 435:10, 435:11, 439:18, 454:10, 454:19, 455:11, 456:1, 458:11, 459:10, 460:14, 482:8, 517:2, 528:4, 531:11, 533:7, 543:22, 546:12, 568:2, 568:8, 570:2, 594:2, 611:4, 611:13, 611:15, 612:1, 612:2, 612:6, 612:10, 612:11, 615:13, 615:14, 617:19, 620:18, 621:1, 621:6, 621:8, 622:16 times 349:4, 354:11, 354:13, 361:22, 396:5, 412:22, 419:10, 422:7, 425:2, 440:8, 454:11, 469:11, 475:18, 476:21, 478:12, 485:11, 485:12, 486:22, 488:13, 532:7, 533:7, 548:16, 569:16, 571:2, 576:19, 576:20, 577:14, 577:15, 579:1, 608:2, 611:17, 612:16, 613:6, 614:7, 622:10, 622:12 tip 592:11, 592:17, 593:16, 593:18 tire 496:8, 496:11,	496:13, 496:14, 590:20 tires 496:6, 566:10 title 312:12, 313:4, 381:19, 414:2, 414:13, 414:18, 498:2, 506:20, 506:21, 519:19, 519:22 titled 438:21, 595:19 tlp 339:2, 348:14, 349:3, 349:18, 349:21, 350:4, 350:6, 350:12, 350:18, 351:3, 351:5, 351:10, 351:14, 351:18, 352:1, 353:1, 438:14, 438:16, 438:17, 453:19, 453:22, 454:5, 454:15, 455:6, 455:15, 521:7, 521:12, 521:14, 521:16, 521:21, 522:13, 523:3, 524:3, 524:9, 525:10, 529:14, 530:6, 530:9, 530:12, 531:4, 531:8, 531:13, 531:19, 532:5, 532:13, 532:16, 532:19, 533:3, 539:11, 540:16, 547:5, 547:6, 547:8, 547:10, 547:12, 547:21, 554:10, 554:17, 554:22, 555:3, 555:4, 555:18, 556:3, 556:7, 556:10, 556:16, 558:14, 558:21,	559:10, 560:1, 562:16, 563:1, 567:8, 568:12, 569:19, 570:4, 570:10, 571:6, 571:10, 572:5, 610:12, 610:17, 610:20, 611:1, 612:18, 612:19 today 305:5, 306:13, 504:14, 519:13, 567:6, 612:17, 613:6, 614:5, 622:12 today's 306:19, 308:11, 504:11 todd 302:4, 305:9 together 384:20, 391:5, 394:1, 563:2, 576:18 tonight 581:17, 585:10 took 403:9, 606:21 top 308:14, 315:16, 346:3, 346:8, 358:13, 362:14, 397:11, 397:16, 452:12, 453:3, 453:15, 490:15, 492:1, 501:19, 505:8, 569:10, 588:18, 592:3, 618:7 topic 438:2 topics 409:2 torso 554:15, 554:19, 555:5, 555:11, 555:12, 555:20, 555:22, 556:12,	556:14, 557:20, 561:8 total 580:13 totality 589:20 totally 424:13, 508:5, 512:21, 517:12, 518:13, 523:1, 560:2, 561:14, 564:15, 577:2, 581:7, 589:12, 590:1, 606:8, 608:22 track 310:4, 310:17, 311:3, 351:4, 384:10, 517:21, 518:8, 609:15, 609:17 tracked 609:12 tracking 303:13, 303:20, 310:5, 310:6, 310:17, 310:19, 311:1, 311:3, 311:5, 311:8, 311:10, 312:11, 312:14, 313:6, 313:21, 314:4, 314:12, 339:11, 350:7, 350:14, 401:1, 442:21, 446:9, 452:4, 452:18, 454:10, 459:3, 459:6, 518:11, 538:9, 538:11, 545:20, 546:3, 552:5, 602:2, 602:8, 602:11, 602:19, 603:6, 603:8, 603:9, 607:18, 607:19, 609:18, 612:20, 613:4 tracks 609:4, 609:9,
--	--	---	---

