

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

TESLA, INC.,

Petitioner,

v.

INTELLECTUAL VENTURES II LLC,

Patent Owner.

Case No. IPR2025-00339

U.S. Patent No. 7,916,180

**DECLARATION OF DR. ELI SABER IN SUPPORT OF
PATENT OWNER'S RESPONSE**

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I, Dr. Eli Saber, do hereby declare:

I. INTRODUCTION

1. I am making this declaration at the request of Intellectual Ventures II, LLC (“Intellectual Ventures”) in the matter of the *Inter Partes* Review (“IPR”) proceedings before the United States Patent and Trademark Office (“USPTO”) of U.S. Patent No. 7,916,180 (“the ‘180 Patent”) to provide expert technical opinions with respect to the ‘180 Patent.

2. I am being compensated for my work in this matter at my standard hourly rate for such consulting services. My compensation in no way depends on the outcome of this case, and I have no financial interest in the outcome.

3. In preparing this Declaration, I considered the following materials, the subject matter of which are all within the scope of my education and professional experience:

- The ‘180 Patent, Ex. 1001;
- The Petition for *Inter Partes* Review of U.S. Patent No. 7,916,180 (“Pet.”);
- the Declaration of R. Michael Guidash (Ex. 1003);
- JP Application Publication No. JP2003-319231 to Matsushima (Certified English Translation + Declaration + Japanese) (Matsushima) (Ex. 1007);
- U.S. Patent No. 6,611,289 (Ex. 1005)(Yu);
- U.S. Patent No. 7,365,780 (Ex. 1006)(Miyazaki);

- U.S. Patent Publ. 2005/0128323 (Ex. 1008)(Choi);
- U.S. Patent No. 7,206,136 (Ex. 1010)(Labaziewicz);
- EP Appl. Pub. No. EP0858208 (Ex. 1014)(Weldy);
- U.S. Provisional Appl. No. 60/604,854 (Ex. 1047) and
- Exhibits 2005-2012, 2015-2019 and 2021-2029.

II. PROFESSIONAL BACKGROUND

4. Based on my qualifications, education, knowledge, expertise, experience, and work background, I believe I am qualified to offer opinions relating to the technology described in the '180 Patent. Exhibit 2030 is a copy of my current *curriculum vitae* ("CV"), detailing my education and experience. Additionally, the following overview of my background pertains to my qualifications for providing expert testimony in this matter.

5. I am a Professor in the Department of Electrical and Microelectronic Engineering (EME) and at the Chester F. Carlson Center for Imaging Science at the Rochester Institute of Technology (RIT) in Rochester, New York. I also serve as the Director of the Image, Video and Computer Vision Laboratory. I joined RIT's full-time faculty in 2004. I have over thirty-four (34) years of industry and academic experience, thirty (30) of which are in the fields of Computer Vision, Digital Image/Video Processing, Pattern Recognition and Machine Learning.

6. I received a Ph.D. in Electrical Engineering from the University of Rochester in 1996. My concentration was in Signal/Image/Video Processing, Pattern

Recognition, and Computer Vision. I received a Master of Science Degree in Electrical Engineering from the University of Rochester in 1992 in the same concentration as listed above, and I received a Bachelor of Science Degree in Electrical and Computer Engineering, *Summa Cum Laude*, from the State University of New York at Buffalo in 1988.

7. Before becoming a full-time professor, I worked for Xerox Corporation from 1988 to 2004. During my 16 years at Xerox, I was – generally speaking – responsible for: a) delivering color management solutions, image processing innovations, architectures, and algorithms for high-end color printing systems, b) xerographic sub-systems for a variety of color products, and c) control systems for toner production facilities. Among other roles, as an Advanced Development Scientist and Manager, I established the Advanced Design Laboratory – an Imaging/Xerographics lab – and provided technical and managerial leadership for the Electrical, Imaging and Xerographics Department. As a Product Development Scientist and Manager, I led the research and development of color management algorithms and image quality metrics for various product platforms. I also led the Image Science, Analysis, and Evaluation area, with twelve to fifteen direct reports and a budget of approximately \$2 million.

8. From 1997 until 2004, I was an adjunct faculty member at the Electrical Engineering Department of the Rochester Institute of Technology and at the

Electrical & Computer Engineering Department at the University of Rochester. I was responsible for teaching undergraduate and graduate coursework in signal, image, video processing, pattern recognition, and communications and performing research in multimedia applications, pattern recognition, image understanding and color engineering.

9. Since joining RIT full time, I have been responsible for teaching several undergraduate and graduate courses in Digital Signal Processing, Digital Image Processing, Digital Video Processing, Engineering Analysis, Random Signal & Noise, Advanced Engineering Mathematics, Matrix Methods, Pattern Recognition, Communications, Modern Control Theory, and Linear Systems.

10. I proposed, developed and introduced the “Digital Video Processing” and the “Advanced Neural Network and Deep Learning: Part 1” courses; and reestablished the Pattern Recognition course at the Electrical Engineering Department at RIT. These graduate courses were instrumental in providing MS/PhD students with the proper foundation and knowledge in all aspects of the subject areas in order to perform in-depth research in the field and continue to advance the state of the art.

11. The Digital Video Processing course is designed to provide a thorough and comprehensive coverage of the field. Topics covered include the mathematical representation of digital video including motion and time-varying image formation

models, spatio-temporal sampling/reconstruction, sampling structure conversions, motion estimation using optical flow, block-based, pel-recursive, Bayesian and point correspondence type methodologies, segmentation, motion tracking, filtering, restoration, super-resolution and compression.

12. The Pattern Recognition course, on the other hand, covers pertinent concepts in Bayes decision theory, linear and nonlinear classifiers, artificial neural networks, feature selection/generation/extraction and clustering.

13. The graduate course titled: “Advanced Neural Networks and Deep Learning: Theory, Mathematics and Algorithms: Part 1” is intended to provide an in-depth comprehensive study of the theory, mathematics and algorithms for advanced neural networks and their usage in deep learning. It is primarily targeted for upper graduate students that are planning to pursue advanced studies/research in the field. The course begins with an in-depth study of the mathematical methodologies for neural networks and optimization (zero-, first- and second-order) techniques. It then progresses to provide a thorough study of shallow and deep neural networks architectures and algorithms, activation functions, regression, two- and multi-class classification, unsupervised learning, feature engineering/selection, backpropagation along with applications to a variety of engineering problems.

14. I am currently working to develop a follow-on course (Part 2) to the Advanced Neural Networks and Deep Learning course described above. This course

is intended to cover convolutional and recurrent style neural networks, principles of feature engineering, kernel methods, tree-based learners, attention mechanisms/transformers, reinforcement learning and generative adversarial networks. This course is targeted to debut in Fall 2025.

15. My current research focuses on machine learning for object tracking/remote sensing applications; image/video processing for multimedia, military & biomedical applications; and computer vision and three-dimensional scene reconstruction. As a principal investigator (PI) or co-principal investigator, I have acquired almost \$6 million in research funding since joining RIT and have managed multiple government grants from the Department of Defense as well as several corporate grants from Hewlett-Packard, Lenel, and Data Physics. I am currently managing (as PI) a multiyear government grant from the Department of Defense titled “Target Detection/Tracking and Activity Recognition from Multimodal Data.” In this project, we propose to develop operational target detection/tracking techniques and activity recognition/understanding methods that can leverage multimodal data in a fusion framework using deep learning algorithms while providing accurate and near real-time performance.

16. In 2012, I was awarded the Prestigious Trustees Scholarship, the highest award at RIT with regard to research recognition.

17. I am the author or co-author of 38 peer-reviewed journal publications.

18. I have also authored or co-authored 102 conference and workshop publications and a book entitled Advanced Linear Algebra for Engineers with MATLAB, published by CRC Press in February 2009, and am a named inventor on multiple U.S. and foreign patents.

19. I am a senior member of the Institute of Electrical and Electronic Engineers and a member of the IEEE Signal Processing Society, the Electrical Engineering Honor Society, and Eta Kappa Nu.

20. With respect to the technologies relevant to the '180 Patent, I have extensive experience in developing computer vision and digital image/video processing algorithms and techniques that utilize single and/or multiple RGB as well as hyperspectral/multispectral and/or multimodal camera systems for motion estimation, segmentation, registration, classification, identification, pattern recognition, shape recognition/matching, stereo imaging, facial recognition, biomedical image processing, compression, surveillance systems, 3d scene reconstruction, machine learning, deep learning for a variety of applications including object recognition and tracking, video analysis, video surveillance, change detection, biomedical, color engineering, grayscale and color document processing.

21. A complete statement of my industrial and academic records including a listing of the above publications and patents is included with my curriculum vitae in Exhibit 2030.

III. RELEVANT LEGAL STANDARDS

22. I have been asked to provide my opinion as to whether certain claims of the ‘180 Patent are obvious over specific combinations of Matsushima, Yu, Weldy, Choi and Labaziewicz.

23. The opinions I am expressing in this report involve the application of my knowledge and experience to the evaluation of certain references with respect to the ‘180 patent. My formal knowledge of patent law is no different than that of any lay person. Therefore, I have requested the attorneys from Volpe Koenig, who represent Intellectual Ventures, to provide me with guidance as to the applicable patent law in this matter. The paragraphs below express my understanding of how I must apply current principles related to patent validity to my analysis.

24. I understand that an IPR is a proceeding before the USPTO for evaluating the patentability of an issued patent’s claims based on prior-art patents and printed publications.

25. I understand that the claims of a patent are reviewed from the point of view of a hypothetical person of ordinary skill in the art (“POSITA”) at the time of the filing of the patent. The “art” is the field of technology to which a patent relates.

26. I understand that in determining whether a patent claim is anticipated or obvious in view of the prior art, the Patent Office must apply the *Phillips* standard to construe the claims.

27. I understand that, in this proceeding, Petitioners have the burden of proving that the challenged claims of the '180 Patent are unpatentable by a preponderance of the evidence. I understand that "preponderance of the evidence" means that a fact or conclusion is more likely true than not true.

28. I understand that there are two ways in which prior art may render a patent claim unpatentable. First, the prior art can "anticipate" the claim. Second, the prior art can render the claim "obvious" to a POSITA. I understand that for an invention claimed in a patent to be patentable, it must not be anticipated and must not be obvious based on what was known before the invention was made. For purposes of this Declaration only, I have applied the definition of a POSITA proposed in the Petition.

29. I understand that a patent claim may be invalid as "anticipated" under 35 U.S.C. § 102 if each and every limitation of the claim as construed by the court is found, either expressly or inherently, in a single prior art reference, such as a publication or patent, that predates the claimed subject matter. The mere fact that a certain thing may result from a given set of circumstances is not sufficient to establish inherency. Rather, the limitation at issue necessarily must be present in order to be inherently disclosed.

30. I also understand that a patent claim may be invalid as obvious under 35 U.S.C. § 103 if the differences between the subject matter claimed and the prior art

are such that the claimed subject matter as a whole would have been obvious to a POSITA at the time the invention was made. I also understand that several factual inquiries underlie a determination of obviousness. These inquiries include (1) the scope and content of the prior art, (2) the level of ordinary skill in the field of the invention, (3) the differences between the claimed invention and the prior art, and (4) any objective evidence of non-obviousness (i.e., “secondary considerations”).

31. I also understand that, when a party alleges obviousness based on a combination of references, that party should identify a reason why a POSITA would have been motivated to combine the asserted references in the manner recited in the claims and to explain why a POSITA would have had a reasonable expectation of success in making such combinations.

32. I understand that an obviousness analysis permits the application of “common sense” in examining whether a claimed invention would have been obvious to a POSITA. For example, I understand that combining familiar elements according to known methods and in a predictable way may suggest obviousness when such a combination would yield nothing more than predictable results. And I understand a party asserting obviousness should still provide a specific motivation to combine the references as recited in the claims and explain why one would have reasonably expected to succeed in doing so.

33. I understand that one indicator of non-obviousness is when a prior art reference leads in a different direction or discourages that combination, recommends steps that would not likely lead to the patent's result, or otherwise indicates that a seemingly inoperative device would be produced.

IV. THE SPECIFICATION OF THE '180 PATENT

A. Background of the '180 Patent

34. The Background of the '180 Patent discussed several challenges associated with implementing a “zoom” feature in digital cameras. One challenge involved the power and time required to move the optical elements associated with a zoom lens, which limited the ability of “optical zoom” to acquire multiple fields of view in rapid and/or simultaneous fashion. From the '180 Patent:

One obstacle in the challenge to deliver higher image quality is the lens system of digital cameras. The ability to image with different fields of view (zoom in and out) is a highly desired feature. Zoom, as performed by the lens system, is known as “optical zoom”. This desirable ‘zoom lens’ feature adds additional components, size and cost to a lens system. The zoom lens also requires significant *power and time to operate*. The time to move the optical elements in the zoom lens limits the ability to *acquire multiple fields of view in rapid and/or simultaneous fashion*. Ex. 1001, 1:46-55 (emphasis added).

35. Digital cameras provided an alternative to “optical zoom” which the '180 Patent described as “electronic zoom.” The '180 Patent went on to explain that “electronic zoom” resulted in a pronounced loss of resolution. As the '180 Patent explained:

Digital camera suppliers have one advantage over traditional film providers in the area of zoom capability. Through electronic processing, digital cameras can provide ‘electronic zoom’ which provides the zoom capability by cropping the outer regions of an image and then electronically enlarging the center region to the original size of the image. In a manner similar to traditional enlargements, a degree of resolution is lost when performing this process. Further, since digital cameras capture discrete input to form a picture rather than the ubiquitous process of film, the lost resolution is more pronounced. As such, although ‘electronic zoom’ is a desired feature, it is not a direct substitute for ‘optical zoom.’ Ex. 1001, 1:56-66 (emphasis added).

