

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

TVISION INSIGHTS, INC.,

Petitioner,

v.

THE NIELSEN COMPANY (US), LLC,

Patent Owner.

IPR2023-01014

U.S. Patent No. 11,470,243

**PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 11,470,243**

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EXHIBIT LIST

Exhibit No.	Description
1001	U.S. Patent No. 11,470,243 (“the ’243 Patent”)
1002	Prosecution History for the ’243 Patent
1003	Declaration of Dr. David Scott Doermann
1004	U.S. Patent Application Publication No. 2002/0059577 (“Lu-577”)
1005	Ying-li Tian, <i>Evaluation of Face Resolution for Expression Analysis</i> , 2004 Conference on Computer Vision and Pattern Recognition Workshop, Washington, DC, USA, 2004, pp. 82-82, doi: 10.1109/CVPR.2004.334 (“Tian”)
1006	U.S. Patent Application Publication No. 2010/0274372 (“Nielsen-372”)
1007	U.S. Patent Application Publication No. 2010/0066822 (“Steinberg”)
1008	U.S. Patent No. 4,858,000 (“Lu-000”)
1009	U.S. Patent No. 4,677,466 (“Lert”)
1010	U.S. Patent Application Publication No. 2011/0081052
1011	Brent Merritt, <i>A Brief History of Media Measurement</i> , Media, available at https://medium.com/@brentmerritt/a-brief-history-of-media-measurement-flf28aa807ce
1012	U.S. Patent Application Publication No. 2011/0265110
1013	Bernhard Fröba and Christian Küblbeck, <i>Robust Face Detection At Video Frame Rate Base on Edge Orientation Features</i> , International Conference on Audio- and Video-Based Biometric Person Authentication (2001)
1014	U.S. Patent No. 7,315,631
1015	European Patent Application No. 0932114
1016	Erik Larson, <i>Watching American Watch TV</i> , The Atlantic Monthly (1992)
1017	U.S. Patent No. 6,173,074
1018	U.S. Patent No. 7,359,889
1019	Cha Zhang and Zhengyou Zhang, <i>A Survey of Recent Advances in Face Detection</i> , MSR-TR-2010-66, available at https://www.microsoft.com/en-us/research/publication/a-survey-of-recent-advances-in-face-detection/
1020	E. Murphy-Chutorian and M. M. Trivedi, <i>Head Pose Estimation in Computer Vision: A Survey</i> , in IEEE Transactions on Pattern

Exhibit No.	Description
	Analysis and Machine Intelligence, vol. 31, no. 4, pp. 607-626, April 2009, doi: 10.1109/TPAMI.2008.106
1021	W. Zhao, R. Chellappa, P. J. Phillips, and A. Rosenfeld, <i>Face recognition: A literature survey</i> , ACM Comput. Surv. 35, 4 (December 2003), 399–458
1022	G. Shakhnarovich, L. Lee and T. Darrell, <i>Integrated face and gait recognition from multiple views</i> , Proceedings of the 2001 IEEE Computer Society Conference on Computer Vision and Pattern Recognition. CVPR 2001, Kauai, HI, USA, 2001, pp. I-I, doi: 10.1109/CVPR.2001.990508
1023	Qaim Rizvi, <i>A Review on Face Detection Methods</i> , Journal of Management Development and Information Technology (2011)
1024	Duane M. Blackburn, Mike Bone, P. Jonathon Phillips, <i>Facial Recognition Vendor Test 2000</i> , Evaluation Report
1025	Vidit Jain and Erik Learned-Miller, <i>FDDB: A Benchmark for Face Detection in Unconstrained Settings</i> (2010)
1026	Avery Wang, <i>The Shazam Music Recognition Service</i> , Commun. ACM 49 (2006)
1027	J. Wang, C. Zhang, and H. Shum, <i>Face Image Resolution versus Face Recognition Performance Based on Two Global Methods</i> (2004)
1028	Declaration of Gordon MacPherson for Tian

I. BACKGROUND

A. Television Audience Measurement

Automated systems to provide television audience measurement services were well-known before 2011 and typically included obtaining information about a presented television program (e.g., identity of the program) and its audience (e.g., identities of individuals in the audience). Ex-1003, ¶6; Ex-1011; Ex-1016; Ex-1004; Ex-1006. In fact, PO or its affiliate has developed automated systems for television audience identification at least by 1992 and obtained patent rights for systems that monitor television programs and the audience based audio and video data well before the '243 patent. Ex-1016, 000003, 000009-10; Ex-1004, Abstract; Ex-1006, ¶0036, FIG. 1; Ex-1003, ¶¶7-8. All of the technology enablers for automated television audience measurement were all widely available before 2011. Ex-1003, ¶9.

B. Audio Content Recognition

Audio content recognition based on acoustic features and fingerprinting technology were available since at least the early 2000s. *See, e.g.*, Ex-1017, Abstract; Ex-1018, Abstract; Ex-1026, 000003-04; Ex-1003, ¶10. Audio content recognition was applied in audience measurement systems. Ex-1004, Abstract; Ex-1006, Abstract; Ex-1003, ¶11.

C. Image Processing and Facial Analysis

By 2011, facial analysis techniques (e.g., face detection, face or head pose estimation, and face recognition) were widely available and applied to real-world problems. Ex-1019, 000002; Ex-1020, 000003; Ex-1021, 000002-03; Ex-1023; Ex-1024; Ex-1025; Ex-1003, ¶¶12-13. One well-known method to save computation resources in facial analysis was to process lower-resolution images. Certain facial analysis methods (e.g., face detection) tolerate low-resolution images better than others (e.g., face recognition). Ex-1005, 000005; Ex-1027, 000005, FIG. 7; Ex-1003, ¶14. By 2011, techniques (e.g., subsampling, interpolation) for obtaining reduced-resolution images were widely known. Ex-1003, ¶15.

II. THE '243 PATENT

A. Overview

The '243 patent relates to “[m]ethods and apparatus to obtain exposure data for media exposure environment(s)[,]” which “determine[s] audience identification information and content identifying data.” Ex-1001, Abstract, 2:25-56; Ex-1003, ¶16. The '243 patent does not purport to invent media content identification or audience recognition (e.g., based on facial recognition), explaining in its “Background” section that these functionalities were known in the prior art. Ex-1001, 1:43-2:3; Ex-1003, ¶17.

The '243 patent purports to address disadvantages of frequently using illumination by selectively activating an illumination source and processing images

taken without illumination to enhance the lighting while reducing the resolution and analyzing them for certain purposes. Ex-1001, 2:42-4:4; Ex-1003, ¶¶18-19. None of the challenged claims include any limitation directed to the purported new approach of illumination. Ex-1001, 15:13-17:61; Ex-1003, ¶20.

B. Prosecution History

The '243 patent was allowed as originally filed. In the Notice of Allowance, the Examiner referred to U.S. Patent Application Publication No. 2011/0164188 (“Karaoguz”) as relevant art and distinguished the claims from its teachings. Ex-1002, 000293-94; Ex-1003, ¶21.

C. Priority Date

The '243 patent cites a continuation chain to December 15, 2011. All relied-upon art predates December, 2011. Ex-1003, ¶22.

III. IDENTIFICATION OF CHALLENGE

A. Statutory Grounds

Petitioner requests *inter partes* review and cancelation of the challenged claims on the following grounds:

Grounds	Claims	Statutory Basis	Prior Art
1	1, 4-6, 8, 9, 11-14, 16, 18-20	§ 103	Lu-577 and Tian
2	1, 9, 16	§ 103	Nielsen-372 and Steinberg
3	1, 4-6, 8, 9, 11-14, 16, 18-20	§ 103	Nielsen-372, Steinberg, and Tian

The Grounds render the challenged claims obvious because any differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a POSITA to which the subject matter pertains. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007).

B. Relied-Upon Prior Art¹

1. Lu-577 (Exhibit 1004)

Lu-577 was published May 16, 2002; it is pre-AIA §102(b) prior art. Ex-1003, ¶27. Lu-577 teaches “[a] television audience measurement system[.]” Ex-1004, Abstract. Lu-577’s system analyzes audio data to identify a television program (e.g., based on an audio signature), for which Lu-577 incorporates Lert (Ex-1009) by reference. Ex-1004, Abstract, ¶¶0003, ¶0017, ¶¶0035-0038, ¶¶0040-0041, FIG. 2; Ex-1003, ¶28. Lu-577 further identifies persons watching television using head detection and face recognition, for which Lu-577 incorporates Lu-000 (Ex-1008) by reference. Ex-1004, ¶0039; Ex-1008, Abstract, 2:10-47, 3:27-60, 3:61-4:8, 7:39-8:6, 9:47-52, FIGs. 6-7; Ex-1003, ¶¶29-30. Lu-577 is in the same field of endeavor as the ’243 patent, which is media analysis. *Infra* §IV; Ex-1003, ¶32.

¹ Pre-AIA 35 U.S.C. §102 applies. MPEP §2159.02.

2. Tian (Exhibit 1005)

Tian was published by IEEE and publicly available no later than July 2004; it is pre-AIA §102(b) prior art. Ex-1028; Ex-1003, ¶33. Tian teaches analyzing a sequence of images of human subjects at different resolutions to detect heads and estimate poses. Ex-1005, Abstract, 000001-03, 000005; Ex-1003, ¶34. According to Tian, the accuracy of face detection and pose estimation can be maintained at relatively low resolutions. Ex-1005, 000005. Tian further teaches tracking the location of head/face in a sequence of images. Ex-1005, 000001, 000003; Ex-1003, ¶35. Tian is in the same field of endeavor as the '243 patent, which is media analysis. *Infra* §IV; Ex-1003, ¶36.

3. Nielsen-372 (Exhibit 1006)

Nielsen-372 was published October 28, 2010; it is pre-AIA §102(b) prior art. Ex-1003, ¶37. Nielsen-372 teaches a local metering system that identifies a displayed television program based on the audio signals (e.g., by generating and comparing audio signatures). Ex-1006, ¶0036, ¶0044, ¶¶0049-0051, ¶¶0055-0057, ¶¶0095-0100, FIGs. 1-3, 14-15; Ex-1003, ¶¶38-39.. The system also detects the identities of persons viewing programs on a television. Ex-1006, ¶0003, ¶0048; Ex-1003, ¶39. The system outputs viewing records to a central office or data processing facility over a network connection. Ex-1006, ¶0036, ¶0041, FIG. 1; Ex-

1003, ¶40. Nielsen-372 is in the same field of endeavor as the '243 patent, which is media analysis. *Infra* §IV; Ex-1003, ¶41.

4. Steinberg (Exhibit 1007)

Steinberg was published March 18, 2010; it is pre-AIA §102(b) prior art. Ex-1003, ¶42. Steinberg teaches detecting faces in the captured images, detecting the orientations of the faces, and identifying known persons based on a faceprint. Ex-1007, Abstract, ¶0003, ¶0005, ¶0057, ¶0092, ¶0096, ¶0099, ¶¶0117-0118, ¶0120, ¶¶0126-0130, ¶¶0135-0136, ¶0151, ¶¶0156-0157, ¶0166, ¶0168, ¶0176, ¶0178, FIGs. 1(a)-(c), FIGs. 4(a)-(b), FIGs. 5(a)-(b), FIG. 9(a); Ex-1003, ¶¶43-44. Steinberg is in the same field of endeavor as the '243 patent, which is media analysis. *Infra* §IV; Ex-1003, ¶45.

C. Standing

Petitioner certifies it is not barred or estopped from requesting this *inter partes* review and the '243 patent is eligible for such review.

D. Discretionary Analysis for Review

This Petition's merits are compelling, which "alone demonstrates that the PTAB should not discretionarily deny institution under *Fintiv*." See June 21, 2022 Memorandum at 3-5 ("Director's Memo"). Even if the Board addresses *Fintiv*, denial of institution under §314 is not warranted. Judge Noreika has stayed cases pending IPR institution decisions and after institution of IPRs. See, e.g., *Valyant AI, Inc. v. Kea Cloud, Inc.*, No. 21-cv-1698-MN (D. Del. Mar. 23, 2023), Dkt. 31.

A jury trial is set for November 3, 2025, almost one year after the expected statutory deadline for a final written decision. The *Fintiv* factors favor institution. If facts change, Petitioner will seek a Reply to the POPR to address any new facts.

Denial of institution under §325(d) is likewise unwarranted because none of the relied-upon art was cited or considered during the '243 patent's prosecution. Ex-1003, ¶¶25-26. And this is the only IPR filed against the challenged claims to date.

IV. LEVEL OF ORDINARY SKILL IN THE ART

A POSITA would have been a person with a bachelor's degree in computer science, electrical engineering, or a similar field with at least two years of experience in media analysis or a person with a master's degree in computer science, electrical engineering, or a similar field with a specialization in media analysis. Ex-1003, ¶¶46-48. A person with less education but more relevant practical experience may also meet this standard. *Id.* A POSITA in 2011 would have known or been able to implement systems that collect and analyze audio and image data, techniques for audio feature extraction and identification, techniques for image processing (e.g., resolution adjustment), and face or head analysis techniques. Ex-1003, ¶49.

V. CLAIM CONSTRUCTION

A. Media Exposure Environment

A POSITA would have understood the meaning of “media exposure environment” to at least encompass a space in which a television is located. Ex-1001, 1:56-2:3, 2:25-41, 4:15-5:8, 15:13-17:61, FIG. 1; Ex-1003, ¶¶51-52.

VI. CHALLENGED CLAIMS

A. Ground 1

1. Combination of Lu-577 and Tian

Lu-577 teaches a television audience measurement system that identifies a television program based on an audio signature. Ex-1004, Abstract, ¶0017, ¶0035, ¶0040, FIG. 2; Ex-1003, ¶55. Lu-000, which Lu-577 incorporates by reference, captures and analyzes images to locate the heads or faces of audience members and extracts and compares pattern image signatures with stored signatures to identify the audience members. Ex-1008, Abstract, 7:39-9:52; Ex-1004, ¶0013, ¶0039; Ex-1003, ¶¶55-56.

Tian similarly teaches techniques for image processing and facial analysis. Ex-1005, Abstract, 000002, 000005; Ex-1003, ¶57. A POSITA would have found it obvious to combine Lu-000 and Tian because they are similarly directed to image processing and facial analysis, and to use Tian’s techniques to improve Lu-000. Ex-1003, ¶58. Employing the solutions of Tian in Lu-577’s system would have been obvious because Lu-577 explicitly invites employing “known head location and face recognition software.” Ex-1004, ¶0039; Ex-1003, ¶59.

Tian teaches performing facial analysis on sequences of images of subjects. Ex-1005, 000005. This is compatible with Lu-577 and Lu-000's teaching of using a video camera, which is capable of taking a sequence of images. Ex-1004, ¶0039; Ex-1008, 3:27-4:8; Ex-1003, ¶60. A POSITA would have been motivated to apply Tian's teaching because performing facial analysis on a sequence of images can improve the confidence level of person identification and allow the selective performance of face recognition on suitable images (e.g., where a person opens her eyes and faces the camera). *See, e.g.*, Ex-1022, 000007; Ex-1010, ¶0003; Ex-1003, ¶61.

Tian teaches determining a face/head location in a first image and using this location for subsequent images unless a change is detected. *See, e.g.*, Ex-1005, 000001, 000003; Ex-1003, ¶62. As suggested by contemporary writings, it would have been obvious to apply Tian's teaching to Lu-577's system, such that it determines a face or head location in a first image and use the determined location for subsequent images. Ex-1010, ¶0003; Ex-1003, ¶¶63-64. This approach is applicable when a video camera is used to take multiple images in a short period of time. A POSITA would have been motivated to apply this approach because it saves processing resources and time by reducing the times face detection needs to be applied. Ex-1003, ¶64.

Tian teaches performing head pose estimation on a subject based on an image. *See, e.g.*, Ex-1005, 000002-03. A POSITA would have found it obvious to apply this teaching to Lu-577's system. Ex-1003, ¶65 A POSITA would have found it obvious to determine a person's head pose to determine whether an image is suitable for face recognition and understood that this improves the performance of face recognition. Ex-1005, 000002; Ex-1010, ¶0003; Ex-1021, 000042; Ex-1003, ¶¶65-66. A POSITA would have been further motivated to perform pose estimation to determine whether a person is watching the television, which was known in the art. Ex-1012, ¶0039. This is beneficial in light of Lu-577's function of measuring viewing of a television program. Ex-1003, ¶67.