609:13 traded 507:14 trademark 300:1 train 507:10, 512:7 trained 356:6 training 354:8, 356:7, 439:11, 497:9, 497:20, 498:8, 498:15, 500:11 trajectories 602:4 trajectory 602:15 transcript 308:2, 623:5 transform 584:5 transformation 404:13, 405:10, 405:11, 407:7, 408:14, 595:3, 599:9 transforms 583:6, 584:4, 584:6, 585:16, 585:17, 585:19, 585:22, 589:14, 589:22, 591:4 translation 405:14, 415:13 translations 404:9 treated 525:22 trial 300:2 tried 394:2 trs 415:10, 415:13 true 311:18, 389:16, 439:18, 501:11,	623:5 truth 305:5, 305:6, 572:19, 573:11 try 343:6, 392:17, 406:9, 414:17, 465:20, 510:13, 553:12, 605:11 trying 327:13, 353:4, 390:20, 404:5, 465:19, 466:11, 491:18, 493:5, 494:16, 495:4, 496:18, 500:16, 510:6, 550:2, 550:6, 550:17, 550:18, 561:18, 596:11, 603:15 tuesday 300:20, 623:21 tuning 498:9 turn 329:20, 343:20, 344:19, 380:3, 400:9, 409:5, 431:4, 438:19, 472:22, 480:3, 487:8, 554:9, 607:10, 610:20, 613:21 tutorial 569:14 two 358:11, 368:4, 381:6, 381:8, 382:9, 383:21, 393:19, 397:15, 401:8, 404:13, 405:13, 407:5, 407:8, 408:9, 408:10, 408:11, 421:15, 458:6, 459:2, 463:4, 463:6, 468:4, 487:17, 490:13,	490:22, 491:19, 522:21, 522:22, 530:15, 532:12, 575:3, 575:14, 575:19, 576:7, 576:16, 577:13, 578:8, 578:16, 578:22, 579:4, 579:18, 579:22, 580:6, 580:10, 580:13, 580:18, 582:12, 583:8, 584:7, 584:9, 584:16, 586:1, 586:2, 606:4, 620:13 two-layer 340:2, 340:7, 340:14, 345:1, 347:17, 350:2, 351:8, 366:22, 367:2, 378:14, 378:22, 387:1, 387:3, 389:8, 389:17, 390:5, 390:12, 390:13, 442:22, 444:2, 444:11, 522:18, 524:5, 524:14, 548:19, 549:9, 549:16, 556:5, 558:7, 558:18, 559:17, 560:1, 561:15, 563:8, 564:8, 565:18, 566:20 two-level 547:2, 595:16 two-thirds 378:11, 468:12 type 319:11, 322:7, 323:16, 364:21, 439:21, 440:19, 446:14, 450:5, 474:17, 501:18, 503:14, 547:17, 548:20, 550:19,	590:14, 602:16, 605:12 typed 310:20, 311:6, 312:8, 312:22 types 321:17, 321:21 typewriting 623:8 typical 503:14 typically 392:12, 393:12, 398:19, 398:21, 405:16, 408:14, 428:1, 469:6, 479:18, 486:6, 486:12, 501:17, 568:18, 568:20, 573:7, 592:9 typo 360:3, 452:5, 452:6, 452:9, 614:20 U uber 321:13 uh-huh 346:2, 346:5, 357:10, 358:14, 358:17, 358:21, 359:8, 359:14, 359:18, 359:21, 364:2, 364:12, 365:9, 371:17, 378:17, 378:19, 380:17, 381:9, 381:11, 381:14, 381:21, 383:19, 396:21, 397:3, 401:17, 401:21, 403:14, 405:2, 407:16, 421:16, 429:12, 447:14, 447:20, 449:15, 449:21, 450:2, 463:18, 464:2,
--	---	--	--

471:12, 481:15, 484:2, 493:19, 506:15, 526:14, 526:20, 527:4, 543:4, 576:10, 584:19, 585:2, 585:4 umbrella 571:22 unambiguously 316:17 uncertain 555:20, 556:12, 557:19 under 470:19, 534:18, 534:19, 535:4, 536:14, 568:15, 623:8 underlying 603:16 underneath 359:13, 382:18, 383:8, 384:13, 525:13 understand 309:2, 313:2, 314:8, 315:13, 316:5, 317:4, 317:11, 318:1, 318:8, 318:19, 319:4, 319:15, 320:21, 326:10, 336:10, 339:7, 352:18, 352:22, 353:13, 354:21, 365:2, 370:14, 384:1, 392:8, 392:21, 397:14, 401:3, 416:10, 416:14, 416:16, 436:8, 436:14, 444:14, 444:17, 