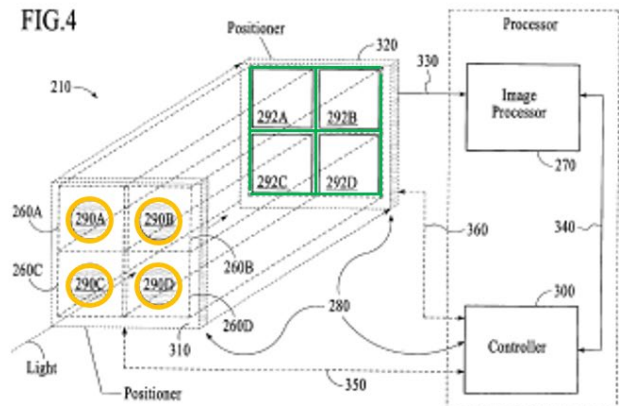
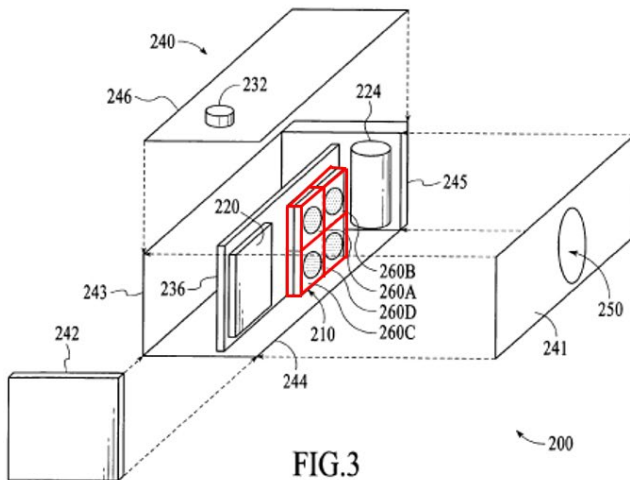
B. Overview of the ‘180 Patent

36. The first paragraph of the Detailed Description of the ‘180 Patent summarized the invention as follows:

A digital camera system and methods are described below that provide a digital camera in which multiple fields of view (FOV) of an image are simultaneously acquired. The digital camera system includes a digital camera having two or more camera channels each with independent image sensors. The sensor of each camera channel has an active area that includes multiple picture elements (pixels), and image capture includes simultaneous or nearly simultaneous use of the multiple camera channels. Each camera channel and associated optics of that camera channel has a predetermined field of view that can be different from other camera channels of the digital camera system. The digital camera system therefore makes possible the formation of multiple high resolution images in which different fields of view are acquired simultaneously. The digital camera system further includes methods for forming images as described below *Id.*, 3:21-36 (emphasis added).

37. Figure 3 (reproduced below with annotations) illustrates “a digital camera 200 configured for simultaneous acquisition of multiple fields of view.” *Id.*, 5:45-46. The digital camera subsystem includes four camera channels 260A-260D

(red boxes). *Id.*, 5:56-58. As shown in Figure 4 (also reproduced below with annotations), each of the independently controlled camera channels 260A-260D includes an optics component 290A-290D (orange circles), respectively, and a sensor component 292A-292D (green boxes), respectively. *Id.*, 6:19-22.



38. The system disclosed in the '180 Patent further includes an "image processor ... configured to generate a combined image or data based at least in part on the images from the first and second camera channels (and additional camera channels when present)." *Id.*, 9:3-5; 9:53-57, 10:7-10, 10:42-45 and 15:11-12.

39. The '180 Patent stresses over and over again that data acquisition with each of the camera channels occurred simultaneously. *Id.*, Title ("Simultaneous Multiple Field Of View Digital Camera"), Abstract ("Digital camera systems and methods are described that provide digital cameras configured to simultaneously acquire image data via multiple channels ... The processing component is configured to independently control simultaneous data acquisition"), 2:42-43 ("FIG. 3 shows a

digital camera configured for simultaneous acquisition of multiple fields of view"), 2:46-47 ("FIG. 5 is a flow diagram for simultaneous acquisition of multiple fields of view"), 3:21-23 ("A digital camera system and methods are described below that provide a digital camera in which multiple fields of view (FOV) of an image are simultaneously acquired"), 3:51-54 ("The electrical operation of each camera channel is independent of the other camera channels and multiple fields of view can be acquired simultaneously"), 4:9-13 ("The digital camera system of an embodiment improves performance of imaging systems and improves functions of search, detection, recognition and tracking by providing simultaneous high resolution imaging in multiple fields of view"), 5:43-45 ("The digital cameras described herein enable imaging that includes simultaneous acquisition of multiple fields of view of an image.")

40. In addition to operating simultaneously, the '180 Patent described the "electrical operation of each camera channel" as being "independent of the other camera channels." Ex. 1001, 3:49-54. In this regard, the '180 Patent states:

Digital camera systems and methods are described that provide digital cameras configured to simultaneously acquire image data via multiple channels having different fields of view. The digital cameras include multiple channels coupled to a processing component. Each channel includes an optics component and an array of sensors or photo-detectors integrated on a semiconductor substrate. The channels include a first channel having a first field of view (FOV) and a second channel having a second FOV, and the second FOV is different than the first FOV. The processing component is configured to independently control

simultaneous data acquisition with each of the channels ... *Id.*, Abstract (emphasis added).

* * *

A digital camera system and methods are described below that provide a digital camera in which multiple fields of view (FOV) of an image are simultaneously acquired. The digital camera system includes a digital camera having two or more camera channels each with independent image sensors. *Id.*, 3:21-25 (emphasis added).

* * *

The combination of the focal plane or image sensor size along with the optical focal length associated with each image sensor is chosen to provide a desired field of view. The electrical operation of each camera channel is independent of the other camera channels and multiple fields of view can be acquired simultaneously. ... The imager electrical operation can be similar in each camera channel or configured so as to be optimized for each field of view (such as imager frame rate and integration time). The multiple camera channels operate independently ... *Id.*, 3:49-61 (emphasis added).

41. The ‘180 Patent identified two electrical parameters to be independently controlled “for each camera channel,” namely, “imager frame rate and integration time.” *Id.*, 3:58-60 (emphasis added). Later in the specification, the ‘180 Patent reiterated its disclosure of controlling each channel or field of view both simultaneously and independently. *Id.*, 4:9-15, 5:63-66 and 7:23-27.

42. The ‘180 Patent explained that the integration time control for each sensor can be accomplished using a technique that was known as rolling mode. *Id.*, 20:48-50. As a person of ordinary skill would have understood, operation of an image sensor in a “rolling mode” involves control during a frame of the start and stop times of the integration period for individual rows of pixels in the sensor. An

image sensor operating in a “rolling mode” is synonymous with a “rolling shutter,” meaning that the start and end time of the integration interval for each row of the sensor are staggered. A diagram illustrating a rolling shutter from the time of the ‘180 Patent is set forth below. Ex. 2006, Figure 4 (annotations added). The vertical axis (labelled scanline index) corresponds to individual rows of pixels (numbered from 1 to M) on the image sensor, while the horizontal axis corresponds to time. *Id.*, 6:1-5; Ex. 2007, Figure 2A, 1:37-42.

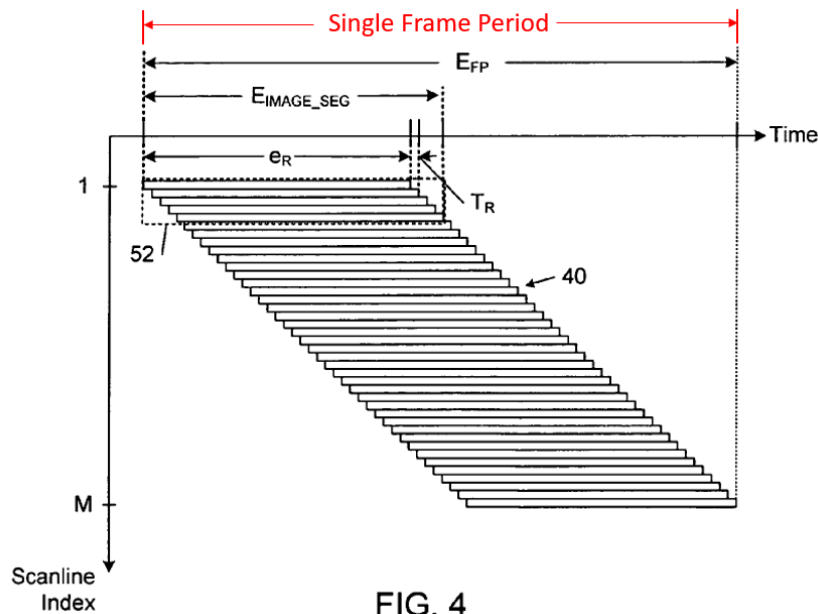


FIG. 4

Ex. 2006, Figure 4.

43. In the diagram above, the time interval labelled e_R , corresponds to the exposure interval for row 1, and T_R corresponds to the time when the information in the first row (or first scanline) is read out. *Id.*, 6:1-5. As shown above, the start time of the interval for each subsequent row (or scanline) in the sensor is some interval

after the start time of the exposure interval for the previous row. Ex. 2006, 6:1-5; Ex. 2007, 1:37-42. In this example, the integration period for each row (or scanline) is the same, but the start and stop times for each row (or scanline) are different. Ex. 2007, 1:42-45.

44. Referring still to the diagram above, the time interval labelled E_{FP} corresponds to the frame exposure period, which extends from the start of the exposure interval of the first row (or scanline) to the stop time of the exposure interval for the last row or scanline. Ex. 2006, 6:5-19. The time interval labelled E_{FP} is also referred to as a “single frame period” and corresponds to the continuous exposure time over which any of the entire array of pixels is integrating photons. Ex. 2009, 11:49-51 (“A single frame period is the continuous exposure time over which any of the entire array of pixels or plate of film is exposed.”). As a person of ordinary skill would have understood, when an image sensor is operating in the rolling mode (or rolling shutter mode), the start and stop time of the integration interval of individual rows (or scanlines) of pixels is controlled during the frame. As a person of ordinary skill would have understood, in embodiments of the ‘180 Patent that use the rolling mode, independent integration control during the frame is applied to each camera channel that is simultaneously acquiring a field of view. Ex. 1001, 4:9-15, 5:63-66, 7:23-27 and 20:48-50. As explained more fully later, such embodiments are the subject of claim 22 of the ‘180 Patent, which recites

“independently controlling simultaneous data acquisition with each of the first and second channels during a frame.” Ex. 1001, 25:31-33 (emphasis added).

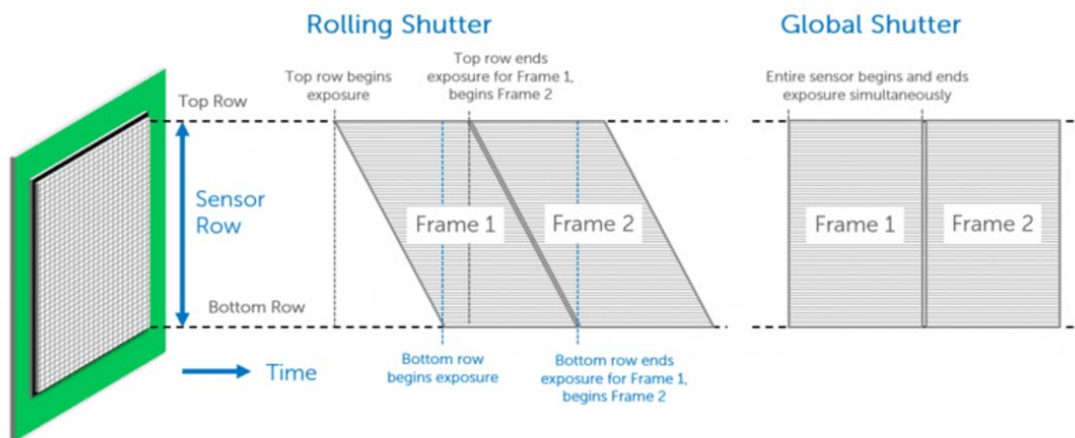
45. For completeness, it bears noting that the ‘180 Patent discloses other embodiments (which are not the subject of claim 22) in which independent control of the simultaneous data acquisition of each of the channels does not occur during the frame.¹ For example, in connection with Figure 4, the ‘180 Patent discloses the use of “positioners 310 and 320” to “position each of the one or more optics portions (e.g., optics portions 290A-290D) of a camera channel” relative to one of “respective sensor portions 292A-292D.” *Id.*, 8:16-38. Here, control of the position of the optics portions (i.e., moving each optics portion into its proper position) would necessarily need to occur before the frame during which data was acquired with the channels.

46. In another example where the simultaneous data acquisition of each of the channels does not occur during the frame, the ‘180 Patent discloses that the image sensors can be operated in a “snap-shot” mode (also referred to as a “global shutter.”)² *Id.*, 20:51. When a snapshot (or global) shutter is used, there is a common exposure period for each of the plurality of rows of pixels which “begins at a

¹ Unlike claim 22 which recites “independently controlling simultaneous data acquisition with each of the first and second channels during a frame,” claim 1 does not recite independently controlling simultaneous data acquisition “during a frame.”