Tian teaches obtaining and analyzing reduced-resolution images and that the accuracy of face detection and head pose estimation can be maintained for reduced-resolution images. *See, e.g.*, Ex-1005, Abstract, 000002, 000005; Ex-1003, ¶68. A POSITA would have found it obvious to apply Tian's teaching to Lu-577's system to perform facial analysis on reduced-resolution images. Ex-1003, ¶69. Doing so can reduce the time and resource consumption of tasks such as face detection and pose estimation, without substantially reducing the accuracy of these tasks. Ex-1013, 000001; Ex-1014, 2:43-53; Ex-1015, ¶0022; Ex-1005, 000005. However, it was known that the performance of face recognition may be adversely affected by the reduction of image resolution. Ex-1027, 000004-05. A

POSITA would have been motivated to perform certain facial analysis techniques (e.g., face detection, head pose estimation) on reduced-resolutions images, while other techniques (e.g., face recognition) on full-quality images. Ex-1003, ¶¶69-70.

A POSITA would have found it obvious and been motivated to apply the teachings of Tian to Lu-577 because this is an application of known techniques (e.g., facial analysis techniques) to a known system (e.g., audience measurement system) and method ready for improvement. Doing so would have improved accuracy of face recognition and saved processing resources, and would have yielded predictable results at least because Tian provides experimental assessments of its techniques. Ex-1003, ¶71.

The combination simply uses Tian's teachings about image processing and facial analysis, in the manner taught by Tian, to implement functionalities in Lu-577, which a POSITA would have been more than capable of doing. *See supra* §I. A POSITA would have had a reasonable expectation of success in combining the references given the overlap between Lu-000 and Tian and because the combination uses well-known techniques that would not have changed the principle of operation for any of the references. Ex-1003, ¶72.

2. Claim 1

1[p].²

Lu-577 teaches the preamble. Ex-1003, ¶¶73-80. Lu-577 teaches **an audience measurement system**. Ex-1004, Abstract (“A television audience measurement system”); ¶¶0014-0017; Ex-1003, ¶75. Lu-577’s system is **to obtain exposure data** (e.g., data identifying a television program, data identifying the audience) **for a media exposure environment** (e.g., a statistically selected site). Ex-1004, Abstract, ¶0017, ¶0035, ¶¶0039-0040, FIG. 2. Lu-577’s system “measures viewing of a television program viewed on digital television located in a statistically selected site[.]” Ex-1004, Abstract, ¶0017, ¶0035. The system identifies the television program and identifies the persons watching television. Ex-1004, Abstract, ¶0017, ¶0035, ¶¶0039-0040, FIG. 2; Ex-1003, ¶76.

Lu-000 teaches “identifying predetermined individual members of a viewing audience in a monitored area.” Ex-1008, Abstract. Lu-577 teaches obtaining information regarding the television program and the persons as “television audience data.” Ex-1004, ¶0050³; Ex-1003, ¶77. The television audience data in Lu-577 constitute “exposure data,” which, according to the ’243 patent, include

² The numbering of claim elements are set forth in the Claim Appendix.

³ The embodiments of Lu-577’s Figures 2 and 3 are compatible with each other and intended to be applied together. Ex-1003, ¶77.

media content identification(s) and personal identification(s). Ex-1001, 5:9-28, 1:43-2:3; Ex-1003, ¶78.

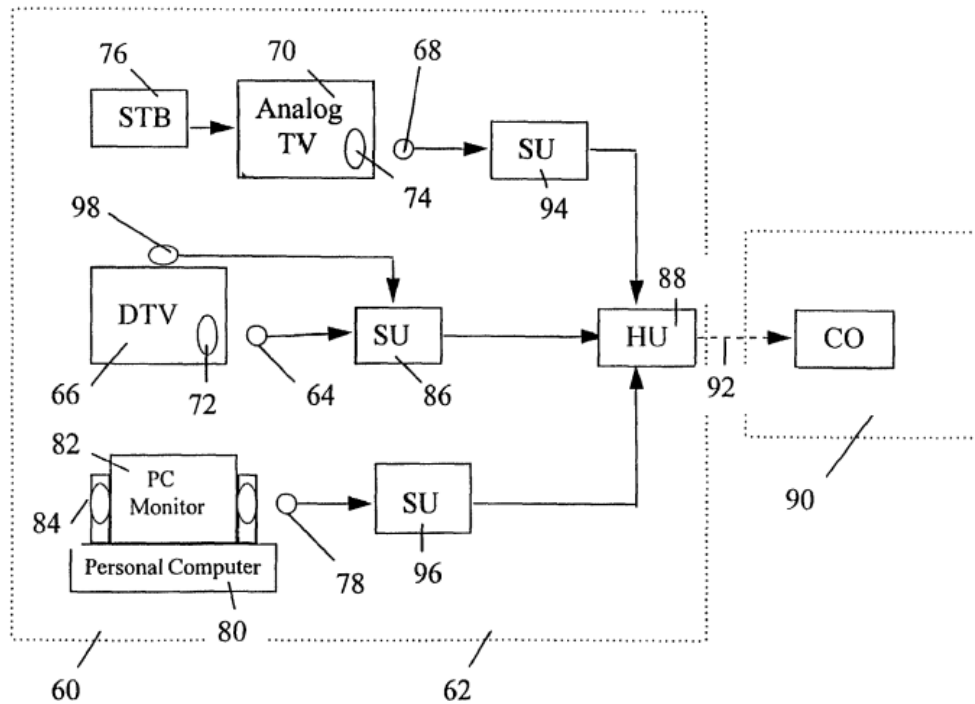
The statistically selected site in Lu-577 and the monitored area in Lu-000 both refer to a “media exposure environment” as they are spaces in which a television is located. *Supra* §V.A; Ex-1004, ¶0017, ¶0089; Ex-1008, Abstract, 1:15-19; *see also* Ex-1001, 4:56-5:8; Ex-1003, ¶79.

The ’243 patent admits that the preamble was known. Ex-1001, 1:56-2:3; Ex-1003, ¶80.

[1a]

Lu-577 teaches limitation [1a]. Ex-1003, ¶¶81-85. Lu-577’s audience measurement system includes detectors (64, 68, 78) that detect audio data and site units (86, 94, 96) or a home unit (88) that analyze the data to identify a television program, for which it incorporates Lert by reference. Ex-1004, ¶0003, ¶¶0035-0040, FIG. 2:

Figure 2

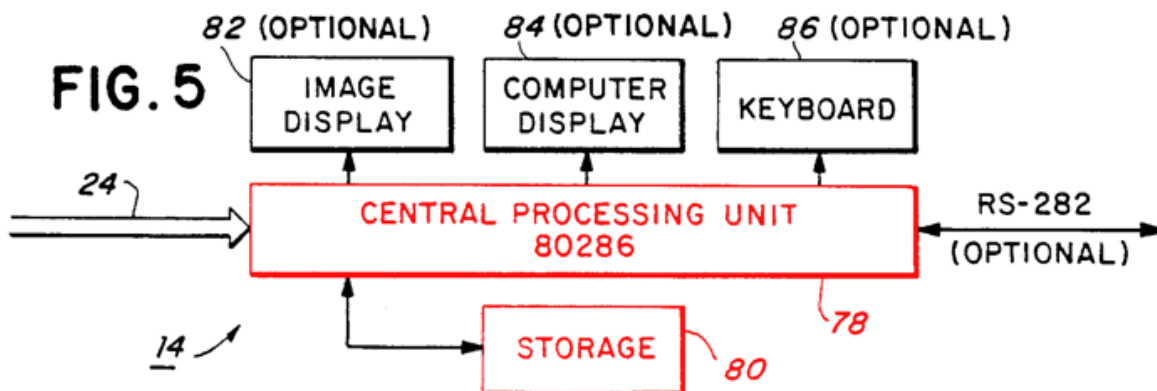


Ex-1003, ¶¶81-82. Lu-577 further teaches a person identifier (98) that feeds image data to the site unit (86), which employs “known head location and face recognition software” (e.g., as taught by Lu-000) to identify viewing persons in the audience. Ex-1004, ¶0039; Ex-1003, ¶82.

Lert teaches using **processor circuitry** (e.g., audio processing circuitry, signature recognition computer) for extracting and comparing audio signatures and **memory** for storing audio signatures. Ex-1009, 3:57-4:42, 4:61-5:19, FIGs. 1-2; Ex-1003, ¶83.

Lu-000 teaches using **processor circuitry** (e.g., audience locating circuitry, control command processor subsystem, audience recognition subsystem) for locating and recognizing audience members and **memory** for storing pattern image

signatures. Ex-1008, 2:20-38, 3:27-60, 7:25-8:6; Ex-1003, ¶84. For example, Lu-000's control command processor subsystem includes a central processing unit 78 and a memory device 80. Ex-1008, 5:61-6:4, FIG. 5⁴:



By incorporating Lert and Lu-000 by reference, Lu-577 teaches identifying a television program and audience members (*infra* §VI.A.2[1b-1g]) using memory and processor circuitry. The processor circuitry performs these operations by **executing machine readable instructions** (e.g., head location and face recognition software, software program for identifying television program based on audio data). Ex-1004, ¶¶0039-0040. By 2011, basic computer components such as memories, processor circuitries, and machine readable instructions executable by the processor circuitries were well developed and commonly used. Ex-1003, ¶85; *see e.g.*, Ex-1004, cl. 14. A POSITA would have found it obvious

⁴ All emphasis added unless otherwise noted.

to implement Lu-577's television audience measurement system using this ordinary architecture. Ex-1003, ¶85.

[1b]

Lu-577 teaches that the audience measurement system **generates an audio signature of media content presented by a television** (e.g., a television program viewed on digital television) **within the media exposure environment** (e.g., statistically selected site). Ex-1004, Abstract (“A television audience measurement system measures viewing of a television program ... in a statistically selected site by ... (iii) extracting an audio signature from the television program in order to identify the television program....”); ¶0017; Ex-1003, ¶¶86-89. A television program is media content presented by a television; Lu-577's statistically selected site is a media exposure environment. Ex-1003, ¶86; *supra* §VI.A.2[1p].

Lu-577 sets forth the extraction of an audio signature as one of the techniques for identifying a television program. Ex-1004, ¶0041 (“... determine the programs being viewed ... by extracting characteristic signatures from these programs....”), ¶0035, ¶0040; Ex-1003, ¶87. Lu-577's extraction of a characteristic signature is at least one way to generate an audio signature. Ex-1003, ¶88.

The '243 patent admits that this limitation was known. Ex-1001, 1:43-55; Ex-1003, ¶89.

[1c]

Lu-577 teaches that its television audience measurement system **obtains content identifying data** (e.g., data identifying a television program) **corresponding to the presented media content** (e.g., television program), **the content identifying data based on the audio signature of the media content presented by the television within the media exposure environment** (e.g., statistically selected site). Ex-1004, ¶0017 (“The extracting means extracts an audio signature from the television program in order to identify the television program.”), Abstract; Ex-1003, ¶¶90-93.

Lu-577 teaches identifying the media content (e.g., television programs) “by extracting characteristic signatures from these programs and by matching the extracted signatures to reference signatures stored in a reference signature database based on the audio signature.” Ex-1004, ¶0041, *see also* ¶0035, ¶0040; Ex-1003, ¶91.

Lu-577 teaches representing information identifying a television program as “tuning data.” Ex-1004, ¶¶0044-0045, ¶0050. The tuning data is “content identifying data” because the tuning data identifies the media content that is presented by a television. Lu-577 teaches obtaining such content identifying data. Ex-1003, ¶92.

The '243 patent admits that this limitation was known. Ex-1001, 1:43-55; Ex-1003, ¶93.

[1d]

The combination teaches limitation [1d]. Ex-1003, ¶¶94-102. Lu-577's system includes a person identifier and incorporates Lu-000's teachings on head location and face recognition software for identifying members of a viewing audience. Ex-1004, ¶0013, ¶0039; Ex-1003, ¶94.

The combination teaches **obtaining a sequence of images by a camera while the media content** (e.g., television program) **corresponding to the content identifying data** (e.g., data identifying the television program) **is presented by the television**. Lu-577's person identifier identifies "persons watching television programing" based on image recognition. Ex-1004, ¶0039. Since the identified persons are "watching television programing" on the television set, the images of the persons are captured while the media content (e.g., television program) is presented by the television. *Id.* The images are captured by a camera. Ex-1004, ¶0039 ("The person identifier 98 may be video camera, an IR camera, or the like."). The presented media content corresponds to content identifying data. *Supra* §VI.A.2[1c]; Ex-1003, ¶95.

Lu-000 teaches obtaining (e.g., capturing) images for audience members in the monitored area using a video camera. Ex-1008, Abstract ("A video image is

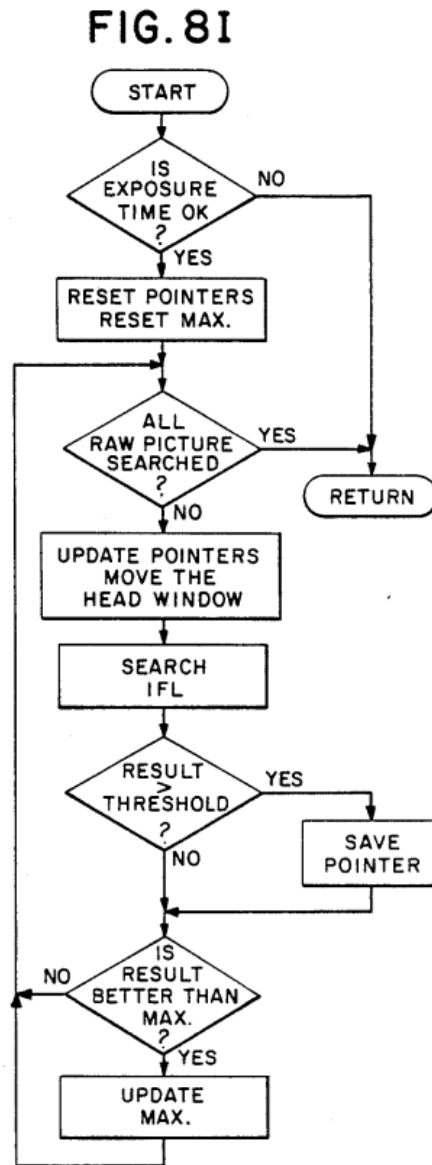
captured for each of the located individual audience members in the monitored area.”), 2:20-38, 3:27-4:8. Lu-teaches capturing multiple “images of the audience members[.]” Ex-1008, 3:27-60. In light of Lu-000’s teachings of obtaining the images using a video camera, which a POSITA would have known to be capable of taking sequences of images over time, Lu-000 teaches or renders obvious obtaining **a sequence of images**. Because Lu-000 teaches a television audience (Ex-1008, 1:15-19), the images are obtained when media content is presented by a television. Ex-1003, ¶96.

To the extent it is argued that Lu-577 does not teach “a *sequence* of images,” Tian teaches obtaining a sequence of images of human subjects using a camera. Ex-1005, 000005 (“The database contains 704 image sequences from 97 subjects.”). *Supra* §VI.A.1; Ex-1003, ¶97.

The combination further teaches **analyzing a sequence of images of the media exposure environment to detect a head appearing in one or more of the images**. Lu-577 teaches using “head location” software that detects a head appearing in an image. Ex-1004, ¶0039. Lu-000 teaches analyzing images to detect a head appearing in an image and to determine the location of the head based on a “search raw picture for heads subroutine” and a “search head(s) subroutine.” Ex-1008, 9:47-52 (“The sequential steps begin with a search raw

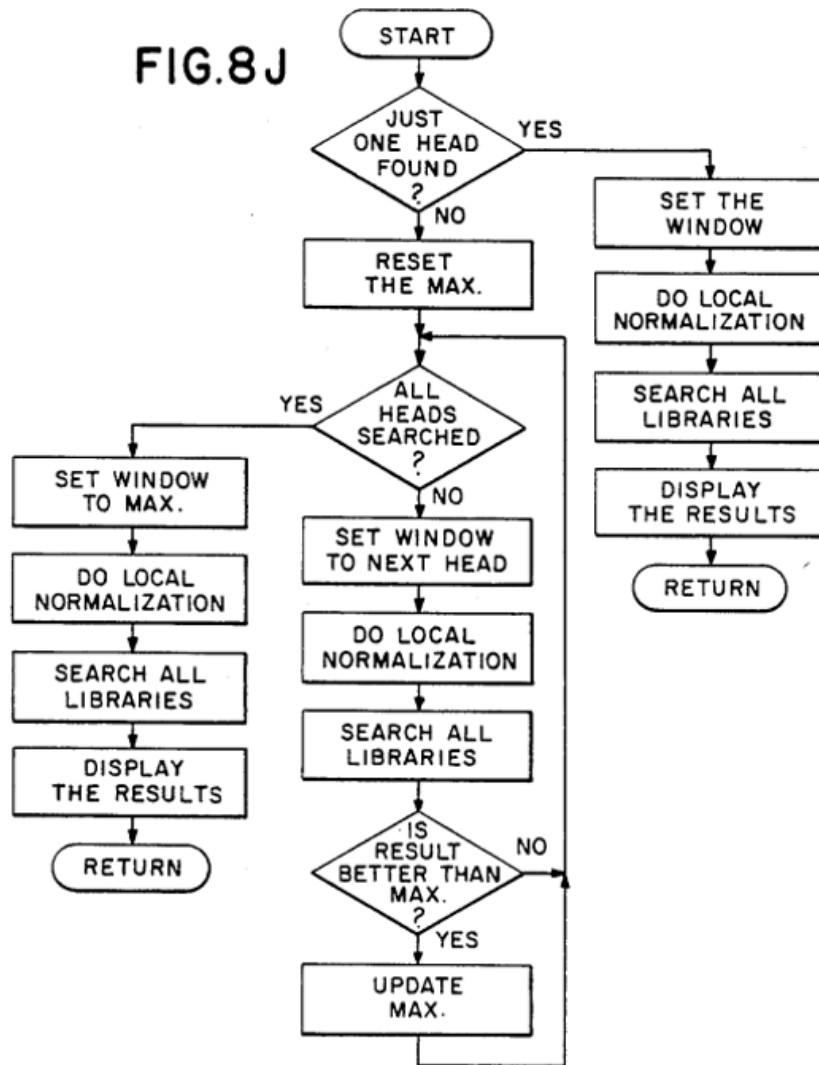
picture for heads subroutine illustrated in FIG. 8I. Next a locate and search head(s) subroutine illustrated in FIG. 8J is performed.”), 7:39-47; Ex-1003, ¶98.

