

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

AMAZON.COM, INC., AMAZON.COM SERVICES, LLC,

Petitioner

v.

NOKIA TECHNOLOGIES OY,

Patent Owner

Case: IPR2024-00921
U.S. Patent No. 8,077,991

DECLARATION OF DR. MICHAEL ORCHARD

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I, Dr. Michael Orchard, declare as follows:

I. INTRODUCTION

1. I have been retained on behalf of Nokia Technologies OY and asked to provide opinions in respect of two Inter Partes Review (IPR) proceedings, IPR2024-00920 and IPR2024-00921, both of which relate to U.S. Patent No. 8,077,991, the '991 Patent.

2. This Declaration summarizes the independent opinions that I have formed to date, based on the material currently available to me. I reserve the right to modify my opinions, if necessary, based on further review and analysis of information that I receive subsequent to the filing of this Declaration, including in response to any positions taken by Petitioners or their experts that I have not yet been provided with. I further understand that an institution decision is “all-or-nothing” and so I have focused my opinions on the independent claim at issue in this petition. Should the petition be instituted, I anticipate offering additional opinions regarding both the dependent and independent claims. I have also been asked to compare the art raised and applied in the petition to art that was before the PTO during the prosecution of the '991 Patent and its family members.

3. My findings, as explained below, are based on my study, experience, knowledge and background in the fields discussed below. I am informed by my education and my extensive experience in the fields of video compression and

multimedia coding and communications. I have also relied on my review and analysis of the prior art, information provided to me and information I have independently reviewed.

II. EDUCATIONAL BACKGROUND AND QUALIFICATIONS

4. Details of my professional qualifications and background are summarized below and are set out in detail in my Curriculum Vitae, attached to this declaration.

5. I am a Professor of Electrical and Computer Engineering at Rice University in Houston, Texas. This report reflects my analysis and opinions in connection with my role as an expert on behalf of Nokia in the above-referenced IPRs.

6. I received my Bachelor of Science in Electrical Engineering from San Diego State University in 1981. In 1986, I received a Master of Science in Electrical Engineering from San Diego State University. In 1988, I received a Master of Arts in Electrical Engineering from Princeton University. In 1990, I received a Ph.D. in Electrical Engineering from Princeton University.

7. My graduate studies were concentrated in the area of image and video processing algorithms, with my doctoral dissertation detailing a method for displaying digital images on video display monitors with limited palette size, and advanced methods for video compression. During my graduate studies, I also

worked at AT&T Bell Laboratories in the Video Communications department. After I received my Ph.D. degree, I stayed on at AT&T Bell Laboratories as a consultant while I took a position as Assistant Professor in the Department of Electrical and Computer Engineering at the University of Illinois at Urbana-Champaign. During my time at the University of Illinois, I taught the fundamental undergraduate courses in digital signal processing and graduate courses in advanced digital signal processing and image processing. I continued my academic career as an Associate Professor at Princeton University where I continued to teach classes in digital signal processing and image processing. Since 2001, I have been a Professor in the Department of Electrical and Computer Engineering at Rice University. In this position, I teach undergraduate courses on the analysis and modeling of randomness in engineering design, and on the design of digital signal and image processing systems, as well as a lab course in electronic system design. I also teach graduate level courses in digital signal processing and digital image processing. The subject matter of these courses cover the application of image and signal processing in consumer devices, including multimedia compression for transmission over general communications channels and networks. My research continues to explore image and video compression algorithms and applications thereof, including advanced techniques of image and video compression for use in digital cameras, cellular telephones, and general computer platforms and networks.

8. I have consulted extensively in the fields of digital signal processing and image and video processing, including through consulting positions with AT&T Bell Laboratories (and later AT&T Laboratories), NEC Research Institute, Flextronics Corporation, Schlumberger, and Interdigital. These engagements have involved investigation, development and simulation of software algorithms for efficient representation of image and video data for transmission over a variety of communications channels and networks.

9. In the course of my academic and industrial career, I have published over 100 technical papers for journals and conferences on various aspects of my research, and I am named inventor on seven patents issued by the USPTO:

- U.S. Patent No. 5,047,842 – “Color image display with a limited palette size”
- U.S. Patent No. 6,556,624 – “Method and apparatus for accomplishing multiple description coding for video”
- U.S. Patent No. 6,628,845 – “Method for subpixel registration of images”
- U.S. Patent No. 6,823,018 – “Multiple description coding communication system”
- U.S. Patent No. 6,920,177 – “Method and apparatus for accomplishing multiple description coding for video”
- U.S. Patent No. 7,289,565 – “Multiple description coding communication system”

- U.S. Patent No. 8,594,205 – “Multiple description coding communication system”

10. I have served as an Associate Editor for the IEEE Transactions on Image Processing, and have been Co-General Chair of OSA’s Digital Image Processing and Analysis Conference, and Technical Program Chair for the IEEE International Conference on Image Processing.

11. My research expertise has focused on image and video processing with a concentration in image and video compression. I have supervised 12 Ph.D. students in these research topics, with three currently tenured at research universities. My students and I have made significant contributions to the development of digital signal processing software algorithms for compressing image and video data, enabling the widespread transmission of multimedia data over communications channels and networks. My research contributions in these areas led me to be named an IEEE Fellow in 2000, “for contributions to the theory and development of image and video compression algorithms.”

III. MATERIALS REVIEWED AND TIME OF INVENTION

12. The opinions contained in this Declaration are based on the documents that I have reviewed, including the Petition and all materials cited therein, my professional judgment, as well as my education, experience, and my knowledge regarding technologies related to the ’991 Patent. I have also reviewed and

considered Koga, Lin, and Narroschke which I understand have been designated Exhibits Ex-1004 – Ex-1006.

IV. LEGAL STANDARDS

A. Overview

13. I am not an attorney or a legal expert, and I do not opine on matters of law. All the legal standards, which are listed in this section and which I applied in reaching the conclusions expressed throughout this Declaration, were provided to me and explained to me by counsel. In preparing this Declaration, I have endeavored to faithfully apply these legal standards. I do not intend to offer opinions on the law. Below, I describe the legal standards that I applied in my analysis of the claims of the '991 Patent.

