

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent of: Ingemar J. Cox

U.S. Patent No.: 8,656,441

Issue Date: February 18, 2014

Appl. No.: 13/839,717

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Title: SYSTEM FOR USING EXTRACTED FEATURES FROM AN
ELECTRONIC WORK

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PETITIONER'S EXHIBIT 1004

**DECLARATION OF DR. PIERRE MOULIN IN SUPPORT OF
PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 8,656,441
UNDER 35 U.S.C. §§ 311-319**

I, Dr. Pierre Moulin, D. Sc., declare as follows:

I. INTRODUCTION

1. My name is Pierre Moulin, D. Sc. I am a Professor of Electrical and Computer Engineering ("ECE") and Statistics at the University of Illinois. My business address is University of Illinois, Beckman Institute, 405 N. Matthews Ave., Urbana, IL 61801. I have been retained by counsel for Google Inc. ("Petitioner"), as a technical expert witness with respect to the *inter partes* review petition filed by Petitioner concerning U.S. Patent No. 8,656,441 (the "'441 patent").

2. For purposes of this Declaration, I have been asked to provide an expert technical analysis and opinion, including whether a single prior art reference or combination of references discloses the elements of the claims of the '441 patent. In addition, I have been asked to provide opinions on the knowledge of skill in the art, the scope and content of the prior art, the motivations to combine certain prior art references, and other matters as set forth in this Declaration.

3. My investigation into the matters addressed herein is ongoing and I reserve the right to supplement this Declaration as my investigation continues.

II. EDUCATIONAL AND PROFESSIONAL BACKGROUND

4. My qualifications, including my publications, are generally summarized in my Curriculum Vitae, attached hereto as Exhibit 1005.

III. MATERIALS REVIEWED

5. I have considered a number of references in connection with the preparation of this Declaration, including the '441 patent and file history. In addition, I have reviewed all references cited in this Declaration and the references identified in the Exhibit List included in Petitioner's petition. Further, I have conducted an independent review of available prior art. Finally, I have relied on my own expertise when formulating the opinions contained in this Declaration.

IV. PERSON OF ORDINARY SKILL IN THE ART

6. I understand that the present owner of the '441 patent, Network-1 Technologies, Inc., has represented that the inventor conceived of the purported inventions embodied in the '441 patent no earlier than July 1, 2000 (the "critical date"). Ex. 1019 at 30.

7. In my opinion, the relevant field of art for the '441 patent is that of automatic content recognition algorithms. It is my opinion that a person of ordinary skill in the art as of the critical date of July 1, 2000 would have been highly skilled, and typically would have possessed at least an M.S. in computer science, electrical engineering, or mathematics; knowledge of video and audio processing techniques; and 1-2 years of experience in audio, video, or image processing. I personally possessed this level of experience in 2000, and I worked closely with numerous other individuals who also possessed this level of experience.

V. BACKGROUND IN THE FIELD OF AUTOMATED CONTENT RECOGNITION

8. I provide the following background that relates to any opinions on the claims of the '441 patent.

9. In the 1990s, the emergence of affordable computing power sufficient to process electronic media spurred researchers and entrepreneurs to automate various tasks within the field of content publication and consumption. Ex. 1001 at 1:57-60. Three exemplary problems were (1) television viewers often disliked watching commercials; (2) television advertisers had no means to verify that commercials they paid to air were in fact aired, and aired in the correct time slot; and (3) radio listeners often failed to purchase music albums because they did not know the titles of songs that they enjoyed. Before 2000, numerous individuals concurrently developed the same two solutions to all three problems: (1) embedding hidden "watermarks" in electronic works, which could later be interpreted to identify the work; and (2) using computer-automated systems to recognize audio, video, and/or image content by analyzing the intrinsic features of a video work. The second technology is at issue in the present petition.

10. Content recognition schemes universally relied on two widely known technologies: feature extraction and neighbor searching in a database.

11. Feature extraction refers to quantifying a media work in a form that—unlike a raw video feed—is easily parsed by a computer. Typically, extracted

features were compact, meaning they occupied less memory on a computer than the corresponding video file did. Furthermore, extracted features were typically structured in a format that facilitated efficient search. In the context of a content identification system, each set of extracted features corresponding to a given media work was stored as an entry in a database. Within such a database, entries were typically organized to facilitate efficient search. Such organization was known as "preprocessing."

12. Neighbor searching refers to algorithms for comparing a first set of extracted features with one or more additional sets of extracted features to locate a close, but not necessarily exact, match. Because neighbor searching is computationally intensive for large feature sets, content recognition schemes typically employed search algorithms that increased efficiency by intelligently searching only a subset of potential matches (i.e., "non-exhaustive" algorithms).

VI. OVERVIEW OF THE '441 PATENT

13. It is my understanding that Petitioner is requesting *inter partes* review on the '441 patent, entitled "Method For Using Extracted Features From An Electronic Work." The '441 patent lists Ingemar J. Cox as inventor. It issued on February 18, 2014, with 30 claims, of which claims 1, 13, and 25 are independent. The patent application that led to the '441 patent (Application No. 13/829,717) was filed on March 14, 2013, and was a continuation of Application No. 13/800/573,

filed on March 13, 2013, which is a continuation of Application No. 13/338,079, filed on December 27, 2011. That application, in turn, was a continuation of Application No. 11/977,202, which issued as U.S. Patent No. 8,205,237. That application, in turn, was a continuation of Application No. 11/445,928, filed June 2, 2006, which issued as U.S. Patent No. 8,010,988. That application, in turn, was a continuation-in-part of Application No. 09/950,972, filed September 13, 2001, which issued as U.S. Patent No. 7,058,223. That application, in turn, claims priority to Provisional Application No. 60/232,618, filed September 14, 2000.

14. The claims of the '441 patent relate to identifying an unknown media work and, based on its determined identity, performing an action.

15. The independent claims of the '441 patent recite the following five elements: (1) one or more "databases" containing "compact electronic representation[s] of one or more reference electronic works" and "electronic data related to an action . . . corresponding to each of the one or more reference electronic works"; (2) "obtaining . . . a second digitally created compact electronic representation" of an unknown work; (3) "identifying" the unknown work "using a non-exhaustive neighbor search"; (4) "determining" an appropriate action based on the "electronic data related to an action"; and (5) "associating . . . the determined action with the" identified work. Ex. 1001 at Claim 13; *see id.* at Claims 1, 25.

16. The specification of the '441 patent concedes that these five elements were well known prior to the filing of the '441 patent.

17. First, the specification of the '441 patent explains that "[t]he database centers . . . can use traditional database technology." Ex. 1001 at 22:29-30. The '441 specification does not purport to present any novel database technology.

18. Second, the specification of the '441 patent explains that "[t]he recognition literature contains many different representations" of extraction algorithms, including "a pseudo-random sample of pixels from the frame or a low-resolution copy of the frame or the average intensities of $n \times n$ blocks of pixels," "a frequency-based decomposition of the signal, such as produced by the Fourier, wavelet and or discrete cosine transforms," "principal component analysis," "a temporal sequence of feature vectors," or "Fourier frequency decompositions." Ex. 1001 at 6:61-7:16. The '441 specification does not purport to present any novel means of "obtaining . . . a second digitally created compact electronic representation."

19. Third, the '441 specification explains that the purported invention employs "common statistical measures" and "[o]ther forms of matching" already known in the art, such as "correlation coefficient," "Euclidean distance," "Lp-norms," "kd-trees, vantage point trees and excluded middle vantage point forests" (Ex. 1001 at 8:32-9:7) for "electronically determining an identification of the

electronic work based on the extracted features" by performing "a non-exhaustive search identifying a neighbor." The '441 specification explicitly credits these algorithms to various third party sources. *Id.* The '441 specification does not purport to present any novel means of "electronically determining an identification of the electronic work based on the extracted features" by performing "a non-exhaustive search identifying a neighbor." *See also*, Ex. 1018 at 1-3, 10-11 (explaining, in 1999, that "there are many applications of nearest neighbor search where an approximate answer is good enough" and that "approximate similarity search can be performed much faster than the exact one").

20. Fourth and fifth, the '441 specification explains that there already existed "[k]nown techniques of linking works delivered via traditional media channels to a more interactive system" for "electronically determining an action based on the identification of the electronic work" and subsequently "electronically performing the action." Ex. 1001 at 2:34-56. For instance, conceded prior art systems used an identification of a work to "access[] a database . . . and match[] the ID with the associated web address" and subsequently navigate to the web address. *Id.* at 2:43-56. The '441 specification does not purport to present any novel means of "determining" an appropriate action based on the "electronic data related to an action" or "associating . . . the determined action with the" identified work.

21. As expressed herein, it is further my opinion that persons skilled in the art had already combined the foregoing known elements as of September 14, 2000. Even if they had not, it is my opinion that a person skilled in the art would have recognized a reason to combine these elements (to create a content recognition system), and the combination would have yielded predictable results.

22. The dependent claims modify these elements by further specifying (a) the process of extracting features from the electronic work or obtaining such extracted features (*id.* at Claims 2-9, 27-29); (b) the associating an action, or the characteristics of the action (*id.* at Claims 8-12, 14-22, 30); or (c) failing to locate a match (*id.* at Claims 23-24, 26).

23. Although the specification highlights the use of the claimed features to identify a television commercial (*e.g.*, Ex. 1001 at 9:52-10:18), the claims are not limited to the identification of television commercials and the specification explicitly envisions the identification of "content" generally (*e.g.*, *id.* at 1:46-50 ("e.g., content or an advertisement")). Further, while the specification highlights the use of certain exemplary algorithms for extracting features from an electronic work (*e.g.*, *id.* at 19:42-20:10, 6:56-7:16) and determining an identification of an electronic work by performing a non-exhaustive search identifying a neighbor (*e.g.*, *id.* at 8:65-9:7, 10:59-11:2, 20:54-21:4, 21:33-22:3), a person skilled in the

art would have understood that extraction can be performed using a wide variety of algorithms.

24. The claimed steps are illustrated in several figures of the '441 patent, including Figure 1, which demonstrates (1) "feature (vector) extraction operation(s)" (140), which "extract features from [an electronic] work" (Ex. 1001 at 6:39-43); (2) "feature (vector) lookup operation(s)" (150), which identify a work by "search[ing] for a matching feature vector" (*id.* at 6:44-48); (3) "work-associated information lookup operation(s)" (160), which "retrieve associated information, such as an action" (*id.* at 6:49-52); and (4) "action initiation operation(s)" (170), which "perform some action based on the associated information" (*id.* at 6:53-54). Figures 2-4 clarify that, in the absence of claim language to the contrary, the foregoing claimed steps can be performed on any combination of a local device and a remote server. *E.g.*, Fig. 2 (depicting all steps (140a, 150a, 160a, and 170a) performed on "user computer, set-top-box or equivalent" (210)); Fig. 3 (depicting extraction, identification, and action (140b, 150b, and 170b) performed on "user computer, set-top-box or equivalent" (310) and information lookup (160b) performed on "monitoring center" (340)); Fig. 4 (depicting extraction and action (140c and 170c) performed on "user computer, set-top-box or equivalent" (410), and identification and information lookup (150a and 160c) performed on "monitoring center" (440)).

VII. UNDERSTANDING OF THE LEGAL PRINCIPLES RELEVANT TO MY DECLARATION

25. In performing my analysis, I was given a basic understanding of certain applicable patent law concepts, which I have applied herein.

26. I understand that the subject matter sought to be patented is anticipated if each and every limitation of a claim is found, expressly or inherently, in a single prior art reference. To the extent that I refer to a particular reference as "anticipating" a particular claim, I am using this phrasing as a shorthand to refer to the facts that underlie a determination of anticipation, including the element-by-element comparison of the claims to the prior art.