The search raw picture for head(s) subroutine searches for heads and saves search area pointers that identify areas corresponding to heads. Ex-1008, 9:53-10:3, FIG. 8I:



Ex-1003, ¶99.

The locate and search head(s) subroutine sets a search area window based on the saved pointer. Ex-1008, 10:4-12, FIG. 8J:



Ex-1003, ¶100.

Tian also teaches analyzing a sequence of images to detect a head appearing in one or more of the images. Ex-1005, 000005 (“All images in 704 sequences from 97 subjects are used for face detection and head pose estimation.”), 000002; Ex-1003, ¶101.

The '243 patent admits the prior art included approaches for identifying a number of people in a media exposure environment, which commonly involved identifying heads. Ex-1001, 1:56-2:3; Ex-1003, ¶102.

[1e]

Tian teaches **determining an orientation of the head** (e.g., pose estimation) **with respect to the camera**. Ex-1005, 000001 (“[P]ose estimation can be applied[.]”), 000002 (“[T]he head pose was estimated based on the detected head.”); Ex-1003, ¶¶103-105. Pose estimation outputs a head pose that describes the view of the head (e.g., frontal or near frontal view, side view), which describes the orientation of the head with respect to the camera. Ex-1005, 000002; Ex-1003, ¶103. Tian provides examples of head poses:

Poses	Frontal or near frontal	Side view or profile	Others
Definitions	Both eyes and lip corners are visible	One eye or one lip corner is occluded	Not enough facial features
Examples			

Ex-1005, 000003; Ex-1003, ¶104.

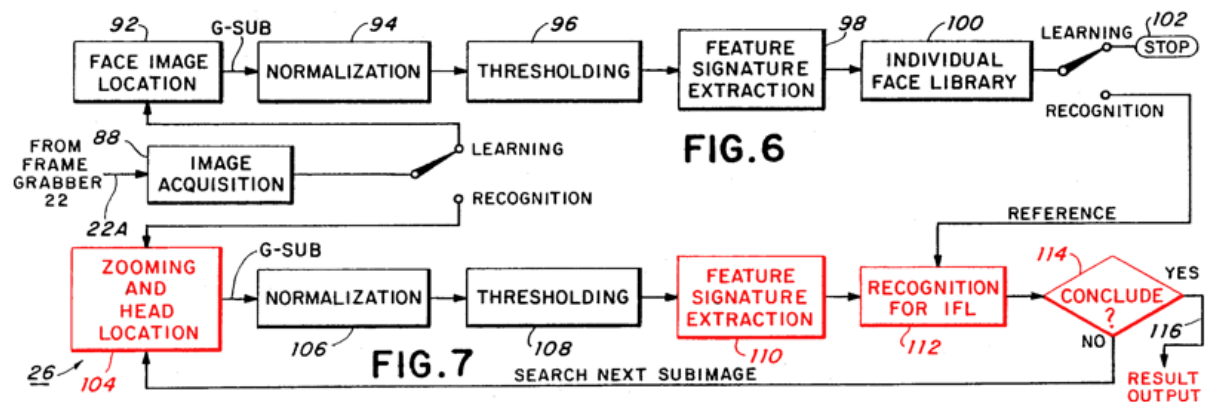
It would have been obvious to apply Tian’s teaching to Lu-577 such that the audience measurement system determines an orientation of the head with respect to the camera. *Supra* §VI.A.1; Ex-1003, ¶105.

[1f]

Lu-577 teaches limitation [1f]. Ex-1003, ¶¶106-111. Lu-577 teaches “a person identifier 98 [that] identif[ies] the persons watching television programming[.]” Ex-1004, ¶0039; Ex-1003, ¶106. Lu-000 teaches **determining audience identification information based on a match of the head to a known person** (e.g., predetermined individual) **associated with the media exposure environment** (e.g., monitored area). Lu-000 teaches “identifying predetermined individual members of a viewing audience in a monitored area,” which is a media exposure environment (*supra* §VI.A.2.1[p]). Ex-1008, Abstract, 2:10-14, 2:20-38. Lu-000 teaches storing a pattern image signature “corresponding to each predetermined individual member.” Ex-1008, Abstract, 2:20-47. Because Lu-000’s monitored area is a media exposure environment (*supra* §VI.A.2.1[p]) and the predetermined individuals are in the monitored area, Lu-000 teaches storing pattern image signatures of known person associated with the media exposure environment. Ex-1003 ¶107.

Lu-000 next teaches identifying an audience member by comparing a newly extracted pattern image signature with the stored pattern image signatures. Ex-

1008, Abstract, 2:20-38 (“The extracted pattern image signature is compared with each of the stored pattern image signatures to identify a particular one of the predetermined audience members.”), 7:39-8:6; Ex-1003, ¶¶108-109. A newly extracted pattern image signature is generated based on a “B-Sub image” that corresponds to the “head location” of a person. Ex-1008, 7:39-8:6, FIGs. 6-7:



Lu-000 thus teaches that the identification is based on a match of the head to a known person. Ex-1003, ¶109.

Lu-000 teaches searching through stored image feature signatures and identifying one having the greatest similarity with an extracted signature. Ex-1008, 8:46-9:2, 9:18-31, FIGs. 8B, 8E. Next, “results” are displayed and is verifiable by a person. Ex-1008, 9:3-10, 9:32-46, 10:4-32, FIG. 8C, 8F-8G, 8J. A POSITA would have understood or found it obvious that the displayed result includes audience identification information by indicating the most similar image feature signature or the corresponding individual. Ex-1003, ¶110.

The '243 patent admits that audience identification based on facial recognition was known. Ex-1001, 1:56-2:3; Ex-1003, ¶111.

[1g]

The combination teaches **network interface circuitry** (e.g., interface and communication apparatus) **to output a signal indicative of the content identifying data and the audience identification information to a data collection facility** (e.g., intermediate data collector, data collection central office).

The combination teaches obtaining content identifying data and determining audience identification information. *Supra* §VI.A.2[1b-1f]; Ex-1003, ¶¶112-114.

Lu-577 teaches the audience measurement system determining these information locally in the statistically selected site. Ex-1004, ¶¶0039-0040; Ex-1003, ¶112.

Lu-577 further teaches that “television audience data ... can be communicated, via the Internet ... to a locally located or remotely located intermediate data collector 128 and then to a remotely located central office 130 through a communication channel 170.” Ex-1004, ¶0050, ¶0037. A POSITA would have understood that the television audience data in Lu-577 includes television content identifying data and audience identification information and that data commonly transmit over networks in the form of electromagnetic signals. Therefore Lu-577 teaches outputting a signal to a data collection facility. Ex-1003 ¶113.

The intermediate data collector and the data collection central office in Lu-577 are data collection facilities because they collect and store data. Ex-1003, ¶114. Lu-577’s audience measurement system includes “an interface and communication apparatus” that includes network communication features such as “a serial port” and functionalities such as sending data “to an internet service provider via the internet.” Ex-1004, cls. 13, 29-33, ¶0015. It would have been understood or obvious that this apparatus comprises a network interface circuitry and is suitable to be used for outputting the content identifying data and audience identification information to the data collection facilities. Ex-1003, ¶114.

3. Claim 4

4[p].

The combination teaches claim 1. *Supra* §VI.A.2. It would have been obvious to use the processor circuitry to perform the operations of limitations [4a] and [4b]. *Supra* §VI.A.2[1a]; Ex-1003, ¶¶115-116.

[4a]

The combination teaches limitation [4a]. Ex-1003, ¶¶117-120. Tian describes “the effects of different image resolutions” for facial analysis. Ex-1005, Abstract; 000002; Ex-1003, ¶118. Tian creates lower-resolution images by down-sampling from original images. Ex-1005, 000002 (“The lower resolution images are down-sampled from the originals.”), Abstract; Ex-1003, ¶119.

The combination teaches determining an orientation of the head in one or more images. *Supra* §VI.A.2[1d-1e]. A POSITA would have found it obvious to apply Tian's teaching such that Lu-577's system reduces the resolution of a first image of the one or more of the images and performs face detection or head pose estimation on the reduced-resolution image. *Supra* §VI.A.1; Ex-1003, ¶120.

[4b]

The combination teaches limitation [4b]. Ex-1003, ¶¶121-122. Tian's head pose estimation teaches determining an orientation of the head with respect to the camera. *Supra* §VI.A.2[1e]. Tian teaches performing pose estimation based on a reduced-resolution image. Ex-1005, 000005 ("[H]ead pose estimation can detect 98% faces for all the resolutions."); Ex-1003, ¶121. A POSITA would have found it obvious that head orientation is determined based on an reduced-resolution image at least because doing so would have saved processing resources without substantially reducing the accuracy of determination. *Supra* §VI.A.1; Ex-1003, ¶122.

4. Claim 5

5.

The combination teaches claim 4. *Supra* §VI.A.3. It would have been obvious to use the processor circuitry to perform the operations of claim 5. *Supra* §VI.A.2[1a]; Ex-1003, ¶¶124-132.

Lu-000 teaches **generating a facial signature** (e.g., pattern image signature) **from a region of an image corresponding to a location of the head.** *Supra* §VI.A.2[1f]. Lu-000 teaches that “[a] pattern image signature is extracted from [a] captured image.” Ex-1008, Abstract, 2:20-38; Ex-1003, ¶125. The pattern image signature is a facial signature because it is extracted from a “head location” and is alternatively called a “face pattern image signature.” Ex-1008, 6:49-51, 7:25-27, 7:39-8:6; Ex-1003, ¶126. Lu-000’s extraction of a pattern image signature teaches generating a facial signature because “extracting” and “generating” are used interchangeably. Ex-1003, ¶127.

The combination teaches generating the facial signature from a region of a **second image of the one or more of the images** corresponding to a location of the head **in the reduced-resolution image.** Tian teaches generating a reduced-resolution image. *Supra* ¶VI.A.3[4a]. Tian also teaches determining a face/head location in a first image and using this location for subsequent images unless a change is detected. Ex-1005, 000001 (“... just detect face in the first frame and then track the face in the remainder of the video sequence.”), 000003. A POSITA would have found it obvious to determine a person’s face/head location in a reduced-resolution image and perform face recognition on regions of this location in one or more subsequent images of the sequence, including a second image. Ex-1005, 000001, 000005; *supra* §VI.A.1; Ex-1003, ¶¶128-130.

Lu-000 further teaches **comparing the generated facial signature** (e.g., pattern image signature) **to a database of facial signatures** (e.g., individual face storage library (IFL)). *Supra* §VI.A.2[1f]. Lu-000 teaches that “[t]he extracted ... image feature signature is compared with each of the pattern image signatures stored in the individual face library.” Ex-1008, 7:39-8:6, FIG. 7; *see also* Ex-1008, 8:46-9:31, FIGs. 8B, 8E, 8G; *supra* §VI.A.2[1f]. Lu-000’s individual face storage library is a database because it includes a structured collection of data (e.g., pattern image signatures) stored in memory. Ex-1008, 7:25-38; Ex-1003, ¶131.

Lu-577 further teaches **determining the audience identification information** by generating the facial signature and comparing the generated facial signature to a database of facial signatures. *Supra* §VI.A.2[1f]; Ex-1004, ¶0039; Ex-1008, Abstract (“The extracted pattern image signature is compared with each of the stored pattern image signatures to identify a particular one of the predetermined audience members.”), 2:20-38; Ex-1003, ¶132.

5. Claim 6

6[p].

The combination teaches claim 4. *Supra* §VI.A.3. It would have been obvious to use the processor circuitry to perform the operations of limitations [6a]-[6c]. *Supra* §VI.A.2[1a]; Ex-1003, ¶¶133-140.

[6a]

The combination teaches **identifying a region corresponding to the head within an image**. *Supra* §VI.A.2[1d]. Lu-000 teaches analyzing images to detect a region corresponding to the head. *Supra* §VI.A.2[1d]; Ex-1008, 7:39-47, 9:47-52, 9:53-10:3, 10:4-12, FIGs. 8I-8J. Tian teaches determining a face/head location in a first image and using this location for subsequent images unless a change is detected. *Supra* §VI.A.4; Ex-1005, 000001, 000003; Ex-1003, ¶135.

Tian further teaches **obtaining a reduced-resolution image from the first image**. *Supra* ¶VI.A.3[4a]. Therefore, the combination teaches identifying a region corresponding to the head within the first image from which the reduced-resolution image was obtained. Ex-1003, ¶136.

[6b]

It would have been obvious to apply Tian's teaching to Lu-577 such that the television audience measurement system determines a face or head location in a first image and use the determined location for subsequent images. *Supra* §VI.A.4; Ex-1003, ¶¶137-138.

Lu-000 teaches analyzing a portion corresponding to the identified region of the head or face to determine that the head matches the known person based on the analysis. *Supra* §VI.A.2[1f], §VI.A.4; Ex-1008, 7:39-8:6, FIG. 7; *see also* Ex-

1008, 8:46-9:31, FIGs. 8B, 8E, 8G. Ex-1003, ¶139. Therefore, the combination teaches limitation [6b]. Ex-1003, ¶140.

6. Claim 8

8.

The combination teaches claim 6. *Supra* §VI.A.5. It would have been obvious to use the processor circuitry to perform the operations of claim 8. Ex-1003, ¶¶141-144.

Lu-577 teaches determining audience identification information based on a match of the head to a known person, outputting the identification information as an output signal, and storing “identified individual viewing member data.” *Supra* §VI.A.2[1f].; Ex-1008, 7:67-8:6. A POSITA would have understood or found it obvious that the stored individual viewing member data includes an identifier associated with the known person. Ex-1003, ¶143. In fact, the ’243 patent admits that the concept of an identifier was known in the prior art. Ex-1001, 1:43-55.

Lu-577 teaches that the audience measurement system includes a memory. *Supra* §VI.A.2[1a]. Lu-000 teaches storing data related to facial recognition using a memory. Ex-1008, 2:39-47 (“[E]ach of the plurality of feature image signatures are stored in a distinct memory space....”), 5:61-6:4, 7:25-38. It would have been obvious to cause the identifier associated with the person to be stored in memory. Ex-1003, ¶144.

7. Claim 9

9[p].

As explained for claim 1, Lu-577 teaches this preamble. *Supra* §VI.A.2.1[p]; Ex-1003, ¶146.

[9a]

As explained for claim 1, Lu-577 teaches that the audience measurement system includes components such as audio detectors, cameras, and site unit/home unit implemented in a **media exposure environment**. *Supra* §VI.A.2[1a]; Ex-1004, ¶¶0035-0040, FIG. 2; Ex-1003, ¶147. A combination of these components constitutes **an audience measurement device** because they perform operations that measure exposure of an audience to media content.⁵ Ex-1004, ¶¶0035-0040; Ex-1001, 8:7-43. A POSITA would have found it obvious to integrate the components of Lu-577 in a single body. Ex-1003, ¶148.

In light of its components, it would have been obvious to implement the audience measurement device using the structure of memory, machine readable instructions, and processor circuitry such that it performs the operations recited in limitations [9b]-[9g]. *Supra* §VI.A.2[1a]; *infra* §VI.A.7[9b-9g]; Ex-1003, ¶149.

⁵ The '243 patent describes the audience measurement device broadly and clarified that it is not limited to the example implementations. Ex-1001, 8:7-43.

[9b]

As explained for claim 1 and limitation [9a], Lu-577 teaches limitation [9b].
Supra §VI.A.2[1b], §VI.A.7[9a]; Ex-1003, ¶150.

