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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ARASHI VISION (U.S.) LLC (D/B/A INSTA360),
Petitioners,

v.

GOPRO, INC.,
Patent Owner

Case IPR2024-01052
U.S. Patent No. 11,336,832

**DECLARATION OF HASSAN FOROOSH PH.D.
IN SUPPORT OF PATENT OWNER'S PRELIMINARY RESPONSE**

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1. I have been retained on behalf of GoPro, Inc. (“Patent Owner”) in connection with the above-captioned *inter partes* review (IPR). I have been retained to provide my opinions in support of Patent Owner’s Preliminary Response. I am being compensated for my time at my standard rate of \$650 per hour. I have no interest in the outcome of this proceeding.

2. In preparing this declaration, I have reviewed and am familiar with the Petition for IPR2024-01052, U.S. Patent No. 11,336,832 (“the ’832 patent”) and its file history, and all other materials cited and discussed in the Petition (including the declaration of Petitioner’s expert Dr. Aggelos Katsaggelos), and cited and discussed in this Declaration.

3. The statements made herein are based upon my own knowledge and opinion. This Declaration represents only the opinions I have formed to date. I may consider additional documents as they become available or other documents that are necessary to form my opinions. I reserve the right to revise, supplement, or amend my opinions based on new information and on my continuing analysis.

I. QUALIFICATIONS

4. I have been retained to serve as a technical expert in this matter based upon my educational and research experience, and specifically my work in the fields of computer vision, image processing, and optics. My curriculum vitae

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(“CV”) submitted as Exhibit 2002, which contains details about my education, experience, publications, and other qualifications to render an expert opinion in this matter.

5. I am a Professor of Computer Science at the University of Central Florida. My primary research interests include computer vision, image/video processing, and machine learning, including deep learning and large language models.

6. I received my Ph.D. in Computer Science from INRIA (French National Institute for Research on Informatics and Control), University of Nice Sophia Antipolis in 1996. I also earned a Master of Science in Computer Science from the University of Nice Sophia Antipolis in 1993, a Master of Science in Electrical Engineering from Kingston University, U.K., in 1990, and a Bachelor of Science in Electrical Engineering from Kingston University, U.K., in 1989.

7. Prior to research and teaching, I worked as an R&D Engineer at Innovative Engineering Solutions Ltd. in London from 1990 to 1992. Between 1993 and 1996, I served as a Research Assistant in the Scene Analysis and Symbolic Image Processing Group of INRIA, where I performed research in areas such as 3D super-resolution, sub-pixel image registration, and image-based depth and shape recovery and analysis. From 1997 to 2000, I served as an Assistant Research

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Scientist at the University of Maryland, College Park, where I investigated topics such as image registration (2D and 3D), super-resolution of video data for unmanned aerial vehicles, super-resolution of Synthetic Aperture Radar (SAR) and Foliage Penetrating SAR (FOPEN-SAR), and Automatic Target Detection, Tracking, and Recognition (ATD/R). During this time, I authored one of the most cited works on sub-pixel registration and alignment based on phase correlation: (Hassan Foroosh (Shekarforoush), Josiane Zerubia and Marc Berthod, Extension of Phase Correlation to Sub-pixel Registration, IEEE Transactions on Image Processing, vol. 11, Issue 3, pp. 188-200, 2002). Between 2000 to 2002, I served as Senior Research Scientist at the University of California, Berkeley where I also served as the Technical Coordinator and Principal Research Scientist of a Multi-University Research Initiative (MURI) funded by the Office of Naval Research. As part of the project, I conducted research on multi-sensor acquisition of 3D data for autonomous 3D modeling and visualization of urban environments.

8. I joined the Department of Computer Science at the University of Central Florida (UCF) as an Assistant Professor in 2002. Since then, I have served as an Associate Professor, Professor, and CAE Link Professor of Computer Science in the same department. I also served in various other capacities within the department, such as the Graduate Program Coordinator, chair of various leadership

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committees, and most recently in the Faculty Senate Strategic Planning Council for UCF.

9. I have taught a number of courses directed to computer vision and 3D modeling, including 3D Computer Vision, Image Processing, Special Topics in 3D Computer Vision, and Visual Simulation. Since joining UCF, I have also advised and chaired the dissertation of over 30 doctoral students, 28 of whom have already successfully defended their doctoral dissertation, and secured academic positions or industry jobs with major high-tech corporations. As one example, I served as the advisor for a dissertation directed to *“Improving Matching and Classification Through Deep Learning of Structure and Varying Illumination”*. This dissertation involved also working with GoPro camera systems for mobile aerial platforms.

10. I have been the principal investigator or co-principal investigator of numerous research projects funded by the National Science Foundation (NSF), NASA, DoD, and other industry participants, with total funding exceeding \$14M since joining UCF, and ongoing funded projects for additional \$3M. As one related example, I recently served as the principal investigator in two projects funded by the National Science Foundation (NSF) on 3D modeling and camera systems, and the role of 3D information in machine understanding of digitized 3D world.