27. I understand that a patent claim may also be invalid if it would have been obvious to a person of ordinary skill in the art, at the time the invention was made. In evaluating whether a prior art reference or a combination of prior art references renders a patent claim obvious, it is necessary to determine the scope and content of the prior art references, ascertain the differences between the prior art references and the claim in issue, resolve the level of ordinary skill in the pertinent art, and evaluate evidence of secondary considerations. I further understand that a claim is not proved obvious merely by demonstrating that each of the claimed elements was independently known in the prior art. Rather, there must be some reason why a person of ordinary skill in the art would have been prompted to combine the elements in the manner claimed. A reason to combine known

elements could come from a variety of sources, including but not limited to the prior art itself, the background knowledge of one of ordinary skill in the art, the nature of the problem to be solved, market demand, or common sense. To the extent that I refer to a particular reference or combination of references as rendering a particular term "obvious," I am using this phrasing as a shorthand to refer to the facts that underlie a legal determination of obviousness.

28. I understand that secondary considerations are objective factors which may be considered when determining whether a claim was obvious at the time of invention. These include indicia of commercial success of the invention, lack of commercial success of the prior art, long-felt but unsolved need to solve the problem addressed by the invention, unexpected results, failure of others to develop a similar invention, and copying of the invention by others. In addition, I understand that if the claimed invention was invented independently by other persons, either before it was invented by the patentee or at about the same time, then this fact indicates that a claimed invention is obvious.

VIII. SUMMARY OF OPINIONS

29. It is my opinion that the combination of U.S. Patent No. 6,505,160 ("Levy", Ex. 1013) and Sunil Arya, et al., "An Optimal Algorithm for Approximate Nearest Neighbor Searching in Fixed Dimensions" ("Arya", Ex. 1006) discloses each and every element of claims 1-3, 9, 11-14, 18-19, 21-26, and 30 of the '441

patent. Therefore, these claims are rendered obvious by Levy in view of Arya. It is further my opinion that it would be obvious to a person skilled in the art to modify Levy and Arya to disclose all elements of claims 6-8 and 10 of the '441 patent. It is further my opinion that a person skilled in the art would have been motivated to make such modifications. Therefore, these claims are obvious over Levy in view of Arya.

30. It is my opinion that U.S. Patent No. 6,970,886 ("Conwell", Ex. 1009) discloses each and every element of claims 1-3, 6, 8-14, 19, 21-26, and 30 of the '441 patent. Therefore, these claims are anticipated by Conwell.

31. It is my opinion that U.S. Patent No. 7,743,092 ("Wood", Ex. 1015) discloses each and every element of claims 1-3, 8-14, 19, 21-22, 25, 27, and 29-30 of the '441 patent. Therefore, these claims are anticipated by Wood.

32. It is my opinion that the combination of U.S. Patent No. 5,874,686 ("Ghias", Ex. 1010) and U.S. Patent No. 6,098,106 ("Philyaw", Ex. 1014) discloses each and every element of claims 1-3, 8, 10-14, 18-19, 21-27, and 29-30 of the '441 patent. Therefore, these claims are rendered obvious by Ghias in view of Philyaw.

IX. CONSTRUCTION OF CLAIM TERMS

33. I understand that, for purposes of this proceeding, the claim terms of the '441 patent should be given their broadest reasonable construction in light of

the specification. I further understand that this standard of claim construction can be broader than that generally employed by a federal district court, which assigns claim terms their ordinary and customary meaning to a person of ordinary skill in the art at the time of filing, considering: (1) in the context of the entire patent, intrinsic evidence, such as the claims, specification, and file history; and (2) in the context of the intrinsic evidence, and to a lesser degree, extrinsic evidence, such as inventor testimony, dictionaries, and learned treatises.

34. For the purposes of this Declaration, I will base my construction of the claim terms on the Petitioner's position in this proceeding. I understand and agree with Petitioner that for the majority of terms, the broadest reasonable construction is the plain and ordinary meaning to a person of ordinary skill in the art.

35. It is my opinion that, regardless of the claim constructions ultimately adopted by the Board, the prior art references discussed herein anticipate and/or render obvious the enumerated claims of the asserted patents under any possible constructions.

36. I understand and agree with Petitioner's position that the terms "extracted features," "compact electronic representation," and "compact electronic representation comprising an extracted feature vector" all mean "a quantitative

representation of the features of a media work, or a subset of the features of a media work."

37. The patent specification recognizes that "[t]he recognition literature contains many different" extraction algorithms, including "pseudo-random sample[s] of pixels," "the average intensities of nxn blocks of pixels," "frequency-based decomposition of the signal, such as produced by the Fourier, wavelet and or discrete cosine transforms," or "a combination of these." *E.g.*, Ex. 1001 at 6:56-7:16. The only unifying characteristic of these methods is that they generate a quantitative representation of the features of a media work.

38. Moreover, in 2000, persons skilled in the art consistently employed this definition of "extracting features." In particular, persons skilled in the art understood that it was advantageous for content identification systems to generate quantitative representations of the features of a media work, because such representations were typically compact and logically organized, and therefore were more easily processed and searched by computers than raw media files. See Ex. 1001 at 6:62-64. Such representations were often, but not always, formatted to maximize the efficiency of subsequent search.

39. A person skilled in the art would further understand that the '441 specification confirms that "compact electronic representation" and "compact electronic representation comprising an extracted feature vector" are synonymous

with "extracted features." In a single passage, the specification equates all three terms: "[t]he purpose of the **feature extraction** operation is to derive a **compact representation** of the work that can subsequently be used for the purpose of recognition. In the case of images and video, **this feature vector** might be . . ." Ex. 1001 at 6:61-65. *E.g., id.* at 19:43-44 ("Typically, a compact representation of each frame is extracted."), 5:45-46 (explaining that the system functions by "extracting features from the work to define a feature vector"), 6:35, 6:41-43, 7:47-49, 7:59-60, 8:8-10, 8:32-54, 9:21-34. Further, in 2000, persons skilled in the art understood that these terms were synonymous. I use these terms interchangeably throughout this declaration.

40. I understand and agree with Petitioner's position that the broadest reasonable construction of the term "non-exhaustive . . . search" is "a search that locates a match without conducting a brute force comparison of all possible matches, and all data within all possible matches." The specification never uses the terms "non-exhaustive" or "exhaustive." Ex. 1001. Moreover, in 2000, persons skilled in the art did not have a precise technical definition for "non-exhaustive search," and only used the term colloquially. As such, "non-exhaustive search" was understood to have multiple possible definitions, the broadest of which was consistent with the above definition. In particular, the broadest definition of "non-exhaustive search" employed by persons skilled in the art encompassed anything

other than a "brute force" search. (As a corollary, the narrowest definition of "exhaustive search" was "brute force search.") A "brute force" search, in turn, is a search wherein a query is compared to every single portion of every single item in a database. Persons skilled in the art recognized that, while a properly constructed brute force search was guaranteed to find the best match in a database, brute force searches were inherently inefficient and required on average $N/2$ comparison operations (where N is the number of entries in the search database). *See id.* at 8:55-64. Therefore, to maximize search efficiency, persons skilled in the art routinely employed more efficient searches that did not conduct a comparison of every single item in a database, sometimes referred to as non-exhaustive searches.

41. Because a brute force search conducts a comparison of every item in a search database, it is guaranteed to find the best match. Thus, any search that is not guaranteed to find the best match is necessarily not brute force, and therefore is necessarily non-exhaustive.

42. By contrast, certain non-exhaustive search algorithms are guaranteed to find the best match. Thus, the fact that a search is guaranteed to find the best match does not necessarily indicate that it is a brute force search, and therefore does not preclude it from being considered non-exhaustive.

43. For the avoidance of doubt, it is my opinion that a search that does compare a query item to all items in a database, but does not consider all data

within each database item, is non-exhaustive. For instance, suppose a content identification system in which each item of extracted data contains a first part and a second part. If that system compares an unknown work to every known work in the database, but does so only on the basis of the first part of each item of extracted data (ignoring the second part of each item of extracted data), the search is non-exhaustive.

44. It is further my opinion that, when evaluating whether a search is non-exhaustive, only the search algorithm should be considered, and not the preprocessing algorithm, if any. When database entries are ingested into a content recognition database, the system will typically preprocess the data to organize it into a form that facilitates efficient search using a dedicated preprocessing algorithm. Subsequently and separately, when a search operation is initiated, the system will locate the best match in the database using a dedicated search algorithm. The search algorithm and the preprocessing algorithm are distinct, and operate at separate points in time. Thus, the fact that a preprocessing algorithm may analyze all data entries in a database at the time of ingestion does not render a search algorithm brute force.

45. I understand and agree with Petitioner's position that the term "neighbor search" means "identifying a close, but not necessarily exact, match." In 2000, persons skilled in the art consistently employed this definition. In particular,

persons skilled in the art typically designed content identification systems that compared extracted features from a query work to extracted features from a known work. However, due to discrepancies in the source material, such as noise, distortion, and source, two different copies of the same work might produce somewhat different sets of extracted features. Ex. 1001 at 8:32-54. Thus, rather than design systems that searched only for exact matches, persons skilled in the art typically designed systems that identified close, but not necessarily exact, matches. *Id.* Persons skilled in the art understood that the term "identifying a neighbor" referred to such searches.

46. It is my opinion that different algorithms for identifying a neighbor can employ different measures of distance. For instance, "Euclidean" distance refers to the literal distance between data points (i.e., "as the crow flies"); "Manhattan" distance refers to the sum of the absolute differences of the coordinates of data points (i.e., as car drives in a city); and Hamming distance refers, in the context of binary data points, to a count of the number of bits that are not equal.

47. Consistent with the above, I understand and agree with Petitioner's position that a "neighbor" means "a close, but not necessarily exact, match."

48. I understand and agree with Petitioner's position that the term "associating . . . the determined action with the first electronic work" (and slight

variations thereof) means "establishing any relationship between an action and an identified work, including performing the action in response to identifying the work." Though the '441 specification notes that the database "may associate" known works "with associated information 136, such as an action" (Ex. 1001 at 6:26-28), it never discloses the association of a *newly identified work* with an action. However, the specification makes clear that associating an action with a newly identified work cannot refer to recording in the database that the action and the work correspond, because the database already contains this information. That is, because the '441 patent determines an action by retrieving a record in the database relating the work to the action (*e.g.*, *id.* at 6:49-52), it would be nonsensical for the system to subsequently rewrite the same information back to the same database. Thus, in the absence of guidance from the specification, a person skilled in the art would understand the term to refer broadly to establishing any relationship between a work and an action. A person skilled in the art would understand that this includes performing an action in response to determining an identification, which requires establishing a relationship between a work and an action.

49. I understand and agree with Petitioner's position that the term "portable client device" means "any portable electronic device" including, for example, a laptop. The specification never uses the terms "portable" or "client."

However, in 2000, persons skilled in the art consistently employed the above definition. Further, persons skilled in the art understood that computers could embody essentially any form—including portable forms, such as laptops—while still being considered computers. Thus, it is further my opinion that the term "computer" broadly refers to any electronic device. As such, it is my opinion that any disclosure of a "computer" amounts to disclosure of a "portable client device."

50. The below table summarizes my constructions, consistent with the discussion above:

Claim Term	Construction
"associating . . . the determined action with the first electronic work"	"Establishing any relationship between an action and an identified work, including performing the action in response to identifying the work."
"extracted features," "compact electronic representation," and "compact electronic representation comprising an extracted feature vector"	"A quantitative representation of the features of a media work, or a subset of the features of a media work."
"neighbor"	"A close, but not necessarily exact, match."
"neighbor search"	"Identifying a close, but not necessarily exact, match."
"non-exhaustive . . . search"	"A search that does not conduct a brute force comparison of all possible matches, and all data within all possible matches."
"portable client device"	"Any portable electronic device."

X. OPINION AS TO THE OBVIOUSNESS OF CLAIMS 1-3, 6-14, 18-19, 21-26, AND 30 OVER LEVY IN VIEW OF ARYA

A. Background on Levy

51. I provide the following summary of Levy as a matter of convenience to the reader. This summary is not intended to be a full recitation of my opinions on the subject.