14. I have been informed by counsel that an issued patent is presumed valid and that the challenger of a patent's validity bears the burden of proving invalidity of the patent.

B. Patent Claims

15. I have been informed by counsel that a patent's claims describe the invention made by the inventors and describe what the patent owner owns and what the owner may prevent others from doing.

16. I have been informed by counsel that claims may describe products, such as machines or chemical compounds, or processes for making or using a product. Claims are usually divided into parts or steps called limitations.

17. I have been informed by counsel that there are two types of claims: independent claims and dependent claims. An independent claim sets forth all the requirements that must be met in order to be covered by that claim. Thus, it is not necessary to look at any other claim to determine what an independent claim covers. A dependent claim does not itself recite all of the requirements of the claim, but refers to another claim for some of its requirements. In this way, a dependent claim depends on another claim. The law considers a dependent claim to incorporate all of the requirements of the claims to which it refers.

18. I have been informed by counsel that a dependent claim then adds its own additional requirements. To determine what a dependent claim covers, it is necessary to look at both the dependent claim and any other claims to which it refers.

19. I have been informed by counsel that in a case where a dependent claim incorporates the limitations of an independent claim upon which it depends, if a reference fails to disclose any of the limitations of the independent claim, the claims which depend on that independent claim cannot be made invalid by such a reference. As a result, any of the references at issue in this proceeding that fail to disclose all

of the limitations of an independent claim necessarily also fail to disclose all of the limitations of claims which depend on that independent claim.

C. Burden of Proof for Invalidity

20. I have been informed by counsel and I understand that the party challenging the validity of an issued U.S. patent in an IPR bears the burden of proving invalidity through facts supported by a preponderance of the evidence. I have been informed that a “preponderance of the evidence” means evidence sufficient to prove that a fact is more likely true than it is not.

D. Claim Construction

21. I have been informed by counsel and I understand that the first step in determining validity is to properly construe the claims. I have further been informed by counsel that, in this proceeding, the Board must determine the scope of the claims by using the same claim construction standard that United States District Courts use. Under this standard, the words of a claim are given their “ordinary” and “customary” meaning as would have been understood by a person of ordinary skill in the art at the time of the invention. I have been informed that such a person looks to the claims, specification, and file history in understanding the meaning of the claim terms. I have applied this understanding in this declaration.

E. Person of Ordinary Skill in the Art

22. I have been informed by counsel and I understand that a person having ordinary skill in the art may be defined by factors such as, when considered at the

time of the alleged invention: (a) the levels of education and experience of the inventor and other persons actively involved in the field; (b) the types of problems encountered in the field; (c) prior art solutions to those problems; (d) rapidity with which innovations are made; and (e) the sophistication of the technology.

F. Anticipation

23. I have been informed by counsel and I understand that a patent claim can be found invalid as anticipated if each and every element of the claim, as properly construed, is found either explicitly or inherently in a single prior art reference. If the single prior art reference does not disclose explicitly or inherently any one claim limitation, then that claim is not anticipated. I have further been informed that the single prior art reference cannot merely disclose each element; rather, it must disclose all of the elements as arranged in the claim. I have been informed that for a prior art reference to “inherently” disclose something, the reference must necessarily function in accordance with, or include the claimed limitations, to anticipate. The missing descriptive matter cannot merely probably or possibly include the claimed limitations. I have further been informed by counsel that, with respect to an anticipation analysis, it is improper to combine separate, distinct embodiments of a single prior art reference.

24. I have been informed that for a reference to be anticipatory, the reference must contain an enabling disclosure. I have been informed that merely

naming or describing the subject matter is insufficient if it cannot be produced without undue experimentation.

G. Obviousness

25. I have been informed by counsel that a patent claim can be found invalid as obvious if the differences between the claim and the prior art references would have been obvious to a person of ordinary skill in the art at the time of the invention, taking into account (1) the scope and content of the prior art, (2) the differences between the prior art and the claims, (3) the level of ordinary skill in the art, and (4) any objective indicia of non-obviousness. I have further been informed by counsel that a claim can be found to be obvious in light of either a single prior art reference or multiple prior art references. I have been informed that references qualify as prior art for an obviousness determination only when they are analogous to the claimed invention. Two separate tests define the scope of analogous prior art: (1) whether the art is from the same field of endeavor, regardless of the problem addressed; and (2) if the reference is not within the field of the inventor's endeavor, whether the reference still is reasonably pertinent to the particular problem with which the inventor is involved.

26. I have been informed that to be obvious in light of a single prior art reference or multiple prior art references, there must be a reason either to modify the single prior art reference or to combine the two or more prior art references to

achieve the claimed invention. I have been informed by counsel that this reason may come from a teaching, suggestion, or motivation to combine which may come from the reference or references themselves, the knowledge or “common sense” of one skilled in the art, or from the nature of the problem to be solved, and may be explicit or implicit from the prior art as a whole.

27. I have been informed by counsel that the combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results.

28. I have further been informed by counsel that there is no suggestion to combine, however, if a reference teaches away from its combination with another source. A reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant, or if it suggests that the line of development flowing from the reference’s disclosure is unlikely to be productive of the result sought by the applicant. If, when combined, the references would produce a seemingly inoperative device, then they teach away from their combination. I have been informed that it is improper to combine references where the references teach away from their combination.

29. I have been informed by counsel that the degree of teaching away will depend on the particular facts; in general, a reference will teach away if it suggests that the line of development flowing from the reference's disclosure is unlikely to be productive of the result sought by the applicant. I have been informed that a reference teaches away, for example, if (1) the combination would produce a seemingly inoperative device, or (2) the references leave the impression that the product would not have the property sought by the applicant.

30. I have been informed by counsel that if the teachings of a prior art reference would lead one skilled in the art to make a modification that would render another prior art device inoperable, then such a modification would generally not be obvious. I have been informed that if a proposed modification would render the prior art device unsatisfactory for its intended purpose, then the proposed modification would generally not be obvious.