[9c]

As explained for claim 1 and limitation [9a], Lu-577 teaches limitation [9c].
Supra §VI.A.2[1c], §VI.A.7[9a]; Ex-1003, ¶151.

[9d]

As explained for claim 1 and limitation [9a], the combination teaches the audience measurement device obtaining (i.e., collecting) a sequence of images of the media exposure environment with a camera while the media content corresponding to the content identifying data is presented by the television and detecting a head appearing in one or more of the images. *Supra* §VI.A.2[1d], §VI.A.7[9a]; Ex-1003, ¶152. A POSITA would have understood that “**collect**” is used interchangeably with “obtain” in the context of a camera capturing images. The one or more images in which a head is detected includes at least one image, which constitutes a **first image** that is collected. Thus, the combination teaches limitation [9d]. Ex-1003, ¶152.

[9e]

As explained for claim 1 and limitation [9a], the combination teaches the audience measurement device detecting a head in one or more images. *Supra* §VI.A.2[1d], §VI.A.7[9a]; Ex-1003, ¶153. The one or more images include the first image. *Supra* §VI.A.7[9d]. Because this approach does not guarantee detecting a head in each image, it includes attempts to detect a head. Thus, the combination teaches limitation [9e]. Ex-1003, ¶153.

[9f]

As explained for claim 1 and limitation [9a], Lu-577 teaches limitation [9f]. *Supra* §VI.A.2[1e], §VI.A.7[9a]; Ex-1003, ¶154.

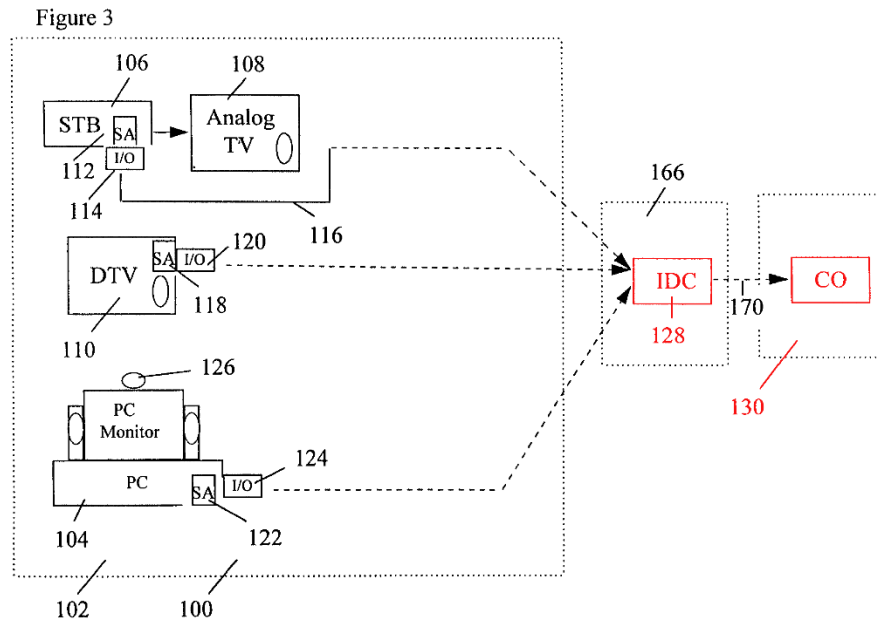
[9g]

As explained for claim 1 and limitation [9a], the combination teaches the audience measurement device determining audience identification information based on a match of the head to a known person associated with the media exposure environment. *Supra* §VI.A.2[1f], §VI.A.7[9a]; Ex-1003, ¶155. Lu-000 teaches outputting and storing a signal and displaying a result after a match of signatures is found. Ex-1008, 7:39-8:6, 9:18-31, 9:40-46. This teaches **an indication that the head matches a known person** (e.g., signal, result, or stored value indicating match), on which audience identification is based. Ex-1003, ¶155.

Because the audience measurement system is set up to monitor the media exposure environment, known persons associated with the media exposure environment are associated with the audience measurement system. Because Lu-577 teaches determining a match with a known person associated with the media exposure environment (*supra* §VI.A.2.1[p]), it teaches determining the match with **a known person associated with the audience measurement system.** Ex-1003 ¶156.

[9h]

As explained for claim 1, the combination teaches a data collection facility (e.g., an intermediate data collector, a data collection central office) to which a network interface circuitry outputs a signal indicative of the content identifying data and the audience identification information. *Supra* §VI.A.2[1g]; Ex-1003, ¶157. Lu-577's audience measurement system includes the intermediate data collector and data collection central office. Ex-1004, ¶0050, FIG. 3:



¶0037, FIG. 2; Ex-1003, ¶158. Therefore, the combination teaches limitation [9h].
Ex-1003, ¶159.

8. Claim 11

11[p].

The combination teaches claim 9. *Supra* §VI.A.7; Ex-1003, ¶161.

[11a]

As explained for claim 4 and limitation [9a], the combination teaches the audience measurement device reducing a resolution of one of the one or more of the images (satisfying the “first image” in claim 9, *supra* §VI.A.7[9d]) of the media exposure environment to obtain a reduced-resolution image. *Supra* §VI.A.3[4a], §VI.A.7[9a]; Ex-1003, ¶162. Thus, the combination teaches limitation [11a]. Ex-1003, ¶162.

[11b]

As explained for claim 4 and limitation [9a], the combination teaches limitation [11b]. *Supra* §VI.A.3[4b], §VI.A.7[9a]; Ex-1003, ¶163.

9. Claim 12

12[p].

The combination teaches claim 11. *Supra* §VI.A.8; Ex-1003, ¶165.

[12a]

As explained for claim 6 and limitation [9a], the combination teaches limitation [12a]. *Supra* §VI.A.5[6a], §VI.A.7[9a]; Ex-1003, ¶166.

[12b]

As explained for claim 6 and limitation [9a], the combination teaches analyzing a portion of a second image corresponding to the identified region to determine that the head matches the known person. *Supra* §VI.A.5[6b], §VI.A.7[9a]; Ex-1003, ¶167.

Lu-000 teaches comparing a signature with stored signatures of different individuals to determine whether there is a match with any of the individuals. Ex-1008, Abstract, 2:20-38, 7:39-8:6. Therefore, the combination teaches determining **whether** the head matches the known person. Ex-1003, ¶167.

10.Claim 13

13.

The combination teaches claim 12. *Supra* §VI.A.9. As explained for claim 8 and limitation [9a], the combination teaches that the audience identification information includes an identifier associated with the known person and that the audience measurement device causes the identifier associated with the person to be stored (i.e., recorded) in the memory responsive to a determination that the head matches the known person. *Supra* §VI.A.6, §VI.A.7[9a]; Ex-1003, ¶169. Lu-577 further teaches representing the match with an indication that the head matches the known person. *Supra* §VI.A.7[9g]. Thus, the combination teaches claim 13. Ex-1003, ¶169.

11.Claim 14

14.

The combination teaches claim 11. *Supra* §VI.A.8. As explained for claim 5 and limitation [9a], the combination teaches claim 14. *Supra* §VI.A.4, §VI.A.7[9a]; Ex-1003, ¶171.

12.Claim 16

16[p].

As explained for claim 1, the combination teaches an audience measurement system that obtains exposure data for a media exposure environment by performing

multiple steps. *Supra* §VI.A.2. Both Lu-577 and Tian contemplate methods that include operations they teach. *See, e.g.*, Ex-1004, ¶0080; Ex-1005, 000002-05. The combination thus teaches a **method** for obtaining exposure data for a media exposure environment that includes the operations recited in claim 16. *Infra* §VI.A.12[16a-16g]; Ex-1003, ¶173.

[16a]

As explained for claim 1, Lu-577 teaches that the audience measurement system, including an audio detector and a site unit/home unit, generates an audio signature of media content presented by a television within the media exposure environment. *Supra* §VI.A.2[1a-1b]. The audio detector and site unit/home unit together form a “program detector” because they detect and analyze audio data to identify a television program. *See* Ex-1004, ¶¶0037-0038, FIG. 2; Ex-1001, 7:1-41. A POSITA would have found it obvious to arrange the hardware and software of these components to form a program detector. Accordingly, Lu-577 teaches performing the operation of limitation [16a] using a program detector. Ex-1003, ¶174.

[16b]

As explained for claim 1 and the preamble 16[p], Lu-577 teaches limitation [16b]. *Supra* §VI.A.2[1c], §VI.A.12.16[p]; Ex-1003, ¶175.

[16c]

As explained for claim 1, the combination teaches that the audience measurement system capturing a sequence of images of the media exposure environment with a camera while the media content corresponding to the content identifying data is presented by the television and detecting a head appearing in one or more of the images. *Supra* §VI.A.2[1d]; Ex-1004, ¶0039; Ex-1008, Abstract, 2:20-38, 3:27-60, 3:61-4:8. When there are more than one images in which a head is detected, the one or more images includes **first and second images** that are captured. Thus, the combination teaches limitation [16c]. Ex-1003, ¶176.

[16d]

As explained for claims 1 and 9, the combination teaches the audience measurement system, including a person identifier (i.e., a camera) and a site unit, analyzing the sequence of images including the first image and attempts to detect a head in the first image. *Supra* §VI.A.2[1a], §VI.A.2[1d], §VI.A.7[9e]; Ex-1003, ¶177. The person identifier and the site unit together form an audience detector because they capture images and identify viewing persons in the audience. Ex-1004, ¶0039, FIG. 2; Ex-1001, 5:29-6:44, 8:7-43. A POSITA would have found it obvious to arrange the hardware and software of these components to form an

audience detector. Accordingly, Lu-577 teaches performing the operation of limitation [16d] using an audience detector. Ex-1003, ¶¶178-179.

[16e]

As explained for claim 1 and limitation [16d], it would have been obvious to use the audience detector to perform the operation of limitation [16e]. *Supra* §VI.A.2[1e], §VI.A.12[16d]; Ex-1003, ¶180.

[16f]

As explained for claim 9 and limitation [16d], it would have been obvious to use the audience detector to perform the operation of limitation [16f]. *Supra* §VI.A.7[9g], §VI.A.12[16d]; Ex-1003, ¶¶181-182.

Because the audience detector is formed by components of the audience measurement system (*supra* §VI.A.12[16d]), known persons associated with the audience measurement system are also associated with audience detector. Thus, Lu-577 teaches determining the match with **a known person associated with the audience detector**. Ex-1003, ¶183.

[16g]

As explained for claim 1 and the preamble 16[p], Lu-577 teaches limitation [16g]. *Supra* §VI.A.2[1g], §VI.A.12.16[p]; Ex-1003, ¶184.

13.Claim 18

18[p].

The combination teaches claim 16. *Supra* §VI.A.12; Ex-1003, ¶186.

[18a]

As explained for claim 11 and the preamble 16[p], the combination teaches limitation [18a]. *Supra* §VI.A.8[11a], §VI.A.12.16[p]; Ex-1003, ¶187.

[18b]

As explained for claim 11 and the preamble 16[p], the combination teaches determining an orientation of the head with respect to the camera based on a reduced-resolution image. *Supra* §VI.A.12[16e], §VI.A.8[11b], §VI.A.12.16[p]; Ex-1003, ¶188.

14.Claim 19

19[p].

The combination teaches claim 18. *Supra* §VI.A.13; Ex-1003, ¶190.

[19a]

As explained for claim 12 and the preamble 16[p], the combination teaches limitation [19a]. *Supra* §VI.A.9[12a], §VI.A.12.16[p]; Ex-1003, ¶191.

[19b]

As explained for claim 12 and the preamble 16[p], the combination teaches limitation [19b]. *Supra* §VI.A.9[12b], §VI.A.12.16[p]; Ex-1003, ¶192.

1. Claim 20

20.

The combination teaches claim 19. *Supra* §VI.A.14. As explained for claim 13 and the preamble 16[p], the combination teaches claim 20. *Supra* §VI.A.10, §VI.A.12.16[p]; Ex-1003, ¶194.

B. Ground 2

1. Combination of Nielsen-372 and Steinberg

Nielsen-372 teaches a local metering system that includes a metering unit or display device ON/OFF detector that identifies a presented television program and a people meter that identifies the persons viewing the program. Ex-1006, ¶0003, ¶¶0036-0037, ¶0040, ¶0044, ¶0048, ¶0057. The people meter takes an approach of “prompt[ing] the audience members to indicate that they are present in the viewing audience[.]” Ex-1006, ¶0048; Ex-1003, ¶196.

Steinberg is directed to “using face detection and face recognition techniques to identify the persons contained within a digital image[.]” Ex-1007, ¶0090. Steinberg teaches detecting a face and its location in an image, determining a pose or orientation of a face, and identifying a person using face recognition. Ex-

1007, ¶¶0005, ¶0057, ¶0092, ¶0096, ¶0118, ¶0120, ¶¶0126-0128, ¶0130, ¶¶0157-0158, ¶0166, ¶0168, ¶0176; Ex-1003, ¶197.

A POSITA would have found it obvious to apply Steinberg's teachings to Nielsen-372, such that audience members are identified by face detection and recognition. Ex-1003, ¶198. Nielsen-372's system includes needed hardware (e.g., a computer and a camera) for implementing Steinberg's approach. *Infra* §VI.B.2[1a]; Ex-1006, FIG. 29, ¶0050, ¶¶0135-0136, ¶0141; Ex-1007, Abstract, ¶0092, ¶0112, ¶0129; Ex-1003, ¶¶199-200.

Nielsen-372's approach of prompting and soliciting manual inputs from the individuals may create a negative audience experience and compromise the accuracy of data. Ex-1006, ¶0048. Applying Steinberg's method to Nielsen-372 would have allowed identification of the audience members without interruptions to the entertainment experience and with improved accuracy. A POSITA would have been motivated to do so because these benefits are consistent with Nielsen-372's goal of collecting viewing information. Ex-1003, ¶201.

A POSITA would have found it obvious and been motivated to apply the teachings of Steinberg to Nielsen-372 because this is a simple substitution of one known element (e.g., audience identification based on facial analysis) for another (e.g., audience identification based on user input) to obtain predictable results. Doing so would have yielded predictable results because the techniques of facial

analysis were well known in the 2011 timeframe and applied to television audience measurement. *Supra* §I; Ex-1003, ¶202.

A POSITA would have had a reasonable expectation of success given that Nielsen-372 provide the hardware architecture for performing Steinberg’s method and that Steinberg’s techniques were admittedly known. Ex-1001, 1:67-2:3. The combination simply implements Steinberg’s teachings about facial analysis, in the manner taught by Steinberg, in Nielsen-372’s system. *See supra* §I. The combination would have been nothing more than the use of a known technique to improve similar devices in the same way and would not have changed the principle of operation for any of the references. Ex-1003, ¶203.

2. Claim 1

1[p].

The combination teaches the preamble. Ex-1003, ¶204-210. Nielsen-372 teaches **an audience measurement system** (e.g., including a local metering system “capable of providing viewing and metering information”).⁶ Ex-1006, ¶0036, FIG. 1:

⁶ Nielsen-372 teaches other systems or devices, such as a central (data processing) facility, that may be included as part of the audience measurement system. Ex-1006, ¶0036, ¶0041.

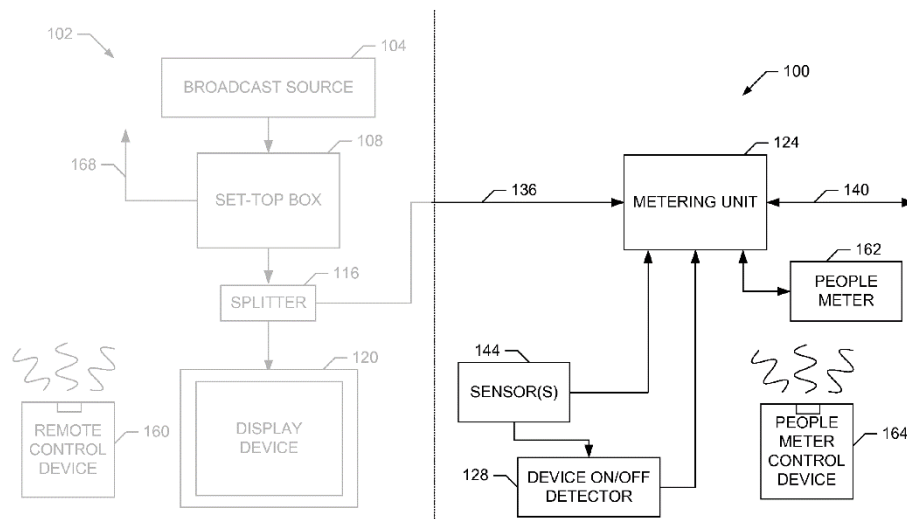


FIG. 1

Ex-1003, ¶206.