52. Levy was filed on May 2, 2000, and issued as a patent on January 7, 2003. Ex. 1013.

53. Levy discloses a system for identifying a media work and executing a related action. Ex. 1013 at Abstract. In particular, Levy teaches "a decoding process that extracts [an] identifier from a media object" (*id.*); "a server [that] maps the identifier to an action" (*id.*); and "executing the action" (*id.* at 16:31-42).

54. Though Levy discloses certain embodiments in which an identifier is embedded into a media work, it additionally discloses embodiments that "derive the identifier from the signal" in which case "the embedding process is unnecessary." *Id.* at 9:42-61. In such embodiments, the system "computes a fingerprint of the audio signal based on a specified fingerprinting algorithm. The fingerprint is a number derived from a digital audio signal that serves as a statistically unique identifier of that signal . . ." *Id.*

55. Levy discloses that a client device may perform such extraction directly (*id.* at 16:60-61 ("in a user's player device, decoding an identifier from the

audio signal")) or may transmit a work to a server to perform the extraction (*id.* at 17:11-13 ("receiving the audio signal from a user's device; dynamically deriving an identifier from the audio signal by computing a fingerprint of the signal")). See also *id.* at 4:35-37 ("The decoding process may be implemented as a separate program or device, or integrated into a player, tuner, or some other capture device . . .").

56. Levy discloses using a determined identity to "perform a variety of actions," including "retriev[ing] related data or actions ('metadata')" such as "title, artist, lyrics, copyright owner, sound recording owner, information about buying or sampling opportunities and URLs to this type of data as well as web sites and other programs and devices." In addition to retrieving such information or advertisements, Levy teaches using a determined identification to "perform[] an electronic transaction (selling products like CDs, DVDs, concert tickets, etc. via computer transaction using credit cards, digital money, etc.)." *Id.* at 13:50-67.

B. Background on Arya

57. I provide the following summary of Arya as a matter of convenience to the reader. This summary is not intended to be a full recitation of my opinions on the subject.

58. Arya was published on July 6, 1998.

59. Arya discloses a neighbor search algorithm wherein "set S of n data points" is "preprocess[ed] . . . into a data structure, so that given any query point q . . . the k nearest neighbors of q can be computed." Ex. 1006 at 1. This neighbor search is non-exhaustive, and "can provide significant improvements over brute-force search." *Id.* at 4, 2, 19 (explaining that, unlike brute force search, Arya "can enumerate the m nearest cells to q in $O(md \log n)$ time").

C. A Person Skilled In The Art Would Have Been Motivated To Combine Levy and Arya

60. It is my opinion that a person skilled in the art would have been motivated to combine Levy and Arya.

61. Levy discloses extracting a "fingerprint of the audio signal based on a specified fingerprinting algorithm" (Ex. 1013 at 9:42-61), which transmits the fingerprint "to one or more other servers, requesting information from another server to identify the media object" (*id.* at 1:48-55). Persons skilled in the art at the time understood that fingerprinting algorithms were designed to generate a "statistically unique identifier of" the media work, but that disparities in the source of a fingerprinted work inevitably led to slight discrepancies in generated fingerprints. *Id.* at 9:42-61. Thus, persons skilled in the art understood that identifying a media work required not only locating exact fingerprint matches, but also near fingerprint matches. Arya expands on the teachings of Levy by providing an algorithm to run such a search for "approximate nearest neighbor[s]." Ex. 1006

at 1. Indeed, Arya explicitly envisioned that such "[n]earest neighbor searching is an important problem in a variety of applications, including . . . pattern recognition . . . [and] multimedia databases." *Id.* at 2. Moreover, a person skilled in the art would be motivated to employ the algorithm of Arya to implement the system of Levy in a more efficient manner than a brute force search would allow.

D. The Combination of Levy and Arya Discloses Each and Every Element of Claims 1-3, 9, 11-14, 18-19, 21-26, and 30

62. It is my opinion that the combination of Levy and Arya discloses all elements of claims 1-3, 9, 11-14, 18-19, 21-26, and 30 in the '441 patent, and therefore renders obvious these claims.

63. The combination of Levy and Arya discloses all five elements of independent claims 1, 13, and 25 of the '441 patent.

64. First, it is my opinion that the combination of Levy and Arya discloses "databases" containing "compact electronic representation[s] of one or more reference electronic works" and "electronic data related to an action . . . corresponding to each of the one or more reference electronic works." Ex. 1001 at Claims 1, 13, 25. For instance, as depicted in Figure 1, Levy discloses a database including first identifying information that is mapped to second action information. Ex. 1013 at Fig. 1; *see id.* at 4:40-61, 17:32-35 ("searching a database for additional information related to the audio signal from which the fingerprint is derived").

65. Second, it is my opinion that the combination of Levy and Arya discloses "obtaining . . . a second digitally created compact electronic representation"—or, synonymously, "extracted features" or a "feature vector"—of an unknown work. Ex. 1001 at Claims 1, 13, 25. Levy teaches that identifiers can be "derive[d] from the audio signal." Ex. 1013 at 2:29-37, *see also id.* at 3:59-64 ("The identifier may also be derived as a function of the audio signal In the case of dynamically derived identifiers, an embedding process is not necessary because the identifier can be derived from the content and decoding time."). Levy further teaches that an identifier can be extracted from ambient audio that is captured by a portable device. *See id.* at 4:33-39. Levy also discloses the use of hash algorithms to create statistically-unique "fingerprints" of the content. *Id.* at 9:40-61.

66. Third, it is my opinion that the combination of Levy and Arya discloses "identifying" the unknown work "using a non-exhaustive neighbor search." Ex. 1001 at Claims 1, 13, 25. Levy teaches that the decoded identifier is transmitted to the server, which then uses the identifier to determine the identity of the electronic work and the actions associated with it. Ex. 1013 at 4:49-56, Fig. 1. Arya discloses a neighbor search wherein a "set S of n data points" is "preprocess[ed] . . . into a data structure, so that given any query point q . . . the k nearest neighbors of q can be computed." Ex. 1006 at 1. This neighbor search is

non-exhaustive, and "can provide significant improvements over brute-force search." *Id.* at 4, 2, 19 (explaining that, unlike brute force search, Arya "can enumerate the m nearest cells to q in $O(md \log n)$ time").

67. Fourth, it is my opinion that the combination of Levy and Arya discloses "determining" an appropriate action based on the "electronic data related to an action." Ex. 1001 at 1, 13, 25. Levy discloses that the server takes the identifier, and using the mapping process, determines the proper action or actions that are associated with that identifier. Ex. 1013 at 2:46-48, 4:49-56, Fig. 1. The server then performs that associated action. *See id.* at 4:62-5:16. Alternatively, if the identifier is not found in the database, the server can enable the user to purchase a link for the identifier. *Id.* at 6:60-65.

68. Fifth, it is my opinion that the combination of Levy and Arya discloses "associating . . . the determined action with the" identified work, which encompasses performing an action. Ex. 1001 at Claims 1, 13, 25. Levy discloses that, after extracting features and determining an identifier, the system "forwards [the identifier] to a server. The server, in turn, maps the identifier to an action." Ex. 1013 at Abstract, 1:48-55. For example, "[t]o find the associated action or actions, the server . . . may: 1) look up the data and actions in a local database stored in its memory subsystem; 2) route the identifier to one or more other servers via the network, which in turn look up related actions and data associated with the

identifier; or 3) perform some combination." *Id.* at 4:53-61. Levy discloses, after mapping the identifier to an action, "executing the action." *Id.* at 16:31-42, 16:58-17:3, 17:9-18. Further, Levy discloses a "variety of actions" including actions to be performed on a client device, such as "downloading media signals in streaming or file format" and "returning data and HTML links" are necessarily performed on a client device. *Id.* at 13:50-67.

69. A claim chart¹ detailing how the combination of Levy and Arya renders obvious claims 1-3, 9, 11-14, 18-19, 21-26, and 30, consistent with the above discussion, is provided below:

'441 patent	Levy (Ex. 1015) and Arya (Ex. 1006)
1. A computer system comprising:	Non-limiting preamble.
one or more electronic communications devices;	Levy teaches a user device that is an electronic device. 14:35-42.
one or more processors operatively connected to the one or more electronic communications devices; and	Levy teaches use of computers and other electronic devices, which contain processors. 4:65-67, 14:35-42.
one or more computer readable media operatively connected to the one or more processors and having stored thereon computer instructions for carrying out the steps of:	Levy teaches the use of computers and other electronic devices, which contain computer readable media connected to the processors. 14:35-42.
(a) maintaining, by the computer system, a database comprising:	Levy teaches a database of content identifiers and actions that are linked to the content. Fig. 1, 4:49-61.

¹ Unless otherwise indicated, citations in this claim chart are to Levy (Ex. 1013).

'441 patent	Levy (Ex. 1015) and Arya (Ex. 1006)
(1) first electronic data related to identification of one or more reference electronic works; and	Levy teaches a first electronic data that has content-identifying information. Fig. 1, 4:49-61.
(2) second electronic data related to action information comprising an action to perform corresponding to each of the one or more reference electronic works;	Levy teaches second electronic data that contains the action or actions to be associated with the content-identifying information. Fig. 1, 4:49-61.
(b) obtaining, by the computer system, extracted features of a first electronic work;	Levy teaches obtaining the extracted features (i.e., the identifier) by extracting them from an audio signal. 4:33-39, 3:59-61, 9:40-61, 12:37-41. Levy discloses "in a user's player device, decoding an identifier from the audio signal." 16:58-17:3. This "decoding device or programmatic process extracts the identifier" from the audio signal. 16:60-61. In one embodiment, the extraction process comprises "comput[ing] a fingerprint of the audio signal based on a specified fingerprinting algorithm." 9:42-61. "[T]he decoding process may be implemented in a variety of devices . . . such as personal digital assistants [or] telephone handsets." 14:35-42.
(c) identifying, by the computer system, the first electronic work by comparing the extracted features of the first electronic work with the first electronic data in the database using a non-exhaustive neighbor search;	Levy teaches that the server uses the identifier to identify the work. 4:49-61. Levy discloses that the "decoding device or programmatic process extracts the identifier from the object and uses it to retrieve related data or actions ('metadata'). In the case of an audio object, like a song, the metadata typically includes the title, artist." 2:46-53. Levy discloses that the server

'441 patent	Levy (Ex. 1015) and Arya (Ex. 1006)
	provides the identification to the decoder by "performing database look up to uniquely identify a media object." 13:62-63. Arya further discloses identifying a neighbor using a non-exhaustive search that "can provide significant improvements over brute force search" in part because it allows some "relatively small average error." Ex. 1006 at 4, 3, 19-21 ("the output of our algorithm is a data point p whose distance from q is at most a factor of $(1 + \epsilon)$ greater than the true nearest neighbor distance").
(d) determining, by the computer system, the action information corresponding to the identified first electronic work based on the second electronic data in the database; and	Levy discloses that "[t]he server, in turn, maps the identifier to an action" to determine action information corresponding to the first electronic work. Abstract, 1:48-55. For example, "[t]o find the associated action or actions, the server . . . may: 1) look up the data and actions in a local database stored in its memory subsystem; 2) route the identifier to one or more other servers via the network, which in turn look up related actions and data associated with the identifier; or 3) perform some combination." 4:53-61.
(e) associating, by the computer system, the determined action information with the identified first electronic work.	Levy discloses "executing the action." 16:31-32, 16:58-17:3, 17:9-18. Levy further discloses that the action could be any of a "variety of actions," including "downloading media signals in streaming or file format" or "returning data and HTML links" on a portable client device. 13:50-67. As explained above, it is my opinion that performing such an action constitutes

'441 patent	Levy (Ex. 1015) and Arya (Ex. 1006)
	associating an action.
2. The computer system of claim 1, wherein the step of obtaining comprises receiving the first electronic work and extracting the extracted features from the first electronic work.	Levy teaches that the user device may receive the first electronic work from "ambient audio waves" "and then extract[] the [extracted features] from the signal." 4:33-39. Alternatively, Levy discloses receiving the first electronic work from "wire networks," "wireless networks," "broadcast," "Digital Versatile Disc (DVD), minidisk, or compact disk (CD)" (2:7-21, 2:29-37) and subsequently extracting features (4:33-39, 3:59-61, 9:40-61, 12:37-41).
3. The computer system of claim 2, wherein the first electronic work is received from at least one of a set-top-box, a video recorder, a cell phone, a computer, or a portable device.	Levy teaches that "a user ultimately receives the linked object in a player, tuner, or capture device" by "transferring an audio object over a computer network, streaming the object over a computer network, or broadcasting" from a computer. 4:26-32, Fig. 1. In at least the case of transfer over a computer network, or streaming over a computer network, it is my opinion that the work is received from a computer.
9. The computer system of claim 1, wherein at least one of the first electronic work or the extracted features of the first electronic work is obtained from at least one of a set-top-box, a video recorder, a cell phone, a computer, or a portable device, and wherein the action information comprises commercial transaction data, and the one or more computer readable	Levy teaches that the server obtains the extracted features from the user device, which can be a computer or portable device such as a player, tuner, or other capture device. 4:33-43. Levy further teaches that action information can comprise commercial transaction data, such as "performing an electronic transaction (selling products like CDs, DVDs, concert tickets, etc.