31. I have been informed by counsel that it is improper to use hindsight in making the obviousness determination.

32. I have been informed by counsel that some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness must be made. I have been informed that, for example, there may be no rational underpinning to support the legal conclusion of obviousness where systems are already complete

and the party challenging validity seeks to mix and match components, which each exist in the separate systems, from these complete systems.

V. PERSON OF ORDINARY SKILL IN THE ART (POSITA)

33. Based on my review of the '991 Patent, the types of problems encountered in the art at and prior to the time of the alleged invention, prior solutions to those problems, the pace with which innovations were made during the relevant time period, the sophistication of the technology, and the educational level of active professionals in the field, I believe that a person of ordinary skill in the art, at the time of the invention, would have had at least a Bachelor's degree in electrical engineering, computer science, or computer engineering; familiarity with the relevant video coding standards as of this time; and at least two years of work experience in research, design, development, and/or testing of video coding hardware and/or software. More education could have substituted for less work experience and vice versa.

34. All of my opinions in this Declaration are from the perspective of a person of ordinary skill in the art, as I have defined it above and during the relevant time frame (e.g., 2007). During that time frame, I possessed at least the qualifications of a POSITA, as defined above.

VI. CLAIM CONSTRUCTION

35. I understand that claim terms are typically given their ordinary and customary meaning, as would have been understood by a person of ordinary skill in the art at the time of the alleged invention. In considering the meaning of the claims, I also understand that one must consider the claim language, specification, prosecution history, and the knowledge of a person of ordinary skill in the art at the relevant time.

VII. BACKGROUND OF THE RELEVANT TECHNOLOGY

36. Motion-compensated hybrid coding (MCHC) has been the general approach used for developing video coding standards for over 3 decades now. Widely used standards such as MPEG-1, MPEG-2, MPEG-4/AVC, H.263, and H.264 all reflect this approach to video coding, and differ from each other in the specific form of the main components of MCHC: intra-prediction, motion-compensated inter-prediction, transform coding, quantization, and entropy coding.

37. The declaration of Creusere (Ex-1003) gives a generic description of these main components of MCHC video coding algorithms in paragraphs 3-15 and 18-23, thus providing a reasonable background to an understanding of the state of video coding standards at the time of the '991 patent. However, the issues in this case involve prior art identified by petitioners that originated more than two decades prior to the '991 patent. Understanding discussions and disclosures of that prior art,

and the relationship of those disclosures to the contributions of the '991 patent, requires historical background missing from Creusere's declaration, without which a reader is likely to mischaracterize the nature of the prior art material.

A. Video Coding Historical Background

38. As a part of the early stages of the development of H.264, Cliff Reader assembled a history (JVT-D068 and JVT-E066) of the development of video coding standards, which provides the most detailed coverage of the period of the Koga patent that I know of. Ex-2003; Ex-2004. The Reader history acknowledges the help of 10 reviewers "... who have provided information, insight and correction of the text", and includes a list of 10 active participants in this history, most of whom were involved in the development of video coding standards much later than 1985. Ex-2004 p. 1. However, the list includes Toshio Koga, the inventor on the Koga patent, and Sakai Okubo the chairman of the H.261 standard development effort, and a POSITA would understand the Reader history for the period of the mid-1980's, and in particular the contributions of Dr. Koga during the very early stages of H.261 standard development, to be reliable.

39. Throughout the period from 1981 to 1985, the NEC group led by Dr. Koga developed and published about various types of video coding algorithms that were based on motion compensated prediction with spatial coding (and no transform coding) of the prediction error. EX-2003, p. 38. While Dr. Koga would certainly

have been aware of parallel work by other groups (e.g. Jain and Jain, EX-2003, p. 40) using transform coding of the prediction error until 1985, Dr. Koga's group was committed to approaches that did not use transforms. In fact, in Nov. 1984, in response to the very first call for contributions to kick off the H.261 development effort, Dr. Koga's NEC group proposed a block-based motion compensation prediction approach that coded prediction errors without transforms. Ex-2003, p. 41. It is worth noting that Koga's '161 patent claims a priority date of March, 1985, only 4 months after the submission of the NEC proposal to H.261.

40. At least by 1985, Dr. Koga's group was forced to recognize the benefits of the transform-based MCHC approach. Besides the '161 "Koga" patent which involves transform coding of motion-compensated prediction errors, Dr. Koga's group published a Dec. 1985 conference paper comparing the MCHC transform-based approach with motion-compensation applying purely spatial coding of the prediction error. By early 1987, Dr. Koga's journal publication with Mutsumi Ohta (Ex-2005) proposed only MCHC transform-based coding approaches, and to my knowledge, all later work of Dr. Koga exclusively proposed MCHC transform-based approaches.

41. Thus, Koga's '161 patent from March, 1985 originated during a short period of time when Dr. Koga was seeking acceptance of an approach that found some use for his and his group's prior contributions to the field while recognizing

that the MCHC transform-based approach was proving to be superior. Consistent with this historical background, the Koga '161 patent proposes combining three types of motion-compensated prediction coding, the first two which were already well known, and a third that is the contribution of the '161 patent. For the first type: Koga teaches that "... if the image to be encoded moves very rapidly, then the orthogonal transformation is useful for effective data compression as well as high quality of resulting images." Ex-1004, 3:55-58. For the second type: Koga teaches that when "... the moving speed is in a range during which the motion compensation is effectively carried out ... the application of orthogonal transformation ... should not be utilized." Ex-1004, 3:39-55.

42. Unlike the first two types of motion-compensated prediction coding, Koga does not suggest that its proposed third type is intended to be efficient under any conditions. Instead, the third type is proposed to address a problem associated with switching between the first two: "... the picture image quality changes abruptly upon changing to a mode wherein orthogonal transformation is not used, and vice versa." Ex-1004, 3:59-64. The third type of prediction coding disclosed in Koga's '161 patent involves using both a transformed and a non-transformed form of the prediction error, and gradually adjust how much of each to use as a way of gracefully transitioning from one to the other. Instead of asserting any efficiency benefits to this combined approach, Koga claims: "... the resulting picture images having

intermediate range of moving speeds have picture quality which changes continuously or smoothly.” Ex-1004, 4:11-20.