² See, e.g., Ex. 2007, at 1 (Specifications for Cypress CMOS Image Sensor, 2007) referring to a “snapshot (or global) shutter.”

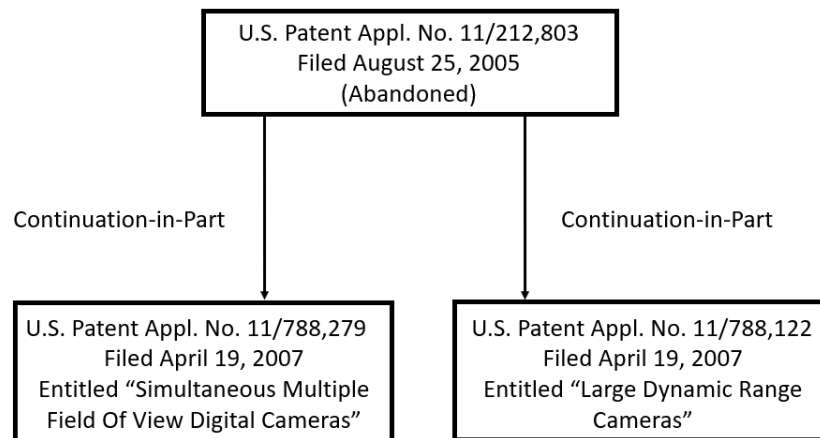
common exposure start time ... and ends at a common exposure stop time.” Ex. 2019, 19:4-18. In contrast to an image sensor operating in the rolling shutter mode where the start and stop times of the integration interval of individual rows of pixels are controlled during the frame -- in the snapshot (or global) shutter mode, common control signals are applied only at the confines of the frame exposure rather than during the frame, i.e., rather than at some point between the beginning and the end of the exposure interval during which an image sensor captures a single image. The following diagram illustrates the difference between the rolling shutter and global shutter modes:



47. Significantly, as depicted above, in the rolling shutter mode the start and stop times of the integration interval of individual rows of pixels must necessarily be controlled during the frame time, while in the global shutter mode no such control is used during the frame time.

V. PROSECUTION HISTORY OF THE ‘180 PATENT

48. The specification of the ‘180 Patent was originally filed as U.S. Patent Application No. 11/788,279 on April 19, 2007 (the ‘279 Application). Ex. 1002, 351. The ‘279 Application claimed priority to U.S. Patent Application No. 11/212,803, filed August 25, 2005 (the ‘803 Application). *Id.* As illustrated below, the ‘279 Application was one of two continuation-in-part applications filed on the same day (April 19, 2007) that claimed priority to the ‘803 Application.



49. Application No. 11/788,122 (bottom right) was directed to increasing the dynamic range of digital camera systems in scenes with, e.g., highly varying illumination. The disclosure of Application No. 11/788,122 corresponds to U.S. Patent No. 9,232,158 which is the subject of co-pending IPR2025-00222. The other Application filed the same day was the ‘279 Application, was directed to the formation of multiple high resolution images in which different fields of view are acquired simultaneously. Ex. 1001, 3:21-36.

50. Prior to the abandonment of the ‘803 Application, the Applicant filed the ‘279 Application. Unlike the ‘803 Application, (i) the Background of the ‘279 Application (which matured into the ‘180 Patent) discussed, *inter alia*, the need for a camera that simultaneously acquired high resolution images associated with multiple fields of view, and (ii) the specification of the ‘279 Application explained that simultaneously acquired high resolution images associated with multiple fields of view would be useful in machine vision applications such as “active vision systems of autonomous or semi-autonomous host systems” ranging from “robots, unmanned vehicles, self-navigating cars, automatic assembly and product inspection systems ... smart weapons and missile defense systems.” Ex. 1002, 352-353 and 356.

51. In contrast to the independent claims of the ‘803 Application, the independent claims of the ‘237 Application recited, *inter alia*, the independent control of simultaneous data acquisition using channels having different fields of view to “provide an image having a relatively high resolution” (original independent claim 1), and “independently controlling simultaneous data acquisition with each of the first and second channels during a frame” (independent claims 17, 22 and 36). Ex. 1002, 389 and 391-392.

52. In the first Office Action, the Examiner rejected the independent claims as being anticipated by U.S. Patent No. 5,691,765 (Schiltz) (Ex. 2017). Ex. 1002,

188-194. Schieltz disclosed a camera with a fisheye lens for use in surveillance systems. Ex. 2017, 2:22, 3:11-14. In response, the Applicant amended independent claim 1 to recite first and second fields of view having different angular extents. Ex. 1002, 131. The Applicant made similar amendments to the other independent claims. *Id.*, 133-134, 136. The Applicant argued that Schieltz failed to disclose first and second fields of view having different angular extents. *Id.*, 140.

53. The Examiner responded with a Final Rejection of the independent claims as being obvious over Schieltz in view of U.S. Patent No. 4,323,925 (Abell) (Ex. 2018). Ex. 1002, 99-107. Abell disclosed a system for “arraying a plurality of image sensor modules so that their individual imaging resolutions may be combined to provide high total imaging resolution.” Ex. 2018, 2:6-9.

54. The Applicant next filed a Response After Final Action in which the Applicant amended the independent claims to recite the first and second fields of view had different angular widths. Ex. 1002, 82, 84-85, 87. In the accompanying Remarks, the Applicant argued that “[t]here is no suggestion in *Abell* that the optical configuration of the arrayed lenses results in different angular widths ... “ *Id.*, 91.

The Examiner responded with a Notice of Allowance. *Id.*, 56.

VI. CHALLENGED CLAIMS OF THE ‘180 PATENT

55. Petitioner challenges independent claims 1 and 22 and dependent claims 2-3, 10-12, 23-25, 28, 30, and 32-33 of the ‘180 Patent. The challenged

independent claims are set forth below.

56. Starting with independent claim 1, this claim recites:

1. A digital camera comprising:

a plurality of channels, wherein each channel includes an optics component and an array of photo-detectors integrated on a semiconductor substrate, the plurality of channels including a first channel having a first field of view (FOV) comprising a first angular width of a scene imaged by the camera and a second channel having a second FOV comprising a second angular width of the scene imaged by the camera, wherein the first and second angular widths are different; and

a processing component coupled to the plurality of channels, the processing component configured to independently control simultaneous data acquisition with each of the plurality of channels, the processing component configured to combine data of a frame from at least one of the plurality of channels to provide an image having a relatively high resolution.

57. Claim 1 recites independently controlling simultaneous data acquisition with first and second optical channels, each of which has a field of view with a different angular width.

58. Turning next to independent claim 22, this claim recites:

22. A method comprising:

configuring a first optics component relative to a first image sensor to form a first channel having a first field of view (FOV) that comprises a first angular width of a scene;

configuring a second optics component relative to a second image sensor to form a second channel having a second FOV that comprises a second angular width of the scene, wherein the first and second angular widths are different;

independently controlling simultaneous data acquisition with each of the first and second channels during a frame; and

combining data received during the frame from one or more of the first and second channels to provide an image.

59. Claim 22 recites independently controlling simultaneous data acquisition with first and second optical channels during a frame, where each channel has a field of view with a different angular width.

VII. CLAIM CONSTRUCTION

60. I understand that claim language is not read in isolation. Rather, the claim language, when read in light of the specification and the prosecution history, elucidates the meaning of the claim language.

A. “*simultaneous data acquisition with each of the plurality of channels*” (claims 1 and 22)

61. Independent claims 1 and 22 both recite the phrase “simultaneous data acquisition with each of the plurality of channels.” The simultaneous aspect of data acquisition with each of the plurality of channels is heavily emphasized in the specification of the '180 Patent. Ex. 1001, Title (“Simultaneous Multiple Field Of View Digital Camera”), Abstract (“Digital camera systems and methods are described that provide digital cameras configured to simultaneously acquire image data via multiple channels ... The processing component is configured to independently control simultaneous data acquisition with each of the channels”), 2:42-43 (“FIG. 3 shows a digital camera configured for simultaneous acquisition of multiple fields of view”), and 2:46-47 (“FIG. 5 is a flow diagram for simultaneous acquisition of multiple fields of view.”)

62. From the perspective of a person of ordinary skill, the plain meaning of "simultaneous" in "simultaneous data acquisition with each of the plurality of channels" requires at least some data acquisition with each of the plurality of channels to occur at the same time. For example, a person of ordinary skill would have understood that the recitation of "simultaneous" in this phrase requires at least some overlap in the data acquisition windows in each of the plurality of channels.

63. A person of ordinary skill would also have understood that the subject claim language is not met where image capture with the plurality of channels is "nearly simultaneous" (i.e., close in time) but not actually simultaneous (i.e., at the same time). While the specification of the '180 Patent disclosed "simultaneous or nearly simultaneous" image capture using multiple camera channels, the Challenged Claims recite only "simultaneous data acquisition with each of the plurality of channels." Ex. 1001, 3:27-28 and 8:63-65. A person of ordinary skill would have understood that where, as here, the patent discloses both "simultaneous or nearly simultaneous" but the claims fail to mention the latter alternative, the latter alternative is not covered by the claims. Thus, the fact that the '180 Patent disclosed "simultaneous or nearly simultaneous" image capture using multiple camera channels, but claimed only "simultaneous" image captures means that the claims do not cover image capture with multiple channels that is only "nearly simultaneous" (i.e., close in time).

B. “*during a frame*” (claim 22)

64. Claim 22 recites “independently controlling ... data acquisition ... during a frame.” A person of ordinary skill would have understood that in this context, a “frame” is digital data corresponding to a single image. See, e.g., Ex. 1001, 20:19-21 (referring to “one frame of digital camera data.”) A person of ordinary skill would also have understood that the phrase “during a frame” in this context corresponds to the exposure interval during which an image sensor captures a single image.” See, e.g., Ex. 2009, 11:49-51 (“A single frame period is the continuous exposure time over which any of the entire array of pixels ... is exposed.”)³ Consistent with this interpretation, the ‘180 Patent repeatedly speaks of controlling the “frame rate,” which is typically expressed as the number of single images captured by the sensor per second. Ex. 1001, 4:57-60 (“imager frame rate”); 4:9-15 (“independent frame rate), 5:63-66 (“frame rate”); 7:23-27 (“frame rate”).

65. The Petition appears to agree with Patent Owner’s interpretation equating “during a frame” to the exposure interval during which an image sensor captures a single image.” Pet., 7-8. However, in its proposed construction of “during a frame,” the Petition omits the connection to the period of time that data for an image is

³ See also, Ex. 2006, 6:5-19 (describing the “frame exposure period” in a rolling mode shutter as extends from the start of the exposure interval of the first row (or scanline) to the stop time of the exposure interval for the last row or scanline.)

acquired. Instead, the Petition proposes to construe “during a frame” as simply “during a period of time” (namely, any period of time) -- which effectively reads the limitation out of the claim. Pet., 6. As discussed below, Petitioner needed to take this tact because none of the references relied on in the Petition show application of the required independent control occurring during the period of time that data is acquired by an image sensor.

66. A person of ordinary skill would have understood that, when used as a preposition as in the case of claim 22, the term “during” imparts a temporal requirement⁴ and means “at some time between the beginning and the end of a period.” Cambridge Dictionary, Ex. 2011, 1; Collins Dictionary, Ex. 2022, 1. Thus, “during a frame” as used in claim 22 means “at some point between the beginning and the end of the exposure interval during which an image sensor captures a single image.”

⁴ Unlike independent claim 22 which recites “independently controlling simultaneous data acquisition with each of the first and second channels during a frame,” independent claim 1 has no corresponding temporal requirement. More specifically, claim 1 does not recite the temporal requirement that the independent control occur “during a frame.” Ex. 1001, 24:12-15. This distinction between independent claims 1 and 22 highlights the importance of imparting meaning to the phrase “during a frame” in claim 22.

C. “*independently controlling simultaneous data acquisition ... during a frame*” (claim 22)

67. In the context of claim 22, a person of ordinary skill would have understood that the plain meaning of the claim language that recites “*independently controlling simultaneous data acquisition* with each of the first and second channels *during a frame*” requires that independent simultaneous *data acquisition be controlled* at some point between the beginning and the end of the exposure interval during which the image sensors capture a single image.

68. The Petition erroneously equates the prepositional phrase “*during* a frame” as used in claim 22 with the prepositional phrase “*for* a frame.” Pet., 7-8 (“[a] POSITA would have understood that “*during* a frame” refers to during a period of time that data *for* an image frame is acquired.”) However, “during” and “for” mean different things. The term “during” imparts a *temporal* requirement and means “at some time between the beginning and the end of a period,” while “for” (as used by Petitioner in the preceding quote) is “a function word to indicate *purpose*.” Compare, Ex. 2011, 1 (Cambridge Dictionary - definition of “during”) and Ex. 2022, 1 (Collins Dictionary -- definition of “during”) with Ex. 2023, 1 (Merriam-Webster -- definition of “for”). By substituting “for” in place of “during” in this manner, the Petition removes the *temporal* requirement that independent control be applied “*during* the frame” and erroneously substitutes the more general notion that the *purpose* of the data acquisition of is “*for* a frame.”