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11. I have also conducted extensive research in partnership with industry in the field of computer vision, in particular 3D computer vision and camera systems, including body-worn cameras and cameras on agile mobile platforms, or cameras operating in various different modalities (EO, FLIR, polarized, etc.). Below, I highlight some of the projects that were funded by industry and state-sponsored technology transfer initiatives that specifically involved using GoPro camera systems or similar platforms. For example, from 2012 to 2018, I received funding from Jackson Technologies related to Airborne Multisensor Visual Data Processing, which studied automated methods of reconstructing 3D panoramic models around a flying aircraft that used the GoPro camera system and software tools extensively; From 2013 to 2018, I received related funding from the Florida High Tech Corridor (“FHTC”) for Rapid Automated 3D Terrain Modeling from Airborne Data, which similarly studied automated methods of reconstructing 3D models of a terrain from a flying aircraft, again using extensively the GoPro cameras and software tools; From 2008 to 2009, I received funding from Electronic Acts – Tiburon related to Modeling and Tracking Human Activities in Sport Events. The goal of this project was to develop algorithms for tracking and recognition of human activities in sport events, using body-worn cameras similar to GoPro systems, as well as surrounding cameras, network of cell phone cameras, and other sensors.

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12. I have authored or co-authored over 200 articles in peer reviewed journals or conference proceedings, relating to the areas of Computer Vision (CVPR, ICCV, ECCV, etc.), Machine Learning (ICLR, AAAI, ACL, EMNLP, etc.), and Image Processing and Pattern Recognition (ICIP, ICPR). Some related example publications include: Yang Zhang, Zixiang Zhou, Philip David, Xiangyu Yue, Zerong Xi, Boqing Gong, Hassan Foroosh, *PolarNet: An Improved Grid Representation for Online LiDAR Point Clouds Semantic Segmentation*, Proceedings of IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2020; Chuan Sun, Imran Junejo, Marshall Tappen, Hassan Foroosh, *Exploring Sparseness and Self-Similarity for Action Recognition*, IEEE Transactions on Image Processing, vol. 24, issue 8, pp. 2488-2501, 2015; Chen Shu, Luming Liang, Wenzhang Liang, Hassan Foroosh, *3D Pose Tracking with Multi-Templates Warping and SIFT Correspondences*, IEEE Trans. on Circuits and Systems for Video Technology, 2015; Nazim Ashraf, Chuan Sun, and Hassan Foroosh, *View-Invariant Action Recognition Using Projective Depth*, Journal of Computer Vision and Image Understanding (CVIU), vol. 123, pp. 41-52, 2014; Yuping Shen and Hassan Foroosh, *View-invariant Action Recognition from Point Triplets*, IEEE Transactions on Pattern Analysis and Machine Intelligence (PAMI), vol. 31, no. 10, pp. 1898-1905, 2009; Nazim Ashraf, Yuping Shen, Xiaochun Cao, and Hassan

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Foroosh, *View-Invariant Action recognition using Weighted Fundamental Ratios*, Journal of Computer Vision and Image Understanding (CVIU), vol. 117, pp. 587-602, 2013.

13. Based on my work, I have also applied for and received several patents in the field of image processing, including U.S. Pat. No. 8,755,569 entitled Methods for Recognizing Pose and Action of Articulated Objects with Collection of Planes and Motion, which was issued in 2014.

14. I have served as the editor and/or committee member on numerous professional organizations. For instance, I have been on the editorial board of the IEEE Transactions on Image Processing (Associate Editor, 2003-2008, 2011-2016); IEEE Conference on Computer Vision and Pattern Recognition (CVPR) serving as area chairs, session chairs and Technical Committee member over many years (2004-2012, 2015-2016, 2019-2023); Organizing Committee and sponsorship chair of ACM Multimedia Conference in 2014; and frequent reviewer on various IEEE transactions, including the IEEE Transactions on Pattern Analysis and Machine Intelligence.

15. For my work, I have been honored with numerous awards, including the *Piero Zamperoni Award*, International Association for Pattern Recognition (IAPR) (2004). I have also received several Best Paper awards, including “*The Best*

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Scientific Paper Award” in the IAPR International Conference on Pattern Recognition in 2008, “*The Best Paper Award*” in the IEEE International Conference on Image Processing (ICIP) in 2018, and the *Distinguished Researcher*, UCF College of Engineering and Computer Science (2004-2005, 2005-2006).

16. In sum, I have studied, taught, practiced, and conducted research in the areas of computer vision, image processing, machine learning (deep learning and large language models), and optics.

II. LEGAL UNDERSTANDING**A. The Person of Ordinary Skill in the Art (“POSITA”)**

17. I understand that a person of ordinary skill in the relevant art at the time of the invention (also referred to herein as “ordinary artisan”) is presumed to be aware of all pertinent art, thinks along conventional wisdom in the art, and is a person of ordinary creativity—not an automaton.

18. I have been asked to consider the level of ordinary skill in the field that someone would have had at the time the claimed invention was made. In deciding the level of ordinary skill, I considered the following:

- the levels of education and experience of persons working in the field;
- the types of problems encountered in the field; and
- the sophistication of the technology.

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19. I have reviewed the declaration of Dr. Katsaggelos, including his opinions regarding the Person of Ordinary Skill in the Art, which is a person with “a bachelor’s degree in engineering or computer science, or equivalent field, and two years of experience working on image or video processing or digital cameras” or alternatively “four years of experience working on image or video processing or digital cameras.” Ex. 1002, ¶37.

20. My opinions set forth in this Declaration apply Dr. Katsaggelos’s definition of a POSITA.

21. I am well-qualified to determine the level of ordinary skill in the art. I was a person of at least ordinary skill in the art at the time of the priority date of the ’832 patent under Dr. Katsaggelos’s definition of a POSITA. If I do not explicitly state that my statements below are based on this timeframe, all of my statements are to be understood as an ordinary artisan would have understood something as of the priority date of the ’832 patent.