Nielsen-372’s local metering system **obtains exposure data** (e.g., data identifying a displayed program, data identifying the audience) **for a media exposure environment** (e.g., environment in which a home entertainment system is placed). The local metering system includes a sensor “to receive audio signals corresponding to the program being displayed.” and “a metering unit 124 and a display device ON/OFF detector 128” that may be “integrated into a single unit” and identify the displayed program based on the audio signals Ex-1006, ¶¶0036, ¶¶0044, ¶¶0049, ¶¶0057; Ex-1003, ¶207.

The local metering system also “includes a people meter 162 to capture information about the audience” viewing a television program. Ex-1006, ¶¶0003, ¶¶0048. It would have been obvious to apply Steinberg to Nielsen-372 such that the

people meter identifies audience members using facial analysis. *Supra* §VI.B.1; Ex-1003, ¶208.

The local metering system is placed in the same environment (e.g., a statistically selected household) as a home entertainment system, which includes a television. Ex-1006, ¶¶0036-0037, ¶0040. This environment is a “media exposure environment” because it is a space in which a television is located. *Supra* §V.A; Ex-1001, 4:56-5:8; Ex-1003, ¶209.

The ’243 patent admits that the preamble was known. *Supra* §VI.A.2.1[p]; Ex-1001, 1:56-2:3; Ex-1003, ¶210.

[1a]

The combination teaches limitation [1a]. Ex-1003, ¶¶211-216. Nielsen-372 teaches “implementing [its] apparatus and methods” using a computer that comprises **memory** (e.g., local memory, memory device, main memory, mass storage devices); **machine readable instructions** (e.g., coded instructions, software); and **processor circuitry** (e.g., processor) **to execute the machine readable instructions**. Ex-1003, ¶211; Ex-1006, ¶¶0135-0136, ¶0141, FIG. 29:

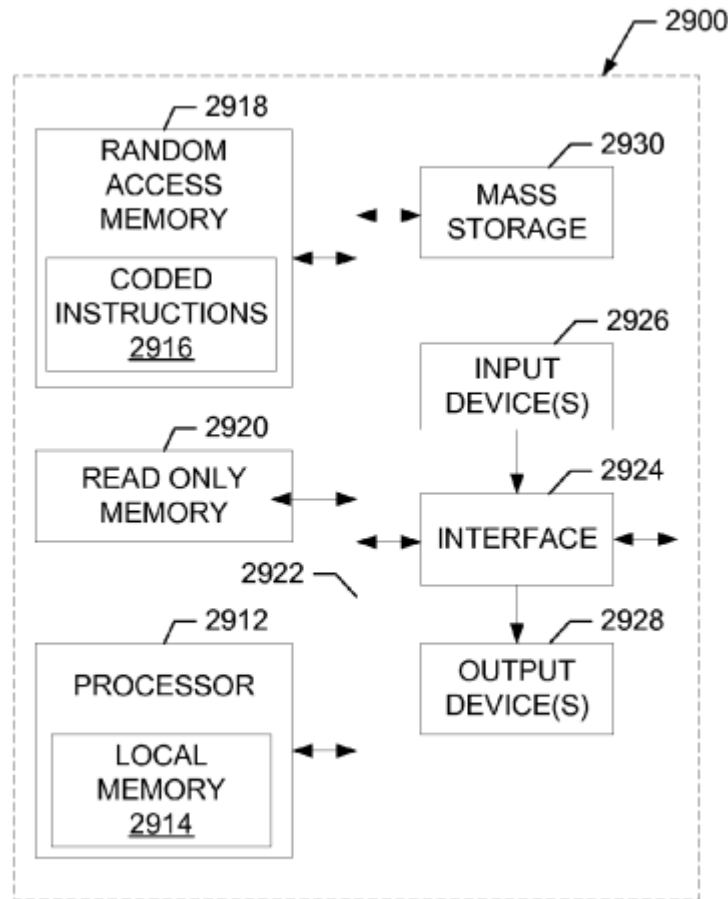


FIG. 29

This computer architecture is applicable to various components of the local metering system (Ex-1006, ¶¶0035-0036, ¶0135, ¶0141; Ex-1003, ¶212), including the audio processor systems of Figures 6 and 7 and the machine readable instructions of Figures 14 and 15 that are used to implement the audio signature processor of the display device ON/OFF detector. Ex-1006, FIGs. 6-7, FIGs. 14-15, ¶0051, ¶0056, ¶0075, ¶0078, ¶0095, ¶0097; Ex-1003, ¶213.

Nielsen-372's metering unit "is a data logging and processing unit that may be used to generate viewing records[.]" Ex-1006, ¶0041. It would have been

obvious to implement the metering unit using a memory for “data logging” functionalities and a processor circuitry and machine readable instructions for “processing” functionalities. Ex-1003, ¶214.

Because the computer architecture of memory, machine readable instructions, and processor circuitry was well known and widely used by 2011, it would have been obvious to implement the people meter (as modified based on Steinberg) using this architecture. *Supra* §VI.B.1; Ex-1003, ¶215. The combination teaches using this architecture to perform the operations of limitations [1b-1f]. *Infra* §VI.B.2[1b-1f]; Ex-1003, ¶216.

[1b]

Nielsen-372 teaches limitation [1b]. Ex-1003, ¶¶217-222. Nielsen-372 teaches that the audience measurement system (e.g., including the local metering system) **generates an audio signature of media content presented by a television** (e.g., a program displayed by the home entertainment system) **within the media exposure environment** (e.g., environment in which the home entertainment system is placed). Ex-1006, Abstract.

Nielsen-372’s sensor (e.g., a microphone) receives audio signals of a displayed program. Ex-1006, ¶0044, ¶0050, FIGs. 1-2; Ex-1003, ¶218. “The metering unit 124 and/or display device ON/OFF detector 128 ... process the audio signals [to] generate one or more audio signatures corresponding to [the] program”

(e.g., including by using an audio signature processor). Ex-1006, ¶¶0044, ¶¶0051, ¶¶0055-0057, FIGs. 2-3. Nielsen-372 teaches methods used by the audio signature processor to generate audio signatures. Ex-1006, ¶¶0095-0096, FIG. 14:

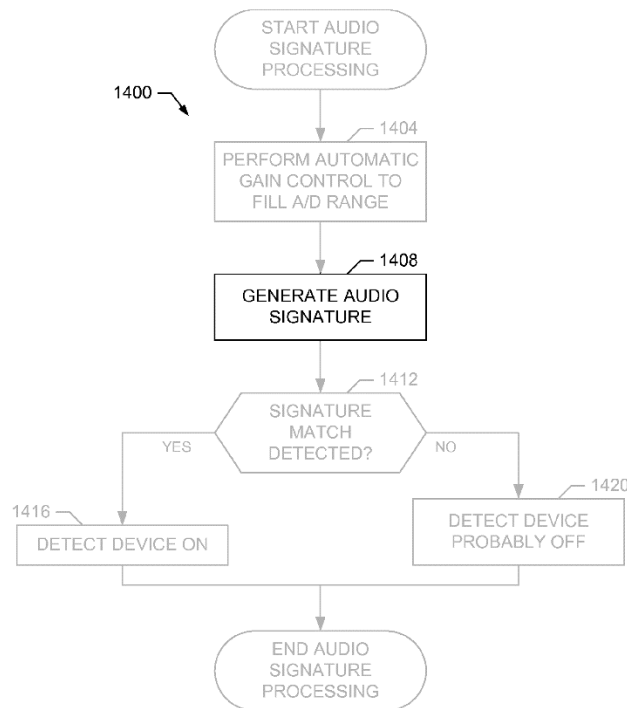


FIG. 14

See also *id.*, ¶¶0097-0100, FIG. 15; Ex-1003, ¶219.

Nielsen-372's displayed program is media content presented by a television. Ex-1006, ¶0037 ("The broadcast source 104 may be ... a cable television service provider"), ¶0036, ¶0040; Ex-1003, ¶220. The media content is presented in a media exposure environment. *Supra* §VI.B.2.1[p]. Ex-1003, ¶221.

The '243 patent admits that this limitation was known. *Supra* §VI.A.2[1b]; Ex-1001, 1:43-55; Ex-1003, ¶222.

[1c]

Nielsen-372 teaches limitation [1c]. Ex-1003, ¶¶223-226. Nielsen-372 teaches that the audience measurement system (e.g., including the local metering system) **obtains content identifying data** (e.g., program identifying information) **corresponding to the presented media content** (e.g., television program).

Nielsen teaches that the local metering system determines “program identifying information.” Ex-1006, ¶0044. The program identifying information is part of viewing data that is collected and transmitted, and is content identifying data because it identifies the presented program. Ex-1006, ¶0036, ¶0041, ¶¶0043-0044; Ex-1003, ¶223.

Nielsen-327’s local metering system generates an **audio signature of media content presented by a television within the media exposure environment**.

Supra §VI.B.2[1b]. Nielsen-372 teaches that **the content identifying data is based on the audio signature** as it teaches identifying the presented media content by comparing the audio signature to “a set of reference signatures” and finding “a match.” Ex-1006, ¶0057, ¶0096, FIG. 14:

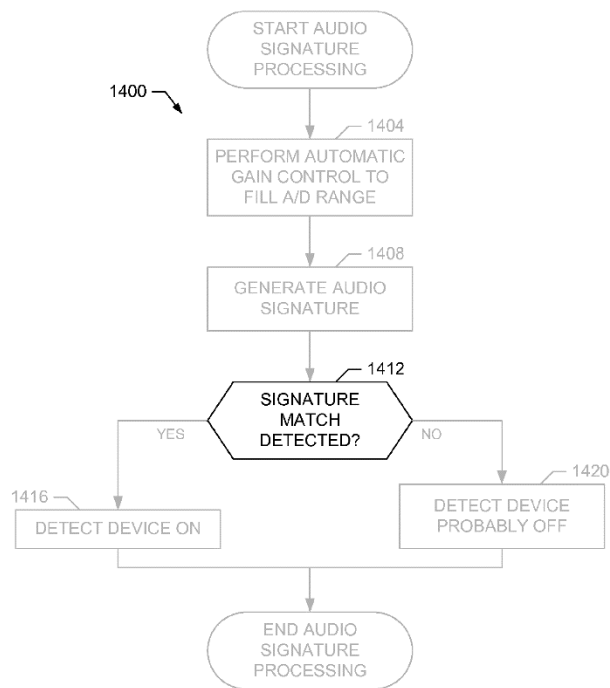


FIG. 14

Ex-1003, ¶224.

Nielsen-372 teaches that the audio signature processor, which is part of the display device ON/OFF detector (*supra* §VI.B.2[1a]; Ex-1006, ¶0051, ¶0056), identifies the presented media content (Ex-1006, ¶0057, ¶¶0095-0096). Thus, the processor circuitry executes the machine readable instructions to perform the operations of limitation [1c]. *Supra* §VI.B.2[1a]; Ex-1003 ¶225.

The '243 patent admits that this limitation was known. *Supra* §VI.A.2[1c]; Ex-1001, 1:43-55; Ex-1003, ¶226.

[1d]

The combination teaches limitation [1d]. Ex-1003, ¶¶227-235. Steinberg teaches **obtaining a sequence of images by a camera** (e.g., digital camera, image capture device). Ex-1007, ¶0010. Steinberg's image capture device (e.g., a digital camera) captures images and handles certain image processing operations. Ex-1007, ¶¶0128-0129, FIGs. 1(b)-1(c); Ex-1003, ¶227.

Steinberg teaches adding sets of new images that a POSITA would have understood to encompass consecutive images obtained by the camera, which form a sequence of images. Ex-1007, ¶0010. Steinberg thus teaches the camera obtaining a sequence of images. Ex-1003, ¶228.

Nielsen-372 teaches that the people meter “detect[s] the identities and/or number of the persons *currently* viewing programs displayed on the television.” Ex-1006, ¶0003, ¶0048. Applying Steinberg's teachings to the people meter (*supra* §VI.B.1), a POSITA would have found it obvious to capture images **while the media content is presented by the television** to detect current viewing activities. As explained above, the media content **corresponds to the content identifying data**. *Supra* §VI.B.2[1c]; Ex-1003, ¶229.

In light of Nielsen-372's teachings, a POSITA would have found it obvious to identify the persons in the audience based on **images of the media exposure environment**. Ex-1003, ¶230. Steinberg teaches that, when new image(s) are

acquired, a Face Detection module is alerted to further process the image(s). Ex-1007, ¶0092, ¶0117, ¶0128, ¶0130, ¶0151. Steinberg teaches or renders obvious analyzing a sequence of images by disclosing analyzing multiple images. *See, e.g.*, Ex-1007, ¶0092 (“new images”), ¶0117, ¶0130; Ex-1003, ¶231.

Steinberg teaches face detection. Ex-1007, Abstract, ¶0005, ¶0057. After the Face Detection module is alerted of new images, it detects a face in one or more of the images. Ex-1007, ¶0130 (“These stored images are then preferably processed by the face detection module 1630 ... when one or more faces are detected within the acquired images....”), ¶0118, ¶0128; Ex-1003, ¶232. Steinberg teaches a workflow for face detection. Ex-1007, ¶0151, FIG. 3:

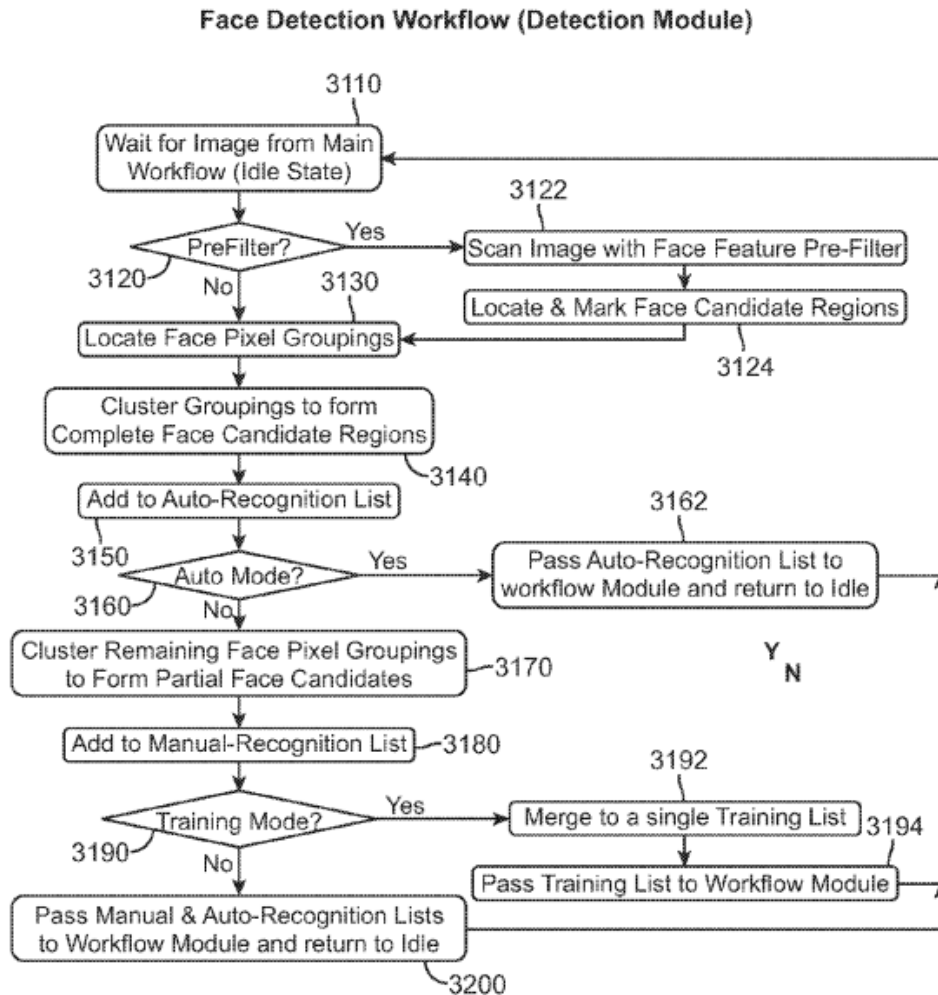


FIG. 3

Steinberg’s face detection teaches **analyzing a sequence of images to detect a head appearing in one or more of the images** since “face detection” is often used interchangeably with “head detection.” Ex-1003, ¶233. Combining Nielsen-372 and Steinberg, it was obvious that the processor circuitry executes the machine readable instructions to perform the operations of limitation [1d]. *Supra* §VI.B.2[1a]; Ex-1003, ¶234.

Furthermore, the '243 patent admits the prior art included approaches for identifying a number of people in a media exposure environment, which commonly involved identifying heads. *Supra* §VI.A.2[1d]; Ex-1001, 1:56-2:3; Ex-1003, ¶235.