69. In the Institution Decision (ID), the Board found that “during a frame,” in claim 22, "modifies the immediately preceding recitation of 'data acquisition with each of the first and second channels,' such that it is the data acquisition which occurs during a frame." ID, 20. I respectfully maintain that the Board's interpretation of the claim language appears to confuse "during" with "for." As explained in the Cambridge Dictionary, we use "during" to say when something happens, if it happens in or over a period of time; while we use for to talk about the length of time something lasts. Ex. 2021, 1. The Cambridge Dictionary compares the usage of "during" and "for" as follows:

<u>Usage</u>	<u>Meaning</u>
<i>They went to Florida during the winter.</i>	They went at one point in the winter.
<i>They went to Florida for the winter.</i>	They went from the beginning to the end of the winter.

Ex. 2021, 1.

70. I respectfully submit that, by failing to require that the performance of "independently controlling simultaneous data acquisition" occur "during a frame," the Board has effectively re-written the language of claim 22 as follows by substituting "for" or "of" for "during" in the claim:

“independently controlling simultaneous data acquisition with each of the first and second channels for ~~during~~ a frame”

or

“independently controlling simultaneous data acquisition with each of the first and second channels of during a frame”

71. Even if "during a frame" modifies "data acquisition" as suggested by the Board, a person of ordinary skill would have nonetheless understood that the language of claim 22 still requires the application of independent control during such data acquisition, i.e., application of independent control at some point between the beginning and the end of the exposure interval during which the image sensors capture a single image. A person of ordinary skill would have understood that, in claim 22, the words "data acquisition" are inextricably tied to the larger phrase that recites "independently controlling simultaneous data acquisition" and thus, if the "data acquisition" occurs "during a frame," then the application of independent control must also happen "during a frame."

72. Finally, I respectfully submit that the Board's suggestion that there is not "sufficient support" in the specification of the '180 Patent for requirement that control occur during a frame, is incorrect. *See*, ID, at 20. The '180 Patent explained that the integration time control for each sensor can be accomplished using a technique that was known as *rolling mode*. Ex. 1001, 20:48-50. As explained above, a person of ordinary skill would have understood that the operation of an image sensor in a "rolling mode" involves control during a frame of the start and stop times

of the integration period for individual rows of pixels in a sensor. *See*, Section IV(B), *supra*.

73. For all of these reasons, a person of ordinary skill would have understood that the meaning of the language in claim 22 that recites “independently controlling simultaneous data acquisition with each of the first and second channels during a frame” requires that independent simultaneous data acquisition be controlled at some point between the beginning and the end of the exposure interval during which the image sensors capture a single image.

VIII. A PERSON HAVING ORDINARY SKILL IN THE ART

74. A person of ordinary skill in the art (“POSITA”) as of the effective filing date of the ‘180 Patent would have had a bachelor’s degree in electrical engineering, computer science, computer engineering, physics, or a related subject, and two to three years of work experience in digital imaging. When I refer to a person of ordinary skill throughout this Declaration, I am referring to a POSITA.

IX. GROUND 1 FAILS TO RENDER CLAIMS 1, 2-3, 10-12, 22-25, 28, 30 AND 32-33 UNPATENTABLE BECAUSE THE PETITION HAS FAILED TO ESTABLISH THAT MATSUSHIMA EXPRESSLY OR INHERENTLY DISCLOSES OR RENDERS OBVIOUS SIMULTANEOUS DATA ACQUISITION WITH EACH OF A PLURALITY OF CHANNELS

75. Claim 1 recites a processing component that is configured to “independently control simultaneous data acquisition with each of the plurality of channels,” while claim 22 recites “independently controlling simultaneous data

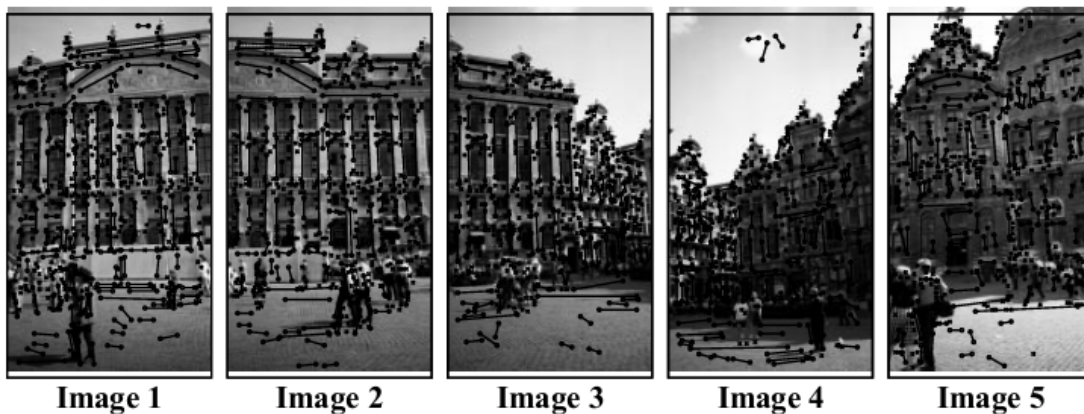
acquisition with each of the plurality of channels." As explained in Section VII(B) above, the plain meaning of these limitations requires that data acquisition "with each of the plurality of channels" occurs at the same time. Moreover, the subject claim language is not met where image capture with the plurality of channels is "nearly simultaneous" (i.e., close in time) but not actually simultaneous (i.e., at the same time).

76. In Ground 1, the Petition relies solely on Matsushima for the claim limitation requiring "simultaneous data acquisition with each of the plurality of channels." Pet., 21-23 (arguing that the "simultaneous" requirement of [22.3] is met by Matsushima), 32 (A POSITA would have been motivated to apply, in Matsushima's multi-channel digital camera performing simultaneous data acquisition, Yu's teaching of independent control ...), 55-56 (arguing that the "simultaneous" requirement of [1.2.2] is met by Matsushima and referring back to arguments for [22.3]). As explained more fully below, the Petition has failed to establish that Matsushima discloses "simultaneous data acquisition with each of the plurality of channels," as recited in the Challenged Claims.

A. State Of The Art For Combining Images At The Time Of Matsushima

77. Before getting into the details of Matsushima, it is important to understand how Matsushima related to the prior art as a whole. At the time of Matsushima, techniques such as mosaicing existed for "effectively increasing the

field of view of a camera, by allowing several views of a scene to be combined into a single view." Ex. 2024, 1. In these techniques, an image sequence (formed by sequential images taken close in time) were "stitched together" in order to provide a panoramic mosaic, i.e., a composite image with a wider field of view than each individual image in the sequence. *Id.*, 1, 6-8. The prior art discloses that application of this technique to the following five sequential images taken with a still camera of the Market Square in Brussels:



Id., 6.

78. The prior art mosaicing techniques were then applied to stitch together these sequentially taken images into the composite image shown below having a wider field of view than each individual image in the sequence.



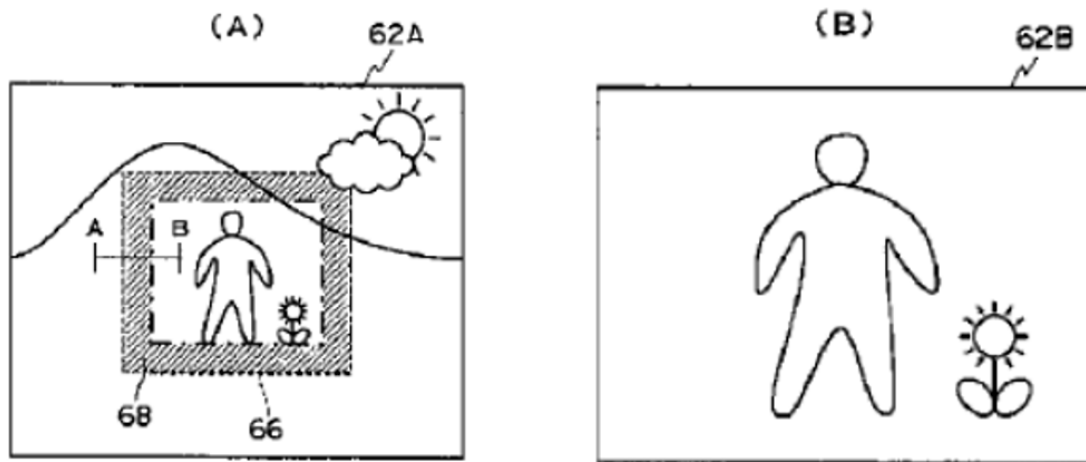
Id., 6.

79. Other references from the time disclosed similar techniques where images taken sequentially were stitched together into a composite image having a wider field of view than each individual image in the sequence. See, e.g., Ex. 2025, 2:16-21, 5:14-19, 6:59-60 and Figure 1 (mosaicing techniques applied in connection with synthesis of four sequentially taken images into a single composite image); Ex. 2026, [0001]-[0002], [0005] and [0010] (disclosing that mosaicing "melds visual information from a set of images taken as a plurality of time instants" into "a single large image"); and Ex. 2027 (disclosing construction of mosaic from image sequences of moving objects).

80. Significantly, in all of the above techniques, the source images used to synthesize the composite (mosaic) image were taken sequentially -- rather than simultaneously -- and subsequently stitched together to form the composite image.

B. Overview of Matsushima

81. Matsushima discloses “a digital camera having a wide-angle first imaging system and a telephoto second imaging system.” Ex. 1007, 1. The first imaging system captures a first image 62A (left side) with a wide angle lens, and the second imaging system captures a second image 62B (right side) using a telephoto lens with a longer focal length than the lens used in the first imaging system. *Id.*, 1, 3.



Ex. 1007, 1.

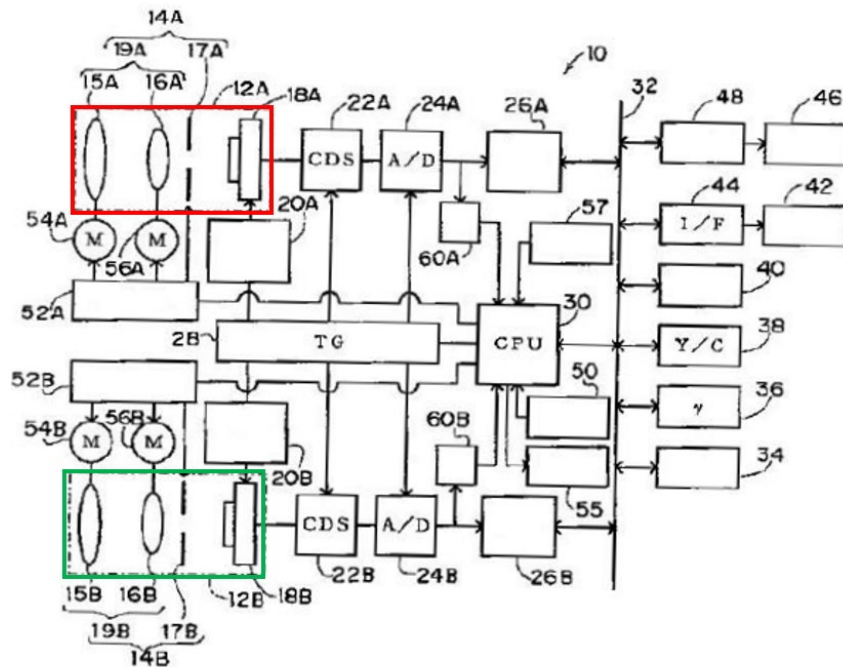
82. A person of ordinary skill would have understood that the images 62A, 62B (above) are still images of a person posed next to a flower, and they are the only examples of images disclosed in the reference. Matsushima makes no mention of images with motion or moving objects.

83. Much like the mosaicing prior art that existed at the time of Matsushima (discussed in Section IX(A), *supra*), Matsushima forms a composite image “by

synthesizing" together captured images 62A, 62B. Ex. 1007, [0048]. For example, Matsushima discloses that image 62B (captured by the second imaging system using the telephoto lens) is then “scaled down to the same magnification” as “captured image 62A taken using the first imaging system” and “synthesized with the captured image 62A taken using the first imaging system.” *Id.*, 1. As explained in Matsushima:

The synthesizing means synthesizes the first captured image with the image that has been scaled down using the scale-down means. At this time, an image that has been scaled down using the scale-down means is generated from an image taken with the telephoto second imaging system, so the amount of information is greater than the amount of information in the central portion of the first captured image. This enables the image quality in the center of the image to be improved. Ex. 1007, [0011].

84. Figure 1 of Matsushita (reproduced below) discloses a first imaging system 12A (red box) and a second imaging system 12B (green box).



85. First imaging system 12A (red box) includes “[i]maging optics 14A” which “are composed of a first lens group 19A with an imaging lens 15A and a focus lens 16A, and an aperture 17A.” Ex. 1007, [0019]. Similarly, the second imaging system 12B (green box) includes “imaging optics 14B” which “are composed of a second lens group 19B with an imaging lens 15B and a focus lens 16B, and an aperture 17B.” *Id.* “Lens group 19A is a wide-angle single focal length lens whose shooting angle α is wider than the shooting angle β of lens group 19B.” *Id.*, [0020]. The first imaging system 12A includes CCD 18A, and the second imaging system includes CCD 18B. *Id.*, [0021]. “CCD 18A and CCD 18B can be ... CCDs of the same size, that is, the same number of pixels.” *Id.*

86. As explained next, Matsushima does not expressly or inherently disclose that its first imaging system 12A and second image imaging system 12B

operate at the same time to simultaneously acquire images.