'441 patent	Levy (Ex. 1015) and Arya (Ex. 1006)
media have stored thereon further computer instructions for carrying out the additional step of:	via computer transaction using credit cards, digital money, etc.)" (13:56-58, 2:59-61) or "information about themselves" that users provide "when they register their decoding device" (2:67-3:2).
electronically performing the commercial transaction through the at least one of a set-top-box, a video recorder, a cell phone, a computer, or a portable device using the commercial transaction data.	Levy discloses, through a computer, "perform[ing] an electronic transaction (selling products like CDs, DVDs, concert tickets, etc. via computer transaction using credit cards, digital money, etc.)" using the commercial transaction data. 13:56-58. Levy additionally discloses, through a computer, performing a commercial transaction using the commercial transaction data consisting of user registration data. 2:67-3:2
11. The computer system of claim 1, wherein the action comprises at least one of directing a user to a website related to the first electronic work, initiating an e-commerce transaction, or dialing a phone number.	Levy teaches that the linked action can provide URLs to web sites and information about buying and sampling opportunities. 2:48-53, 3:4-21, 6:43-59, 13:53-54.
12. The computer system of claim 1, wherein the action comprises providing and/or displaying additional information in association with the first electronic work.	Levy teaches providing "metadata" that is associated with the electronic work, which may include the title, artist, lyrics, copyright owner, and other information. 2:46-53, 13:50-67, 16:31-43 ("returning data to the player device"), 4:49-53 ("the server determines an associated action to perform, such as . . . returning metadata "), Abstract ("returning metadata").
13. A computer system comprising:	Non-limiting preamble.

'441 patent	Levy (Ex. 1015) and Arya (Ex. 1006)
one or more electronic communications devices;	I incorporate my above discussion of Levy regarding Claim 1.
one or more processors operatively connected to the one or more electronic communications devices; and	I incorporate my above discussion of Levy regarding Claim 1.
one or more computer readable media operatively connected to the one or more processors and having stored thereon computer instructions for carrying out the steps of:	I incorporate my above discussion of Levy regarding Claim 1.
(a) maintaining, by the computer system, one or more databases comprising:	I incorporate my above discussion of Levy regarding Claim 1a.
(1) first electronic data comprising a first digitally created compact electronic representation of one or more reference electronic works; and	I incorporate my above discussion of Levy regarding Claim 1(a)(1).
(2) second electronic data related to an action, the action comprising providing and/or displaying an advertisement corresponding to each of the one or more reference electronic works;	I incorporate my above discussion of Levy regarding Claim 1(a)(2). Levy further teaches an action that is providing and/or displaying an advertisement, such as "electronic buying opportunities for music, concert tickets, clothing, etc." 3:4-21, 5:39-50, 6:54-59, 17:9-18, 17:21-26, 2:48-53.
(b) obtaining, by the computer system, a second digitally created compact electronic representation of a first electronic work;	I incorporate my above discussion of Levy regarding Claim 1b. As explained above, the term "compact electronic representation" is synonymous with "extracted features."
(c) identifying, by the computer system, a matching reference electronic work that matches the first electronic work by comparing the first electronic data with the second digitally created compact electronic representation using a non-	I incorporate my above discussion of Levy and Arya regarding Claim 1c.

'441 patent	Levy (Ex. 1015) and Arya (Ex. 1006)
exhaustive neighbor search;	
(d) determining, by the computer system, the action corresponding to the matching reference electronic work based on the second electronic data in the database; and	I incorporate my above discussion of Levy regarding Claim 1d.
(e) associating, by the computer system, the determined action with the first electronic work.	I incorporate my above discussion of Levy regarding Claim 1e.
14. The computer system of claim 13, wherein the action further comprises providing a link to a site on the World Wide Web associated with the advertisement.	Levy teaches that the action taken can be "returning data and HTML links (e.g., in the form of an HTML document, scripts, etc.)." 13:53-54, see 6:43-49.
18. The computer system of claim 13, wherein the action further comprises collecting competitive market research data related to the advertisement.	Levy discloses collective competitive market research data, wherein, "where identifier linking transactions are monitored, it enables the vendors of music to gather data about electronic transactions triggered by the link." 2:62-3:2.
19. The computer system of claim 13, wherein the action further comprises purchasing a product or service related to the advertisement.	Levy discloses "performing an electronic transaction (selling products like CDs, DVDs, concert tickets, etc. via computer transaction using credit cards, digital money, etc.)." 13:56-58, 2:53-56, 2:62-3:23.
21. The computer system of claim 1, further comprising the step of transmitting, by the computer system, the determined action as associated with the first electronic work.	Levy teaches transmitting the action from the computer system to the user's device, for example, using Internet protocols. 5:11-16, 5:51-6:2, 6:43-59.
22. The computer system of claim 1, wherein the one or more electronic works comprise at least one of a video work, an audio work, or an image work.	Levy discloses electronic works that are "audio" or "still images, video, graphics models, etc." 10:4-17.

'441 patent	Levy (Ex. 1015) and Arya (Ex. 1006)
23. The computer system of claim 1, wherein the one or more computer readable media have stored thereon further computer instructions for carrying out the additional steps of:	Non-limiting preamble.
(f) obtaining, by the computer system, second extracted features of a second electronic work;	Levy teaches obtaining the extracted features (i.e., the identifier) by extracting them from an audio signal. 4:33-39, 3:59-61, 9:40-61, 12:37-41. Levy discloses "in a user's player device, decoding an identifier from the audio signal." 16:58-17:3. This "decoding device or programmatic process extracts the identifier" from the audio signal. 2:46-47. In one embodiment, the extraction process comprises "comput[ing] a fingerprint of the audio signal based on a specified fingerprinting algorithm." 9:42-61. "[T]he decoding process may be implemented in a variety of devices . . . such as personal digital assistants [or] telephone handsets." 14:35-42.
(g) searching, by the computer system, for an identification of the second electronic work by comparing the second extracted features of the second electronic work with the first electronic data in the database using a non-exhaustive neighbor search; and	Levy teaches that the server uses the identifier to search for the identity of the work. 4:49-61. The "decoding device or programmatic process extracts the identifier from the object and uses it to retrieve related data or actions ('metadata'). In the case of an audio object, like a song, the metadata typically includes the title, artist." 2:46-53. The server provides the identification to the decoder by "performing database look up to uniquely identify a media object." 13:62-63. Arya further discloses

'441 patent	Levy (Ex. 1015) and Arya (Ex. 1006)
	identifying a neighbor using a non-exhaustive search that "can provide significant improvements over brute force search" in part because it allows some "relatively small average error." Ex. 1006 at 4, 3, 19-21. Ex. 1004 at ¶¶ 60-61.
(h) determining, by the computer system, that the second electronic work is not identified based on results of the searching step.	Levy teaches that the system can determine when the electronic work is not identified (i.e., no link exists). 6:60-7:12. The system can then offer the link for purchase. <i>Id.</i>
24. The computer system of claim 13, wherein the one or more computer readable media have stored thereon further computer instructions for carrying out the additional steps of:	Non-limiting preamble.
(f) obtaining, by the computer system, second extracted features of a second electronic work to be identified;	I incorporate my above discussion of Levy regarding Claim 23f.
(g) searching, by the computer system, for an identification of the second electronic work by comparing the second extracted features of the second electronic work with the first electronic data in the database using a non-exhaustive neighbor search; and	I incorporate my above discussion of Levy regarding Claim 23g.
(h) determining, by the computer system, that the second electronic work is not identified based on results of the searching step.	I incorporate my above discussion of Levy regarding Claim 23h.
25. A computer system comprising:	Non-limiting preamble.
one or more electronic communications devices;	I incorporate my above discussion of Levy regarding Claim 1.
one or more processors operatively connected to the one or more electronic	I incorporate my above discussion of Levy regarding Claim 1.

'441 patent	Levy (Ex. 1015) and Arya (Ex. 1006)
communications devices; and	
one or more computer readable media operatively connected to the one or more processors and having stored thereon computer instructions for carrying out the steps of:	I incorporate my above discussion of Levy regarding Claim 1.
(a) maintaining, by the computer system, one or more databases comprising:	I incorporate my above discussion of Levy regarding Claim 1a.
(1) first electronic data comprising a first digitally created compact electronic representation comprising an extracted feature vector of one or more reference electronic works; and	I incorporate my above discussion of Levy regarding Claim 1(a)(1).
(2) second electronic data related to action information, the action information comprising an action to perform corresponding to each of the one or more reference electronic works;	I incorporate my above discussion of Levy regarding Claim 1(a)(2).
(b) obtaining, by the computer system, a second digitally created compact electronic representation comprising an extracted feature vector of a first electronic work;	I incorporate my above discussion of Levy regarding Claim 1b. As explained above, the term "compact electronic representation comprising an extracted feature vector" is synonymous with "extracted features."
(c) identifying, by the computer system, a matching reference electronic work that matches the first electronic work by comparing the first electronic data with the second digitally created compact electronic representation of the first electronic work using a non-exhaustive neighbor search;	I incorporate my above discussion of Levy and Arya regarding Claim 1c.
(d) determining, by the computer system, the action information corresponding to the matching reference electronic work based on the second	I incorporate my above discussion of Levy regarding Claim 1d.

'441 patent	Levy (Ex. 1015) and Arya (Ex. 1006)
electronic data in the database; and	
(e) associating, by the computer system, the determined action information with the first electronic work.	I incorporate my above discussion of Levy regarding Claim 1e.
26. The computer system of claim 25, wherein the one or more computer readable media have stored thereon further computer instructions for carrying out the additional steps of:	Non-limiting preamble.
(f) obtaining, by the computer system, a third digitally created compact electronic representation comprising an extracted feature vector of a second electronic work;	I incorporate my above discussion of Levy regarding Claim 23g.
(g) searching, by the computer system, for a matching reference electronic work that matches the second electronic work by comparing the third digitally created compact electronic representation of the second electronic work with the first electronic data in the database using a non-exhaustive neighbor search; and	I incorporate my above discussion of Levy regarding Claim 23g.
(h) determining, by the computer system, that a matching reference electronic work that matches the second electronic work does not exist based on results of the searching step.	I incorporate my above discussion of Levy regarding Claim 23h.
30. The computer system of claim 1, wherein the one or more computer readable media have stored thereon further computer instructions for carrying out the additional step of transmitting, by the computer system, the determined action information as associated with the first electronic identified work.	I incorporate my above discussion of Levy regarding Claim 21.

E. The Combination of Levy and Arya Renders Obvious Each and Every Element of Claims 6-8 and 10

70. As I explain below, it is further my opinion that claims 6-8 and 10 of the '441 patent are obvious over Levy in View of Arya.