43. While the detailed timeline provided by the Reader history of video coding provides historical perspective for understanding both the problem addressed and solution proposed by Koga, it is important to note that the Reader history makes no mention of the technical contribution of the ‘161 patent, or of any research at that time considering either switching or transitioning between coding of prediction error with and without transforms. (Ex-2003). Koga himself never included the technical content of the ‘161 patent in any of his academic publications, and I could find no references to this content in any of his later publications.

44. In my opinion, it is misleading to suggest that a POSITA at the time of the ‘991 patent would have believed the Koga ‘161 patent to have any relevance to the state of video coding at that time, or would have considered using teachings of Koga as a basis for improving video coding techniques. The context of the problem addressed by Koga was no longer relevant in 2007. The solution proposed by Koga was understood to offer no coding efficiency benefits in 1985 (Koga asserted no such efficiencies), and would have been even more unacceptable compared with the significantly higher efficiencies of 2007 video coders. I am not aware of any references to Koga ‘161 in any contributions to any video coding standard development efforts after at least as early as MPEG-1 development.

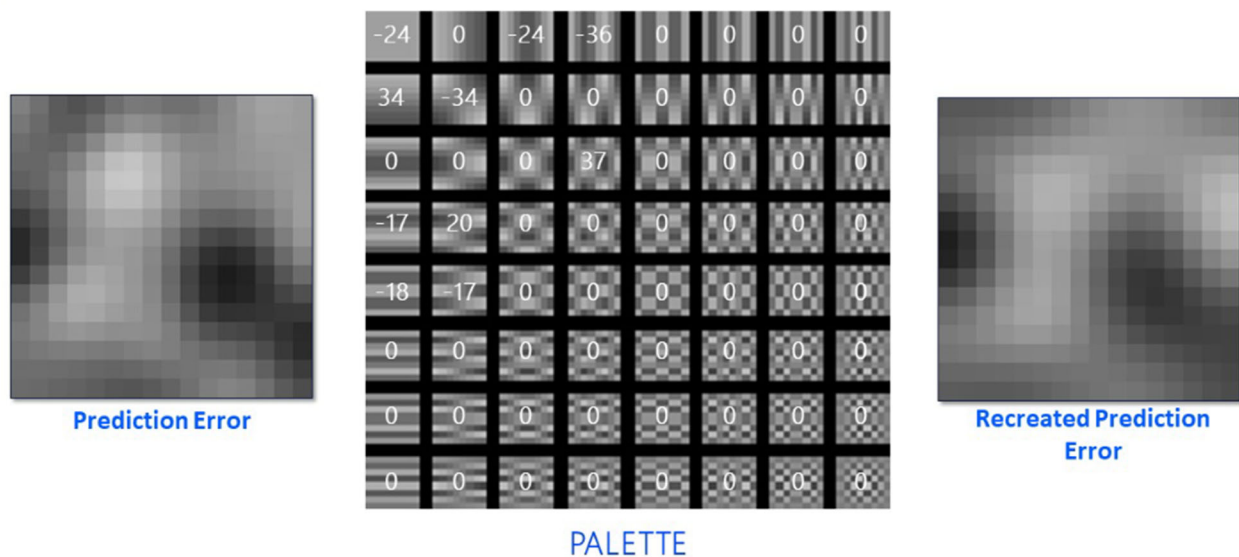
B. Contrasting Contributions of ‘991 and Koga ‘161

45. The disclosures of the ‘991 patent aim to improve the efficiency of prior-art transform-based approaches to prediction error coding through coordinated use of both transform coefficients and a small number of “spatial samples” representing “outlier” values that would otherwise degrade the efficiency of transform coding. The teachings of the ‘991 are based on using transform-information and spatial-information to each represent that which it represents most efficiently. In contrast, Koga combines transform-information and spatial-information for the sole purpose of allowing the graceful transition between an entirely transform-based and an entirely spatial-based coding of prediction error. Because these two objectives are different, it is not surprising that the teachings themselves should be different.

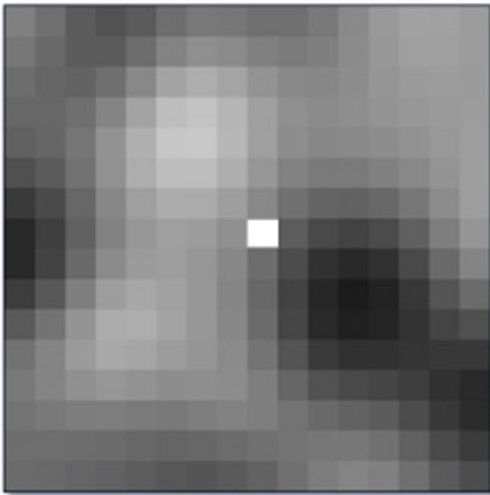
46. The ‘991 patent teaches to improve the efficiency of transform coding of prediction errors by removing outlier spatial samples that degrade transform coding efficiency and code them spatially. Transform coding is a process of calculating an array of transform coefficients that represent weighting values for various basis functions. Transform coding can be used to represent every values in a block, provided enough transform coefficients are coded. Transform coefficients are assigned to basis functions as depicted below:



47. The figure above depicts an 8x8 block of transform coefficients. Each block represents a unique basis function and the numbers placed in each block represent the transform coefficients. When the basis functions are weighted by each transform coefficient, an output block is generated that closely resembles the input block. Transform coding, as in the example above, can code an entire 8x8 block using only a handful of transform coefficients. This is also demonstrated in the figures below, which include an original block on the left, the transform coefficients for said block, and the recreation of the block on the right. It should be noted that the recreation block is not completely identical to the input block because not all transform coefficients were used.