451:15, 456:11, 456:17, 510:16, 537:14, 541:11, 541:13, 541:16, 541:21, 562:19,	571:12, 571:18, 572:7, 572:8, 581:21, 582:11, 593:11, 593:21 understanding 317:14, 331:19, 336:7, 336:19, 338:21, 339:1, 339:11, 357:4, 357:5, 373:2, 397:22, 400:14, 410:14, 426:5, 456:20, 502:5, 502:12, 510:15, 534:11, 541:1, 570:4, 570:7, 570:9, 571:9 understands 582:10 understood 334:22, 388:10, 398:20, 408:18, 534:16, 537:18, 541:2, 561:6, 565:17, 602:1 uniform 391:14, 391:19, 391:22, 395:1 united 300:1 unknowns 408:13 unless 314:20, 315:1, 502:11 unlike 417:8 until 362:8, 409:3, 469:17, 515:18, 518:21, 566:22, 594:6, 613:9 update 429:4, 462:8 updates 472:18, 476:5, 476:7 updating 472:13, 486:18	upper 554:18, 555:5 use 318:15, 319:1, 385:4, 393:2, 398:1, 398:4, 405:18, 408:16, 414:11, 418:3, 428:12, 431:3, 447:15, 449:11, 449:13, 450:19, 452:3, 452:14, 454:9, 454:13, 454:17, 454:20, 455:2, 455:14, 455:16, 463:9, 482:14, 485:20, 486:4, 490:21, 491:1, 491:22, 492:14, 493:9, 494:11, 496:10, 515:16, 519:15, 520:15, 522:3, 522:4, 522:19, 522:20, 522:22, 532:21, 586:3, 586:11, 588:5, 588:22, 589:9, 599:4, 599:5, 603:19, 610:10 useable 552:21 user 609:5, 609:14 uses 351:4, 446:12, 477:17, 492:16, 494:16, 495:1, 496:17, 507:1, 512:16, 513:22, 514:19, 520:2, 520:11, 522:15, 531:5, 556:7, 587:15, 594:17, 604:21 using 303:21, 350:13, 385:16, 393:18,	393:19, 414:7, 415:20, 423:21, 424:17, 431:12, 432:10, 439:11, 440:3, 453:5, 453:19, 455:9, 455:21, 456:6, 458:13, 458:15, 458:21, 461:2, 463:11, 465:7, 478:9, 480:8, 485:15, 485:19, 486:9, 486:13, 488:7, 490:20, 491:2, 493:14, 493:20, 494:21, 496:11, 498:8, 499:6, 499:11, 499:20, 505:14, 508:2, 508:22, 509:6, 511:22, 512:5, 512:20, 514:9, 518:5, 518:10, 519:21, 520:17, 520:21, 549:11, 549:21, 550:12, 550:17, 553:16, 554:6, 558:2, 572:18, 582:16, 582:17, 582:19, 582:22, 583:5, 585:14, 585:21, 602:12, 602:14, 603:10, 604:8, 604:11, 605:2, 605:17, 606:9, 606:12, 606:15 usually 374:21, 392:7 utilize 448:1, 482:10, 574:4, 603:17 utilized 317:2, 318:9, 318:21, 319:16, 320:18, 320:19, 321:15, 322:18,
--	--	--	---

322:20, 350:6, 377:10, 377:13 utilizes 517:7	427:16, 427:18, 427:20, 428:7, 429:3, 429:16, 430:9, 430:10, 430:13, 472:11, 472:21, 477:9, 487:2, 487:4, 516:8, 575:3, 576:8, 576:11, 576:13, 576:14, 576:18, 578:16, 578:17, 578:20, 579:5, 579:6, 579:8, 580:1, 580:2, 583:8, 583:9, 597:2, 597:3, 597:16, 598:16, 601:11, 601:13, 601:14, 601:15, 608:14	vi 577:12 via 305:12, 404:16 vibration 505:21, 509:22 vibration-type 507:5 vibrations 508:15 video 310:12, 314:11, 324:18, 325:15, 334:13, 336:14, 336:15, 342:12, 357:12, 369:17, 371:21, 374:3, 375:2, 375:6, 419:20, 420:21, 431:18, 460:16, 469:4, 469:5, 479:17, 481:20, 482:4, 482:10, 482:19, 485:18, 588:11, 588:22, 589:2, 589:3, 591:3, 594:21, 595:2, 599:6, 599:7, 599:18, 599:22, 600:1, 606:21, 607:1, 608:3, 608:21	volume 300:18