71. Claim 6 depends from claim 1. For the reasons expressed above, it is my opinion that Levy discloses all elements of claim 1. Claim 6 further requires that "the step of obtaining comprises receiving the first electronic work and the extracted features of the first electronic work." Ex. 1001 at Claim 6. Levy discloses receiving extracted features of an electronic work. *E.g.*, Ex. 1013 at 16:58-17:3 ("in a user's player device, decoding an identifier from the audio signal"), 4:33-43. It is my opinion that it would be obvious to a person skilled in the art to modify Levy to further receive the electronic work. This could be achieved using routine techniques—the system would simply need to transmit the electronic work to the server alongside its extracted features. A person skilled in the art would be motivated to make this modification for a variety of reasons, including (1) retaining a copy of the work on the server for future playback; (2) performing a more rigorous extraction using the superior computing power of the server; or (3) performing a supplemental manual inspection of the work at the server in the event no match is detected.

72. Claim 7 depends from claim 6, and additionally requires that the "the extracted features of the first electronic work are received from at least one of a

set-top-box, a video recorder, a cell phone, a computer, or a portable device." Ex. 1001 at Claim 7. It is my opinion that Levy discloses that extracted features may be received from "a variety of devices . . . such as personal digital assistants [or] telephone handsets." Ex. 1013 at 14:35-42. For the foregoing reasons expressed in the context of claim 6, it is my opinion that it would be obvious to a person skilled in the art to modify Levy to further receive an electronic work from such a device, and a person skilled in the art would have been motivated to do so.

73. Claim 8 depends from claim 1. For the reasons expressed above, it is my opinion that the combination of Levy and Arya discloses all elements of claim 1. Claim 8 further requires that "at least one of the first electronic work or the extracted features of the first electronic work is obtained from at least one of a set-top-box, a video recorder, a cell phone, a computer, or a portable device that stores commercial transaction data, and wherein the action information comprises a commercial transaction, and the method further comprises: electronically performing the commercial transaction using the stored commercial transaction data." Levy teaches that the server obtains the extracted features from the user device, which can be a computer or portable device such as a player, tuner, or other capture device. Ex. 1013 at 4:33-43. Levy further teaches that action information can comprise a commercial transaction, such as "performing an electronic transaction (selling products like CDs, DVDs, concert tickets, etc. via computer

transaction using credit cards, digital money, etc.)" (*id.* at 13:56-58, 2:59-61) or "information about themselves" that users provide "when they register their decoding device" (*id.* at 2:67-3:2).

74. It is my opinion that it would be obvious to a person skilled in the art to modify Levy to further store the commercial transaction data on a computer or portable device. This could be achieved using routine techniques, for example, simply including a data entry form to allow a user to input and store commercial transaction data—such as a credit card number—prior to attempting to identify a media work. A person skilled in the art would be motivated to make this modification because the "electronic transaction (selling products like CDs, DVDs, concert tickets, etc. via computer transaction using credit cards" would be less burdensome for the user if credit card information were stored in the user's computer in advance.

75. Claim 10 depends from claim 8, and additionally requires that the "commercial transaction data comprises at least one of a purchaser's name, a purchaser's address, or credit card information." Levy discloses that the commercial transaction data may be information relating to "credit cards" or "digital money." Ex. 1013 at 13:56-58.

XI. OPINION AS TO THE NOVELTY OF CLAIMS 1-3, 6, 8-14, 19, 21-26, AND 30 IN VIEW OF CONWELL

A. Background on Conwell

76. I provide the following summary of Conwell as a matter of convenience to the reader. This summary is not intended to be a full recitation of my opinions on the subject.

77. As I explain below, it is my opinion that each and every element of claims 1-14, 19, 21-26, and 30 of the '441 patent was previously disclosed by Conwell.

78. Conwell was filed on May 25, 2000, and issued as a patent on November 29, 2005. Ex. 1009.

79. Conwell discloses a method for directing users of digital content to websites related to the content being played. *See* Ex. 1009 at Abstract. The identifier can be derived from the content, for example by applying a hashing algorithm to some or all of the content to generate the identifier. *See id.* at 1:60-2:3; *see also id.* at 4:64-5:3 (suggesting the use of "hashing algorithms by which similar or related, but non-identical, inputs map to the same hash outputs"). Each identifier is stored in a database along with an associated web address. *See id.* at 3:43-45, Figs. 3-4.

034	www.sonymusic.com/catalog/05634.html
112	www.sonymusic.com/catalog/00014.html
198	www.supertracks.com/index/artists/taylor.htm
376	www.emusic.com/0555353x.pdf
597	www.cdw.com/music/featured_CDs/index.html
612	www.sonymusic.com/catalog/00231.html
850	www.polygram.com/franklin/adf_234.htm
921	www.loudeye.com/rap/1999/46755646.html

FIG. 3

80. When a user plays digital content with a compatible device, the identifier is generated and sent to the database, which uses the identifier to look up the corresponding URL in the database and sends that URL back to the user. *See* Ex. 1009 at 3:46-60, Figs. 3-4. The user device then accesses that URL. *See id.*

81. In the event that the content identifier is not associated with a URL, the user can opt to purchase the association and provide a link to a specified page, that can include banner advertisements, sponsored links to online retailers, or other methods of generating revenue. *See* Ex. 1009 at 4:14-21, 4:30-34.

B. Conwell Discloses Each and Every Element of Claims 1-3, 6, 8-14, 19, 21-26, and 30

82. It is my opinion that Conwell discloses all elements of claims 1-3, 6, 8-14, 19, 21-26, and 30 of the '441 patent, and therefore anticipates these claims.

83. Conwell discloses all five elements of independent claims 1, 13, and 25 of the '441 patent.

84. First, it is my opinion that Conwell discloses "databases" containing "compact electronic representation[s] of one or more reference electronic works" and "electronic data related to an action . . . corresponding to each of the one or more reference electronic works." Ex. 1001 at Claims 1, 13, 25. Conwell discloses a database in the form of a look-up table that includes an identifier extracted from a reference electronic work and an associated URL constituting the action information. See Ex. 1009 3:43-45, Fig. 3.

85. Second, it is my opinion that Conwell discloses "obtaining . . . a second digitally created compact electronic representation"—or, synonymously, "extracted features" or a "feature vector"—of an unknown work. Ex. 1001 at Claims 1, 13, 25. Conwell discloses this limitation by teaching that the user devices extracts identifiers from content, for example taking select bits of the electronic work or applying a hash algorithm. Ex. 1009 at 1:60-67; *see also id.* at Abstract. Conwell further teaches that a hash algorithm can be selected so that "similar, but non-identical, inputs map to the same hash outputs." *Id.* at 4:64-5:3.

86. Third, it is my opinion that Conwell discloses "identifying" the unknown work "using a non-exhaustive neighbor search." Ex. 1001 at Claims 1, 13, 25. Conwell teaches this limitation in the form of a table look-up using the

identifier decoded from the electronic work. *See* Ex. 1009 at 3:43-62, Figs. 1, 3. Once the user device decodes the identifier from the work, it is sent to the database. *Id.* at 3:46-50. It is my opinion that this constitutes a neighbor search. Specifically, because Conwell also teaches the use of a hash algorithm such that similar, but non-identical, inputs generate the same output identifier, the table look-up will return similar "neighbor" results even when the input work is not identical to the reference work. *See id.* at 4:64-5:3. Further, it is my opinion that this constitutes a non-exhaustive search under Petitioner's construction because it does not require a brute force comparison of all possible hashes, but rather requires a single lookup in a numerically sorted lookup table that uses hash identifiers as an index. *E.g.*, 3:43-50 ("Registry database can be conceptualized as a large look-up table. Each active record includes an identifier and a corresponding URL . . ."), 5:58-64 ("the present disclosure assumes that the entries are sorted, by identifier").

87. Fourth and fifth, it is my opinion that Conwell discloses "electronic data related to an action" and "associating . . . the determined action with the" identified work, which encompasses performing an action. Ex. 1001 at 1, 13, 25. Conwell discloses this limitation by performing the table look-up using the identifier and selecting the corresponding URL that is stored as the second electronic data associated with the identifier (the first electronic data that is determined to match the first electronic work). Ex. Conwell at 3:43-59, Fig. 3.

Conwell then associates the action information with the work by returning the corresponding URL in response to the user's query using the derived identifier, and the user's device accesses the URL. *Id.* The associated URL can be "a portal to a web site dedicated to the music artist, a web site giving concert schedules for the artist, a web site offering CDs," and can further include "banner advertising, co-op links to on-line retailers (e.g., Amazon.com), or other revenue-producing uses." *Id.* at 3:50-55, 4:30-34; *see also id.* at 2:45-46 ("a general consumer/business person could register the CD's identifier to sell Kinks' paraphernalia").

88. Alternatively, if the identifier is not found in the database, Conwell teaches that the action associated is to allow the listener to specify a URL to be associated with the electronic work, in exchange for a small fee. *Id.* at 4:9-21. In another embodiment, the database initiates an online auction for the associated URL. *Id.* at 5:4-14.

89. A claim chart detailing how Conwell anticipates claims 1-3, 6, 8-14, 19, 21-26, and 30, consistent with the above discussion, is provided below:

'441 patent	Conwell (Ex. 1015)
1. A computer system comprising:	Non-limiting preamble.
one or more electronic communications devices;	Conwell teaches an electronic communications device, for example a personal computer or a wireless internet appliance. 3:46-50, Fig. 1.

'441 patent	Conwell (Ex. 1015)
one or more processors operatively connected to the one or more electronic communications devices; and	Conwell teaches processors connected to the electronic communications devices, for example a personal computer. 3:46-50, Fig. 1.
one or more computer readable media operatively connected to the one or more processors and having stored thereon computer instructions for carrying out the steps of:	Conwell teaches computer readable media storing instructions in the form of the electronic communications devices (e.g., a personal computer) and the Internet-accessible database. 3:46-50, Fig. 1.
(a) maintaining, by the computer system, a database comprising:	Conwell teaches a database where "each active record includes an identifier and a corresponding URL." 3:43-44, Figs. 1, 3-4.
(1) first electronic data related to identification of one or more reference electronic works; and	Conwell teaches first electronic data in the form of identifiers that are derived from content. 1:60-67, 3:43-62, Figs. 3-4.
(2) second electronic data related to action information comprising an action to perform corresponding to each of the one or more reference electronic works;	Conwell teaches second electronic data comprising an action to perform, which is a "URL corresponding to" each of the first electronic data (i.e., the identifiers). 3:43-62, Figs. 3-4.
(b) obtaining, by the computer system, extracted features of a first electronic work;	Conwell teaches obtaining extracted features by deriving them from the features of the work, e.g., using a "hashing" algorithm. Abstract, 3:43-62, 1:65-67.
(c) identifying, by the computer system, the first electronic work by comparing the extracted features of the first electronic	Conwell teaches identifying a first electronic work by accessing a lookup table in a computer system

'441 patent	Conwell (Ex. 1015)
work with the first electronic data in the database using a non-exhaustive neighbor search;	to "decode an identifier [i.e., extracted features] from the audio content and send the identifier to the database, [which] responds by returning the URL corresponding to that identifier back to the user device." 3:43-62, Figs. 3-4. Conwell further teaches a neighbor search because "non-identical versions of the same basic content may nonetheless correspond to the same identifier." 4:64-5:3. Conwell further discloses that this neighbor search is non-exhaustive under Petitioner's construction because it uses a sorted lookup table that uses work identifiers as an index. 3:43-50, 5:58-64.
(d) determining, by the computer system, the action information corresponding to the identified first electronic work based on the second electronic data in the database; and	Conwell teaches determining an action based, wherein "the database responds by returning the URL corresponding to that identifier back to the user device." 3:43-62, Figs. 3-4. Alternatively, if the identifier is not found, Conwell discloses determining the action of offering the database association for sale. 4:9-21, 5:4-14.
(e) associating, by the computer system, the determined action information with the identified first electronic work.	Conwell associating the action information with the electronic work by "returning the URL corresponding to that identifier back to the user device. The user device then directs an internet browser to that URL." 3:43-62. Alternatively, if the identifier is not found, Conwell discloses associating by offering the database association for sale. 4:9-