B. Legal Principles

22. I am not a lawyer and will not provide any legal opinions. Though I am not a lawyer, I have been advised that certain legal standards are to be applied by technical experts in forming opinions regarding the meaning and validity of patent claims.

PUBLIC VERSION1. Anticipation

23. I understand that to obtain a patent, a claimed invention must have, as of the priority date, been novel. I understand that to prove that a prior art reference anticipates a patent, the four corners of the prior art reference must describe element of the claimed invention, either expressly or inherently. I also understand that the prior art reference must describe the elements arranged as in the claim and that it is improper to combine disparate embodiments to establish anticipation unless a POSITA when reading the reference could at once envisage such a combination.

2. Obviousness

24. I understand that to obtain a patent, a claimed invention must also have, as of the priority date, been nonobvious in view of prior art in the field. I understand that an invention is obvious when the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art.

25. I understand that to prove that prior art, or a combination of prior art, renders a patent obvious, it is necessary to: (1) identify the particular references that singly, or in combination, make the patent obvious; (2) specifically identify which elements of the patent claim appear in each of the asserted references; and (3) explain how the prior art references could have been combined to create the inventions

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claimed in the asserted claim, including how there would have been a reasonable expectation of success.

26. I understand that a patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art, and that obviousness cannot be based on the hindsight combination of components selectively culled from the prior art to fit the parameters of the patented invention.

27. I also understand that a reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant. Even if a reference is not found to teach away, I understand its statements regarding preferences are relevant to a finding regarding whether a skilled artisan would be motivated to combine that reference with another reference.

3. *My Understanding of Claim Construction Law*

28. I have been informed that patent claims are construed from the viewpoint of a person of an ordinary artisan and that patent claims generally should be understood consistent with their ordinary and customary meaning at the time of the invention. A review of the patent claim language, the patent specification, and

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its prosecution history are also necessary to determine the proper meaning and scope of the term at issue.

29. I have further been informed that in the specification and prosecution history the patentee may define a claim term in a way that differs from the ordinary and customary meaning. I understand that during prosecution of the patent before the U.S. Patent and Trademark Office, the Applicant may make representations or provide definitions of terms that may affect the scope of the patent claims. In particular, the Applicant may, during the course of prosecution, limit the scope of the claims to overcome prior art and/or disavow claim coverage by making clear and unambiguous statements to that effect.

30. I have been informed that an ordinary artisan may, among other things, consider dictionaries, publications, other patents, and treatises (*i.e.*, “extrinsic evidence”). I understand that extrinsic evidence may generally not be relied on if it contradicts the meaning of claim language provided by the intrinsic evidence, such as express definitions given for terms in the specification.

4. *Secondary Considerations of Non-Obviousness*

31. I understand that one of the factual inquiries when determining the obviousness of a patent is to consider objective evidence related to the issue of obviousness, sometimes called “secondary considerations of non-obviousness” or

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“objective indicia of non-obviousness.” I understand that such evidence can often be probative of the issues of obviousness.

32. I understand that examples of objective evidence include (1) commercial success, (2) copying, (3) industry praise, (4) skepticism, (5) long-felt but unsolved need, and (6) failure of others.

33. I understand that there must be a nexus between the patented invention and the evidence of secondary considerations. I further understand that there is a presumption of such a nexus if the claims of the patent are coextensive with a product or products that are the subject of the secondary considerations evidence. I further understand that in order for a claim to be coextensive with a product, one must look at the claims at the whole and not just the new claimed feature. In addition, the claimed invention should not be merely a subcomponent of the products sold but should encompass the entire apparatus.

III. CLAIM CONSTRUCTION

34. In my opinion, all claim terms should be given their ordinary and customary meaning in light of the specification.

IV. ALL GROUNDS: PETITIONER HAS NOT ALLEGED A PROPER MOTIVATION TO COMBINE OR REASONABLE EXPECTATION OF SUCCESS

35. In my opinion, none of Petitioner’s grounds of challenge have explained why a POSITA would combine the references or reasonably expect the

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combination to succeed. It is my understanding that it is Petitioner's burden to provide a non-conclusory, articulate explanation as to why a Petitioner would combine references, and how they would reasonably expect success.

36. For Grounds 1 and 2, Petitioner asserts the combination of Thomason in view of Pacurariu. For Grounds 3 and 4, Petitioner asserts the combination of Voss in view of Derbanne. For both grounds, Petitioner's alleged motivations to combine are nearly identical and do not provide any articulation as to why a POSITA would combine the respective references. Moreover, Petitioner merely asserts reasonable expectation of success without further explanation.

A. Grounds 1 and 2: Thomason in view of Pacurariu

37. The entirety of Petitioner's rationale to combine Thomason and Pacurariu is provided below:

Thomason in the same way. (*Id.*) Combining the teachings of Thomason and Pacurariu as such would yield predictable results of effectively and efficiently horizon-leveling video data. (*Id.*) Further, it would have been obvious to try combining the technical features of Pacurariu with the teachings of Thomason, as there is a finite number of identified, predictable solutions, without requiring much effort and with a reasonable expectation of success. (*Id.*) The known benefits of Pacurariu would prompt the application of Pacurariu in the same field based on design incentives and other market forces. (*Id.*)

Pet. 23-24. Dr. Katsaggelos also provides the same conclusory statements. Ex. 1002, ¶81.