v			W
v1 576:9, 578:16, 583:8 v2 577:12, 583:9 vacuum 456:22 value 405:7, 405:8, 408:1, 408:9, 507:9, 575:14, 575:18, 577:21, 577:22, 579:10, 580:12, 580:14, 580:15, 580:16, 581:1 values 405:1, 405:6, 433:11, 433:13, 433:16, 433:18, 434:6, 434:9, 435:1, 575:21 variant 404:9 variation 446:12 variations 404:10 variety 310:13, 314:12, 321:9, 455:3 various 316:22, 381:13, 384:15, 431:10, 431:17, 431:20, 432:6, 450:7, 602:3 vary 439:9 vastly 517:14 vector 402:6, 403:16,	vectors 518:6, 575:15, 575:19, 576:7, 576:16, 577:8, 577:13, 578:8, 578:12, 579:3, 579:5, 579:15, 579:18, 579:20, 579:22, 580:3, 580:6, 580:10, 580:13, 580:19, 582:12, 583:8, 596:7, 596:19, 596:21, 597:19, 602:12 velocity 427:21, 427:22, 430:22, 488:3 verbal 440:2 version 520:2 versus 383:15, 410:10, 479:20, 489:16, 490:10, 491:8, 549:16, 587:5, 590:19	videos 482:5 viewed 618:14, 618:17 vision 304:10, 568:19 visual 401:12, 402:3 v1 300:12, 303:10, 304:1, 304:11, 304:12, 305:16, 306:6, 445:6, 567:19, 567:21 volkswagon 566:6	w-frame 452:3, 452:14, 458:4 wait 515:18 walk 309:20, 314:9, 353:18, 422:20, 481:8, 511:18, 518:4 walking 425:7, 484:1, 484:3, 485:9, 487:14, 511:13, 603:14, 603:21, 604:5, 604:6, 605:8, 605:20, 606:18, 607:3, 609:16, 610:2, 610:4 want 306:17, 310:16, 336:20, 336:21, 347:17, 348:6, 348:8, 348:10, 362:4, 370:21, 371:6, 389:3, 403:5, 404:8, 414:10, 414:11, 414:14, 414:21, 417:2, 425:3, 428:1, 437:4, 437:19, 455:16, 474:17, 514:20, 515:16, 576:7, 576:8, 610:3, 616:13, 618:6 wanted 437:13, 437:21, 583:8 wants 352:16 washington 302:7

wavelet 583:6, 584:4, 584:6, 585:16, 585:17, 585:19, 585:22, 589:14, 589:22, 591:4 way 326:1, 341:3, 345:21, 347:1, 350:17, 358:10, 358:12, 358:16, 360:16, 384:9, 403:22, 404:16, 410:4, 410:5, 451:17, 459:3, 459:4, 459:5, 459:7, 459:9, 462:21, 463:8, 477:10, 480:19, 502:11, 513:8, 513:9, 520:16, 521:8, 521:19, 522:5, 522:8, 522:9, 523:8, 526:1, 540:1, 545:22, 546:2, 546:12, 546:16, 549:17, 550:1, 550:19, 562:14, 568:19, 585:10, 602:10, 602:21 ways 317:21, 377:14, 450:7, 458:6, 459:2, 502:4, 520:22 we'll 307:20, 308:15, 312:2, 395:1, 453:17 we're 305:22, 311:12, 321:11, 321:12, 325:19, 339:4, 346:20, 348:5, 350:3, 360:19, 382:19, 394:19, 409:1, 412:1,	417:2, 423:10, 454:6, 491:17, 491:18, 505:12, 506:12, 508:21, 510:9, 511:9, 512:13, 515:19, 517:2, 518:12, 528:11, 530:20, 534:12, 539:7, 540:17, 541:19, 544:3, 563:8, 563:17, 589:17, 592:7, 607:9, 617:18 we've 340:8, 349:9, 351:10, 361:21, 368:18, 392:5, 408:21, 412:4, 412:18, 425:2, 455:8, 457:17, 461:21, 469:11, 476:18, 478:12, 486:21, 488:6, 488:13, 518:18, 526:22, 545:15, 546:18, 547:4, 547:9, 547:15, 548:15, 553:2, 553:3, 558:22, 611:16, 612:16 weak 393:20 wear 431:11, 432:6 