'441 patent	Conwell (Ex. 1015)
	21, 5:4-14.
2. The computer system of claim 1, wherein the step of obtaining comprises receiving the first electronic work and extracting the extracted features from the first electronic work.	Conwell teaches that the consumer device receives the electronic work, for instance from a "CD or DVD" (2:4-10) or an MP3 file (1:60-2:3, 7:24-25), and extracts its features (3:43-55).
3. The computer system of claim 2, wherein the first electronic work is received from at least one of a set-top-box, a video recorder, a cell phone, a computer, or a portable device.	Conwell teaches that the consumer device receives the electronic work, for instance from a "CD or DVD" (2:4-10) or an MP3 file (1:60-2:3, 7:24-25), both of which are digital files generated by a computer.
6. The computer system of claim 1, wherein the step of obtaining comprises receiving the first electronic work and the extracted features of the first electronic work.	Conwell teaches that the computer system receives the first electronic work (at the user device) and the extracted features (at the database). 3:43-62.
8. The computer system of claim 1, wherein at least one of the first electronic work or the extracted features of the first electronic work is obtained from at least one of a set-top-box, a video recorder, a cell phone, a computer, or a portable device that stores commercial transaction data, and wherein the action information comprises a commercial transaction, and the one or more computer readable media have stored thereon further computer instructions for carrying out the additional step of:	Conwell teaches that the database receives the extracted features from a computer or a portable device. (3:43-62) which at least temporarily stores commercial transaction data such as a "credit card" number or payment information for "one of several emerging web currencies" (4:22-24). Conwell further teaches that the action information comprises a commercial transaction, such as processing "the payment by various known methods (e.g., via credit card, by one of several emerging web currencies, etc.)" (4:14-29) or holding an auction (5:4-14).
electronically performing the commercial transaction using the stored commercial	Conwell teaches performing the commercial transaction using the

'441 patent	Conwell (Ex. 1015)
transaction data.	stored commercial transaction data by processing "the payment by various known methods (e.g., via credit card, by one of several emerging web currencies, etc.)" or holding an auction. 4:14-29, 5:4-14.
9. The computer system of claim 1, wherein at least one of the first electronic work or the extracted features of the first electronic work is obtained from at least one of a set-top-box, a video recorder, a cell phone, a computer, or a portable device, and wherein the action information comprises commercial transaction data, and the one or more computer readable media have stored thereon further computer instructions for carrying out the additional step of:	Conwell teaches that the database receives the extracted features from a computer or a portable device. 3:43-62. Conwell further teaches that the action information comprises commercial transaction data, such as data relating to processing "the payment by various known methods (e.g., via credit card, by one of several emerging web currencies, etc.)" (4:14-29) or holding an auction (5:4-14).
electronically performing the commercial transaction through the at least one of a set-top-box, a video recorder, a cell phone, a computer, or a portable device using the commercial transaction data.	Conwell teaches performing the commercial transaction through the computer using the stored commercial transaction data by processing "the payment by various known methods (e.g., via credit card, by one of several emerging web currencies, etc.)" or holding an auction. 4:14-29, 5:4-14.
10. The computer system of claim 8, wherein the stored commercial transaction data comprises at least one of a purchaser's name, a purchaser's address, or credit card information.	Conwell teaches storing commercial transaction data such as a "credit card" number or payment information for "one of several emerging web currencies." 4:22-24.
11. The computer system of claim 1, wherein the action comprises at least one of directing a user to a website related to the first electronic work, initiating an e-commerce transaction, or dialing a phone	Conwell teaches that the action may comprise initiating an e-commerce transaction by processing "the payment by various known methods (e.g., via credit card, by one of

'441 patent	Conwell (Ex. 1015)
number.	several emerging web currencies, etc.)"(4:14-29) or holding an auction (5:4-14); or "returning the URL corresponding to that identifier back to the user device," which "then directs an internet browser to that URL" (3:43-62).
12. The computer system of claim 1, wherein the action comprises providing and/or displaying additional information in association with the first electronic work.	Conwell teaches an action that displays additional information in association with the electronic work, such as information related to a payment (4:14-29), an auction (5:4-14), or an associated web page (3:43-62).
13. A computer system comprising:	Non-limiting preamble.
one or more electronic communications devices;	I incorporate my above discussion of Conwell regarding Claim 1.
one or more processors operatively connected to the one or more electronic communications devices; and	I incorporate my above discussion of Conwell regarding Claim 1.
one or more computer readable media operatively connected to the one or more processors and having stored thereon computer instructions for carrying out the steps of:	I incorporate my above discussion of Conwell regarding Claim 1.
(a) maintaining, by the computer system, one or more databases comprising:	I incorporate my above discussion of Conwell regarding Claim 1a.
(1) first electronic data comprising a first digitally created compact electronic representation of one or more reference electronic works; and	I incorporate my above discussion of Conwell regarding Claim 1(a)(1).
(2) second electronic data related to an action, the action comprising providing and/or displaying an advertisement corresponding to each of the one or more reference electronic works;	I incorporate my above discussion of Conwell regarding Claim 1(a)(2). Conwell further discloses that the action comprises providing an advertisement, such as "banner

'441 patent	Conwell (Ex. 1015)
	advertising, co-op links to on-line retailers (e.g., Amazon.com), or other revenue-producing uses," such as "offering CDs." 3:51-55, 4:30-34.
(b) obtaining, by the computer system, a second digitally created compact electronic representation of a first electronic work;	I incorporate my above discussion of Conwell regarding Claim 1b. As explained above, the term "compact electronic representation" is synonymous with "extracted features."
(c) identifying, by the computer system, a matching reference electronic work that matches the first electronic work by comparing the first electronic data with the second digitally created compact electronic representation using a non-exhaustive neighbor search;	I incorporate my above discussion of Conwell regarding Claim 1c.
(d) determining, by the computer system, the action corresponding to the matching reference electronic work based on the second electronic data in the database; and	I incorporate my above discussion of Conwell regarding Claim 1d.
(e) associating, by the computer system, the determined action with the first electronic work.	I incorporate my above discussion of Conwell regarding Claim 1e.
14. The computer system of claim 13, wherein the action further comprises providing a link to a site on the World Wide Web associated with the advertisement.	Conwell teaches the action providing a URL link to a website that is associated with the advertisement (e.g., for CDs). 3:51-55.
19. The computer system of claim 13, wherein the action further comprises purchasing a product or service related to the advertisement.	Conwell discloses providing "opportunities to purchase CDs, etc." (Abstract) such as "banner advertising, co-op links to on-line retailers (e.g., Amazon.com), or other revenue-producing uses" (4:30-34) related to an advertisement. Conwell further

'441 patent	Conwell (Ex. 1015)
	discloses making a payment to effect such a purchase. 4:14-29.
21. The computer system of claim 1, further comprising the step of transmitting, by the computer system, the determined action as associated with the first electronic work.	Conwell teaches transmitting of the determined action (e.g., transmitting the associated URL). 3:43-62.
22. The computer system of claim 1, wherein the one or more electronic works comprise at least one of a video work, an audio work, or an image work.	Conwell teaches that the electronic work is an audio work (3:51-55), or a video work or still image (1:23-27).
23. The computer system of claim 1, wherein the one or more computer readable media have stored thereon further computer instructions for carrying out the additional steps of:	Non-limiting preamble.
(f) obtaining, by the computer system, second extracted features of a second electronic work;	Conwell teaches obtaining extracted features by deriving them from the features of the work, e.g., using a "hashing" algorithm. Abstract, 3:43-62, 1:65-67.
(g) searching, by the computer system, for an identification of the second electronic work by comparing the second extracted features of the second electronic work with the first electronic data in the database using a non-exhaustive neighbor search; and	Conwell teaches searching for a first electronic work by accessing a lookup table in a computer system to "decode an identifier [i.e., extracted features] from the audio content and send the identifier to the database, [which] responds by returning the URL corresponding to that identifier back to the user device." 3:43-62, Figs. 3-4. Conwell further teaches a neighbor search because "non-identical versions of the same basic content may nonetheless correspond to the same identifier." 4:64-5:3. Conwell further discloses that this neighbor

'441 patent	Conwell (Ex. 1015)
	search is non-exhaustive under Petitioner's construction because it uses a sorted lookup table that uses work identifiers as an index. 3:43-50, 5:58-64.
(h) determining, by the computer system, that the second electronic work is not identified based on results of the searching step.	Conwell teaches that the system can determine when the work is not identified in the database and perform the appropriate alternative action. 3:66-4:12 ("Instead, the Registry reports, (e.g., by a default web page) that there is no further information related to that MP3 (i.e., there is no database record corresponding to identifier '883').").
24. The computer system of claim 13, wherein the one or more computer readable media have stored thereon further computer instructions for carrying out the additional steps of:	Non-limiting preamble.
(f) obtaining, by the computer system, second extracted features of a second electronic work to be identified;	I incorporate my above discussion of Conwell regarding Claim 23f.
(g) searching, by the computer system, for an identification of the second electronic work by comparing the second extracted features of the second electronic work with the first electronic data in the database using a non-exhaustive neighbor search; and	I incorporate my above discussion of Conwell regarding Claim 23g.
(h) determining, by the computer system, that the second electronic work is not identified based on results of the searching step.	I incorporate my above discussion of Conwell regarding Claim 23h.
25. A computer system comprising:	Non-limiting preamble.
one or more electronic communications devices;	I incorporate my above discussion

'441 patent	Conwell (Ex. 1015)
	of Conwell regarding Claim 1.
one or more processors operatively connected to the one or more electronic communications devices; and	I incorporate my above discussion of Conwell regarding Claim 1.
one or more computer readable media operatively connected to the one or more processors and having stored thereon computer instructions for carrying out the steps of:	I incorporate my above discussion of Conwell regarding Claim 1.
(a) maintaining, by the computer system, one or more databases comprising:	I incorporate my above discussion of Conwell regarding Claim 1a.
(1) first electronic data comprising a first digitally created compact electronic representation comprising an extracted feature vector of one or more reference electronic works; and	I incorporate my above discussion of Conwell regarding Claim 1(a)(1).
(2) second electronic data related to action information, the action information comprising an action to perform corresponding to each of the one or more reference electronic works;	I incorporate my above discussion of Conwell regarding Claim 1(a)(2).
(b) obtaining, by the computer system, a second digitally created compact electronic representation comprising an extracted feature vector of a first electronic work;	I incorporate my above discussion of Conwell regarding Claim 1b. As explained above, the term "compact electronic representation comprising an extracted feature vector" is synonymous with "extracted features."
(c) identifying, by the computer system, a matching reference electronic work that matches the first electronic work by comparing the first electronic data with the second digitally created compact electronic representation of the first electronic work using a non-exhaustive neighbor search;	I incorporate my above discussion of Conwell regarding Claim 1c.

'441 patent	Conwell (Ex. 1015)
(d) determining, by the computer system, the action information corresponding to the matching reference electronic work based on the second electronic data in the database; and	I incorporate my above discussion of Conwell regarding Claim 1d.
(e) associating, by the computer system, the determined action information with the first electronic work.	I incorporate my above discussion of Conwell regarding Claim 1e.
26. The computer system of claim 25, wherein the one or more computer readable media have stored thereon further computer instructions for carrying out the additional steps of:	Non-limiting preamble.
(f) obtaining, by the computer system, a third digitally created compact electronic representation comprising an extracted feature vector of a second electronic work;	I incorporate my above discussion of Conwell regarding Claim 23f.
(g) searching, by the computer system, for a matching reference electronic work that matches the second electronic work by comparing the third digitally created compact electronic representation of the second electronic work with the first electronic data in the database using a non-exhaustive neighbor search; and	I incorporate my above discussion of Conwell regarding Claim 23g.
(h) determining, by the computer system, that a matching reference electronic work that matches the second electronic work does not exist based on results of the searching step.	I incorporate my above discussion of Conwell regarding Claim 23h.
30. The computer system of claim 1, wherein the one or more computer readable media have stored thereon further computer instructions for carrying out the additional step of transmitting, by the computer system, the determined action information as associated with the first electronic identified work.	I incorporate my above discussion of Conwell regarding Claim 21.