[1e]

The combination teaches limitation [1e]. Ex-1003, ¶¶236-239. Steinberg normalizes detected faces. Ex-1007, ¶0092(“If faces are found, then they are preferably normalized and face prints are generated.”), ¶0120, ¶0130, ¶0136, FIGs. 1(a)-(c). Normalizing includes determining a pose or orientation of the detected face. Ex-1007, ¶0120 (“[T]he Face Normalization module ... analyzes the ... pose, ... orientation of each face candidate region.”), ¶0166, ¶0168, FIG. 5(a):

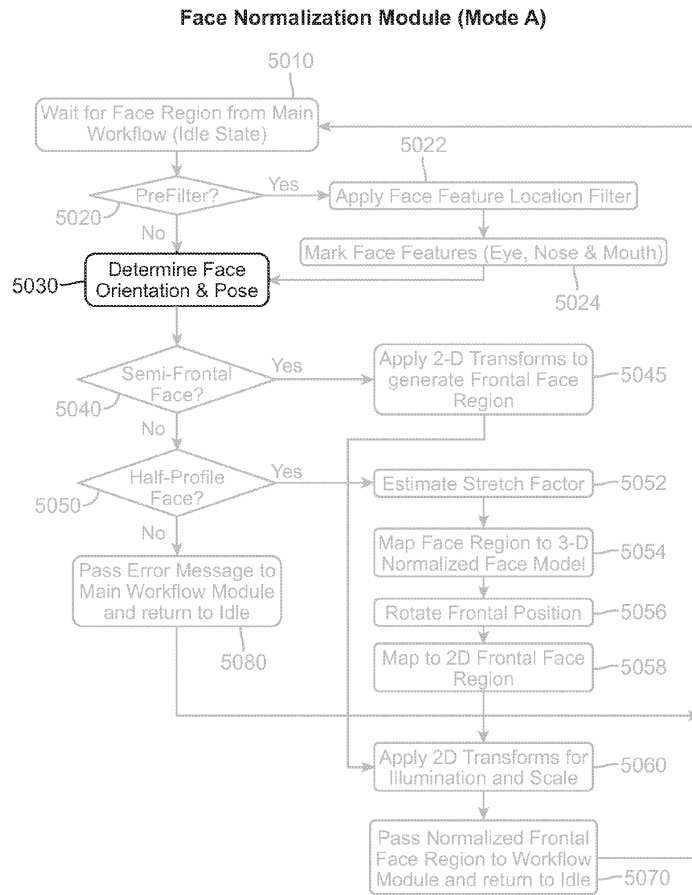
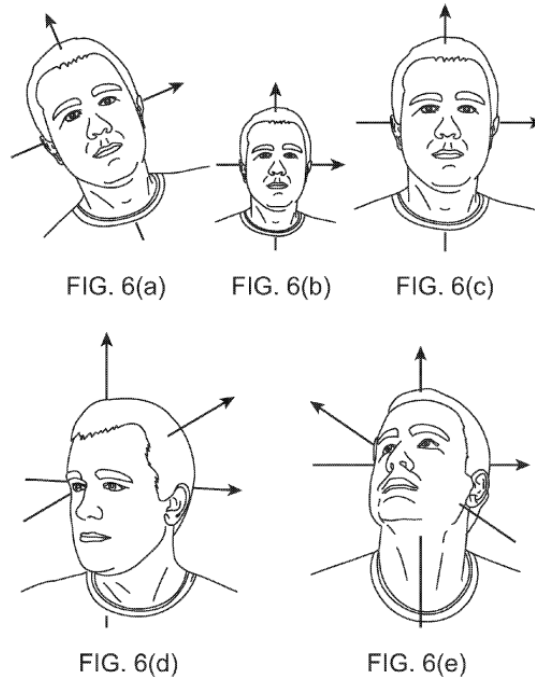


FIG. 5(a)

¶0176, FIG. 5(b); Ex-1003, ¶¶236-237.

The determined facial pose or orientation is **an orientation of the head with respect to the camera** as it reflects different rotation angles of the head in an image with respect to the camera that captured the image (e.g., a frontal pose indicates that the face is directly facing the camera). Ex-1007, ¶0121, ¶0167, FIG. 6(a)-(e):



¶0173; Ex-1003, ¶238.

Combining Nielsen-372 and Steinberg, it was obvious that the processor circuitry executes the machine readable instructions to perform the operations of limitation [1e]. *Supra* §VI.B.2[1a]; Ex-1003, ¶239.

[1f]

The combination teaches limitation [1f]. Ex-1003, ¶¶240-247. Steinberg teaches **determining identification information** (e.g., identity region, identity grouping, face class, identity of person) **based on a match of the head to a known person**. Steinberg teaches face recognition based a match between a “face region” in an image and a “known face.” Ex-1007, ¶0005, ¶0057; Ex-1003, ¶240. Face recognition is performed by generating a faceprint and comparing it with

faceprints stored in a database. Ex-1007, ¶0092 (“[T]he face recognition module ... compares their faceprints with a database of ‘known faceprints’.”), ¶0096, ¶¶0126-0127, ¶0130, FIGs. 1(a)-(c); Ex-1003, ¶241.

The database stores faceprints in association with identity information—for example, a known person is associated with at least one identity region and multiple face classes each comprising faceprints. Ex-1007, ¶0135 (“Each person may have multiple identities... Each identity may include one or more face classes.”), ¶0099, ¶0178, FIG. 9(a):

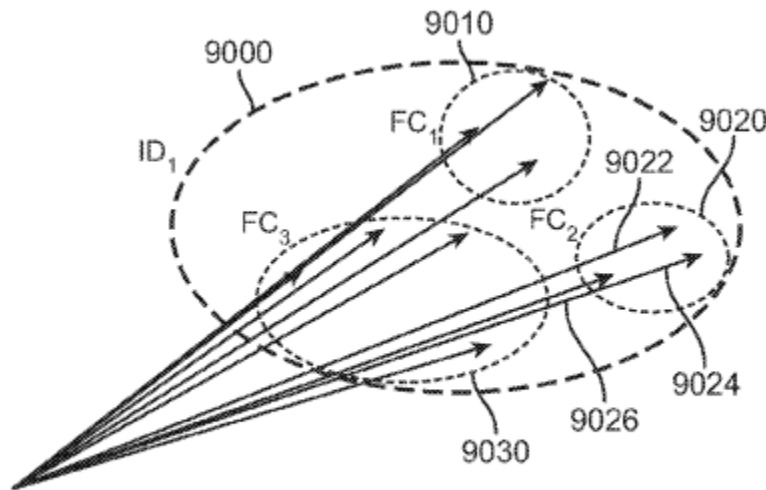


FIG. 9(a)

Ex-1003, ¶242.

A matched faceprint allows the determination of the identity information (e.g., a face class, association with a person). Ex-1007, ¶¶0156-0157, FIGs. 4(a)-(b):

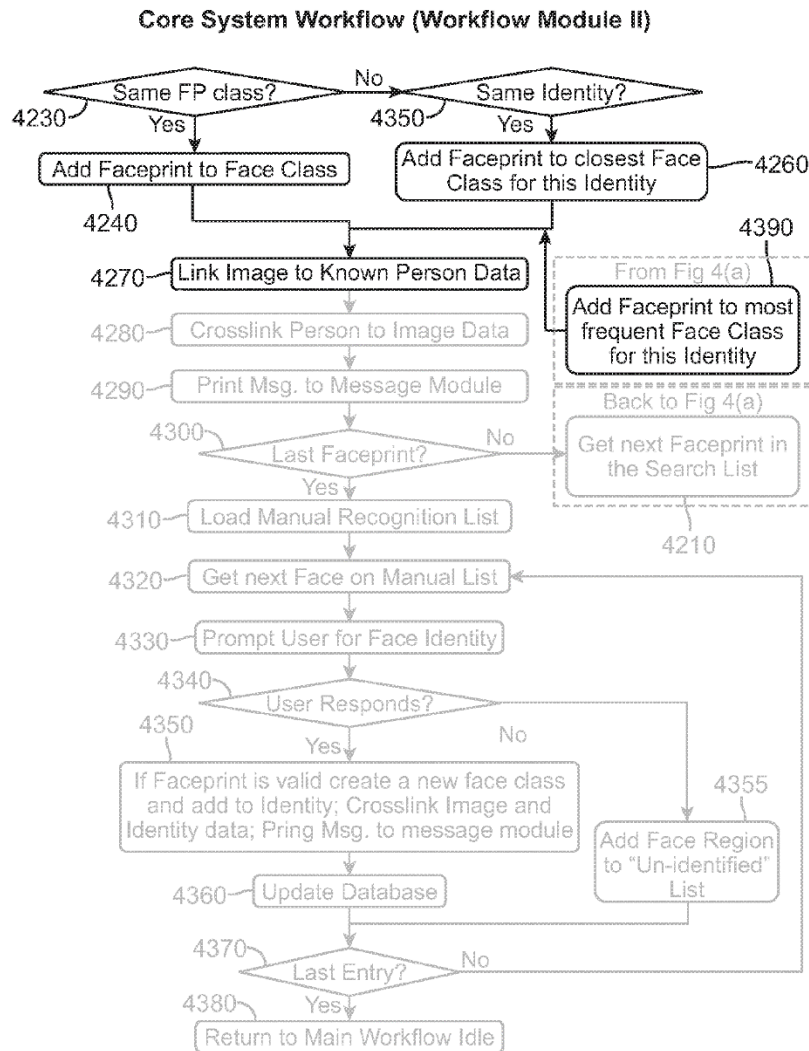


FIG. 4(b)

Ex-1003, ¶243. Steinberg’s teachings regarding faceprints teaches a match of a “head” (e.g., used interchangeably with face) to a known person. *See, e.g.*, Ex-1001, 10:20-38 (“... to identify heads and/or faces”); Ex-1003, ¶244.

Nielsen-372 teaches that its people meter is located in a media exposure environment for identifying members of the **audience**. *Supra* VI.B.2[1d]; Ex-

1006, ¶0003, ¶0048. Combining Nielsen-372 and Steinberg (*supra* §VI.B.1), it would have been obvious to compare a face or head in an image to those for persons **associated with the media exposure environment**.

This can be achieved by, for example, filling the database with faceprints from persons associated with the media exposure environment or compare a new faceprint with a subset of the database corresponding to the media exposure environment, which a POSITA would have recognized as obvious and readily doable. *See, e.g.*, Ex-1007, ¶0156 (“a search of all the known Faceprints, or of a selected sub-set....”); Ex-1003, ¶245. Combining Nielsen-372 and Steinberg, it was obvious that the processor circuitry executes the machine readable instructions to perform the operations of limitation [1f]. *Supra* §VI.B.2[1a]; Ex-1003, ¶246.

The ’243 patent admits that audience identification based on facial recognition was known. *Supra* §VI.A.2[1f]; Ex-1001, 1:56-2:3; Ex-1003, ¶247.

[1g]

The combination teaches limitation [1g]. Ex-1003, ¶¶248-252. Nielsen-372 teaches “implementing the apparatus and methods” using a computer that includes a “interface circuit.” Ex-1006, ¶0135, FIG. 29:

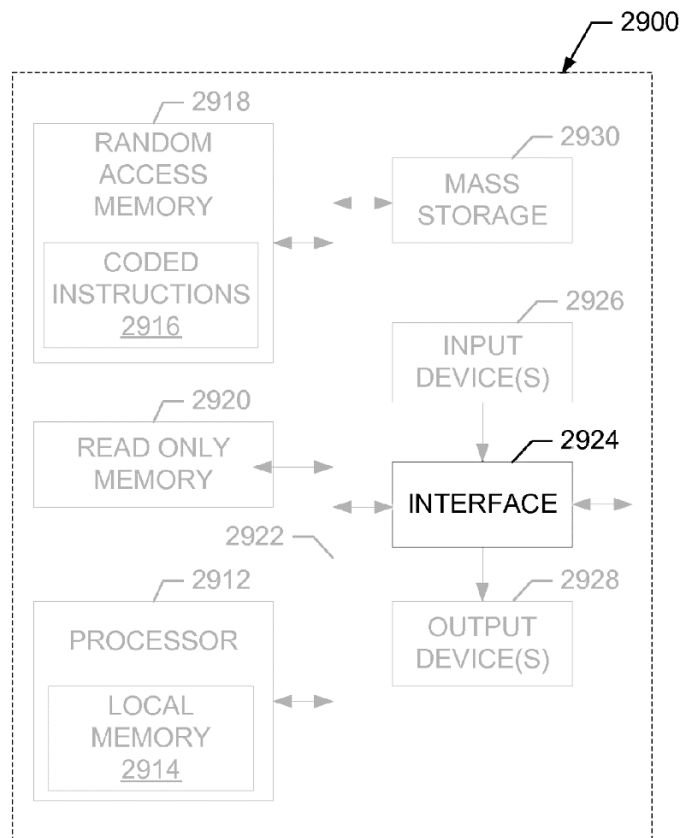


FIG. 29

Nielsen-372's interface circuit can be implemented as an "Ethernet interface," which is a network interface circuitry. Ex-1006, ¶0135; Ex-1003, ¶248.

The combination teaches that the network interface circuitry **outputs a signal indicative of the content identifying data and the audience identification information to a data collection facility** (e.g., central facility, central office, data processing facility, image collection database). Nielsen-372 teaches that the local metering system outputs viewing records to a central office or data processing facility over a network connection. Ex-1006, ¶0041 ("The metering unit 124 ...

transmits the collected viewing records over a connection 140 to a central office or data processing facility[.]”), ¶0036, FIG. 1:

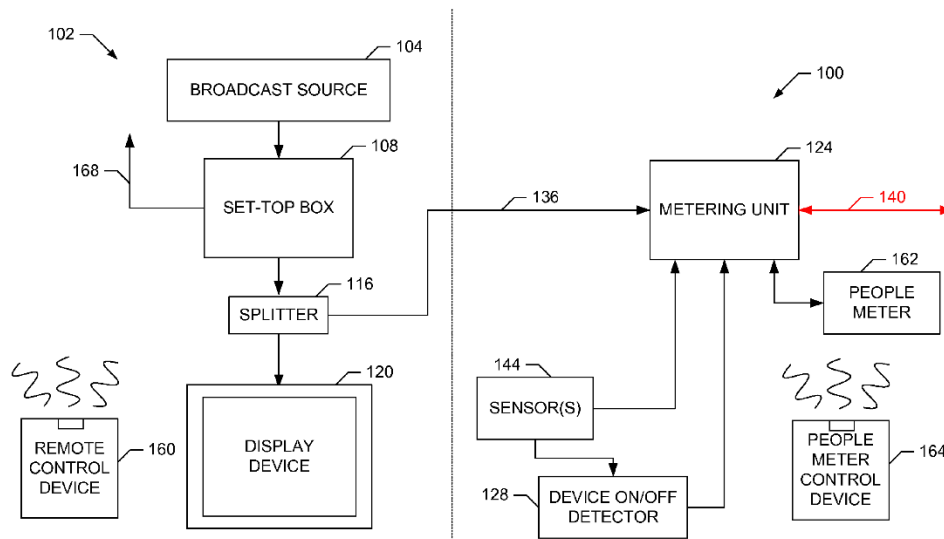


FIG. 1

Ex-1003, ¶249.

Steinberg further teaches a local device (e.g., a camera) outputting data to an image classification database. Ex-1007, ¶0131; Ex-1003, ¶250.

A POSITA would have understood that the central office or data processing facility in Nielsen-372 and the image classification database in Steinberg are data collection facilities because they collect and store data. Because data commonly transmit over networks in the form of electromagnetic signals, Nielsen-372 and Steinberg teach outputting a signal to a data collection facility. Ex-1003, ¶251. A POSITA would have found it obvious that the signal is indicative of the content

identifying data and the audience identification information. *Supra* §VI.B.2[1b-1f]; Ex-1003, ¶252.

3. Claim 9

9[p].

As explained for claim 1, the combination teaches this preamble. *Supra* §VI.B.2.1[p]; Ex-1003, ¶254.

[9a]

As explained for claim 1, Nielsen-372 (as modified based on Steinberg) teaches an audience measurement system at least based on its disclosure of a local metering system, which includes components such as a metering unit, a display device ON/OFF detector, and a people meter, placed in a media exposure environment. *Supra* §VI.B.2.1[p]; Ex-1003, ¶255.

In light of their functionalities, a combination of the aforementioned components constitutes **an audience measurement device** because they measure exposure of an audience to media content. *Supra* §VI.B.2.1[p]; Ex-1006, ¶0044, ¶0048; Ex-1001, 8:7-43; *supra* §VI.A.7[9a]; Ex-1003, ¶256.

It would have been obvious to implement the audience measurement device using the architecture of memory, machine readable instructions, and processor circuitry to perform operations directed to identifying a television program and audience members. *Supra* §VI.B.2[1a]. The combination teaches the audience

measurement device performing the operations recited in limitations [9b]-[9g].

Infra §VI.B.3[9b-9g]; Ex-1003, ¶257.