C. The Petition Has Failed To Establish Matsushima Expressly Or Inherently Discloses Simultaneous Data Acquisition With Each Of The Plurality Of Channels

87. The term "simultaneously" does not appear in Matsushima, and Matsushima never states that images 62A And 62B are acquired at the same time. In alleging that Matsushima discloses "simultaneous data acquisition with each of the plurality of channels," the Petition (at 21) relies on [0031] of Matsushima, which states:

CPU 30 performs various calculations such as focus evaluation calculations and AE calculations based on the image signals outputted from CCD 18A and CCD 18B, and the driving circuits 52A and 52B of the imaging lenses 15A and 15B, the focus lenses 16A and 16B, and the apertures 17A and 17B are controlled based on these calculations. In other words, when the lens groups 19A and 19B are composed of zoom lenses, the motors 54A and 54B are driven to zoom the imaging lenses 15A and 15B and change the imaging magnification. These motors 54A and 54B can be omitted when a manual zooming configuration or a single focal length lens is used. Ex. 1007, [0031].

88. Nothing in [0031] of Matsushima discloses that images 62A and 62B are acquired at the same time, or compels the conclusion the images 62A and 62B are acquired in overlapping acquisition windows. The disclosure in [0031] of Matsushima is consistent with the sequential capturing of images 62A and 62B followed by alignment and stitching the images together as taught in Matsushima and the other references from the time directed to mosaicing.

89. The Petition (at 23-24) also cites to [0021] and Claim 1 of Matsushima for the proposition that Matsushima discloses "simultaneous data acquisition with each of the plurality of channels." Those portions of Matsushima state:

In addition, CCD 18A and CCD 18B can be, for example, CCDs of the same size, that is, the same number of pixels. Therefore, when the image captured with the first imaging system 12A is the captured image 62A shown in FIG. 3 (A), the image captured by the second imaging system 12B is the scaled-up captured image 62B at the center of FIG. 3 (A), as shown in FIG. 3 (B). Ex. 1007, [0021].

* * *

[Claim 1] A digital camera comprising: a first imaging system including a first image sensor for imaging a subject and a first lens for forming an image of the subject on the first image sensor; a second imaging system including a second image sensor for imaging the subject and a second lens with a focal length longer than the first lens for forming an image of the subject on the second image sensor; a scale-down means for scaling down the second captured image taken with the second image sensor to an image with a shooting angle that is almost the same as that of the first captured image taken with the first image sensor; and a synthesizing means for correcting the continuity of the image data in the peripheral regions based on the image data of a predetermined peripheral region of the image scaled down by the scale-down means and the image data corresponding to the peripheral region of the first captured image, and synthesizing the first captured image and the image scaled down by the scale-down means. Ex. 1007, 2.

90. Again, nothing in the above passages of Matsushima discloses that images 62A and 62B are acquired at the same time, or compels the conclusion the images 62A and 62B are acquired in overlapping acquisition windows. The disclosures in the above passages of Matsushima are consistent with the sequential

capturing of images 62A and 62B followed by alignment and stitching the images together as taught in Matsushima and the other references from the time directed to mosaicing.

91. The Petition also argues that Matsushima discloses "simultaneous data acquisition with each of the plurality of channels" because, according to Petitioner, "images 62A and 62B are captured at the same time to avoid image discrepancies due to motion or other artifacts." Petition, 23 (emphasis added). However, Matsushima does not say that images 62A, 62B are captured at the same time, nor does Matsushima even mention images involving motion or motion artifacts. On the contrary, the images 62A, 62B as depicted in Matsushima are still images of a person posed next to a flower, and they are the only examples of images disclosed in the reference. Moreover, even if Matsushima had disclosed that it was applicable to motion images (to be clear, it did not), that fact does not compel the conclusion that images 62A, 62B are captured at the same time. For example, as discussed in Section IX(A), *supra*, it was well known at the time of Matsushima how to stitch together source images taken sequentially in cases where the source images involved motion. Ex. 2027 (disclosing synthesis of composite image (mosaic) from image sequences of moving objects). Thus, Matsushima does not require simultaneous image capture to function as intended.

92. Next, in alleging that Matsushima discloses "simultaneous data

acquisition with each of the plurality of channels," the Petition (at 24) cites to [0027] of Matsushima, which states:

A timing signal generating circuit (TG) 28 provides appropriate timing signals to the CCD drive circuits 20A and 20B, the CDS circuits 22A and 22B, and the A/D converters 24A and 24B in response to commands from the CPU 30, and each circuit is driven synchronously by timing signals applied from the timing signal generating circuit 28. Ex. 1007, [0027].

93. For several reasons, this passage does not disclose simultaneous data acquisition with a plurality of channels.

94. First, Matsushima discloses that these timing signals are used to control the timing of the retrieval of information from the CCDs, rather than the acquisition of data by each CCD. See Ex. 1007, [0023] ("The accumulated signal charges are retrieved by CCD drive pulses applied by CCD drive circuits 20A and 20B, and are sequentially output from CCD 18A and CCD 18B.")

95. Second, Matsushima states only that the timing signal generator 28 provides "appropriate timing signals to the CCD drive circuits 20A and 20B" -- the reference never states that it provides simultaneous timing signals to the CCD drive circuits.

96. Third, even if Matsushima had been referring to image acquisition signals in [0027] (as opposed to data retrieval signals), Matsushima's disclosure that "each circuit is driven synchronously by timing signals applied from the timing signal generating circuit 28" is not equivalent to a disclosure that such circuits are

driven simultaneously. The fact that two circuits operate synchronously means only that the operation of both circuits is based on a common clock signal -- not that the circuits are necessarily driven simultaneously. Ex. 2028. 1:15-24 and 1:60-65 (explaining that synchronous circuits are one that "operate in a synchronous manner relative to a system clock" such that each circuit operates in a fixed relationship with each other); Ex. 2029, 30:58-65 ("Generally, synchronization is used to obtain a fixed relationship among ... two or more signals.")

97. Finally, in alleging that Matsushima discloses "simultaneous data acquisition with each of the plurality of channels," the Petition (at 25) relies on the fact that block 102 in Figure 7 of Matsushima states "Capture images." However, the phrase "Capture images" is not an express or inherent disclosure that the images are captured simultaneously. Again, the phrase "Capture images" is completely consistent with the sequential capturing of images 62A and 62B.

98. In summary, there can be no dispute that Matsushima fails to expressly disclose that images 62A, 62B are taken at the same time. Matsushima simply does not say that. In addition, to the extent the arguments in the Petition are interpreted as alleging that it is inherent in Matsushima that images 62A, 62B are taken at the same time, it is clear for the reasons explained above that nothing in Matsushima

compels the conclusion that images 62A, 62B are taken at the same time.⁵

D. The Petition Has Failed To Establish That Matsushima Renders Simultaneous Data Acquisition With Each Of The Plurality Of Channels Obvious

99. In addition to alleging that Matsushima discloses "simultaneous data acquisition with each of the plurality of channels," the Petition alleges without further explanation that Matsushima renders this limitation obvious. Petition, 21 ("As shown in FIGS. 1-3 below, Matsushima discloses or renders obvious ... simultaneous data acquisition with each of the first and second channels during a frame.") However, other than arguing that Matsushima in fact discloses this limitation, the Petition advances no separate argument that Matsushima renders this limitation obvious. More specifically, other than making the conclusory assertion at the beginning and end of its analysis of [22.3] and [1.2.2] that Matsushima renders obvious the limitation reciting "simultaneous data acquisition with each of the plurality of channels," the Petition provides no further explanation why Matsushima renders this limitation obvious. *See*, Petition, at 21-30, 55-56.

⁵ I understand that the mere fact that a certain thing may result from a given set of circumstances is not sufficient to establish inherency. Rather, the limitation at issue necessarily must be present in order to be inherently disclosed by the reference. Petitioner has not demonstrated that it is inherent in Matsushima that images 62A, 62B are taken at the same time.

X. GROUND 1 FAILS TO RENDER CLAIMS 22, 23-25, 28, 30 and 32-33 UNPATENTABLE BECAUSE MATSUSHIMA-YU FAILS TO DISCLOSE INDEPENDENTLY CONTROLLING SIMULTANEOUS DATA ACQUISITION DURING A FRAME

100. Claim 22 recites “independently controlling simultaneous data acquisition with each of the first and second channels *during a frame*.” As set forth in Section VII, *supra*, the meaning of this claim language requires that simultaneous *data acquisition with the channels be controlled independently* at some point between the beginning and the end of the exposure interval during which the image sensors capture a single image.

101. As explained above, operation of an image sensor in a “rolling mode” (illustrated again below) as disclosed in the ‘180 Patent is an example of controlling data acquisition ... *during a frame*. Ex. 1001, 20:48-50.

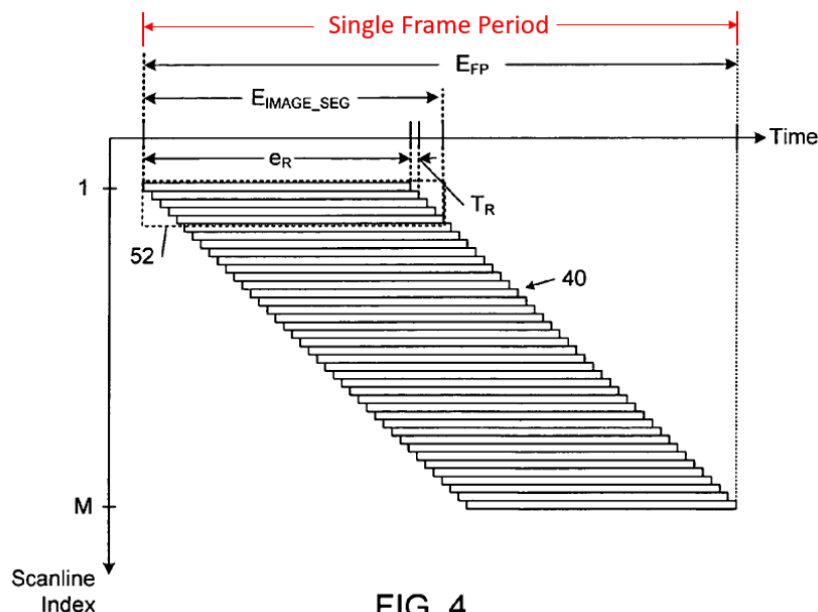


FIG. 4

Ex. 2006, Figure 3.

102. In the rolling mode, the start time of the interval for each subsequent row (or scanline) in the sensor is some interval after the start time of the exposure interval for the previous row. *Id.*, 6:1-5; Ex. 2007, 1:37-42. Thus, when an image sensor is operating in the rolling mode, the start and stop time of the integration interval of individual rows (or scanlines) of pixels is controlled during the frame. See Section IV(B), *supra*. By contrast, a sensor can be operated in a “snap-shot” mode (also referred to as a “global shutter”) where common control signals are applied only at the confines of the frame exposure rather than during the frame, i.e., rather than at some point between the beginning and the end of the exposure interval during which the image sensor captures a single image. See Section IV(B), *supra*.

103. In Ground 1, the Petition alleges that the limitation in claim 22 reciting “independently controlling simultaneous data acquisition ... during a frame” is met by Matsushima alone, or in combination with Yu. Petition, 21-34. However, Petitioner's analysis skips over the temporal aspect of this control requirement, namely that it occur “during a frame.” There is no evidence that any of the control applied by Matsushima or Yu occurs “during a frame” -- as opposed, e.g., before the frame. Set forth below is my analysis of each of the disclosures from Matsushima and Yu relied on in the Petition for the limitation in question.

A. Control of Matsushima's Lenses And Apertures Does Not Occur "During A Frame"

104. The Petition maps each of (i) calculations performed by Matsushima's CPU that control "the driving circuits 52A and 52B of the imaging lenses 15A and 15B, the focus lenses 16A and 16B, and the apertures 17A and 17B" and (ii) the operation of Matsushima's automatic focus (AF) function, to the limitation requiring application of independent control "during a frame." Petition, 21 and 26. However, there is no evidence that any of this control occurs "during a frame," i.e., at a point between the beginning and the end of the exposure interval during which the image sensor captures an image. See Section IV(B), *supra*. On the contrary, a POSITA would have expected any adjustments to Matsushima's lens (e.g., autofocus) and apertures to occur before the exposure interval during which the image sensor captures a single image.

B. Matsushima's Timing Signals Do Not Control Data Acquisition "During A Frame"

105. The Petition also maps the "timing signals" disclosed in [0027] of Matsushima to the limitation requiring application of independent control "during a frame." Petition, 24. For multiple reasons, this passage fails to disclose independent control of data acquisition "during a frame."

106. First, Matsushima discloses that these timing signals are used to control the timing of the retrieval of information from the CCDs, rather than the acquisition

of data by each CCD. See Ex. 1007, [0023].

107. Second, the Petition provides no evidence that these timing signals apply control “during a frame,” i.e., at a point between the beginning and the end of the exposure interval during which the image sensor captures an image. See Section IV(B), *supra*. On the contrary, a POSITA would have understood that Matsushima’s timing signals for retrieving data from the CCDs could occur after the exposure interval during which the image sensor captures a single image.

C. Pressing Matsushima’s “Release Button” Does Not Independently Control Data Acquisition With First And Second Channels “During A Frame”

108. The Petition also maps the pressing of Matsushima’s “release button” to the limitation requiring application of independent control “during a frame.” Petition, 24-25. Pressing of the release button in Matsushima does not equate to the application of independently controlling data acquisition with each of the first and second channels “during a frame.”