48. While transform coding can provide close approximations, its efficiencies break down when there are outlier values in the block to be coded. This is because outlier values require additional detail and must be represented using far more transform coefficients. As an example, the block below has a single pixel in the center that is white while the other pixels are various darker shades. This white pixel would require either additional transform coefficients, or it would be cut from the recreated image. This results in a trade-off of image quality or compression efficiency.



Prediction Error

49. The inventor of the '991 Patent was aware of this issue and conceived of a new means for encoding outlier values. This method included identifying outlier values and spatially coding them in addition to transform coding the non-outlier values.

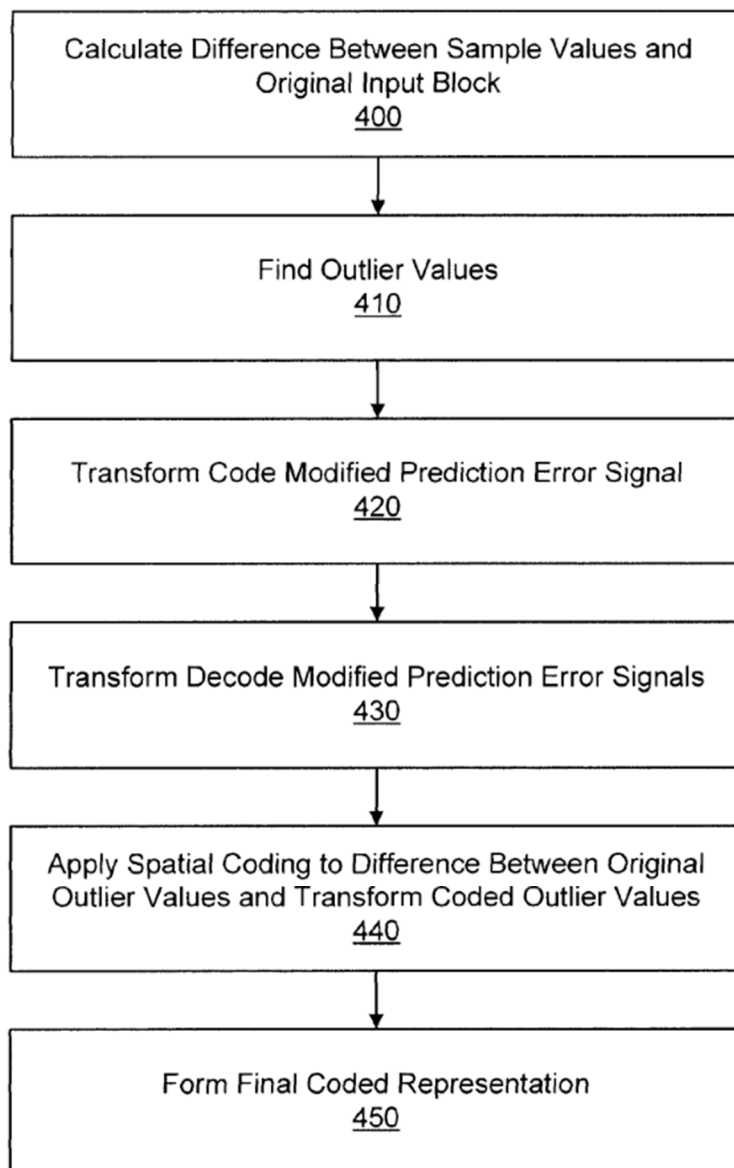
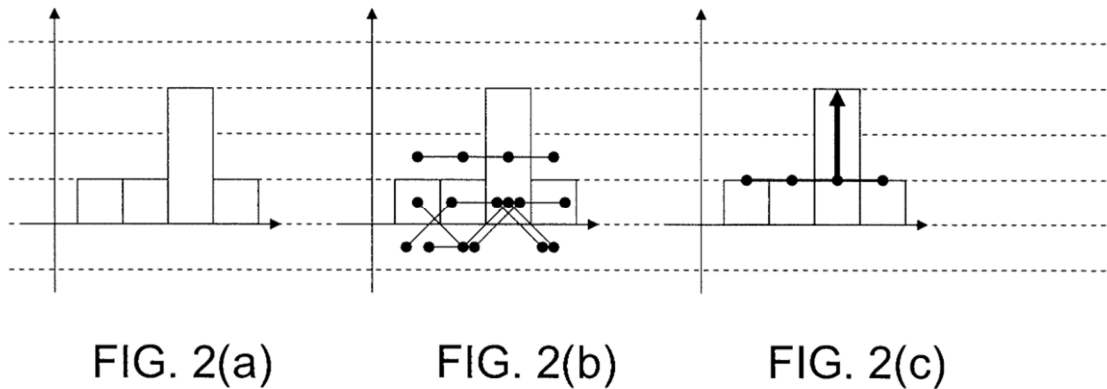


FIG. 4

50. The '991 Patent's coded prediction error signal combines the efficiency benefits of transform coding with the quality benefits of spatial coding. The '991 Patent demonstrates this benefit in Figure 2 of the '991 Patent. Figure 2(b) shows transform coding alone requires the use of four transform coefficient values, while

Figure 2(c) shows that a combination of spatial coding and transform coding requires only one of each.



51. The '991 Patent focuses on the benefits of spatially coding these outlier values throughout the abstract and specification:

In various embodiments, the effects of pixel “outliers” are removed from the transform and are coded separately as a spatially coded pixel prediction, thereby improving the coding gain of the transform.

Ex-1001 at abstract.