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38. In my opinion, Petitioner is essentially saying that a POSITA would combine Thomason and Pacurariu because it would result in improvements. But Petitioner does not explain what those improvements are, or how the combination would result in an improvement. Moreover, Petitioner merely asserts predictable results and a reasonable expectation of success, but does not provide any explanation for why a POSITA would think that.

39. Petitioner also asserts an “obvious to try” argument, but appears to simply be repeating the language found in certain cases. Petitioner does not explain what the “finite number of identified, predictable solutions” are, or the “known benefits of Pacurariu,” or how the “design incentives and other market forces” would prompt a POSITA to apply Pacurariu.

40. In addition, I find no connection between Petitioner’s motivation to combine and the specific teachings Petitioner wishes to combine. According to Petitioner, the combination would use the “tilt value as taught by Pacurariu ... obtained for each frame in Thomason’s video content [and] saved as metadata or as part of each video frame as taught by Pacurariu, and be used to generate a rotated image for each video frame in Thomason’s video content.” Pet. 23. But Petitioner does not explain why a POSITA would find using Pacurariu’s tilt values an

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improvement on Thomason, or how it would yield predictable results or a reasonable expectation of success, or why that particular combination would be obvious to try.

41. It is also my opinion that Petitioner has not properly asserted that Thomason or Pacurariu individually would render obvious the challenged claims.

42. I note that Petitioner does not even assert that Pacurariu discloses all of the limitations. *See, e.g.*, Pet. 13-19 (not relying on Pacurariu for limitations 1[pre] through 1[b]).

43. As for Thomason, Petitioner’s grounds of challenge do not indicate that Thomason alone would anticipate or render obvious any claim. Pet. 8. In any case, in my opinion, Thomason does not disclose limitation 1[c]’s “rotational position information characterizing rotational positions of the image capture device ***as a function of progress through the capture duration.***” While Thomason discloses storing “angle data representing the angle measured by the rotation sensor,” it never discloses that it captures such data as ***a function of progress*** of the captured video’s duration. Indeed, Thomason merely discloses “process[ing] the recorded image data 8 [*i.e.* the captured video] and ***rotation angle***,” indicating that the rotational information is not captured as a function of ***progress*** through the video, such as recording it for each individual frame. Ex. 1004, ¶32.

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44. It is also my opinion that Thomason does not disclose “determin[ing] a viewing window” including “placement of the viewing window,” from which is generated “horizon-leveled visual content” by “a punchout of the extents of the visual content defined by the viewing window.” Instead, Thomason discloses that the replay processor applies “a rotation correction” to the image data. Ex. 1004, ¶36. Indeed, Petitioner describes Thomason’s method as “rotat[ing the image] such that the visual content is horizon-leveled ... and some outer pixels ... are cropped.” Pet. 24-25. In other words, Thomason performs horizon-leveling by rotating and cropping an image instead of the claimed method of placing a viewing window in the image and punching out the portions of the image captured in the viewing window.

45. As I explain below, Thomason also does not disclose determining a viewing window as a function of progress.

B. Grounds 3 and 4: Voss in view of Derbanne

46. Petitioner’s rationale to combine Voss and Derbanne is similar to its rationale for Ground 1, specifically:

The Voss-Derbanne combination results in a system in which data (captured video data, rotational position information) is captured, stored, and maintained in accordance with the teachings of Derbanne, and a punchout may be generated, yielding the predictable result of improving the video management and processing capabilities of Voss. (EX1002, ¶184.) A POSITA would be motivated to use the known techniques of Derbanne to

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improve Voss in the same way. (Id.) Further, it would have been obvious to try combining the teachings of Voss and Derbanne, as these technical features of Derbanne may be combined with the teachings of Voss without requiring much effort and with a reasonable expectation of success. (Id.) The known benefits of Derbanne would prompt the application of Derbanne in the same field based on design incentives and other market forces. (Id.)

Pet. 62. Dr. Katsagellos makes similar statements. Ex 1002, ¶184.

47. While Petitioner claims that the combination would “improve[] the video management and processing capabilities of Voss,” in my opinion, this is merely a generic allegation that amounts to saying that Voss would be improved. Petitioner does not explain how Derbanne’s teachings would actually improve anything. Petitioner also does not explain why a POSITA would think the combination has a reasonable expectation of success, and instead merely states the phrase. And Petitioner’s “obvious to try” argument is the same as in Ground 1, and similarly lacks specificity.

48. I also opine that Petitioner’s reasons for combining Derbanne and Voss are not directed to the specific teachings in Derbanne that Petitioner seeks to combine. For example, Petitioner relies on Derbanne’s disclosure of “defin[ing] visual content viewable as a function of progress through a progress length,” but fails to explain how that teaching in any way improves Voss. Pet. 61 (quoting Ex. 1008, 13:49-53). Nor does Petitioner explain a POSITA would be motivated to incorporate Derbanne’s disclosure of “rotational positions ... as a function of

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progress,” such as how it would improve Voss’s device. Pet. 67 (quoting Ex. 1008, 5:53-57).

49. In my opinion, Petitioner cannot assert that Voss or Derbanne alone render obvious any challenged claim.

50. For Derbanne, Petitioner does not assert that Derbanne discloses, for example, limitations 1[pre] through 1[b][ii] or limitation 1[d][ii]. Pet. 58-60, 71.