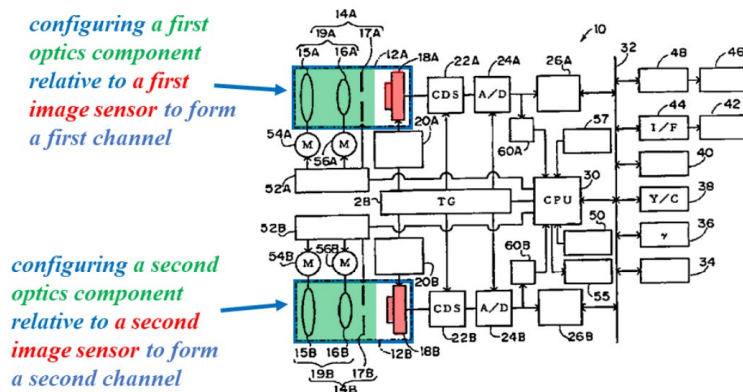
109. First, there is no evidence that depression of the release button independently controls the first and second channels. Rather, to the extent actuation of the release button is “control,” it is common control -- rather than independent control -- with respect to the first and second channels.

110. Second, actuation of the release button does not occur “during a frame,” i.e., at a point between the beginning and the end of the exposure interval during

which the image sensor captures a single image. *See* Section IV(B), *supra*. On the contrary, a POSITA would have understood that actuation of the release button would necessarily need to occur before the exposure interval during which the image sensor captures an image.

D. Matsushima’s Correlated Double Sampling Circuit, A/D Converters And Integration Circuits Do Not Independently Control Data Acquisition With First And Second Channels “During A Frame”

111. The Petition also maps Matsushima’s “correlated double sampling circuits 22A and 22B, and analog-to-digital (A/D) converters 24A and 24B” and “integration circuits 60A and 60B” to the limitation requiring application of independent control of data acquisition with each channel “during a frame.” Petition, 25 and 28. This mapping fails because Matsushima’s correlated double sampling circuits 22A and 22B, analog-to-digital (A/D) converters 24A and 24B, and integration circuits 60A and 60B are not part of the first and second channels as mapped in the Petition. As shown in the image from the Petition reproduced below, the channels simply do not include correlated double sampling circuits 22A and 22B, analog-to-digital (A/D) converters 24A and 24B and integration circuits 60A and 60B.



Pet., 19.

112. Because the correlated double sampling circuits 22A and 22B, analog-to-digital (A/D) converters 24A and 24B and integration circuits 60A and 60B are not part of the first and second channels, it is clear that any control of these components does not amount to “independently controlling simultaneous data acquisition with each of the first and second channels ...,” as claimed.

113. In addition, the correlated double sampling circuits 22A and 22B, analog-to-digital (A/D) converters 24A and 24B, and integration circuits 60A and 60B are downstream of the CCDs 18A and 18B that acquire the images. The Petition provides no evidence that the correlated double sampling circuits 22A and 22B, analog-to-digital (A/D) converters 24A and 24B, and integration circuits apply control “during a frame,” i.e., at a point between the beginning and the end of the exposure interval during which the image sensor captures an image. *See* Section IV(B), *supra*.

E. Matsushima Fails To Teach Control Of Integration Time Or Exposure Time For Its Imaging Systems “During A Frame”

114. There is no evidence that such integration time control is applied “during the frame,” i.e., at a point between the beginning and the end of the exposure interval during which the image sensor captures an image. Matsushima does not disclose that its integration control operates in a “rolling mode” (or using a “rolling shutter”) where the start and stop time of the integration interval of individual rows (or scanlines) of pixels is controlled during the frame. Nor is such an implementation inherent in Matsushima. For example, a sensor can be operated in a “snap-shot” mode (also referred to as a “global shutter”) where common control signals are applied only at the confines of the frame exposure rather than during the frame, i.e., at some point between the beginning and the end of the exposure interval during which the image sensor captures a single image. Thus, Matsushima fails to disclose (expressly or inherently) integration time control that is applied “during the frame.”

F. The Petition Presents No Evidence That Yu Independently Controls Data Acquisition With First And Second Channels “During A Frame”

1. Overview of Yu

115. Yu is directed to “digital photography,” and to a digital camera that takes digital photographs (still images) with colors and details that more closely replicate that of film cameras. Starting with its “Description of Related Art,” Yu

describes the capability of film-photography to produce high-resolution images and vivid colors, and explained the shortcomings of existing digital photography techniques that lacked the high-resolution and vivid colors produced by film. From Yu:

Description of Related Art

Digital photography is one of the most exciting technologies to emerge during the twentieth century. With the appropriate hardware and software (and a little knowledge), anyone can put the principles of digital photography to work. Digital cameras are on the cutting edge of digital photography. ...

Digital cameras, however, do not work in the way as the traditional film cameras do. In fact, they are more closely related to computer scanners, copiers, or fax machines. ...

Nevertheless, there are many cases in which digital cameras simply could not be used due to the limited resolutions from today's digital cameras. Film-based photographs have immeasurably higher resolutions than digital cameras. The comparison magnitude may be somewhere millions of pixels versus tens thousands of pixels in the digital cameras. Although, it is theoretically possible to design a photosensitive chip with multimillion of pixels, the cost of such chip would be a forbidden number and may consequently drag the digital cameras out of the consumer market. ...

To have color images with higher resolutions, the number of photocells in a sensor must be increased. ... Therefore there is a great need for a generic solution that makes digital cameras capable of producing high resolution images without enormously incurring the cost of photosensitive chips with multimillion photocells.

A second noticeable quality between digital cameras and film-based cameras is the dynamic range. Films have the necessary chemical pigments to make colors much more vivid and more adaptive to light conditions than current digital cameras can do. This is largely due to the limited pixel depth the current digital cameras could produce

and the limited sensitivity of the photocells in the image sensor. There is thus a further need for digital cameras that produce better colors and details in a greater range. ... Ex. 1005, 1:12-2:16 (emphasis added).

116. After discussing the deficiencies of digital photography as compared to film-based photography, Yu positioned its invention as having “been made in consideration of the above described problems and needs” in order to improve the image resolution and color ranges of existing digital cameras by providing “film-like true color” images “without incurring substantial costs.” From Yu:

SUMMARY OF THE INVENTION

Recent product introductions, technological advancements, and price cuts, along with the emergence of email and the World Wide Web, have helped make digital cameras the hottest new category of consumer electronics products. But the image qualities, noticeably the image resolutions and color dynamic ranges, have limited the popularity of digital cameras among consumers. Under the constraints of improving image qualities without incurring substantial costs to the digital cameras, the present invention discloses improved digital cameras that use multiple image sensors with multiple lenses.

The present invention has been made in consideration of the above described problems and needs and has particular applications to digital cameras that are demanded to produce digital images of high qualities. ... Using a set of digital image processes embedded in a digital signal processing chip, images from the three color image sensors are processed with reference to the image from the black-and-white image sensor and subsequently produce high quality and film-like true color digital images. Ex. 1005, 2:23-49 (emphasis added).

117. The Detailed Description Of The Preferred Embodiments of Yu also emphasized that Yu was directed to a digital camera that, in some cases, had the

same look as a “regular film camera” and that could capture digital photographs that could be printed “on glossy paper.” From Yu:

FIG. 4B shows another arrangement of four lenses 402, 404, 406 and 408 in a regular camera lens opening 410 so that the exterior appearance of a digital camera with multiple sensors and multiple lenses may look the same as a regular film camera. Ex. 1005, 6:17-21 (emphasis added).

* * *

For completeness, along with digital image processing circuitry 338, post circuitry 350 includes all necessary circuits to further process vector or color image 340. It is understood to those skilled in the art that some of the functions performed may include image compression in a conventional format such as JPEG and necessary I/O functions so that color images generated by digital camera 300 may be downloaded to other computing devices for further artistic editing/processing and subsequently for printing on glossy paper or publication on the Internet or World Wide Web. Ex. 1005, 7:9-18 (emphasis added).

2. There Is No Evidence That Yu Controls Data Acquisition With First And Second Channels “During A Frame”

118. There is no evidence that integration time control in Yu is applied “during the frame,” i.e., at a point between the beginning and the end of the exposure interval during which the image sensor captures an image. Yu does not disclose that its integration control operates in a “rolling mode” (or using a “rolling shutter”) where the start and stop time of the integration interval of individual rows (or scanlines) of pixels is controlled during the frame. Nor is such an implementation inherent in Yu. As described in Section X(F)(1), *supra*, Yu is directed to a digital camera that takes digital photographs (still images) with colors and details that more closely replicate that of film cameras. Thus, Yu’s sensor would have been expected

to operate in a “snap-shot” mode (also referred to as a “global shutter”) where common control signals are applied only at the confines of the frame exposure rather than during the frame, i.e., at some point between the beginning and the end of the exposure interval during which the image sensor captures a single image. Thus, Yu fails to disclose (expressly or inherently) integration time control that is applied “during the frame.”

XI. GROUND 1 FAILS TO RENDER CLAIMS 1, 2-3, 10-12, 22-25, 28, 30 AND 32-33 UNPATENTABLE BECAUSE MATSUSHIMA ALONE FAILS TO DISCLOSE INDEPENDENT CONTROL OF INTEGRATION TIME AND IT WOULD NOT HAVE BEEN OBVIOUS TO COMBINE MATSUSHIMA AND YU AS PROPOSED IN THE PETITION

119. As discussed below, Ground 1 is separately flawed because Matsushima fails to disclose "independent" control of integration time for each channel, and it would not have obvious to fill this gap in Matsushima by combining the reference with Yu as proposed in the Petition.

A. The Text Of Matsushima Describes A Common Integration Time Or Exposure Time For Both Imaging Systems

120. Matsushima's exposure control mechanism uses the same charge accumulation time for both CCDs, indicating that integration time is not independently managed for each sensor. Matsushima's automatic exposure (AE) control relies on a single luminance value to determine a common aperture setting and shutter speed, which are then applied uniformly to both imaging systems. The

common integration time control for both imaging systems in Matsushima fails to meet the limitations in claims 1 and 22 requiring that data acquisition with the channels be independently controlled.

121. In Matsushima, “CPU 30 performs various calculations such as focus evaluation calculations and AE [automatic exposure] calculations.” Ex. 1007, [0031]. However, Matsushima makes clear that a single charge accumulation time is used for both CCD 18A and 18B in Matsushita’s two imaging systems. From Matsushima:

For AE control, the subject luminance (imaging EV value) is determined based on integration of the R, G, and B signals in a single frame by the integration circuits 60A and 60B, and the aperture value and shutter speed are determined based on this imaging EV value. The apertures 17A and 17B are driven via the drive circuits 52A and 52B, and the CCD 18A and CCD 18B charge accumulation time is controlled using an electronic shutter to reach the determined shutter speed. ...

During imaging and recording, the AF operation is performed when the release button is “half-pressed,” and the metering operation is repeated several times to obtain the exact imaging EV. The final aperture value and shutter speed for imaging is then determined based on the imaging EV. The apertures 17A and 17B are then driven to the final aperture value when the release button is “fully press”, and the charge accumulation time is controlled by the electronic shutters at the determined shutter speed. *Id.*, [0034]-[0035] (emphasis added).

122. The fact that Matsushima refers to “the charge accumulation time” (in the singular) of both “the CCD 18A and CCD 18B” indicates that the same charge accumulation time is used for both devices. Matsushima’s references to “the subject luminance” (singular), one EV value (singular), “the final aperture value” (singular)

used for both apertures 17A and 17B, and “the determined shutter speed (singular), likewise indicate that one luminance (EV value) is determined for the subject, and a common aperture value as well as a common shutter speed are used in both imaging systems. Matsushima’s use of a common accumulation time for both of its CCDs fails to disclose “independently” controlling simultaneous data acquisition with each of the first and second channels,” as recited in claims 1 and 22.

1. The Testimony Of Petitioner’s Expert Alleging That Matsushima Uses Different Integration Times Is Unsupported By The Reference

123. The assertions by Petitioner’s expert that Matsushima discloses images with different integration times is unsupported by the disclosure of Matsushima. The passages relied on in the expert declaration do not reference independent integration time control between the two imaging systems. Instead, Matsushima consistently refers to the subject luminance and the charge accumulation time in the singular, indicating that a single exposure value is used for both CCDs.

124. Petitioner’s expert stated:

99. Matsushima performs independent control of aperture and charge accumulation time for each channel to achieve “optimal exposure adjustment” for image acquisition, because the AE control is based on independently determined imaging EV values of the channels with different FOVs, e.g., different EV values for each channel, where the corresponding portions of the FOVs of the same scene have different brightness. Ex.1007, [0017]. The AE control is performed by independently controlling charge accumulation times for the channels, based on the independent determination of the first subject luminance for the first FOV and the second subject luminance for the second FOV.

Ex.1007, [0034]. Matsushima describes that the first subject luminance of shooting angle α and the second subject luminance of shooting angle β are determined independently (by circuit 60A for first channel, and 60B for second channel independently). Ex.1007, [0034] (AE control is based on the subject luminance (imaging EV value) according to the scene of the respective FOV).

Ex. 1003, ¶99 (emphasis added).

125. The assertions that Matsushima has “different EV values for each channel” and that in Matsushima there is “a first subject luminance” and “a second subject luminance” are not supported (either expressly or inherently) in Matsushima. The citations (paragraphs [0017] and [0034] of Matsushima) provided by Petitioner’s expert do not disclose “different EV values for each channel” -- the actual text discloses “this EV value” (singular). Nor does the text of Matsushima describe “a first subject luminance” and “a second subject luminance” -- instead, the actual text of Matsushima refers to “the subject luminance” (singular).