52. Further in the specification, the '991 Patent describes Figure 2 as creating a benefit of representing the “difference signal [1 1 3 1] to be coded” where “[3] is an outlier.” Ex-1001 at 5:51-65. And the “difference between the original outlier samples ([3]) and the transform coded outlier value ([1]) is then spatial coded.” *Id.*

53. Unlike most of the “Overview of the Technology” paragraphs of Creusere’s declarations that describe, reasonably accurately, components of typical video coders, paragraphs 16 and 17 offer opinions that appear to attempt to translate the content of the Koga and Narroschke patents to reflect some relationship to the teachings of the ‘991 patent. These paragraphs allege to cover general understanding of how the presence of a small number of large-valued spatial samples seriously degrades the performance of DCT coding. However, most of the language in these two paragraphs appear to be drawn directly from descriptions in the ‘991 patent: e.g. “outliers”, and “... the prediction error signal ... is constructed using both transform basis functions and spatial samples (i.e. pixel values), thereby combining the desired features of both ... discussed previously.” [‘991: 2:65-3:2]

54. In contrast, the citations from Koga and Narroschke provided by Creusere (Ex-1006, p.0002-0005 and Ex-1004, 2:3-37) provide remarkable little support for any of his discussion. Narroschke provides absolutely no mention of “outliers”, “few spatial samples”, “small number of non-zero samples”, or any related phrases, and only one phrase in Koga can possibly be interpreted to be related to Creusere’s discussion: “... in the case of which the prediction errors occur isolately near the boundaries of a moving object.” [Ex-1004, 2:32-33]. However, this reference to isolated prediction errors is included in Koga’s description of the prior art and is unrelated to any description of the invention of Koga. As discussed

in paragraph 41 of this declaration, Koga describes the use of three different modes of operation: transform coding of prediction error, spatial coding of prediction error, and combination of transform and spatial coding of prediction error. As noted earlier, the first two modes of operation were prior art to the disclosures of Koga, and not part of the contributions of Koga. The only phrase from Koga bearing slight resemblance to Creusere's discussion of his paragraphs 16 and 17 comes from the "Background Of The Invention" section of the Koga specification, and is used in the description of the benefits of the prior art mode of operation: spatial coding of prediction error. No related language about "outliers" or "large spatial values" or "small number of non-zero samples" can be found anywhere in the actual description of the Koga invention, either in describing or motivating particular features of the invention.

55. In my opinion, Creusere's paragraphs 16 & 17 do not accurately present an overview of background technology to the '991 patent (and even less so for the Koga and Narroschke patents) but instead summarize content of the '991 patent itself, and, without any support, incorrectly suggest some vague relationship between the '991 patent and the Koga and Narroschke prior art.

56. In simplified terms, Creusere's paragraphs 16 & 17 suggest that it was well known that transform coding works well when no outliers are found in its input and does not work well when outliers are found in its input. As noted above, the

Koga invention appears to have no relationship to, nor to be motivated by, this fact, even if it were known to Koga. However, perhaps even more significantly, a POSITA with an understanding of how the performance of transform coding is degraded by outliers, and with an understanding of the Koga invention, would understand that the Koga invention does *exactly the opposite* of what might be expected to address the problem of outliers, and, if anything, makes the degradation of transform coding by outliers even worse. I.e., the Koga patent would be understood to be exactly the opposite of the '991 patent in terms of offering a means for improving transform coding efficiency in face of outliers.

57. A POSITA would understand that the Koga proposal *always* applies a transform to the block of prediction error signal that is being processed, whether that block does, or does not, include a small number of large values (“outliers”). The transform of that block is the only transform that is ever applied in Koga’s proposed system, and thus it suffers from all the inefficiencies identified in the ‘991 patent (as well as in Creusere’s paragraphs 16 & 17). The transform of a few large outlier values produces a large number of transform coefficients, and how Koga treats these coefficients depends on what quantization characteristics it uses. Examining the two extremes indicates that neither offers a solution for improved efficiency. If high-precision quantization (small quantization step-size) is used on the transform coefficients, most of the coefficients are coded, and the outlier values are effectively

being represented by transform coding which does nothing to solve the problem that was supposed to be addressed. If low-precision quantization (large quantization step-size) is used on the transform coefficients, a few of the largest outlier coefficients are retained and the smaller coefficients are set to zero, including those coefficients that represent the non-outlier content of the block. Since Koga applies spatial coding to that part of the prediction error that is not represented by the transform coefficients, this means that the non-outlier content of the block will be spatially coded, as well as the inverse transform of some coefficients of the outlier values, which will no longer be isolated to a few spatial samples. But recalling that non-outlier block content is much more efficiently represented as transform information rather than as spatial samples, a POSITA would understand that the Koga invention offers a combination of the worse modes of coding prediction errors: transform coding a significant part of the large-valued outliers, and spatial coding a significant part of the non-outlier content of the block.

58. It is important to highlight that this discussion is not intended as an indictment of the Koga patent, since Koga never suggested that improving transform coding efficiency in the presence of outlier values is the problem being addressed by the proposed invention. Instead, Koga proposes an invention to support gracefully transitioning between transform coding and spatial coding of prediction errors, with no concern for coding efficiency during the period of transition. Since the need for

transitioning between transform and spatial coding of prediction errors was no longer relevant to video coding at the time of the '991 patent, Koga is not relevant prior art to the '991 patent. Reinterpreting the Koga invention as a proposal to improve coding efficiency in the presence of outliers i) is not supported by the teachings of Koga itself, ii) is inconsistent with the stated purpose of the Koga invention, and iii) is inconsistent with what a POSITA would understand to result from actually applying Koga to prediction errors that include outliers.

59. Not surprisingly, because Koga was not conceived with the idea of using spatial samples as a means of efficiently representing outliers that were inefficient to express as transform information, Koga does not teach any type of decoding of spatial samples into spatial information. Thus, despite superficial similarities of some features of the two disclosures, the contrasting objectives of the '991 and Koga contributions lead to significant differences in teachings of the two inventions. Consequently, it is to be expected that there are important elements of the claims of the '991 patent that are not practiced by Koga. Instead of considering contrived suggestions about why it might be obvious to practice modified variations of Koga in order to come closer to matching the teachings of the '991, it should be apparent that Koga lacks the missing elements because it is a different invention with different objectives than the '991 patent.

VIII. Claim Construction

60. I understand that claim terms are typically given their ordinary and customary meaning, as would have been understood by a person of ordinary skill in the art at the time of the alleged invention. In considering the meaning of the claims, I also understand that one must consider the claim language, specification, prosecution history, and the knowledge of a person of ordinary skill in the art at the relevant time.