51. As for Voss, in my opinion, Voss does not disclose “obtain[ing] rotational position information [which] *chracteriz[es] rotational positions of the image capture device as a function of progress.*” Specifically, Voss does not disclose that the rotation data is obtained as a collection of “rotational positions ... as a function of progress.” Instead, Voss discloses that inertial data is continuously sent to the processor so that the processor “continuously synchronizes inset rectangle with the rotational measurement received.” Ex. 1007, 12:14-18. While the inset rectangle is used to transform the image to compensate for rotation, Voss does not disclose that the rotational data is obtained as a collection of points for multiple frames. The rotational data in Voss is simply used for the presently recorded frame and then discarded.

52. As I discuss below, it is also my opinion that Voss does not disclose determining a viewing window *as a function of progress.*

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V. **GROUND 1 AND 2: PETITIONER HAS NOT SHOWN THAT THOMASON AND PACURARIU RENDER OBVIOUS DETERMINATION OF A VIEWING WINDOW AS A FUNCTION OF PROGRESS**

53. The challenged claims each recite a “determine a viewing window for the visual content as a function of progress through the progress length.”

54. In my opinion, Petitioner has not shown that Thomason or Pacurariu, alone or combined, disclose the determination of a viewing window that is a function of progress. Petitioner asserts that performing horizon-leveling on each frame of a video or using per-frame rotation data to perform the horizon-leveling meets this limitation. However, I disagree with that assertion. Such functions are claimed elsewhere in the patent, and so Petitioner’s arguments both render this limitation superfluous and are not consistent with the teachings of the ’832 patent.

A. Thomason

55. Petitioner does not explain how the alleged viewing window is determined as a function of progress. Instead, Petitioner only asserts that “Thomason discloses that the processed image data can be played back,” that is sufficient to meet the claim. Pet. 27. Missing from Petitioner’s analysis, however, is any notion that the determination of the viewing window is a function of progress.

56. I note that Petitioner’s theory is essentially that *any* viewing window determined for frames of a video is sufficient to be *a function of progress* merely

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because they are frames of a video that can be played back. Petitioner appears to be arguing that by placing a viewing window on a frame, the determination is a ***function of progress*** since each frame of a video is viewable as a function of progress. However, I disagree with this theory because it does not give meaning to the limitation of “determine a viewing window ... as a function of progress,” nor is it consistent with the specification.

57. Petitioner’s theory renders this limitation superfluous. This is because the claims already require that the frames of the video be a function of progress. Specifically, the claims require that the “visual content” is “captured at different moments within the capture duration” and “viewable as a function of progress”—in other words, a frame within a video. Having recited that the visual content is viewable as a function of progress, the claims ***further recite*** that the viewing window within the visual content is determined as a function of progress. Thus, in my opinion, the determination of the viewing window as a function of progress must mean more than simply placing it within a frame.

58. I note that the specification provides several examples of determining a viewing window as a function of progress. One of the novel aspects of the invention of the ’832 patent stems from choosing a viewing window for each frame based on properties of nearby frames or the entire video to achieve smoother

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transitions from frame to frame as they are horizon-leveled. For example, the '832 patent describes the use of a “zoom curve 604” which allows for rapid changes in horizon leveling to be smoothed from frame to frame. Ex. 1001, 19:27-32. Thus, instead of using the zoom curve 600 that is based only on rotation data, “the viewing window may be artificially made smaller and/or larger ... during moments that do not require the change in viewing window size to ramp-up and/or ramp-down to the needed viewing window size.” *Id.*, 19:38-42. In order to provide such smoothing, however, nearby frames must also be considered to provide a smooth transition from frame to frame. As the patent explains, “based on the changes in maximum sizes including jittery increase in size over a portion of the progress length, the jittery increase in size may be replaced with a smooth ramp that increases in size.” Ex. 1001, 19:19-23.

59. Figure 6C depicts the different zoom curves, which shows how determination of the viewing window is a ***function of progress***. As can be seen, zoom curve 604 (which determines the viewing window as a function of progress) is significantly smoother than zoom curve 600 (which only determines the viewing window using rotation data).

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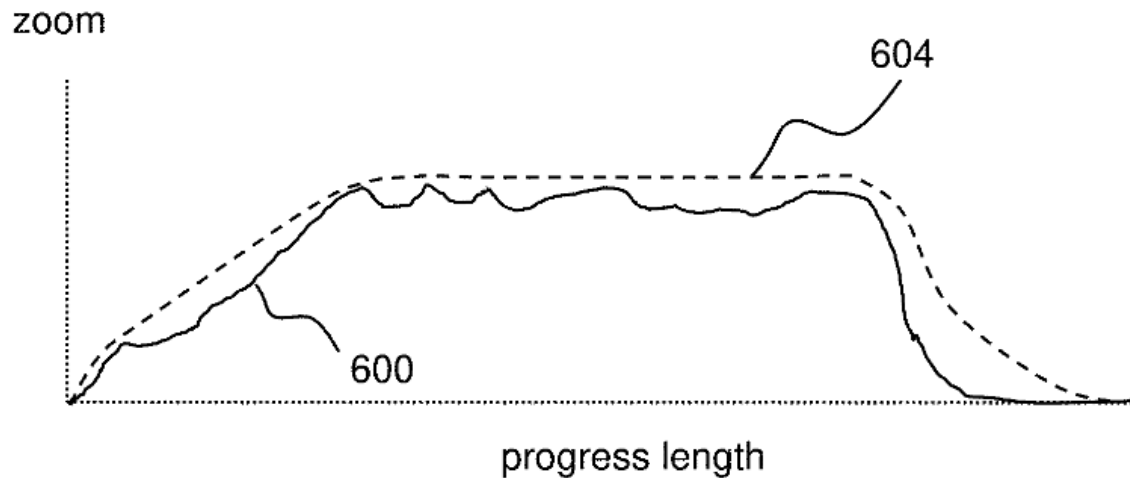


FIG. 6C

60. Similarly, the '832 patent describes that the “location of the viewing window may be changed as a function of progress ... to simulate panning in the horizon-leveled visual content.” Ex. 1001, 20:51-54. Panning can be useful to show “depiction of different things of interest in different spatial locations.” *Id.* In other words, the viewing window is determined as a ***function of progress*** by placing the viewing window based on objects of interest as determined for portions of the video.