welcome 613:12 well-known 388:3 well-recognizable 570:14 well-recognized 570:15 went 403:12, 419:10, 475:18, 485:11 weren't 579:3	wet 605:8, 605:9 whatever 326:17, 328:2, 374:11, 377:17, 430:19, 455:4, 478:6, 547:22, 557:9, 557:13, 582:16, 593:15, 606:19 whatsapp 300:6 whatsoever 420:14, 420:19, 421:8, 422:18, 423:4, 424:11, 424:14, 440:14, 440:17, 442:3, 442:4, 472:12, 477:2, 478:17, 481:11, 486:16, 489:6, 508:8, 508:9, 597:18, 598:18 whenever 366:12 wherein 332:11, 341:13, 344:7, 363:8 whereof 624:1 whether 321:10, 340:13, 340:14, 350:4, 350:18, 350:19, 352:14, 352:15, 374:22, 399:15, 419:11, 421:9, 422:13, 488:15, 556:10, 559:8, 579:21, 583:21, 588:9, 604:21 white 490:17, 490:18 whole 305:5, 308:5, 330:3, 330:7, 331:16, 334:2,	334:9, 335:16, 338:15, 338:19, 339:2, 339:6, 339:9, 351:1, 384:4, 390:3, 391:11, 391:12, 392:21, 437:16, 456:16, 456:21, 490:19, 491:7, 506:18, 554:21, 607:19, 615:20 wi 565:1, 565:11, 565:13 width 565:13, 565:16 willing 392:6, 392:18 window 365:17, 365:20, 368:20, 368:22, 369:2, 369:3, 369:4, 458:16, 458:21, 459:10, 459:12, 459:17, 459:19, 460:15, 460:19, 460:20, 460:22, 461:1, 463:4, 468:17, 528:5, 544:2, 544:4, 545:17, 545:19, 546:8, 546:13, 546:14, 546:17, 620:16 windowed 451:9, 452:3, 452:15, 453:5, 453:11, 453:19, 454:9, 454:14, 454:17, 454:20, 455:3, 455:9, 455:14, 458:4, 458:6, 458:8, 459:2 wing 513:21 wings 328:2
--	--	---	--

within 383:17, 384:17, 406:14, 412:12, 416:17, 418:10, 418:11, 419:19, 420:1, 422:16, 423:15, 425:9, 426:2, 430:6, 432:17, 432:20, 432:21, 434:1, 441:13, 459:12, 462:2, 462:3, 470:16, 471:14, 471:17, 471:22, 472:17, 472:18, 473:5, 473:8, 473:10, 474:3, 474:5, 474:6, 474:7, 474:10, 474:12, 474:14, 476:10, 489:4, 608:5, 612:2 without 307:11, 350:22, 355:22, 369:19, 399:6, 399:10, 430:12, 500:19, 510:10 witness 305:7, 305:17, 307:8, 308:13, 348:18, 355:19, 428:18, 469:16, 480:22, 504:2, 519:1, 613:12, 622:17, 624:1 word 310:6, 310:19, 311:5, 312:8, 312:17, 312:21, 315:11, 322:20, 473:22, 492:9, 495:16, 495:22, 506:19, 592:21, 593:3, 593:6, 597:11 wording 352:19, 536:20,	536:21, 559:16, 559:17 wordings 352:17, 550:18 words 313:17, 340:14, 341:12, 343:7, 343:9, 593:8 work 373:14, 394:9, 417:8, 418:10, 418:20, 461:1, 493:7, 524:16, 562:4, 564:2, 593:14, 607:1 working 460:21, 462:20, 569:12, 599:13 works 462:11, 462:14, 493:6, 524:10, 561:17 world 370:20, 371:5, 371:6 wouldn't 345:10, 347:19, 359:2, 360:7, 361:14, 361:17, 389:14, 394:9, 396:7, 398:4, 398:18, 461:13, 461:16, 479:12, 506:18, 552:21, 566:8 write 361:7, 370:9, 371:5, 576:7, 576:8, 578:18 writing 320:12, 490:18 written 309:19, 313:22, 360:16, 443:5 X x 300:4, 300:14,	614:13 x's 358:7 x0 564:21 x1 561:8, 564:13, 564:21 xi 526:11, 526:18, 564:14, 565:1, 565:3, 565:10, 565:11, 565:12 xio 359:17, 360:4 xj 