[9b]

As explained for claim 1 and limitation [9a], Nielsen-372 teaches limitation [9b]. *Supra* §VI.B.2[1b], §VI.B.3[9a]; Ex-1003, ¶258.

[9c]

As explained for claim 1 and limitation [9a], Nielsen-372 teaches limitation [9c]. *Supra* §VI.B.2[1c], §VI.B.3[9a]; Ex-1003, ¶259.

[9d]

As explained for claim 1 and limitation [9a], the combination teaches the audience measurement device obtaining (i.e., collecting) a sequence of images of the media exposure environment with a camera while the media content corresponding to the content identifying data is presented by the television and detecting a head appearing in one or more of the images. *Supra* §VI.B.2[1d], §VI.B.3[9a]; Ex-1003, ¶260. The one or more images in which a head is detected includes at least one image, which constitutes a **first image** that is collected. Thus, the combination teaches limitation [9d]. Ex-1003, ¶260.

[9e]

As explained for claim 1 and limitation [9a], the combination teaches the audience measurement device detecting a head in one or more images. *Supra* §VI.B.2[1d], §VI.A.3[9a]; Ex-1003, ¶261. The one or more images include the first image. *Supra* §VI.B.3[9d]. Because this approach does not guarantee detecting a head in each image (Ex-1007, ¶0118), it includes attempts to detect a head. Thus, the combination teaches limitation [9e]. Ex-1003, ¶261.

[9f]

As explained for claim 1 and limitation [9a], Nielsen-372 teaches limitation [9f]. *Supra* §VI.B.2[1e], §VI.B.3[9a]; Ex-1003, ¶262.

[9g]

As explained for claim 1 and limitation [9a], the combination teaches the audience measurement device determining audience identification information based on a match of the head to a known person associated with the media exposure environment. *Supra* §VI.B.2[1f], §VI.B.3[9a]; Ex-1003, ¶¶263-264. Steinberg teaches associating a detected face with identity information of a matched faceprint of a known person. *Supra* §VI.B.2[1f]; Ex-1007, ¶0092, ¶0096, ¶¶0126-0127, ¶0130, ¶0157, FIGs. 1(a)-(c). These disclosure of Steinberg teaches

an indication that the head matches a known person, on which audience identification is based. Ex-1003, ¶263.

Because the audience measurement system is set up to monitor the media exposure environment, known persons associated with the media exposure environment are associated with the audience measurement system. Because the combination teaches determining a match with a known person associated with the media exposure environment (*supra* §VI.B.2.1[p]), it teaches determining the match with **a known person associated with the audience measurement system**. Ex-1003 ¶264.

[9h]

As explained for claim 1, the combination teaches a data collection facility (e.g., central facility, central office, data processing facility) to which a network interface circuitry outputs a signal indicative of the content identifying data and the audience identification information. *Supra* §VI.B.2[1g]; Ex-1003, ¶265. Nielsen-372 teaches that the data collection facility further processes the obtained data and information. *Supra* §VI.B.2[1g]; Ex-1006, ¶0036, ¶0041. It would have been obvious to structure the audience measurement system such that it includes the data collection facility in addition to the local metering system. Ex-1003, ¶265. Therefore, the combination teaches limitation [9h]. Ex-1003, ¶266.

4. Claim 16

16[p].

As explained for claim 1, the combination teaches an audience measurement system that obtains exposure data for a media exposure environment by performing multiple steps. *Supra* §VI.B.2. Both Nielsen-372 and Steinberg contemplate methods that include operations they teach. *See, e.g.*, Ex-1006, Abstract, ¶¶0134, ¶0144; Ex-1007, Abstract, ¶0090. The combination thus teaches a **method** for obtaining exposure data for a media exposure environment that includes the operations recited in claim 16. *Infra* §VI.B.4[16a-16g]; Ex-1003, ¶268.

[16a]

As explained for claim 1, Nielsen-372 teaches that the audience measurement system, including a sensor and a metering unit and/or display device ON/OFF detector, generates an audio signature of media content presented by a television within the media exposure environment. *Supra* §VI.A.2[1b-1c]. The sensor and the metering unit and/or display device ON/OFF detector together form a “program detector” because they receive and analyze audio signals to identify a television program. *Supra* §VI.B.2[1b-1c]; Ex-1001, 7:1-41. A POSITA would have found it obvious to arrange the hardware and software of these components to form a program detector. Accordingly, Nielsen-372 teaches performing the operation of limitation [16a] using a program detector. Ex-1003, ¶269.

[16b]

As explained for claim 1 and the preamble 16[p], Nielsen-372 teaches limitation [16b]. *Supra* §VI.B.2[1c], §VI.B.4.16[p]; Ex-1003, ¶270.

[16c]

As explained for claim 1, the combination teaches that the audience measurement system capturing a sequence of images of the media exposure environment with a camera while the media content corresponding to the content identifying data is presented by the television and detecting a head appearing in one or more of the images. *Supra* §VI.B.2[1d]; Ex-1007, ¶0010, ¶¶0128-0129. When there are more than one images in which a head is detected, the one or more images includes **first and second images** that are captured. Thus, the combination teaches limitation [16c]. Ex-1003, ¶271.

[16d]

As explained for claims 1 and 9, the combination teaches the audience measurement system, including the camera and people meter, analyzing the sequence of images including the first image and attempts to detect a head in the first image. Ex-1006, ¶0048; *supra* §VI.B.1, §VI.B.2[1d], §VI.B.3[9e]; Ex-1003, ¶272. The camera and the people meter together form an audience detector because they capture images and identify individuals in the audience. Ex-1001,

5:29-6:44, 8:7-43. A POSITA would have found it obvious to arrange the hardware and software of these components to form an audience detector. Accordingly, the combination teaches performing the operation of limitation [16d] using an audience detector. Ex-1003, ¶¶272-273.

[16e]

As explained for claim 1 and limitation [16d], it would have been obvious to use the audience detector to perform the operation of limitation [16e]. *Supra* §VI.B.2[1e], §VI.B.4[16d]; Ex-1003, ¶274.

[16f]

As explained for claim 9, it would have been obvious to use the audience detector to perform the operation of limitation [16f]. *Supra* §VI.B.3[9g], §VI.B.4[16d]; Ex-1003, ¶¶275-276.

Because the audience detector is formed by components of the audience measurement system (*supra* §VI.B.4[16d]), known persons associated with the audience measurement system are also associated with audience detector. Thus, the combination teaches determining the match with **a known person associated with the audience detector**. Ex-1003, ¶277.

[16g]

As explained for claim 1 and the preamble 16[p], the combination teaches limitation [16g]. *Supra* §VI.B.2[1g], §VI.B.4.16[p]; Ex-1003, ¶278.

C. Ground 3

1. Combination of Nielsen-372, Steinberg, and Tian

The combination of Nielsen-372 and Steinberg teaches an audience measurement system that determines media content presented by a television and identifies individuals in the audience based on facial analysis. *Supra* §§VI.B.1-2. Similar to Steinberg, Tian teaches techniques for image processing and facial analysis. Ex-1005, Abstract, 000002, 000005; Ex-1003, ¶280.

A POSITA would have found it obvious to add Tian to the combination of Nielsen-372 and Steinberg because Steinberg and Tian are directed to similar functionalities (e.g., images process and facial analysis) and address similar software-based tasks (e.g., identifying a head in an image). A POSITA would have found it obvious and been motivated to use Tian's techniques to improve Steinberg and to apply these techniques to the people meter of Nielsen-372. Ex-1003, ¶281.

Tian teaches performing facial analysis on sequences of images of subjects. *See, e.g.*, Ex-1005, 000005. Tian's teaching are compatible with Steinberg, which teaches identifying analyzing one or multiple images (*see supra* §VI.B.2[1d-1f]); it was obvious for the people meter to analyze sequences of images to identify

audience members. Ex-1003, ¶282. A POSITA would have been motivated to apply Tian's teaching because performing facial analysis on a sequence of images can improve the confidence level of identification and allow the selective performance of face recognition on suitable images. *Supra* §VI.A.1; Ex-1022, 000007; Ex-1010, ¶0003; Ex-1003, ¶283.

Tian teaches determining a face/head location in a first image and using this location for subsequent images unless a change is detected. *See, e.g.*, Ex-1005, 000001, 000003; Ex-1003, ¶284. Contemporary writings demonstrates that it was obvious to apply Tian's approach to Nielsen-372 and Steinberg. Ex-1010, ¶0003; Ex-1003, ¶¶284-285; *supra* §VI.A.1. A POSITA would have been motivated to apply this approach because it saves processing resources and time by not repeating face detection for entire images. Ex-1003, ¶285; *supra* §VI.A.1.

Tian teaches obtaining and analyzing reduced-resolution images and that the accuracy of face detection and head pose estimation can be maintained for reduced-resolution images. *See, e.g.*, Ex-1005, Abstract, 000002, 000005; Ex-1003, ¶286. Analyzing reduced-resolution images can reduce the time and resource consumption of tasks such as face detection and pose estimation. Ex-1013, 000001; Ex-1014, 2:43-53; Ex-1015, ¶0022; Ex-1005, 000005; Ex-1003, ¶287. However, it was known that the performance of face recognition may be adversely affected by the reduction of image resolution. Ex-1027, 000004-05. A

POSITA would have been motivated to perform certain facial analysis techniques (e.g., face detection, head pose estimation) on reduced-resolutions images, while other techniques (e.g., face recognition) on full-quality images. Ex-1003, ¶¶287-288; *supra* §VI.A.1.

A POSITA would have found it obvious and been motivated to apply the teachings of Tian to the combination of Nielsen-372 and Steinberg because this is an application of known techniques (e.g., Tian’s facial analysis techniques) to a known system (e.g., Nielsen-372’s people meter) and method (e.g., Steinberg’s facial analysis methods) ready for improvement. *Supra* §VI.B.1. Doing so would have improved accuracy of face recognition and provided savings in processing resources and time, and would have yielded predictable results at least because Tian provides experimental assessments of its techniques. Ex-1003, ¶289.

The combination simply uses Tian’s teachings about image processing and facial analysis, in the manner taught by Tian, to implement functionality in Nielsen-372. *See supra* §I. A POSITA would have been motivated and would have had a reasonable expectation of success in combining the references given the overlap between Steinberg and Tian and because the combination uses well-known techniques that would not have changed the principle of operation for any of the references. Ex-1003, ¶290.

2. Claim 1

1[p].

Nielsen-372 and Steinberg teach the preamble. *Supra* §VI.B.2.1[p]; Ex-1003, ¶¶292-293.

[1a]

Nielsen-372 and Steinberg teach limitation [1a]. *Supra* §VI.B.2[1a]; Ex-1003, ¶¶294-295.

[1b]

Nielsen-372 teaches limitation [1b]. *Supra* §VI.B.2[1b]; Ex-1003, ¶¶296-297.

[1c]

Nielsen-372 teaches limitation [1c]. *Supra* §VI.B.2[1c]; Ex-1003, ¶¶298-299.

[1d]

Nielsen-372 and Steinberg teach limitation [1d]. *Supra* §VI.B.2[1d]; Ex-1003, ¶300. Tian further teaches obtaining a sequence of images of human subjects using a camera and analyzing the sequence of images to detect a head appearing in one or more of the images. Ex-1005, 000002, 000005; *supra* §VI.A.2[1d]. Ex-1003, ¶¶300-302.

[1e]

Nielsen-372 and Steinberg teach limitation [1e]. *Supra* §VI.B.2[1e]; Ex-1003, ¶303. Tian further teaches determining an orientation of the head with respect to the camera. *Supra* §VI.A.2[1a]; Ex-1005, 000001-03; Ex-1003, ¶¶303-304.

[1f]

Nielsen-372 and Steinberg teach limitation [1f]. *Supra* §VI.B.2[1f]; Ex-1003, ¶¶305-306.

[1g]

Nielsen-372 and Steinberg teach limitation [1g]. *Supra* §VI.B.2[1g]; Ex-1003, ¶¶307-308.

3. Claim 4

4[p].

The combination teaches claim 1. *Supra* §VI.C.2. It would have been obvious to use the processor circuitry to perform the operations of limitations [4a] and [4b]. *Supra* §VI.B.2[1a], §VI.C.2[1a]; Ex-1003, ¶310.

[4a]

Tian teaches reducing the resolution of an image to obtain a reduced-resolution image. *Supra* §VI.A.3[4a]; Ex-1005, Abstract, 000002. A POSITA

would have found it obvious to apply this teaching to a first image of the media exposure environment. *Supra* §VI.C.1, §VI.A.3[4a]; Ex-1003, ¶311. Steinberg’s teachings of processing images of different resolutions would have further motivated a POSITA to apply Tian’s teachings. Ex-1007, ¶0141, ¶0142, ¶0196. Therefore, the combination teaches limitation [4a]. Ex-1003, ¶312.

[4b]

Tian teaches determining a pose estimate (i.e., determining orientation of head, *see* §VI.C.2[1e]) based on a reduced-resolution image. Ex-1005, 000005; *supra* §VI.A.3[4b]. A POSITA would have found it obvious to apply Tian’s teachings to the audience measurement system. *Supra* §VI.C.1, §VI.A.3[4b]. Therefore, the combination teaches limitation [4b]. Ex-1003, ¶313.

4. Claim 5

5.

The combination teaches claim 4. *Supra* §VI.C.3. It would have been obvious to use the processor circuitry to perform the operations of claim 5. *Supra* §VI.B.2[1a], §VI.C.2[1a]; Ex-1003, ¶315.

Steinberg teaches **generating a facial signature** (e.g., faceprint) **from a region of an image corresponding to a location of the head** (e.g., face candidate region). *Supra* §VI.B.2[1f]; Ex-1007, ¶0092, ¶0096, ¶¶0126-0127, ¶0130, FIGs. 1(a)-(c). Steinberg’s faceprint is a “facial signature” because it is a feature vector

corresponding to parameters associated with a face region. Ex-1007, ¶0077, ¶0124, ¶0126; Ex-1001, 6:3-44; Ex-1003, ¶316. Steinberg's face candidate region corresponds to a location of the face, which is also the location of the head. Ex-1007, ¶0118, ¶0120. Ex-1003, ¶317.

The combination teaches generating the facial signature from a region of **a second image of the one or more of the images** corresponding to a location of the head **in the reduced-resolution image**. In light of Tian's teachings of generating a reduced-resolution image and tracking face in a sequence of images, a POSITA would have found it obvious to determine the location of a person's face in a reduced-resolution image and use this location to perform facial recognition based on higher-resolution images. *Supra* §VI.A.4, §VI.C.1; Ex-1005, 000001, 000003, 000005; Ex-1003 ¶¶318-319. In this manner, after a location of the head is determined in a reduced-resolution image generated from a first image, facial recognition is performed on a region corresponding to the location in one or more images of the sequence, including a second image. Ex-1003 ¶320.

Steinberg teaches **comparing the generated facial signature** (e.g., faceprint) **to a database of facial signatures**. *Supra* §VI.C.2[1f]; Ex-1007, ¶0092, ¶0096, ¶¶0126-0127, ¶0130, FIGs. 1(a)-(c). Steinberg further teaches **determining the audience identification information** by generating the facial signature and comparing the generated facial signature to a database of facial signatures. *Supra*

§VI.C.2[1f]; Ex-1007, ¶0099, 0135, 0156-0157, 0178, FIGs. 4(a)-(b), FIG. 9(a).

Therefore, the combination teaches claim 5. Ex-1003, ¶321.

5. Claim 6

6[p].

The combination teaches claim 4. *Supra* §VI.C.3. It would have been obvious to use the processor circuitry to perform the operations of limitations [6a]-[6c]. *Supra* §VI.C.2[1a]; Ex-1003, ¶323.

[6a]

The combination teaches **identifying a region corresponding to the head within an image**. *Supra* §VI.B.2[1d], §VI.C.2[1d]. Steinberg teaches analyzing images to detect a “face region,” which is a region corresponding to the face and head. *Supra* §VI.B.2[1d]; Ex-1007, Abstract, ¶0005, ¶0057, ¶0118, ¶0128, ¶0130, ¶0151, FIG. 3. Furthermore, Tian teaches determining a face/head location in a first image and using this location for subsequent images unless a change is detected. *Supra* §VI.A.4, §VI.C.4; Ex-1005, 000001, 000003; Ex-1003, ¶324.

Tian further teaches **obtaining a reduced-resolution image from the first image**. *Supra* ¶VI.A.3[4a], ¶VI.C.3[4a]. Therefore, the combination teaches identifying a region corresponding to the head within the first image from which the reduced-resolution image was obtained. Ex-1003, ¶325.

[6b]

It would have been obvious to apply Tian's teaching to Nielsen-372 and Steinberg such that the television audience measurement system determines a face or head location in a first image and use the determined location for subsequent images. *Supra* §VI.C.4; Ex-1003, ¶¶326-327.