61. In my opinion, the novelty of determining a viewing window as a function of progress, and the lack of similar disclosure in Thomason, is confirmed by a Chinese patent application owned by Petitioner, CN 112804444 B (“’444 application”). See Ex. 2003, 2004 (certified translation). The ’444 application notes that, when determining a viewing window (which the ’444 application calls an “FOV”) based on motion data, “there are inherent flaws in using a fixed FOV for the

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output video,” *i.e.* there are inherent flaws in using a fixed viewing window that is not determined as a function of progress. Ex. 2004, ¶¶3-5.

62. In particular, the '444 application explains that a large fixed viewing window will have a poor horizon-leveled image if the “movement is relatively intense,” because the boundaries of the new image are too close to the boundary of the original image, which prevents the new image from having an “ideal smooth motion state.” Ex. 2004, ¶4. What the application means is that, when the viewing window is fixed to a large size, it can only be rotated by a certain amount before the window exceeds the boundaries of the original frame. Thus, it is unable to provide the “ideal smooth motion state.” Yet as the '444 application further explains, if the fixed viewing window is too small, then much of the original image will not be captured, resulting in a “waste of FOV.” Ex. 2004, ¶5. The '444 application thus explains that dynamically changing the size of the viewing window allows for maximum capture of the original image while providing a smooth leveling. This is done with a method for “calculat[ing] the target FOV value of each video frame” by maintaining “the smoothness of adjacent video frames ... to the greatest extent.” *Id.*, ¶38. In other words, the '444 application provides a method for determining a viewing window as a function of progress in order to accomplish the “ideal smooth motion state.”

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63. Thomason’s method by contrast merely rotates a frame based on rotation data. To the extent this can even be considered a viewing window, it is a “fixed” viewing window, in the sense that it is not ***determined as a function of progress*** to maintain smooth transitions among frames, which both the ’824 patent and the ’444 application recognized as flawed and sought to improve. Thomason does not describe any capability of determining the viewing window as a function of progress, such as by determining viewing windows by analyzing adjacent frames to capture a desired smoothness or desired objects within the view.

B. Pacurariu

64. Petitioner’s theory for Pacurariu is also flawed. Petitioner again does not explain how the viewing window is determined ***as a function of progress***. Petitioner instead makes two arguments: (1) that this limitation is met because “Pacurariu provides a playback of processed sequential frames of the video,” the same argument Petitioner made for Thomason, and (2) because “Pacurariu processes each video frame in a video based on a ***frame-specific tilt value***.” Pet. 28-30.

65. The first argument is the same as that made for Thomason, and thus I disagree with it for the same reasons.

66. In my opinion, the second argument should fail. Petitioner does not explain how horizon-leveling a frame using frame-specific rotation data satisfies the

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limitation of determining the viewing window as a function of progress. Moreover, the claims already require that the processing use frame-specific rotation information.

67. Specifically, the claims already require that the system obtain “rotational positions of the image capture device as *a function of progress* through the capture duration.” Indeed, Petitioner asserts that Pacurariu’s “tilt value for each video frame” meets the “rotational positions ... as a function of progress.” Pet. 22 (“[I]t follows that the tilt values of the video frames may also be expressed as a function of progress through the capture duration.”). Moreover, the claims require that the determination of the viewing window is “based on the rotational positions ... as the function of progress through the capture duration.” In other words, the claims separately require (1) obtaining rotation positions that are captured as a function of progress, and (2) determining the viewing window as a function of progress based on those rotation positions. In my opinion, satisfying the first limitation cannot automatically satisfy the second without rendering the claim language superfluous.

68. Thus, the mere use of per-frame rotational data cannot meet the separate limitation of “determine a viewing window ... as a function of progress.” Indeed, Pacurariu explains that its horizon-leveling involves merely applying “a correction

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... in the image area 305 to provide an image that is not rotated or tilted.” Ex. 1005, ¶45. In other words, the alleged viewing window is solely determined by rotation data for that specific frame and does not take into consideration any other frames of the video, or the progress of the video—thus failing to determine a viewing window as a function of progress.

69. As I explained above, the specification and Petitioner’s own Chinese patent application confirm that this limitation was a key novelty that allowed the ’832 patent to improve on prior art horizon-leveling methods by determining the viewing window in such a way as to smooth the transition from frame to frame.

C. Thomason and Pacurariu Combined

70. In my opinion, because neither Thomason nor Pacurariu disclose determining a viewing window as a function of progress, Petitioner’s combination of the two references likewise does not. Petitioner alleges that its combination “results in a system in which rotational positional information, such as a tilt value as taught by Pacurariu, may be obtained for each video frame in Thomason’s video content, be saved as metadata or as part of each video frame as taught by Pacurariu, and be used to generate a rotated image for each video frame in Thomason’s video content.” Pet. 23. Nothing about this combination cures the deficiencies with the individual references described above.