126. Later, Petitioner’s expert alleges:

102. In Matsushima, the charge accumulation time/integration times of the two channels would have independent values, because the first and second channels are controlled independently based on captured images of different subject luminance with different FOVs. Ex.1007, [0034]. For example, the first sensor imaging the larger FOV (see 62A including the sun, the sky and other background objects) has a different subject illuminance (e.g., a higher subject illuminance) from the second sensor imaging the smaller FOV (see 62B including a person and a flower), thereby a different integration time (e.g., a shorter integration time) is determined for the first channel. (Emphasis added).

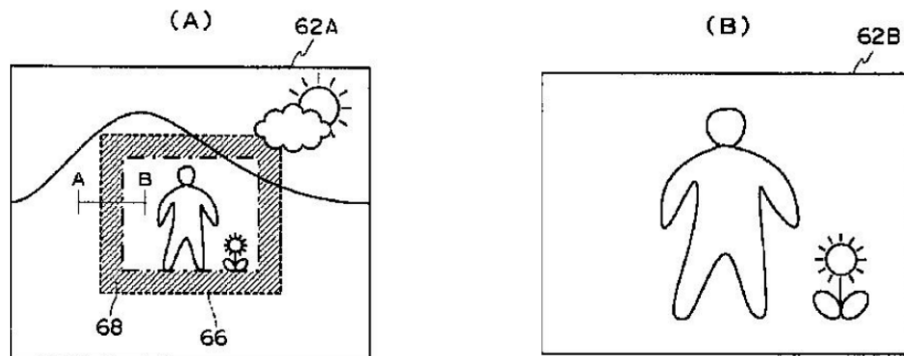
127. The text of Matsushima (e.g., at [0034]-[0035]) says just the opposite. Specifically, those portions of Matsushima describe “the subject luminance” (singular) and “the charge accumulation time” (singular) -- rather than different subject luminances or different integration times. The reasoning proposed by Petitioner’s expert is not grounded in the actual words of Matsushita.

2. Given The Known Obstacles To Synthesizing Digital Images With Different Exposures, Interpreting Matsushima As Disclosing Different Integration Times Would Be Inconsistent With The Prior Art As A Whole

128. Petitioner’s argument that Matsushima’s images 62A and 62B have different exposure times—and that this equates to different integration times—is both inconsistent with Matsushima’s disclosure and contrary to the understanding of the prior art. Matsushima explicitly describes a synthesis process aimed at achieving a natural boundary between images of different resolutions. However, a person of ordinary skill would have understood that Matsushima’s solution is not applicable to merging images with different exposures. More specifically, prior research, including studies on image mosaics, highlighted the difficulty of blending images with differing exposures without producing unnatural seams.

129. As shown in Figures 4A and 4B of Matsushima (reproduced below), Matsushima disclosed that “a scaled down image 66 is generated from a captured image 62B” by scaling down image 62B “to the same magnification (shooting angle) as the captured image 62A,” and then “both images are synthesized by replacing the

image in the center of the captured image 62A corresponding to the scaled down image 66, with the scaled down image 66.” Ex. 1007, [0049].



130. Matsushima recognized that “simply replacing the image in the center of the captured image 62A with the scaled down image 66 may result in an unnatural boundary between the two images,” and stated that “correction data is generated to correct the image in the peripheral regions 68 based on the image data in the peripheral region 68 (shaded region) of the scaled down image 66 and the image data in the peripheral region 68 of the captured image 62A.” Ex. 1007, [0050]-[0051] (emphasis added). The “correction data” is used so that “the boundary between the captured image 62A and the scaled down image 66 can be kept from becoming unnatural.” *Id.*, [0057]. Matsushima’s “correction data” is represented by the “correction curve” illustrated in Figure 5 of the reference, which functions to “blend” the areas of overlap.

131. Matsushima does not state, nor would a person of ordinary skill understood, that Matsushima's techniques were useful for synthesizing images with

different exposures. This is not surprising, because synthesizing images with different exposures in a manner that resulted in a natural boundary was a known problem that Matsushima did not address. Given the depth of work relating to synthesizing images with different exposures in a manner that resulted in a natural boundary (explained next), it strains credulity that Matsushima would have addressed and solved this problem without referring to it anywhere in Matsushima's disclosure.

132. As explained in one paper from the time (authored by researchers at Harvard and Microsoft), synthesizing images with different exposures in a manner that resulted in a natural boundary was a known problem:

When capturing images to create mosaics, automatic cameras often change their exposure settings. Even if the images are blended in the areas of overlap, if the exposure difference between images is too high, it will give the panorama a creased look around the edges of the overlap. Feathering [10] the effect of the blend into the rest of the image will help remove creases, but the exposure change will still be too abrupt to appear natural. (Figure 7) Uyttendaele, Matthew, Ashley Eden, and Richard Skeliski. "Eliminating ghosting and exposure artifacts in image mosaics." *Proceedings of the 2001 IEEE Computer Society Conference on Computer Vision and Pattern Recognition. CVPR 2001*. Vol. 2. IEEE, 2001. Ex. 2012, 4 (emphasis added).

133. The unnatural boundary after synthesis of the images with different exposures is illustrated in Figure 7(A) of the paper (reproduced below):



(A)

Id., 6.

134. Figure 7(A) (above) shows a two image mosaic where two images with different exposures have been blended and feathered. *Id.*, 4, 6. The boundary between the two images is highly noticeable and far from a “natural” boundary. This is precisely the case between images 62A and 66 called for in Matsushima. *Id.*, 6 (referring to “the sharp transition between images in the center of the mosaic”).

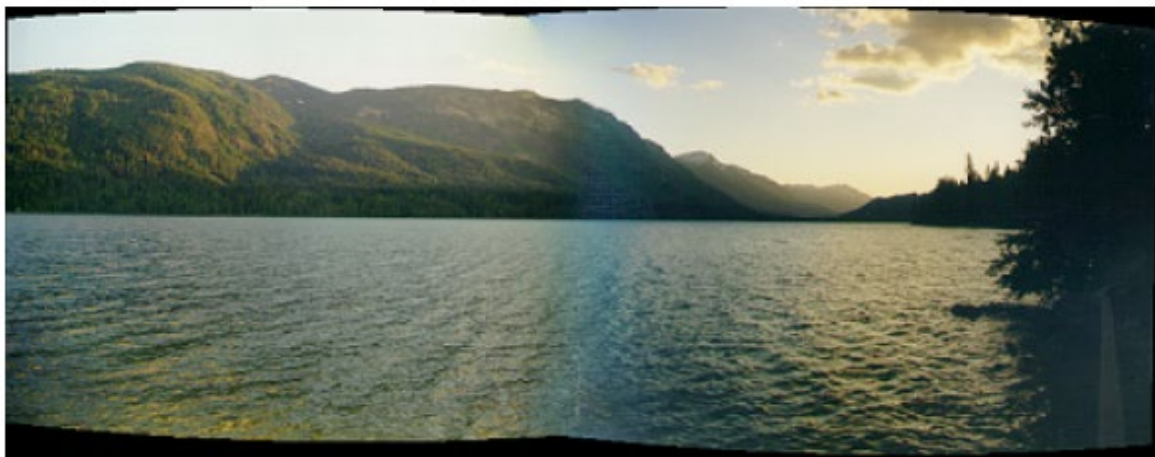
135. The paper discussed two methods for potentially ameliorating the unnatural boundary shown in Figure 7(A), neither of which resulted in a natural boundary. One method, referred to as a “block based exposure adjustment,” resulted in the image shown in Figure 7(B) of the paper (reproduced below):



(B)

After “block based exposure adjustment,” the boundary between the two images is still highly noticeable and far from “natural” boundary between images 62A and 66 called for in Matsushima. *Id.*

136. The other method for potentially ameliorating the unnatural boundary method involved the application of an “exposure compensation algorithm” and resulted in the image shown in Figure 7(C) of the paper (reproduced below):



(C)

While somewhat improved, the boundary between the two images is still noticeable and far from “natural” boundary between images called for in Matsushima.

137. Thus, in addition to deviating from the actual text of Matsushima, Petitioner’s reading of Matsushima is inconsistent with the state of the art, which recognized that achieving a natural boundary⁶ between images with different exposures was problematic. For these additional reasons, the Petitioner has failed to demonstrate that Matsushima expressly or inherently discloses independent control of the integration time of channel.

138. Respectfully, the Board's assertion that "a person of ordinary skill in the art at the time of the invention would have possessed the skill and ability to address any unnatural boundary concerns" in a composite image synthesized from images with different exposures, "particularly because Matsushima discloses a technique for generating and using correction data to prevent any unnatural boundary," is incorrect and unsupported by any evidence. ID, 22 (emphasis added). More specifically,

⁶ Avoiding an unnatural boundary between image seams was central to Matsushima, which, like Yu, was directed to images like those captured with film that would be pleasing to the eye. By contrast, the ‘180 Patent was directed to “visual imaging tasks including search, detection, recognition and tracking” associated with “active vision systems of autonomous or semi-autonomous host systems” ranging from “robots, unmanned vehicles, self-navigating cars, automatic assembly and product inspection systems ... smart weapons and missile defense systems.” Ex. 1001, 3:32-34 and 3:64-4:9. While high resolution images are required for these machine vision applications, there is no requirement that the images be pleasing to the eye.

Matsushima did not disclose a technique for generating and using correction data to prevent any unnatural boundary. Rather, a person of ordinary skill would have understood that Matsushima taught only how to correct an unnatural boundary that resulted from combining images of different resolutions, not how to correct an unnatural boundary that resulted from combining images taken with different exposures. Synthesizing images with different exposures in a manner that resulted in a natural boundary was a known problem that Matsushima did not even purport to solve. Ex. 2012. A POSITA would have understood that application of Matsushima's techniques would not have corrected the unnatural boundary that would have been introduced by the synthesis of images with different exposures.

B. It Would Not Have Been Obvious To Combine Matsushima With Yu As Proposed In The Petition

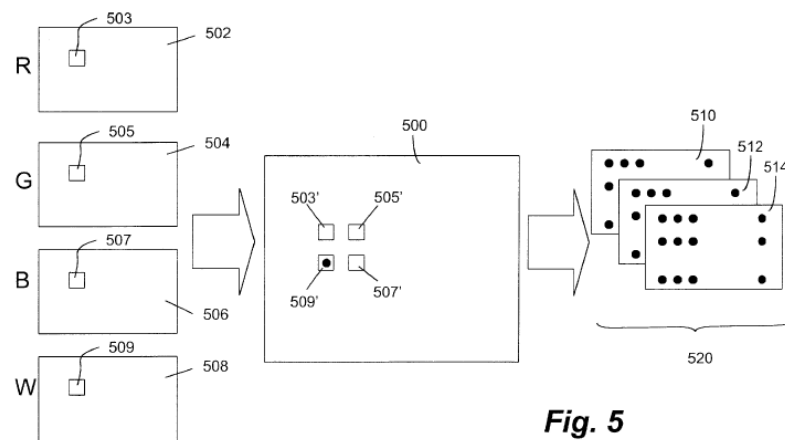
139. The Petition argues in the alternative that it would have been obvious to apply Yu's independent integration time control to Matsushima in order to increase the dynamic range of Matsushima. Petition, 32. As explained below, a POSITA would not have been motivated to combine the references for that purpose.

1. Yu's Pixel Technique For Increasing Dynamic Range Is Not Compatible With The Images Of Different Fields Of View Stitched Together In Matsushima

140. A POSITA would have recognized that Yu's technique for increasing dynamic range was not compatible with the images of different fields of view captured and stitched together by Matsushima.

a) Yu's Technique For Increasing Dynamic Range

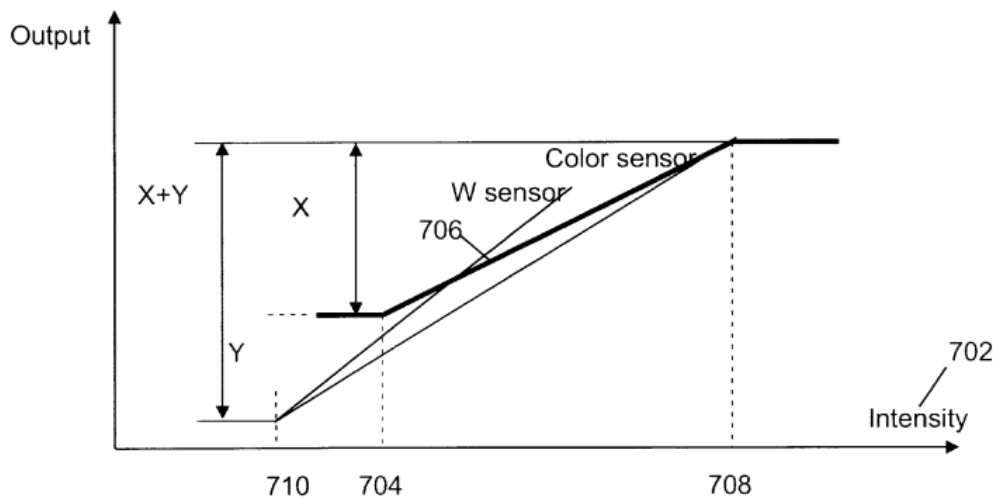
141. Turning first to Yu's technique for increasing dynamic range, Figure 5 of Yu illustrates "a virtual color image 500 formed by combining four intensity images 502, 504, 506 and 508." Ex. 1005, 7:47-50. In the disclosed example, images 502, 504, 506 correspond to color images captured by sensors 302, 304, 306, while image 508 corresponds to a black and white image captured by sensor 308. *Id.*, 7:50-52, 8:6-11 and 9:4-6.