Steinberg teaches analyzing a portion corresponding to the identified region of the head or face to determine that the head matches the known person based on the analysis. *Supra* §VI.B.2[1f], §VI.C.2[1f], §VI.C.4; Ex-1007, ¶0092, ¶0096, 0099, ¶¶0126-0127, ¶0130, ¶0135, ¶¶0156-0157, ¶0178, FIGs. 1(a)-(c), FIGs. 4(a)-(b); Ex-1003, ¶328. Therefore, the combination teaches limitation [6b]; Ex-1003, ¶329.

6. Claim 8

8.

The combination teaches claim 6. *Supra* §VI.C.5. It would have been obvious to use the processor circuitry to perform the operations of claim 8. *Supra* §VI.B.2[1a], §VI.C.2[1a]; Ex-1003, ¶331.

The combination teaches determining audience identification information based on a match of the head to a known person and outputting such information. *Supra* §VI.B.2[1f-1g], §VI.C.2[1f-1g]. Steinberg teaches the local metering unit storing viewing records, which includes information regarding the audience, before

sending the records to a central facility. Ex-1006, ¶¶0036, ¶¶0041, ¶¶0048. Steinberg also stores identification information in association with faceprints. *See, e.g.*, Ex-1007, ¶¶0099, ¶¶0150; Ex-1003, ¶¶332.

The audience identification information includes, for example, identity region, identity grouping, face class, and identity of person. *Supra* §VI.B.2[1f], §VI.C.2[1f]; Ex-1007, ¶¶0099, ¶¶0135, ¶¶0156-0157, ¶¶0178. The identification information are linked to database profiles of known persons. Ex-1007, ¶¶0159. Because the identification information identifies known persons, a POSITA would have understood or found it obvious for it to include identifiers, which the '243 patent also admits to be known in the prior art. Ex-1001, 1:43-55; Ex-1003, ¶¶333.

The combination teaches that the audience measurement system includes a memory. *Supra* §VI.B.2[1a], §VI.C.2[1a]. A POSITA would have found it obvious to cause the identifier associated with the person to be stored in memory. Ex-1003, ¶¶334.

7. Claim 9

9[p].

Nielsen-372 and Steinberg teach the preamble. *Supra* §VI.B.3.9[p]; Ex-1003, ¶¶336-337.

[9a]

Nielsen-372 and Steinberg teach limitation [9a]. *Supra* §VI.B.3[9a]; Ex-1003, ¶¶338-339.

[9b]

Nielsen-372 teaches limitation [9b]. *Supra* §VI.B.3[9b]; Ex-1003, ¶¶340-341.

[9c]

Nielsen-372 teaches limitation [9c]. *Supra* §VI.B.3[9c]; Ex-1003, ¶¶342-343.

[9d]

Nielsen-372 and Steinberg teach limitation [9a]. *Supra* §VI.B.3[9d]; Ex-1003, ¶¶344-345.

[9e]

Nielsen-372 and Steinberg teach limitation [9e]. *Supra* §VI.B.3[9e]; Ex-1003, ¶346. Tian also teaches attempting to detect a head appearing in an image. Ex-1005, 000002, 000005; Ex-1003, ¶¶346-347.

[9f]

Nielsen-372 and Steinberg teach limitation [9f]. *Supra* §VI.B.3[9f]; Ex-1003, ¶348. Tian further teaches determining an orientation of the head with

respect to the camera. *Supra* §VI.A.2[1e]; Ex-1005, 000001-03; Ex-1003, ¶¶348-349.

[9g]

Nielsen-372 and Steinberg teach limitation [9g]. *Supra* §VI.B.3[9g]; Ex-1003, ¶¶350-351.

[9h]

Nielsen-372 and Steinberg teach limitation [9h]. *Supra* §VI.B.3[9h]; Ex-1003, ¶¶352-353.

8. Claim 11

11[p].

The combination teaches claim 9. *Supra* §VI.C.7; Ex-1003, ¶355.

[11a]

As explained for claim 4 and limitation [9a], the combination teaches the audience measurement device reducing a resolution of one of the one or more of the images (satisfying the “first image” in claim 9, *supra* §VI.B.3[9d], ¶VI.C.7[9d]) of the media exposure environment to obtain a reduced-resolution image. *Supra* §VI.C.3[4a], §VI.B.3[9a], §VI.C.7[9a]; Ex-1003, ¶356. Thus, the combination teaches limitation [11a]. Ex-1003, ¶356.

[11b]

As explained for claim 4 and limitation [9a], the combination teaches limitation [11b]. *Supra* §VI.C.3[4b], §VI.B.3[9a], §VI.C.7[9a]; Ex-1003, ¶357.

9. Claim 12

12[p].

The combination teaches claim 11. *Supra* §VI.C.8; Ex-1003, ¶359.

[12a]

As explained for claim 6 and limitation [9a], the combination teaches limitation [12a]. *Supra* §VI.C.5[6a], §VI.B.3[9a], §VI.C.7[9a]; Ex-1003, ¶360.

[12b]

As explained for claim 6 and limitation [9a], the combination teaches analyzing a portion of a second image corresponding to the identified region to determine that the head matches the known person. *Supra* §VI.C.5[6b], §VI.B.3[9a], §VI.C.7[9a]; Ex-1003, ¶361.

Steinberg teaches determining **whether** the head matches the known person. *See, e.g.*, Ex-1007, ¶0126. Therefore, the combination teaches limitation [12b]. Ex-1003, ¶361.

10. Claim 13

13.

The combination teaches claim 12. *Supra* §VI.C.9. As explained for claim 8 and limitation [9a], the combination teaches that the audience identification information includes an identifier associated with the known person and that the audience measurement device causes the identifier associated with the person to be stored (i.e., recorded) in the memory responsive to a determination that the head matches the known person. *Supra* §VI.C.6, §VI.B.3[9a], §VI.C.7[9a]; Ex-1003, ¶363. The combination further teaches representing the match with an indication that the head matches the known person. *Supra* §VI.B.3[9g], §VI.C.7[9g]. Thus, the combination teaches claim 13. Ex-1003, ¶363.

11. Claim 14

14.

The combination teaches claim 11. *Supra* §VI.C.8. As explained for claim 5 and limitation [9a], the combination teaches claim 14. *Supra* §VI.C.4, §VI.B.3[9a]; §VI.C.7[9a]; Ex-1003, ¶365.

12. Claim 16

16[p].

Nielsen-372 and Steinberg teach the preamble. *Supra* §VI.B.4.16[p]; Ex-1003, ¶¶367-368.

[16a]

Nielsen-372 teaches limitation [16a]. *Supra* §VI.B.4[16a]; Ex-1003, ¶¶369-370.

[16b]

Nielsen-372 teaches limitation [16b]. *Supra* §VI.B.4[16b]; Ex-1003, ¶¶371-372.

[16c]

Nielsen-372 and Steinberg teach limitation [16c]. *Supra* §VI.B.4[16c]; Ex-1003, ¶373. Tian further teaches obtaining a sequence of images of human subjects using a camera. Ex-1005, 000005; *supra* §VI.A.2[1d]. A POSITA would have found it obvious that the sequence of images include first and second images, in which a head is detected. Ex-1003, ¶¶373-374.

[16d]

Nielsen-372 and Steinberg teach limitation [16d]. *Supra* §VI.B.4[16d]; Ex-1003, ¶375. Tian also teaches analyzing an image to attempt to detect a head appearing in an image using face detection techniques. Ex-1005, 000002, 000005; Ex-1003, ¶¶375-376.

[16e]

Nielsen-372 and Steinberg teach limitation [16e]. *Supra* §VI.B.4[16e]; Ex-1003, ¶377. Tian further teaches determining an orientation of the head with respect to the camera. *Supra* §VI.A.2[1e]; Ex-1005, 000001-03. Ex-1003, ¶¶377-378.

[16f]

Nielsen-372 and Steinberg teach limitation [16f]. *Supra* §VI.B.4[16f]; Ex-1003, ¶¶379-380.

[16g]

Nielsen-372 and Steinberg teach limitation [16g]. *Supra* §VI.B.4[16g]; Ex-1003, ¶¶381-382.

13. Claim 18

18[p].

The combination teaches claim 16. *Supra* §VI.C.12; Ex-1003, ¶384.

[18a]

As explained for claim 11 and the preamble 16[p], the combination teaches limitation [18a]. *Supra* §VI.C.8[11a], §VI.B.4.16[p], §VI.C.12.16[p]; Ex-1003, ¶385.

[18b]

As explained for claim 11 and the preamble 16[p], the combination teaches determining an orientation of the head with respect to the camera based on a reduced-resolution image. *Supra* §VI.C.12[16e], §VI.C.8[11b], §VI.B.4.16[p], §VI.C.12.16[p]; Ex-1003, ¶386.

14. Claim 19

19[p].

The combination teaches claim 18. *Supra* §VI.C.13; Ex-1003, ¶388.

[19a]

As explained for claim 12 and the preamble 16[p], the combination teaches limitation [19a]. *Supra* §VI.C.9[12a], §VI.B.4.16[p], §VI.C.12.16[p]; Ex-1003, ¶389.

[19b]

As explained for claim 12 and the preamble 16[p], the combination teaches limitation [19b]. *Supra* §VI.C.9[12b], §VI.B.4.16[p], §VI.C.12.16[p]; Ex-1003, ¶390.

15. Claim 20

20.

The combination teaches claim 19. *Supra* §VI.C.14. As explained for claim 13 and the preamble 16[p], the combination teaches claim 20. *Supra* §VI.C.10, §VI.B.4.16[p], §VI.C.12.16[p]; Ex-1003, ¶392.

VII. MANDATORY NOTICES AND FEES

Real Party In Interest: The real party-in-interest here is TVision Insights, Inc. No other parties directed, controlled, or funded this Inter Partes Review proceeding (IPR).

Related Matters: *The Nielsen Company (US), LLC v. TVision Insights, Inc.*, 1:22-cv-01345 (D. Del.).

Lead and Backup Counsel: Pursuant to 37 C.F.R. §42.8(b)(3) and 42.10(a), Petitioner designates Harper Batts (Reg. No. 56,160) as lead counsel and Chris Ponder (Reg. No. 77,167) and Jeffrey Liang (Reg. No. 69,043) as back-up counsel, each of Sheppard, Mullin, Richter & Hampton LLP.

Service Information: Petitioner consents to service by electronic mail addressed to:

HBatts@sheppardmullin.com;
CPonder@sheppardmullin.com; and
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Petitioner's counsel may also be served by mail or hand delivery at Sheppard, Mullin, Richter & Hampton LLP, 1540 El Camino Real Suite 120, Menlo Park, CA 94025. Petitioner's counsel may be reached by telephone at (650) 815-2673 and by facsimile at (650) 815-4668.

Fees: The Office is authorized to charge fees for this Petition to Deposit Account 50-4561, Ref. 88PD-370181.

Respectfully submitted,

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/Harper Batts/

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CLAIM APPENDIX

1[p]. An audience measurement system to obtain exposure data for a media exposure environment,

[1a] the audience measurement system comprising:

memory;

machine readable instructions; and

processor circuitry to execute the machine readable instructions to:

[1b] generate an audio signature of media content presented by a television within the media exposure environment;

[1c] obtain content identifying data corresponding to the presented media content, the content identifying data based on the audio signature of the media content presented by the television within the media exposure environment;

[1d] analyze a sequence of images of the media exposure environment to detect a head appearing in one or more of the images, the sequence of images obtained by a camera while the media content corresponding to the content identifying data is presented by the television;

[1e] determine an orientation of the head with respect to the camera; and

[1f] determine audience identification information based on a match of the head to a known person associated with the media exposure environment; and

[1g] network interface circuitry to output a signal indicative of the content identifying data and the audience identification information to a data collection facility.

4[p]. The audience measurement system of claim 1, wherein the processor circuitry is to:

[4a] reduce a resolution of a first image of the one or more of the images of the media exposure environment to obtain a reduced-resolution image, and

[4b] determine the orientation of the head with respect to the camera based on the reduced-resolution image.

5. The audience measurement system of claim 4, wherein the processor circuitry is to determine the audience identification information by: (i) generating a facial signature from a region of a second image of the one or more of the images corresponding to a location of the head in the reduced-resolution image, and (ii) comparing the generated facial signature to a database of facial signatures.

6[p]. The audience measurement system of claim 4, wherein the processor circuitry is to:

[6a] identify a region corresponding to the head within the first image from which the reduced-resolution image was obtained;

[6b] analyze a portion corresponding to the identified region of a second image; and based on the analysis of the region of the second image, determine that the head matches the known person.

8. The audience measurement system of claim 6, wherein the audience identification information includes an identifier associated with the known person and the processor circuitry is to, responsive to a determination that the head matches the known person, cause the identifier associated with the person to be stored in the memory.

9[p]. An audience measurement system, comprising:

[9a] an audience measurement device at a media exposure environment, the audience measurement device to:

[9b] generate an audio signature of media content presented by a television within the media exposure environment;

[9c] obtain content identifying data corresponding to the presented media content, the content identifying data based on the audio signature;

[9d] while the media content corresponding to the content identifying data is presented by the television, collect a first image of the media exposure environment with a camera;

[9e] attempt to detect a head in the first image;

[9f] determine an orientation of the head with respect to the camera;

[9g] determine audience identification information based on an indication that the head matches a known person associated with the audience measurement system; and

[9h] a data collection facility to obtain the content identifying data and the audience identification information from the audience measurement device.

11[p]. The audience measurement system of claim 9, wherein the audience measurement device is to:

[11a] reduce a resolution of the first image of the media exposure environment to obtain a reduced-resolution image, and

[11b] determine the orientation of the head with respect to the camera based on the reduced-resolution image.

12[p]. The audience measurement system of claim 11, wherein the audience measurement device is to:

[12a] identify a region corresponding to the head within the first image from which the reduced-resolution image was obtained; and

[12b] analyze a portion of a second image corresponding to the identified region to determine whether the head matches the known person.

13. The audience measurement system of claim 12, wherein the audience identification information includes an identifier associated with the known person and the audience measurement device is to, responsive to the indication that the head matches the known person, cause recordation of the identifier associated with the known person in a memory.

14. The audience measurement system of claim 11, wherein the audience measurement device is to determine the audience identification information by: (i) generating a facial signature from a region of a second image corresponding to a location of the head in the reduced-resolution image, and (ii) comparing the generated facial signature to a database of facial signatures

16[p]. A method for obtaining exposure data for a media exposure environment, the method comprising:

[16a] generating, using a program detector, an audio signature of media content presented by a television within the media exposure environment;

[16b] obtaining, based on the audio signature, content identifying data corresponding to the presented media content;

[16c] while the media content corresponding to the content identifying data is presented by the television, capturing first and second images of the media exposure environment with a camera;

[16d] analyzing, using an audience detector, the first image to attempt to detect a head in the first image;

[16e] determining, using the audience detector, an orientation of the head with respect to the camera;

[16f] determining, using the audience detector, audience identification information based on an indication that the head matches a known person associated with the to a data collection facility. audience detector; and

[16g] providing the content identifying data and the audience identification information to a data collection facility.

18[p]. The method of claim 16, further comprising:

[18a] reducing a resolution of the first image of the media exposure environment to obtain a reduced-resolution image, and

[18b] wherein the determining of the orientation of the head includes determining the orientation of the head with respect to the camera using the reduced-resolution image.

19[p]. The method of claim 18, further comprising:

[19a] identifying a region corresponding to the head within the first image from which the reduced-resolution image was obtained;

[19b] analyzing a portion of the second image corresponding to the identified region; and based on the analyzing of the region of the second image, determining whether the head matches the known person.

20. The method of claim 19, wherein the audience identification information includes an identifier associated with the known person, and further including recording the identifier associated with the known person in a memory.

CERTIFICATE OF SERVICE

The undersigned hereby certifies that on June 16, 2023, true and correct copies of the foregoing Petition for *Inter Partes* Review of U.S. Patent No. 11,470,243 and Exhibits 1001-1028 were served in entirety on the Patent Owner at the following addresses of record as listed on PAIR, via Priority Mail Express®:

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The undersigned certifies that true and correct copies of the Petition for *Inter Partes* Review of U.S. Patent No. 11,470,243 and Exhibits 1001-1028 were also sent via electronic mail to the attorneys of record for Plaintiff in the concurrent litigation matter:

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**CERTIFICATE OF COMPLIANCE WITH
TYPE-VOLUME LIMITATION, TYPEFACE REQUIREMENTS,
AND TYPE STYLE REQUIREMENTS**

1. This Petition complies with the type-volume limitation of 14,000 words, comprising 13,139 words, as counted using the Microsoft Word software that was used to prepare this paper, excluding the parts exempted by 37 C.F.R. § 42.24(a).

2. This Petition complies with the general format requirements of 37 C.F.R. § 42.6(a) and has been prepared using Microsoft® Word in 14-point Times New Roman.

Respectfully submitted,

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