PUBLIC VERSION**VI. GROUNDS 3 AND 4: PETITIONER HAS NOT SHOWN THAT VOSS AND DERBANNE RENDER OBVIOUS DETERMINATION OF A VIEWING WINDOW AS A FUNCTION OF PROGRESS**

71. In my opinion, Petitioner has not shown that Voss or Derbanne, alone or combined, disclose the determination of a viewing window that is a function of progress. Petitioner makes the same assertions as in Ground 1 wherein merely processing frames within a video meets this limitation, but this cannot be since it would render the limitation superfluous and is inconsistent with the specification.

72. Petitioner asserts that this limitation is rendered obvious because (1) Voss “discloses playing back the processed video (with processed frames defined by viewing windows as shown in Figure 2),” and alternatively because (2) “[t]he Voss-Derbanne combination would process the video content in Derbanne’s format, which is ‘viewable as a function of progress ...’ as taught by Derbanne, to determine the viewing windows for different frames in the video content.” Pet. 69. In other words, Petitioner asserts this limitation is met merely by horizon-leveling frames within a video.

73. But as explained for Ground 1, this alone cannot meet a determination of a viewing window as a function of progress. Specifically, the claims elsewhere recite the requirement that “visual content” is “viewable as a function of progress”—and thus, determining a viewing window as a function of progress must mean

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something else lest it be rendered superfluous. And as discussed above, the specification and Petitioner's own patent application explain the benefits of determining a viewing window as a function of progress, such as the capability of smoothing the transition from frame to frame. *See, e.g.*, Ex. 1001, 19:28-42, Fig. 6C; Ex. 2004, ¶¶3-5, 38

VII. SECONDARY CONSIDERATION OF NON-OBVIOUSNESS

74. In my opinion, there is strong, objective evidence that the '832 patent is not obvious. Patent Owner GoPro, Inc. ("GoPro") successfully manufactured and sold wearable action cameras that include GoPro's novel Horizon Leveling functionality, which I understand GoPro asserts is an embodiment of the '832 patent. Ex. 2006 (Complaint), ¶23; *see also* Ex. 2005, 1 ("HERO9 Black has a new feature called in-camera Horizon Leveling.").

75. I have reviewed certain GoPro documentation describing GoPro's novel Horizon Leveling functionality. In my opinion, when used on a GoPro camera, the Horizon Leveling functionality practices at least claim 1 of the '832 patent. [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

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[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

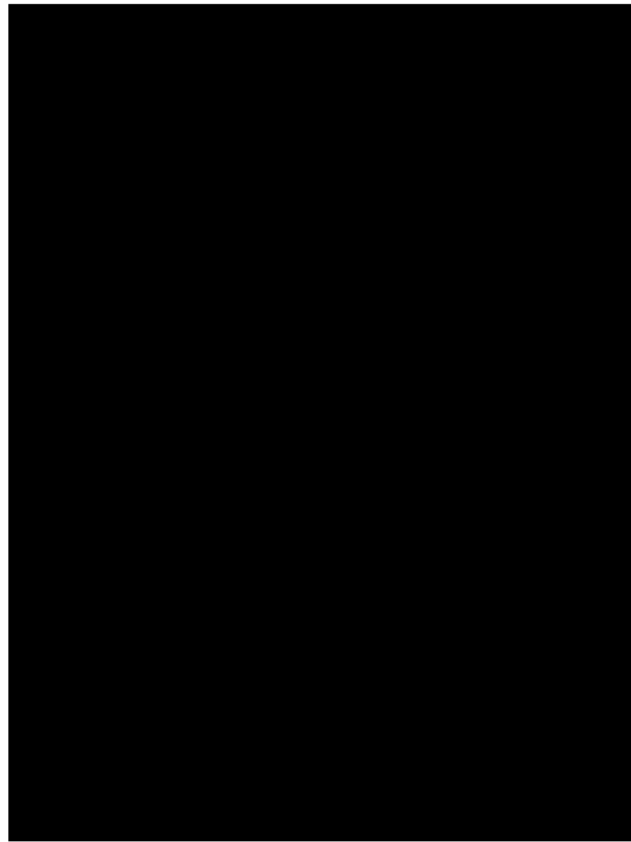
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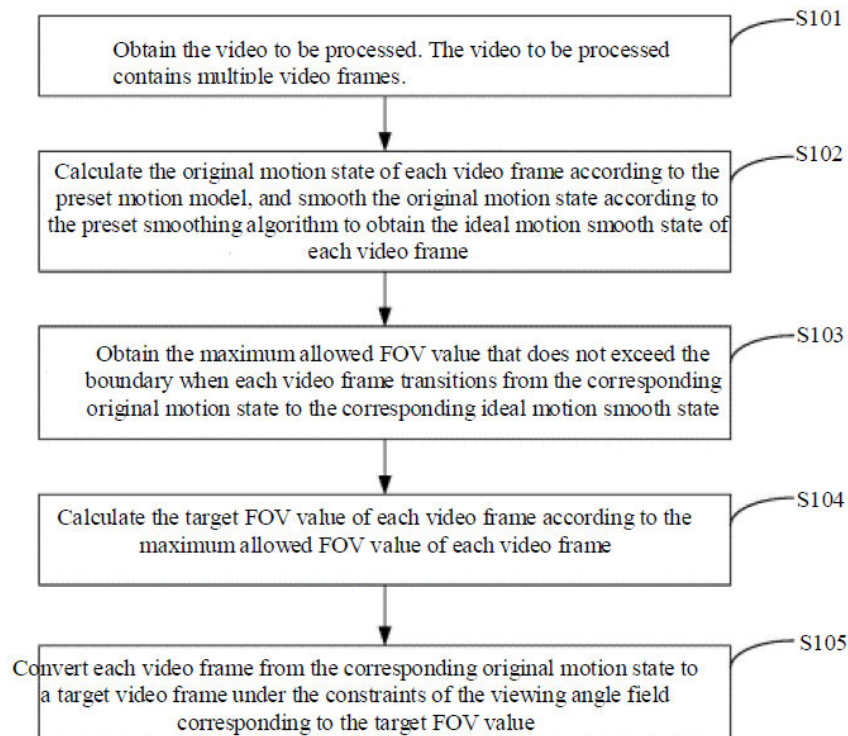
[REDACTED]