XII. OPINION AS TO THE NOVELTY OF CLAIMS 1-3, 8-14, 19, 21-22, 25, 27, AND 29-30 IN VIEW OF WOOD

A. Background on Wood

90. I provide the following summary of Wood as a matter of convenience to the reader. This summary is not intended to be a full recitation of my opinions on the subject.

91. As I explain below, it is my opinion that each and every element of claims 1-3, 8-14, 19, 21-22, 25, 27, and 29-30 of the '441 patent was previously disclosed by Wood.

92. Wood was filed on August 28, 2003, but claims priority to continuation-in-part parent Application No. 09/438,469, which was filed on November 12, 1999.

93. I have analyzed Wood's continuation-in-part parent application, Application No. 09/438,469 (Ex. 1016 at 18-25), and it is my opinion that it properly supports the subject matter of Wood relied upon in Petitioner's petition and my report. In particular, all portions of Wood cited in Petitioner's petition and this report were originally present in Application No. 09/438,469. Moreover, only a short portion (comprising approximately lines 2:16-19, 3:6-8, 12:63-14:4, and Fig. 10) of Wood was not present in Application No. 09/438,469. These portions are either cosmetic, or unrelated to the disclosure relied upon in Petitioner's petition or my report.

94. Wood discloses a computer system for identifying over the Internet a song hummed or sung by a user. Ex. 1015 at Abstract. Specifically, "a musical composition can be recognized by extracting features from a specimen that has been vocalized by a person, generating a pattern from the extracted features, comparing this pattern with patterns in a pattern library, and identifying at least one musical composition as a result of this comparison." *Id.* at 2:34-39. After the song is identified, "identifiers such as title and singer or group . . . are transmitted to the customer for display on the customer's monitor." *Id.* at 6:19-46. The customer is then provided the option to purchase a copy of the song "by entering a credit card number" and subsequently "download[ing] a file containing the selection, such as an MP3 file." *Id.* at 5:8-23.

B. Wood Discloses Each and Every Element of Claims 1-3, 8-14, 19, 21-22, 25, 27, and 29-30

95. It is my opinion that Wood discloses all elements of claims 1-3, 8-14, 19, 21-22, 25, 27, and 29-30 of the '441 patent, and therefore anticipates these claims.

96. Wood discloses all five elements of independent claims 1, 3, and 25 of the '441 patent.

97. First, it is my opinion that Wood discloses "databases" containing "compact electronic representation[s] of one or more reference electronic works" and "electronic data related to an action . . . corresponding to each of the one or

more reference electronic works." Ex. 1001 at Claims 1, 13, 25. Wood discloses that "pattern library 88 stores normalized features extracted from all of the songs or other musical compositions that are stored in a music library 90," which constitutes a database storing compact representations of works. Ex. 1015 at 5:66-6:7, Fig. 4 at 88. Wood further discloses a "music library 90" which stores "not only the encoded songs, but also identification information such as the title of the song and the name of the singer or group." *Id.* at 6:19-23. Because this information is provided to a user in response to identifying a song, the music library constitutes a database containing electronic data related to an action.

98. Second, it is my opinion that Wood discloses "obtaining . . . a second digitally created compact electronic representation"—or, synonymously, "extracted features" or a "feature vector"—of an unknown work. Ex. 1001 at Claims 1, 13, 25. Wood discloses a "feature extraction unit" which "extracts from the specimen musical features which characterize the song." Ex. 1015 at 5:50-55, 2:34-46, 7:34-8:13.

99. Third, it is my opinion that Wood discloses "identifying" the unknown work "using a non-exhaustive neighbor search." Ex. 1001 at Claims 1, 13, 25. Wood discloses "generating a pattern from the extracted features, comparing this pattern with patterns in a pattern library, and identifying at least one musical composition as a result of this comparison." *Id.* at 2:34-39.

100. It is my opinion that Wood further discloses that this constitutes a neighbor search because, "[a]lthough it is possible for the normalized features extracted from the specimen to exactly match an entry stored in the pattern library 88, typically a distan[ce] score is calculated between the specimen and each entry in the pattern library, and a particular entry is determined to be a candidate if the distance is smaller than a predetermined value." *Id.* at 6:8-19, 10:56-11:19.

101. It is my opinion that Wood further discloses that this search is non-exhaustive because it explains that "the speed of the pattern matching could be increased considerably" by performing a non-exhaustive search that compares "only . . . portions of each composition, possibly the chorus and one or two other memorable stretches of music." *Id.* at 11:28-42. Alternatively, Wood discloses the use of a non-exhaustive search that "ignore[s] periods of silence in the specimen." *Id.* at 8:5-12, 6:3-7.

102. Fourth, it is my opinion that Wood discloses "determining" an appropriate action based on the "electronic data related to an action." Ex. 1001 at 1, 13, 25. Wood discloses, after identifying a song, determining an action to perform such as transmitting a "corrupted version" of the song (i.e., a version "with superimposed noise" that will assist the user to confirm the identity of the song, but is not a substitute for purchasing a copy of an uncorrupted version) (Ex. 1015 at 2:29-33) and/or transmitting information about the song "for display on the

customer's monitor" (*Id.* at 6:44-46). In either case, Wood must determine the appropriate corrupted version and/or information to transmit.

103. Fifth, it is my opinion that Wood discloses "associating . . . the determined action with the" identified work, which encompasses performing an action. Ex. 1001 at Claims 1, 13, 25. Wood discloses, after identifying a song, determining an action to perform such as transmitting a "corrupted version" of the song (Ex. 1015 at 2:29-33) and/or transmitting information about the song "for display on the customer's monitor" (*Id.* at 6:44-46).

104. Claim 27 of the '441 patent further requires that the "extracted feature is extracted using frequency based decomposition." Ex. 1001 at Claim 27. The specification explains that "frequency-based decomposition of the signal" can employ a wide variety of algorithms, "such as produced by the Fourier, Fourier-Mellin, wavelet and or discrete cosine transforms" Ex. 1001 at 20:18-21, 7:9-12. A person skilled in the art would understand that the common characteristic of these algorithms is that they evaluate the intensity of a signal at different frequencies. It is my opinion that Wood discloses such an algorithm for frequency based decomposition. In particular, Wood discloses "dividing the specimen into a plurality of frequency bands, finding a first one of the frequency bands that has the strongest signal . . ., detecting when the strongest signal shifts to a second one of the frequency bands . . ., and detecting the number of half tones between the first

one of the frequency bands and the second one of the frequency bands." Further, Wood explains that the invention builds on known technology that extracts features by "identify[ing] a range of frequencies that are present during extremely brief slices of time and the power at those frequencies"). Ex. 1015 at Claim 1; 1:50-53.

105. A claim chart detailing how Wood anticipates claims 1-3, 8-14, 19, 21-22, 25, 27, and 29-30, consistent with the above discussion, is provided below:

'441 patent	Wood (Ex. 1015)
1. A computer system comprising:	Non-limiting preamble.
one or more electronic communications devices;	Wood discloses "a computer 28 having a hard disk 30, a drive 32 for a removable recording medium, and a speaker 34." 3:25-27.
one or more processors operatively connected to the one or more electronic communications devices; and	Wood discloses "a computer 28 having a hard disk 30, a drive 32 for a removable recording medium, and a speaker 34." 3:25-27.
one or more computer readable media operatively connected to the one or more processors and having stored thereon computer instructions for carrying out the steps of:	Wood discloses "a computer 28 having a hard disk 30, a drive 32 for a removable recording medium, and a speaker 34." 3:25-27.
(a) maintaining, by the computer system, a database comprising:	Wood discloses a pattern library database (Fig. 4 at 88) and a "music library" database (Fig. 4 at 90). 5:66-6:7, 6:19-23.
(1) first electronic data related to identification of one or more reference electronic works; and	Wood discloses that the "pattern library [database] stores" data related to identification, such as "normalized features extracted from all of the songs or other musical compositions that are stored in a music library [database]." 5:66-6:7,

'441 patent	Wood (Ex. 1015)
	Fig. 4 at 88.
(2) second electronic data related to action information comprising an action to perform corresponding to each of the one or more reference electronic works;	Wood discloses a "music library" database which stores "not only the encoded songs, but also [data related to the action of displaying an identification,] such as the title of the song and the name of the singer or group." 6:19-23.
(b) obtaining, by the computer system, extracted features of a first electronic work;	Wood discloses obtaining extracted features by "extract[ing] from the specimen musical features which characterize the song." 5:50-55, 2:34-46, 7:34-8:13.
(c) identifying, by the computer system, the first electronic work by comparing the extracted features of the first electronic work with the first electronic data in the database using a non-exhaustive neighbor search;	Wood discloses identifying the work using a neighbor search wherein "a distan[ce] score is calculated between the specimen and each entry in the pattern library [database], and a particular entry is determined to be a candidate if the distance is smaller than a predetermined value." 6:8-19, 10:56-11:19. Wood further discloses the search is non-exhaustive and compares "only . . . portions of each composition, possibly the chorus and one or two other memorable stretches of music" (11:28-42) or "ignore[s] periods of silence in the specimen" (8:5-12, 6:3-7).
(d) determining, by the computer system, the action information corresponding to the identified first electronic work based on the second electronic data in the database; and	Wood discloses determining an action to perform, such as transmitting a "corrupted version" of the song (2:29-33) and/or transmitting information about the song "for display on the customer's monitor" (6:44-46) that was retrieved from the "music library" database (6:19-23).
(e) associating, by the computer system, the determined action	Wood discloses associating an action by performing an action on a user's computer,

'441 patent	Wood (Ex. 1015)
information with the identified first electronic work.	such as playing a "corrupted version" of the song (2:29-33) and/or transmitting information about the song "for display on the customer's monitor" (6:44-46).
2. The computer system of claim 1, wherein the step of obtaining comprises receiving the first electronic work and extracting the extracted features from the first electronic work.	Wood discloses receiving the electronic work "provided by a customer (as by humming, singing, or otherwise vocalizing the specimen . . .)." 1:15-18. Wood discloses that the system subsequently "extracts from the specimen musical features which characterize the song." 5:50-55, 2:34-46, 7:34-8:13.
3. The computer system of claim 2, wherein the first electronic work is received from at least one of a set-top-box, a video recorder, a cell phone, a computer, or a portable device.	Wood discloses that the system receives the electronic work from the user's computer. 5:24-42 ("the result of the customer's audibilization of the song . . . is an audio file that is conveyed to the music distribution company 18 via the internet"); 2:6-7 ("The specimen may be sent via the internet or telephone to a remote location for analysis and pattern matching.").
8. The computer system of claim 1, wherein at least one of the first electronic work or the extracted features of the first electronic work is obtained from at least one of a set-top-box, a video recorder, a cell phone, a computer, or a portable device that stores commercial transaction data, and wherein the action information comprises a commercial transaction, and the one or more computer readable media have stored thereon further computer instructions for carrying out the additional step of:	Wood discloses obtaining from a computer either the first electronic work (2:7-8, 5:24-42) or the extracted features (2:8-12). Wood further discloses that the computer at least temporarily stores the commercial transaction data of "a credit card number," and that the action information comprises a commercial transaction such as purchasing a copy of the song and subsequently "download[ing] a file containing the selection, such as an MP3 file." 5:8-23.
electronically performing the commercial transaction using the	Wood discloses performing a commercial transaction by purchasing a copy of the

'441 patent	Wood (Ex. 1015)
stored commercial transaction data.	song and subsequently "download[ing] a file containing the selection, such as an MP3 file" using the commercial transaction data of the user's "credit card number." 5:8-23.
9. The computer system of claim 1, wherein at least one of the first electronic work or the extracted features of the first electronic work is obtained from at least one of a set-top-box, a video recorder, a cell phone, a computer, or a portable device, and wherein the action information comprises commercial transaction data, and the one or more computer readable media have stored thereon further computer instructions for carrying out the additional step of:	Wood discloses obtaining from a computer either the first electronic work (2:7-8, 5:24-42) or the extracted features (2:8-12). Wood further discloses that the action information comprises commercial transaction data, such as purchasing a copy of the song and subsequently "download[ing] a file containing the selection, such as an MP3 file." 5:8-23.
electronically performing the commercial transaction through the at least one of a set-top-box, a video recorder, a cell phone, a computer, or a portable device using the commercial transaction data.	Wood discloses performing a commercial transaction through the computer by purchasing a copy of the song and subsequently "download[ing] a file containing the selection, such as an MP3 file" using the commercial transaction data of the user's "credit card number." 5:8-23.
10. The computer system of claim 8, wherein the stored commercial transaction data comprises at least one of a purchaser's name, a purchaser's address, or credit card information.	Wood discloses that the commercial transaction data is the user's "credit card number," which is at least temporarily stored on the device. 5:8-23.
11. The computer system of claim 1, wherein the action comprises at least one of directing a user to a website related to the first electronic work, initiating an e-commerce transaction, or dialing a phone	Wood discloses initiating an e-commerce transaction "by entering a credit card number" and subsequently "download[ing] a file containing the selection, such as an MP3 file." 5:8-23.