A. “spatial samples”

61. I understand that the parties agreed to construe the term “spatial samples” as “pixel values” in the co-pending International Trade Commission Investigation 337-TA-1380. I agree with this construction and apply it throughout my analysis.

B. “spatial coding”

62. I understand that Patent Owner does not contest Petitioner’s construction for the sake of this POPR. Petitioner’s opinion does not impact my opinion of validity.

C. “difference signal” (Claims 1 and 39)

63. In my opinion, the term “difference signal,” as it appears in Claims 1 and 39, needs no construction. A POSITA would readily understand from the claim language that the claimed “difference signal” is a signal which “represents differences between sample values of a predicted block of data and values for an

original input block.” Ex-1001 Claim 1. If a construction is deemed necessary, the most accurate construction would be “a signal which represents differences between sample values of a predicted block of data and values for an original input block.”

64. In my opinion, Petitioner’s construction of “prediction error signal” provides no additional clarity to the meaning of the disputed term. Petitioner’s construction vaguely applies the broad concept of a prediction error signal without any further explanation of what the claimed prediction error signal consists of. Additionally, a coded prediction error signal is the output of the processes performed on the difference signal in the claims. *See e.g.*, Ex-1001 at Claim 1 (“joining, by a processor, the first and second representations to form a coded prediction error signal”).

65. I disagree with Petitioner that the claimed “difference signal” is synonymous with the prior art concept of a prediction error signal. To begin, the description of a prior art prediction error signal in the specification is not identical to the description of the difference signal in claim 1. Petitioner’s construction invites dispute over what exactly the definition of the prior art prediction error signal consists of. Additionally, Petitioner’s construction invites all pre-conceived notions about a prediction error signal that a POSITA may understand from the prior art. I believe that the inventor of the ’991 Patent was familiar with the concept of a

prediction error signal and explicitly chose to claim the term “difference signal” instead.

66. I also disagree with Petitioner’s arguments regarding Claims 2 and 14. Petitioner basis its argument on the claim language that describes “substituting outlier values in the difference signal with non-outlier values to create a modified prediction error signal.” Petitioner argues that the fact that the modification of the difference signal results in a modified prediction error signal supports Petitioner’s opinion that the terms “prediction error signal” and “difference signal” are synonymous. However, Petitioner ignores basic arithmetic in this argument. As an example, if you have an equation $x+y=z$ and then modify the variable x , the output of z will also be modified. This does not prove that x and z are equal, but rather that z depends on x . This same concept applies to the derivation of the coded prediction error signal.

67. While I disagree with Petitioner’s construction of the term “difference signal,” the differences in proposed constructions do not change my opinion on validity.

D. “the difference signal” (Claims 13 and 14)

68. I understand that Patent Owner is not contesting Petitioner’s proposed construction for the sake of the preliminary response. As such, I offer no opinion on the construction of this term.

E. “outlier values”

69. In my opinion, no construction is necessary for the term “outlier values.” A POSITA would be familiar with the concept of outlier values in video coding and would also understand that thresholds for determining said outliers can vary depending on the goal of the encoder. The ’991 Patent makes this clear as well, stating that “smaller amplitude representations qualify as outliers if one is targeting high bitrate good quality representation, and only high amplitude representations qualify if one is targeting a lower bitrate, lower quality representation.” Ex-1001 at 5:32-37. The concept of providing different encoding techniques for different purposes is well known in video coding. For example, if a video is being encoding to be used in a high-quality streaming service, the encoder will likely focus on providing a good quality image with a reasonable bandwidth and not care about increasing computational complexity. On the other hand, a home security camera will likely focus on computational efficiency as the quality of the image is a lower priority.

70. Petitioner’s construction creates a requirement for “significant” variation in pixel values, but a POSITA would understand that the determination of outlier values is case specific in video coding. Although I disagree with Petitioner’s proposed construction, it does not change my opinion regarding validity.

F. Second Recitations of “a first component”

71. I understand that Patent Owner accepts Petitioner’s construction for the second recitations of “a first component.” I do not disagree with the parties.

G. “the non-outlier values used to replace the outlier values” (Claim 19)

72. I understand that Patent Owner accepts Petitioner’s construction for the non-outlier values used to replace the outlier values.” I do not disagree with the parties.

IX. THE GROUNDS IN THE PETITION DO NOT ANTICIPATE OR RENDER OBVIOUS THE CHALLENGED CLAIMS

73. In my opinion, Petitioner has failed to show that the Challenged Claims are obvious in light of any cited prior art. As the independent claims are all valid, the dependent claims are also valid and will not be discussed in detail in this declaration.

A. Petitioner’s Grounds 1 and 2

74. In my opinion, Petitioner has failed to show that Claim 1 is obvious in light of Koga. Petitioner offers no additional argument regarding Claim 13, other than the combination of Lin to show disclosure of the apparatus limitations. As this additional argument does not cure the defects of Petitioner’s argument regarding Claim 1, I do not believe that Petitioner demonstrated that Claim 13 is obvious. I also disagree with Petitioner’s argument regarding any motivation to combine Koga

and Lin. As such, it is my opinion that a POSITA would not have been motivated to combine the two to arrive at Claim 39.

1. Koga alone does not render obvious Claim 1

75. I disagree with Petitioner's explanation of how Koga maps on to Claim 1. As an initial matter, Petitioner is inconsistent with its treatment of the signals within Koga's described encoder. Petitioner refers to multiple distinct signals to satisfy the limitation of "a difference signal." Petitioner also refers to a single signal as (1) a difference signal, (2) spatial samples, and (3) in, Petition 00920, spatial information. It cannot be that one signal satisfies these three distinct concepts.