142. Yu explains that while the pixels in images 502, 504, 506 and 508 may be "very closed positioned" they "are not in registration, which means that four respective pixels at the same coordinates in images 502, 504, 506 and 508 "do not correspond to the same spatial point in a scene." *Id.*, 7:66-8:5. Yu therefore applies a registration process wherein each pixel in color images 502, 504, 506 are spatially aligned (or registered) with a corresponding pixel in black and white image 508. *Id.*, 8:6-58.

143. Following registration of the pixels in the four images, Yu discloses a

process where a pixel in the black and white intensity image 508 is used to increase the dynamic range of one or more spatially aligned pixels in color images 502, 504 and 506. *Id.*, 9:4-6. Yu explains that, unlike sensors 302, 304, 306 which are each coated with a color filter, the black and white sensor 308 is not coated with any color filters which gives sensor 308 a larger dynamic range than that of sensors 302, 304 and 306. *Id.*, 9:19-23. Yu depicts this difference in dynamic range in Figure 7 (below):

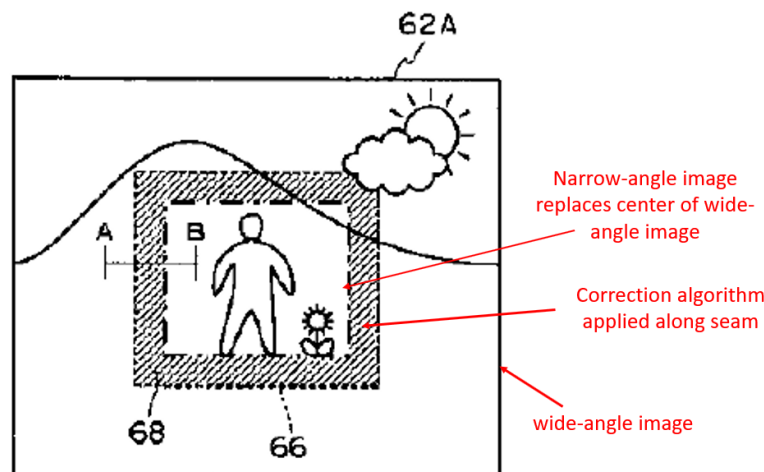


144. As shown above, one of the color sensors has a dynamic range of "X" while the black and white sensor has a dynamic range of "Y." *Id.*, 9:19-23. Yu's approach for expanding the dynamic range of a given color pixel is simply to add any "extra dynamic range Y level" sensed by the black and white sensor to "what the color sensor cannot sense." *Id.*, 9:29-40. Therefore, Yu's process for expanding the dynamic range in any given area of an image is dependent upon there being a plurality of spatially aligned pixels (captured by different sensors) in the area of

interest. Without such spatially aligned pixels, Yu would not be able to increase the dynamic range of one image (e.g., a color image) by adding the "extra dynamic range Y level" sensed by the black and white sensor to "what the color sensor cannot sense." *Id.*, 9:29-40.

b) Yu's Technique For Increasing Dynamic Range Is Incompatible With The Different Images Captured And Stitched Together In Matsushima

145. Matsushima's technique for image synthesis stands in contrast to Yu's technique where a plurality of spatially aligned pixels captured by different sensors are used to expand the dynamic range. In Matsushima, the region in the center of the wide-angle image 62A is simply replaced by a scaled-down version of narrow-angle image 62B, and then applying a correction algorithm (that has nothing to do with increasing dynamic range) in a narrow region on either of the seam where the images come together in order to address an unnatural boundary between the images. Ex. 1007, [0049]-[0059].



146. Completely lacking from Matsushima's techniques are spatially aligned pixels captured by different sensors, as used in Yu to increase dynamic range. Rather, in Matsushima, only pixels captured for narrow-angle image 62B are positioned in the center of the composite image, and only pixels captured for the wide-angle image 62A surround the center region with the scaled-down version of the narrow-angle image. As a result, there is no region in Matsushima's composite image where spatially aligned pixels captured by different sensors even exist. Since application of Yu's dynamic range extension technique is predicated on the existence of spatially aligned pixels captured from different sensors, there is no way of applying Yu's technique for extending dynamic range to the images with different fields of view captured and stitched together by Matsushima.

147. In short, a POSITA would not have been motivated to apply Yu's independent integration time control to Matsushima in order to increase the dynamic range of Matsushima because there is no way of combining the references to achieve this result. The Petition offers no explanation how a POSITA could have applied Yu's technique to Matsushima in order to increase the dynamic range when Yu's dynamic range extension technique is predicated on the existence of spatially aligned pixels captured from different sensors, which simply do not exist in Matsushima.

2. A POSITA Would Not Have Been Motivated To Combine Yu And Matsushima As Alleged Because Doing So Would Have Destroyed The Intended Purpose Of Matsushima

148. The stated purpose of Matsushima was to prevent any unnatural boundary in a synthesized image. Ex. 1005, [0004]-[0007] ("[Problem to Be Solved by the Invention] However, the conventional technology experiences a problem in which the boundary between an image taken with a wide-angle lens and an image taken with a telephoto lens is unnatural, causing a deterioration in image quality. ... It is an object of the present invention to solve these problems by providing a digital camera that can prevent unnatural boundary regions ...") (emphasis added). For the reasons explained in Section X(A)(2), *supra*, if images 62A, 62B have different exposures, an unnatural boundary will be introduced between the peripheral region of Matsushima's composite image formed from the wide-angle image taken at one exposure and the scaled-down version of narrow-angle image taken at another exposure. Ex. 2012, 7. Introduction of such an unnatural boundary into Matsushima would defeat the primary purpose of Matsushima, which is to prevent unnatural boundaries.

149. In the Institution Decision, the Board did not agree that a synthesized image that may have unnatural boundaries would have discouraged a person of ordinary skill in the art from combining the teachings of Matsushima and Yu, given Petitioner's assertion of the advantages of Matsushima's synthesized image having

increased overall dynamic range and improved sharpness of scene objects compared to the input images. ID, 22. The Board appeared to weigh the supposed benefits of the combination asserted in the Petition against the disadvantages of an unnatural boundary, and found that the alleged benefits of the combination outweighed the disadvantages of introducing an unnatural boundary into Matsushima's composite image. Respectfully, there is no evidence that, from the perspective of a POSITA, the alleged benefits of the combination outweighed the disadvantages of introducing an unnatural boundary into Matsushima's composite image. To be clear, from the perspective of a POSITA, the disadvantages of introducing an unnatural boundary into Matsushima would have far outweighed the alleged benefits of the combination, as the proposed combination would have eviscerated the very purpose of Matsushima by introducing into Matsushima the very thing the reference sought to prevent -- namely, an unnatural boundary.

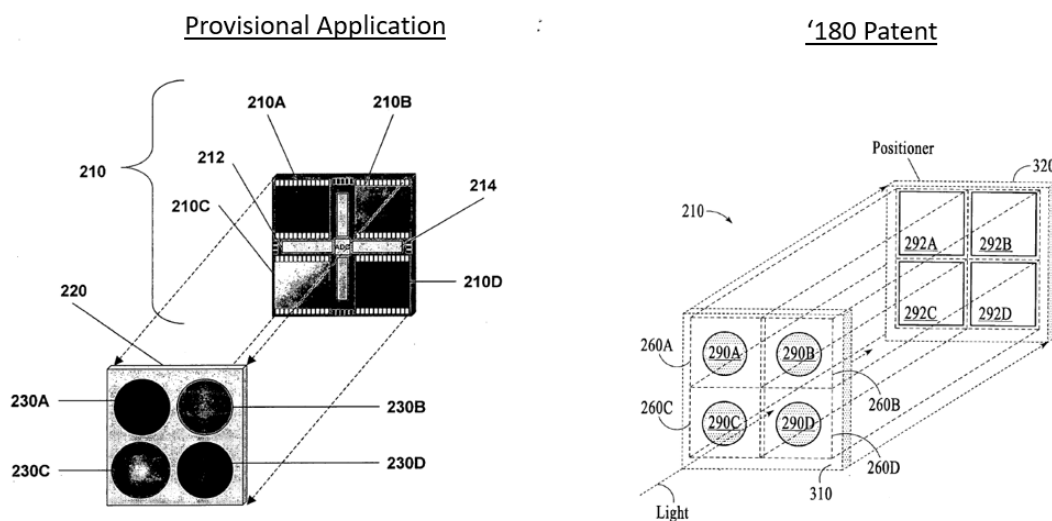
XII. GROUND 3 FAILS TO RENDER CLAIMS 22-23, 28 AND 30 UNPATENTABLE

A. Labaziewicz Is Not Prior Art

150. Ground 3 alleges that claims 22-23, 28 and 30 are obvious over a combination of Choi, Labaziewicz and Wu. Ground 3 fails because Labaziewicz (Ex. 1010) is not prior art. Labziewicz was filed February 18, 2005, which is after the filing date on August 25, 2004 of U.S. Provisional Application No. 60/604854 (the "Provisional Application") (Ex. 1047). The '180 Patent claims priority based

on the Provisional Application. The Petition advances several arguments why the Challenged Claims are not supported by the Provisional Application, none of which has merit.

151. Set forth below is a diagram depicting aspects of Figure 3 of the Provisional Application (left side) (Ex. 1047, 22) and aspects of Figure 4 of the '180 Patent.



152. The Provisional Application disclosed that "[p]referred embodiments include three of more arrays of photodetectors, wherein the signal processing circuitry processes the signals from each array and then combines the signals from all of the arrays to produce a composite image." Ex. 1047, 4-5 (emphasis added). In connection with Figure 3 (depicted in part on the left above), the Provisional Application stated that the device shown includes multiple "arrays (210A - 210 D)" and "lenses 230A-D" and that the lenses will "differ from one another in size and

shape." *Id.*, 7-8 (emphasis added). The Provisional Application also explained that the depth of the mounting hole (in the camera frame) "may be different for each lens and is a result of the specific focal length for the particular lens tailored for each array." *Id.*, 12 (emphasis added). The Provisional Application went on to explain that the "invention allows for exposure control to occur for each array and targeted band of wavelengths differently" and that there may be "different integration times for each array enhancing both dynamic range as well as color specificity." *Id.*, 10 (emphasis added).

153. The Petition argues that the Provisional Application fails to support the Challenged Claims because "no written description exists for ... providing multiple channels with different FOVs." Petition, 4. That assertion is incorrect. The Provisional Application discloses multiple "arrays (210A - 210 D)" and multiple "lenses 230A-D." Each pairing between one of these arrays with its corresponding lens is a channel, and thus the Provisional Application clearly discloses multiple channels. In addition, the Provisional Application discloses that the lenses will "differ from one another in size and shape" *Id.*, (emphasis added). The Provisional Application also explained that the depth of the mounting hole (in the camera frame) "may be different for each lens and is a result of the specific focal length for the particular lens tailored for each array." *Id.*, 7-8, 12 (emphasis added). The Provisional Application thus disclosed that each channel could have a lens with a

different focal length. Focal length is directly related to field of view in that, as the focal length increases, the field of view narrows, and as focal length decreases, the field of view widens. Thus, by disclosing that each channel could have a lens with a different focal length, the Provisional Application inherently disclosed multiple channels with different fields of view.

154. Next, the Petition argues that the Provisional Application fails to support claim 22 because "no written description exists for ... configuring multiple optics components relative to multiple sensors respectively to form these multiple channels." Petition, 4. That assertion is incorrect. The Provisional Application discloses multiple "arrays (210A - 210 D)" (each of which is a sensor) and multiple "lenses 230A-D." Each pairing between one of these arrays with its corresponding lens is a channel. Thus, contrary to the Petition, the Provisional Application clearly discloses "multiple optics components relative to multiple sensors respectively to form multiple channels." The Petition argues incorrectly that the Provisional Application discloses only "a single sensor" because the Provisional Application refers to arrays (210A - 210 D) collectively as a sensor. This argument is specious, because under any reasonable definition of sensor, each array (210A - 210 D) also comprises a sensor. The disclosure in the Provisional Application that the "invention allows for exposure control to occur for each array and targeted band of wavelengths

differently," underscores the fact that each array (210A - 210 D) also comprises a sensor. *Id.*, 10 (emphasis added).

155. Finally, the Petition argues that the Provisional Application fails to support the Challenged Claims because the Provisional Application does not provide support for "combining data captured with the channels with different FOVs." Petition, 5. Again, that assertion is also incorrect. As explained above, the Provisional Application disclosed each channel could have a lens with a different focal length, (which inherently discloses multiple channels with different fields of view) and signal processing circuitry that "processes the signals from each array and then combines the signals from all of the arrays to produce a composite image." Ex. 1047, 4-57-8 and 12. Thus, the Provisional Application provides clear support for combining data captured with the channels with different FOVs.

B. Ground 3 Fails Because Yu Fails To Disclose Controlling Simultaneous Data Acquisition "During A Frame"

156. With respect to independent claim 22, Ground 3 relies on Yu for the limitation reciting "independently controlling simultaneous data acquisition with each of the first and second channels during a frame." Pet., 84-85. As explained in Section IX(F)(2), *supra*, Yu fails to meet this limitation.

XIII. DECLARATION

157. I, Dr. Eli Saber, declare that all statements made herein on my own knowledge are true and that all statements made on information and belief are believed to be true, and further, that these statements were made with the knowledge that willful 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.

Date: October 17, 2025

By:  _____
Dr. Eli Saber