526:11, 526:18 xjo 359:17, 360:4 xocn 359:3 xoco 359:3 xoo 359:2 xy 403:13, 403:16, 405:1, 405:5, 405:7, 405:8, 406:21, 408:1, 408:9, 582:15 Y y0 564:22 yeah 327:10, 327:12, 359:12, 359:19, 378:12, 384:12, 385:8, 416:4, 431:19, 439:16, 439:20, 474:10, 478:6, 497:6, 504:2, 546:9, 552:1, 563:14, 571:17, 591:21, 601:5, 609:10, 617:12, 620:19	year 571:14, 571:16, 571:17, 572:5, 572:9 years 377:3, 571:19 yi 565:1, 565:3, 565:11, 565:12 york 300:19, 301:12, 302:15, 623:20, 624:12 yourself 439:3, 504:19, 551:22, 558:11, 560:19 yugo 321:7 yup 359:11, 382:9, 518:20 Z zero 358:19, 406:11, 406:12, 554:14 zeros 358:9, 358:11 zhao's 414:18, 415:15, 418:10, 418:20, 419:3, 420:9, 437:22, 440:12, 441:8, 470:12, 478:9, 484:4, 485:4, 586:13 zoom 305:12 's 569:13 0 00924 300:10, 306:1 01 518:21, 575:15
---	--	--	---

08 594:6	512:14, 512:18, 514:9, 514:12, 515:10, 515:11, 515:22, 516:3, 516:4, 517:4	402:11, 409:3, 591:14, 623:21	443:6
1	1015	1301	1e
1 469:17, 533:6	304:7, 518:15, 518:17, 519:2, 519:4, 519:7, 519:12, 519:15, 521:6, 522:3, 522:10, 522:13, 526:2, 526:6, 527:7, 527:17, 528:1, 548:6, 548:8, 548:9, 548:11, 548:13, 548:17, 548:18, 549:1, 549:10, 549:20, 550:11, 551:10, 552:4, 554:7	302:6 14 302:14, 391:8 14604 301:6, 623:21 15 391:8, 391:10, 406:13, 407:1, 429:16, 449:20 155 301:5, 623:20 16 309:14, 343:13, 400:9, 400:10, 400:12, 610:10 168 591:13 17 615:18 18 624:6 180 577:4 19 362:13, 449:14 190 476:15 1965 302:16 1a 322:17, 325:9, 326:17, 332:14, 332:15, 341:19, 398:10 1b 325:14, 330:14, 340:20, 341:9, 341:17 1c 326:18, 330:20, 340:20, 341:9, 398:12, 521:17 1d 340:20, 341:9, 341:15, 342:18,	308:22, 309:5, 309:7, 309:10, 340:20, 341:9 1j 577:15
10 343:13, 362:8, 407:1, 427:19, 428:8, 429:16, 429:17, 477:9, 510:12, 530:16, 577:12, 577:13, 577:14, 577:15, 577:16, 578:17, 579:1, 584:12, 613:8	1016 303:20, 438:4, 438:5, 438:19, 441:14 1019 304:8, 559:3, 560:4, 560:10, 560:11 1052 304:5, 503:18, 503:20, 504:5, 504:6, 504:18 1053 303:16, 399:22, 400:5, 400:6 11 343:8, 409:3, 459:1 12 362:8, 362:15, 469:17, 479:5, 518:21, 591:17, 591:18 13 300:20, 400:9, 400:10, 400:11,	15 391:8, 391:10, 406:13, 407:1, 429:16, 449:20 155 301:5, 623:20 16 309:14, 343:13, 400:9, 400:10, 400:12, 610:10 168 591:13 17 615:18 18 624:6 180 577:4 19 362:13, 449:14 190 476:15 1965 302:16 1a 322:17, 325:9, 326:17, 332:14, 332:15, 341:19, 398:10 1b 325:14, 330:14, 340:20, 341:9, 341:17 1c 326:18, 330:20, 340:20, 341:9, 398:12, 521:17 1d 340:20, 341:9, 341:15, 342:18,	2 2,1 610:21 2.2 537:8 2.3 415:7, 447:1, 447:2, 447:5, 447:11, 537:9, 543:15, 543:18 2.4 379:22, 380:2, 380:15, 385:13, 415:8, 415:12, 537:10 2.5 380:3, 380:6, 385:13, 385:20, 386:6, 387:15 20 362:10, 370:5, 377:3, 479:20, 571:19 2000 568:2 20004 302:7 2004 304:1, 307:22, 308:1, 317:16, 318:13, 376:17, 377:3, 399:11, 439:18, 445:5, 445:7, 454:19, 455:11, 456:1, 573:15, 573:22 2005 318:13, 439:18, 454:19, 455:11, 456:1