2. Koga background

3. Claim 1[a] calculating, by a processor, a difference signal representing differences between sample values of a predicted block of data and values for an original input block;

76. Petitioner's first identification of the claimed "difference signal" in Koga is the signal calculated at subtracter 12 in Koga's model encoder. Pet. 31. In viewing Koga, subtracter 12 "determines the difference between the two signals applied thereto, and outputs prediction error signals which are applied to the delay circuit 16." Ex-1004 at 4:57-61. The two input signals to subtracter 12 are a predicted block of data and the original input block, as such, I don't disagree that subtracter 12 produces a signal that represents differences between sample values of a predicted block of data and values for an original input block. However, in Claim 1, this same

difference signal must undergo transform coding and spatial coding to form representations of the difference signal that are ultimately combined to form a coded prediction error signal. In my opinion, Petitioner has failed to show that this same signal is subjected to both transform and spatial coding. To illustrate this, I have provided Petitioner's annotated Figure 3 below with an additional green highlighting that shows the entire path of this signal produced from subtracter 12.

Pet. 34 (Citing Ex-1004 Fig. 3 (further annotated)).

4. Claim 1[b] performing, by a processor, transform coding to the difference signal, thereby creating a first representation of a first component of the difference signal;

78. Following Petitioner's argument, the difference signal identified as the output of subtracter 12 is fed into an inverse orthogonal transform. Petitioner refers to the output of this orthogonal transform as "a first representation of a first component of the difference signal." Pet. 37-38. I do not disagree that the signal from subtracter 12 is transform coded at the orthogonal transformer. However, after the orthogonal transformer, the signal then proceeds through quantizer 14. Quantization is a lossy process, meaning that some information in the transformed signal is lost. This means that when the signal then proceeds through inverse orthogonal transformer 15, the output signal is distinct from the input signal to the orthogonal transformer 13. This new signal is then sent to subtracter 19 where it is subtracted from the output signal of subtracter 12. This leads to a key departure of Koga from Claim 1.

5. Claim 1[c] performing, by a processor, spatial coding to the difference signal, thereby creating a second representation of a first component of the difference signal;

79. In my opinion, Petitioner attempts to mix and match signals found in Koga's model encoder to satisfy this limitation. Petitioner claims that the output of subtracter 19, which Petitioner also refers to as "spatial samples," is spatially coded. Following Petitioner's argument, while the output of subtracter 19 may be spatially

coded, it is not the claimed difference signal. Instead, the signal that Petitioner argues is the difference signal is fed into subtracter 19 and the result of the inverse orthogonal transform to the signal that Petitioner associates with the “first representation” is subtracted from the difference signal. This creates an entirely new signal which, using Petitioner’s characterizations, represents the difference between the claimed difference signal and the claimed first representation of the difference signal.

80. Petitioner’s argument regarding Claim 1[c] disregards the claim language and required antecedent basis in order to mold Koga into the claims of the ’991 Patent. However, tracing the distinct signals disclosed in Koga demonstrates an entirely different process where a residual of the difference signal is spatially coded. This type of recursive coding creates increased complexity on the encoding side and requires additional bandwidth to spatially code a signal for an entire block. The ’991 Patent is focused on increasing efficiency and avoids this unnecessary step that leads to no benefit.

B. Ground 2: Koga and Lin

6. Claims 1, 13, and dependent claims

81. Petitioner’s reliance on Lin to satisfy the apparatus and “computing environment” limitations of Claims 1 and 13 does not remedy the mischaracterizations present in Petitioner’s argument regarding Koga alone. As

such, it is my opinion that a combination of Koga and Lin does not render obvious Claims 1 and 13, nor any claims depending from the two.

7. Claim 39

82. In my opinion, Petitioner has failed to show that a POSITA would have any motivation to combine Koga and Lin to arrive at Claim 39 of the '991 Patent. Petitioner's arguments amount to overgeneralizing the field of video coding to the point of essentially saying that every video coding reference is obvious to combine with any other reference.

83. To begin, Petitioner argues that Lin suggests combining its teachings with other video coding methods. Petitioner points to what amounts to boilerplate language describing implementation in generic video coding systems. Petitioner's reliance on Koga being a hybrid-video codec is likewise generic and un-instructive. Virtually every major video codec is a hybrid-video codec that utilizes both spatial and temporal coding in one manner or another. Typically this is achieved through the use of spatial coding for intra-frame prediction and temporal coding for inter-frame prediction. Petitioner points to nothing unique about either reference that would motivate a POSITA to combine the two.

84. I also disagree with Petitioner's argument that a POSITA would have been motivated to combine Lin with Koga to improve Koga's efficiency because they share a similar purpose and architecture. To begin, Koga and Lin do not share

a similar purpose. As I have already explained, Koga was not seeking to improve the coding efficiency of any video coding techniques at its time. It was merely proposing a means to allow for encoders to use either spatial or transform coding for a prediction error signal while maintaining adequate picture quality in transitional scenarios. Ex-1004 at 3:59-66. Koga solves a problem that never existed in major video codecs because major codecs traditionally coded prediction error solely in the transform domain. Lin is directed to an adaptive coding model that may apply a median filter to the prediction error signal prior to transform coding to improve the efficiency of the transform. Ex-1005 at [0031]. Lin does not suggest spatially coding the prediction error, nor any way to provide information representing the values lost through the filtering process. Lin disregards the outlier information, creating a loss in picture quality but reducing the necessary bitstream size.

85. Additionally, an application of Lin's median filter to Koga would render useless Koga's method of coding the prediction error signal entirely in the spatial domain. A POSITA would understand that Koga's solution to signals that aren't well suited for transform coding is to rely only on spatial coding. This is what facilitated the need for Koga's interim method that combines spatial and transform coding. Without the need for spatial only coding, the inventions described in Koga do not fit within a video coding system. A POSITA would have understood this and would have no inclination to combine the two references.

C. Ground 3 and 4: Koga, Lin, and Narroschke

86. Petitioner's Grounds 3 and 4 are only directed to dependent claims. As the independent claims of the '991 Patent are not obvious in light of any previous Grounds, the dependent claims are not rendered obvious either.

Dated: November 27, 2024

A handwritten signature in cursive script, reading "M. C. Orchard", written in black ink on a white background.

Dr. Michael Orchard