[REDACTED]

[REDACTED]

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76. I have seen possible evidence of copying, including by Petitioner. Petitioner's '444 Chinese application describes what GoPro earlier claimed in the '832 patent and implemented in the Horizon Leveling functionality. The '444 application describes obtaining video information, obtains rotational position information captured as a function of progress through a capture duration, and then, based on the rotational position information and boundary constraints, determining a dynamic FoV for each frame with a adequate stabilization margin:

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Ex. 2003, ¶¶27-44.

77. I have seen evidence of a long-felt, but unmet need. For example Petitioner’s ’444 application notes that a dynamic viewing window was a critical issue for stabilization that had not yet been met. The ’444 application explains that “existing technical solution[s]” had “inherent flaws in using a fixed FOV for the output video.” Ex. 2003, ¶¶2-3.

78. I have seen evidence of commercial success, specifically surveys indicating that Horizon Leveling was a driver of demand. [REDACTED]

[REDACTED]

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[REDACTED]

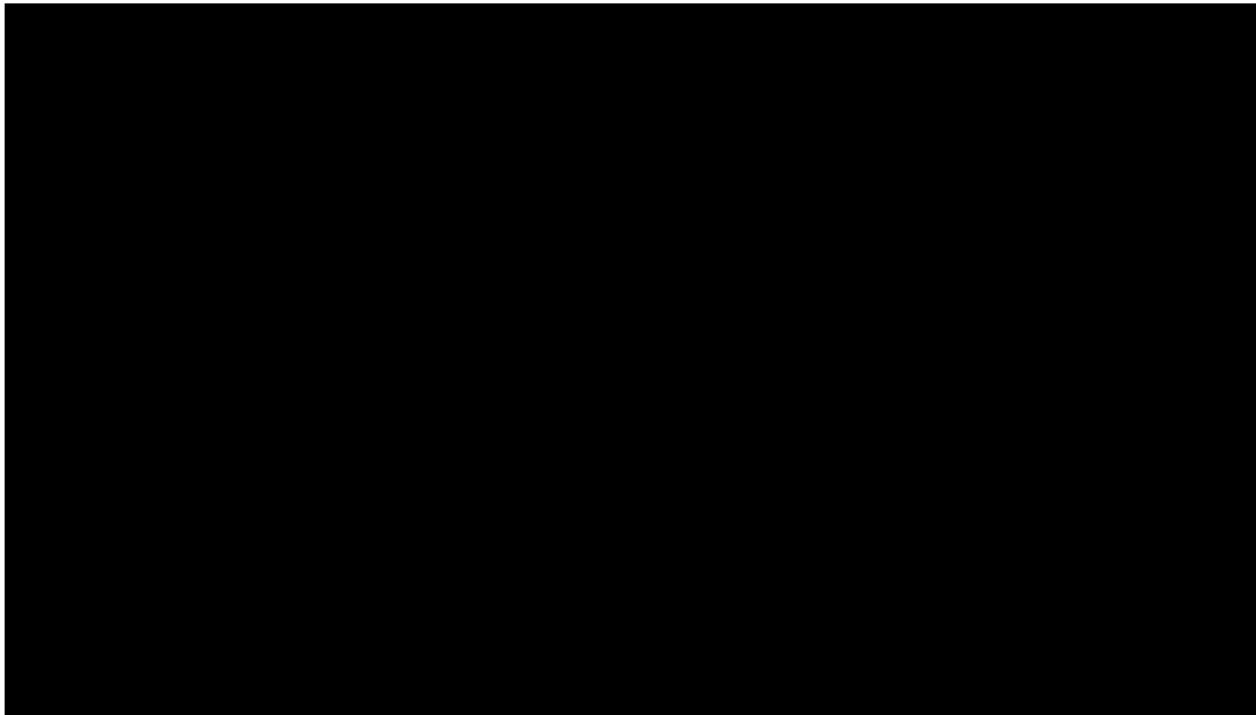
[REDACTED]

[REDACTED]

Ex. 2018, 23

79. [REDACTED]

[REDACTED]

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Ex. 2019, 14.

VIII. CONCLUSION

80. In signing this declaration, I recognize that the declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I also recognize that I may be subject to cross-examination in the case and that cross-examination will take place within the United States. If cross-examination is required of me, I will appear for cross-examination within the United States during the time allotted for cross-examination.

81. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on the information and belief are believed to be true; and further that these statements were made with the knowledge that willful

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false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Executed: October 16, 2024

/s/ Hassan Foroosh
Hassan Foroosh, Ph.D.