2007 303:10, 306:5, 306:7, 306:22, 409:7 2009 304:11, 567:17, 567:20 201 334:7 2010 304:12, 567:18, 567:22 202 302:8 2023 300:10, 306:1 2024 300:20, 623:21, 624:3 2026 624:6 203 334:9 212 302:16 22 566:22 23 409:3, 446:22, 448:3, 448:7, 451:16, 451:21, 609:9, 624:2 232 301:7 24 315:13, 609:9 25 316:13, 316:14, 322:6, 381:20, 385:12, 407:4, 410:9, 587:11, 587:12 26 317:15 27 362:14 29 408:19, 409:6	2a 327:7, 328:18, 333:22, 334:4, 334:7, 334:9, 345:22, 346:19, 347:2, 347:7, 396:20, 397:17, 398:5, 398:15, 536:10, 615:3, 615:9, 615:12, 616:19, 619:15, 622:2 2b 327:1, 327:4, 334:10, 536:10, 615:9, 616:19 2c 619:17 2cd 452:20 2d 303:21, 619:15, 619:17, 620:4 2j 576:9, 576:12, 576:14, 576:18, 577:15, 578:17 3 3 518:21 3-frame 453:19, 454:9, 454:14 3.3 492:12, 493:18, 562:5, 562:18, 564:4, 564:6, 564:18 3.4 480:5 30 476:16, 479:17 300 300:24 306 303:10 308 303:12	31 476:15 314 303:4 32 315:7, 315:16, 316:11, 407:4, 410:8 33 442:15, 442:18, 456:10, 542:4, 542:6, 595:18, 601:1 34 566:22, 613:9 348 303:13 35 607:10 36 445:12, 535:5 37 470:2, 470:8, 607:10 377 303:14 38 506:3 381 302:16 389 302:8 39 479:1, 504:18, 504:22, 506:3, 509:10, 613:9 3d 303:20, 612:20, 613:3 3i 576:9, 576:12, 576:14, 576:18 3j 577:12, 577:13 4 4 566:22	4.2 480:16, 481:9 4.4 480:3, 480:5, 480:6, 481:5 40 535:12 400 302:14, 303:16 406 599:14, 599:21 408 598:6, 598:7 413 303:17 42 521:4, 551:12, 558:10, 559:9 43 344:22, 347:10, 395:7, 395:12 438 303:20 44 551:3, 558:10, 559:9, 610:8 445 304:1 45 344:22, 347:10, 395:8, 395:12, 601:1 46 469:17 47 536:18 48 574:20 49 300:21, 406:4, 623:22 497 304:3 5 5 594:6, 613:9, 622:19, 623:22
---	---	--	---

5.6 423:10, 423:12, 487:13, 487:17 5.7 431:9, 431:17, 431:20, 431:22, 432:2, 432:5, 432:8, 434:16 50 354:14, 356:4, 358:2, 622:11, 622:19, 623:22 5000 301:7, 302:8 504 304:5 51 406:4, 535:12 519 304:7 52 469:17, 535:20, 575:13, 575:17 53 535:22 54 471:4, 478:6 548231 300:23 55 357:21, 358:2, 358:3, 358:4, 534:13, 538:19, 614:6 56 472:22, 473:7, 473:18, 473:20, 478:6 560 304:8 567 304:11, 304:12 57 362:8 574 304:13 58 594:14	585 301:7 594 304:14 5a 511:18 5b 511:21, 512:6 6 610:8 6,301,370 304:13 6,597,801 303:16 60 329:20, 329:21, 329:22, 333:16, 380:21, 381:2, 393:21, 412:5, 527:1, 538:19, 601:21, 613:22, 614:2, 614:10 62 585:1 624 300:24 65 349:6, 349:8, 357:21, 358:3, 358:4, 534:13, 614:6 7 7,200,266 304:14 7,436,908 303:12 7,436,980 300:11 7-0 480:21, 480:22 70 480:13, 480:14, 480:15, 480:17, 480:18, 481:12 71 481:13	72 306:11 75 560:16, 560:20 8 300:21, 623:22 80 423:13 9 362:8 90 569:13 91 472:9, 487:8, 487:10 92 472:9, 476:12 93 431:4, 431:5, 472:9 9a 349:12	
---	--	--	--