'441 patent	Wood (Ex. 1015)
number.	
12. The computer system of claim 1, wherein the action comprises providing and/or displaying additional information in association with the first electronic work.	Wood discloses that "identifiers such as title and singer or group . . . are transmitted to the customer for display on the customer's monitor." 6:19-46, 2:20-23, Fig. 5 at 102, 14:28-29 ("sending information to identify the musical compositions in writing to the person over the internet"), 15:18-20, 16:21-22.
13. A computer system comprising:	Non-limiting preamble.
one or more electronic communications devices;	I incorporate my above discussion of Wood regarding Claim 1.
one or more processors operatively connected to the one or more electronic communications devices; and	I incorporate my above discussion of Wood regarding Claim 1.
one or more computer readable media operatively connected to the one or more processors and having stored thereon computer instructions for carrying out the steps of:	I incorporate my above discussion of Wood regarding Claim 1.
(a) maintaining, by the computer system, one or more databases comprising:	I incorporate my above discussion of Wood regarding Claim 1a.
(1) first electronic data comprising a first digitally created compact electronic representation of one or more reference electronic works; and	I incorporate my above discussion of Wood regarding Claim 1(a)(1).
(2) second electronic data related to an action, the action comprising providing and/or displaying an advertisement corresponding to each of the one or more reference electronic works;	I incorporate my above discussion of Wood regarding Claim 1(a)(2). Wood further discloses that the action may be an advertisement, such as providing the customer the option to purchase a copy of the song "by entering a credit card number" and "download[ing] a file

'441 patent	Wood (Ex. 1015)
	containing the selection, such as an MP3 file." 5:8-23.
(b) obtaining, by the computer system, a second digitally created compact electronic representation of a first electronic work;	I incorporate my above discussion of Wood regarding Claim 1b. As explained above, the term "compact electronic representation" is synonymous with "extracted features."
(c) identifying, by the computer system, a matching reference electronic work that matches the first electronic work by comparing the first electronic data with the second digitally created compact electronic representation using a non-exhaustive neighbor search;	I incorporate my above discussion of Wood regarding Claim 1c.
(d) determining, by the computer system, the action corresponding to the matching reference electronic work based on the second electronic data in the database; and	I incorporate my above discussion of Wood regarding Claim 1d.
(e) associating, by the computer system, the determined action with the first electronic work.	I incorporate my above discussion of Wood regarding Claim 1e.
14. The computer system of claim 13, wherein the action further comprises providing a link to a site on the World Wide Web associated with the advertisement.	Wood discloses that the action may comprise providing links on a Web page: "The customer starts by logging on with the customer's internet service provider 14 and then addressing the music distribution company (step 52) by typing in the company's worldwide web address or URL. The company thereupon downloads the selection options available to the customer (step 54)." 4:27-41, 3:49-52.
19. The computer system of claim 13, wherein the action further comprises purchasing a product or service related to the advertisement.	Wood discloses purchasing an advertised song "by entering a credit card number" and subsequently "download[ing] a file containing the selection, such as an MP3

'441 patent	Wood (Ex. 1015)
	file." 5:8-23.
21. The computer system of claim 1, further comprising the step of transmitting, by the computer system, the determined action as associated with the first electronic work.	Wood discloses that "[t]he identification information (i.e., identifiers such as title and singer or group) is . . . transmitted to the customer for display on the customer's monitor" (6:19-46) along with a "corrupted version" of the identified song (2:29-33) and an offer to purchase the song (5:8-23).
22. The computer system of claim 1, wherein the one or more electronic works comprise at least one of a video work, an audio work, or an image work.	Wood discloses that the electronic work is a "song," i.e., an audio work, that the user "may hum or otherwise vocalize." Abstract.
25. A computer system comprising:	Non-limiting preamble.
one or more electronic communications devices;	I incorporate my above discussion of Wood regarding Claim 1.
one or more processors operatively connected to the one or more electronic communications devices; and	I incorporate my above discussion of Wood regarding Claim 1.
one or more computer readable media operatively connected to the one or more processors and having stored thereon computer instructions for carrying out the steps of:	I incorporate my above discussion of Wood regarding Claim 1.
(a) maintaining, by the computer system, one or more databases comprising:	I incorporate my above discussion of Wood regarding Claim 1a.
(1) first electronic data comprising a first digitally created compact electronic representation comprising an extracted feature vector of one or more reference electronic works; and	I incorporate my above discussion of Wood regarding Claim 1(a)(1).

'441 patent	Wood (Ex. 1015)
(2) second electronic data related to action information, the action information comprising an action to perform corresponding to each of the one or more reference electronic works;	I incorporate my above discussion of Wood regarding Claim 1(a)(2).
(b) obtaining, by the computer system, a second digitally created compact electronic representation comprising an extracted feature vector of a first electronic work;	I incorporate my above discussion of Wood regarding Claim 1b. As explained above, the term "compact electronic representation comprising an extracted feature vector" is synonymous with "extracted features."
(c) identifying, by the computer system, a matching reference electronic work that matches the first electronic work by comparing the first electronic data with the second digitally created compact electronic representation of the first electronic work using a non-exhaustive neighbor search;	I incorporate my above discussion of Wood regarding Claim 1c.
(d) determining, by the computer system, the action information corresponding to the matching reference electronic work based on the second electronic data in the database; and	I incorporate my above discussion of Wood regarding Claim 1d.
(e) associating, by the computer system, the determined action information with the first electronic work.	I incorporate my above discussion of Wood regarding Claim 1e.
27. The computer system of claim 1, wherein the extracted feature is extracted using frequency based decomposition.	Wood discloses extracting features by frequency based decomposition: "dividing the specimen into a plurality of frequency bands, finding a first one of the frequency bands that has the strongest signal . . . , detecting when the strongest signal shifts to a second one of the frequency bands

'441 patent	Wood (Ex. 1015)
	. . . , and detecting the number of half tones between the first one of the frequency bands and the second one of the frequency bands." 14:22-57, 1:50-53 (explaining that the invention builds on known technology that extracts features by "identify[ing] a range of frequencies that are present during extremely brief slices of time and the power at those frequencies"). For the reasons expressed above, it is my opinion that this algorithm constitutes frequency based decomposition.
29. The computer system of claim 1, wherein the extracted feature is extracted using temporal sequence of feature vectors.	Wood discloses extracting a temporal sequence of feature vectors in the form of "a sequence of notes in the specimen without rests between the notes, and information about the time interval between the beginning of one note in the sequence and the beginning of the next note." 16:14-42, 16:49-17:8, 12:40-57. "The net result would be somewhat like creating a pitch-with-respect-to-time graph of the customer's specimen." 10:66-11:1.
30. The computer system of claim 1, wherein the one or more computer readable media have stored thereon further computer instructions for carrying out the additional step of transmitting, by the computer system, the determined action information as associated with the first electronic identified work.	I incorporate my above discussion of Wood regarding Claim 21.

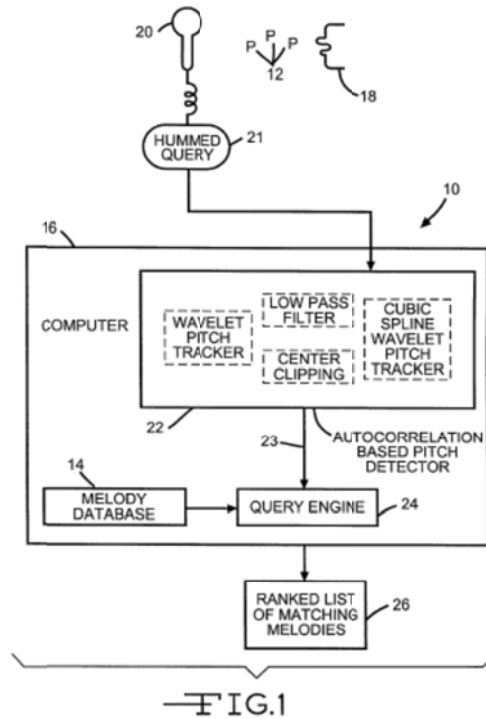
XIII. OPINION AS TO THE OBVIOUSNESS OF CLAIMS 1-3, 8, 10-14, 18-19, 21-27, AND 29-30 OVER GHIAS IN VIEW OF PHILYAW

A. Background on Ghias

106. I provide the following summary of Ghias as a matter of convenience to the reader. This summary is not intended to be a full recitation of my opinions on the subject.

107. Ghias was filed on October 31, 1996, and issued as a patent on February 23, 1999. Ex. 1010.

108. Ghias discloses identifying a melody hummed by a user. As illustrated by Figure 1 of Ghias, a "tune 12 is hummed by a person 18 into a microphone 20." Ex. 1010 at 2:41-42. The data from the microphone is fed into "pitch tracking module 22 in computer 16" which extracts "a contour representation" of the melody. *Id.* at 2:46-49. The computer then "searches the melody database 14" to locate a matching melody. *Id.* at 2:50-59. Subsequently, the computer takes the action of "output[ting] a ranked list of approximately matching melodies." *Id.* at 2:50-52, 6:60-63, 7:4-5, 8:26-28, 8:61-63.



B. Background on Philyaw

109. I provide the following summary of Philyaw as a matter of convenience to the reader. This summary is not intended to be a full recitation of my opinions on the subject.

110. Philyaw was filed on September 11, 1998, and issued as a patent on August 1, 2000. See Ex. 1014.

111. Philyaw discloses extracting identifying information embedded into a broadcast signal and, based upon that identifying information, viewing corresponding information, such as an advertisement. *E.g.*, Ex. 1014 at Abstract, 1:66-2:8. Specifically, a PC "extract[s] the unique identifier information" (*id.* at

16:18-23, 4:30-33) from a broadcast "program having embedded therein an encoded signal having unique identifier information contained therein" (*id.* at 15:48-16:2, 2:1-3, 5:47-52, 9:37-39). Using this identifying information, the PC queries an Advertiser Reference Server ("ARS") (*id.* at 5:52), which contains "a database . . . of product codes and associated manufacturer URLs" (*id.* at 5:57-58, Abstract ("the advertiser reference server which contains a cross-referenced database of advertiser product identifier information and associated advertiser server URLs")). "[T]he ARS . . . responds by returning the URL of advertiser server 312 to the PC 302," which uses the URL to view the advertisement. *Id.* at 8:10-18, Abstract, 5:23-27, 5:64-6:2. Alternatively, the ARS may facilitate direct transmission of the advertisement to the user. *Id.* at 7:43-56.

112. Philyaw is not limited to the display of advertisements, but also discloses interactive actions, such as "a sports game that would . . . allow a user access to information that is not available over the broadcast network, such as additional statistics." Ex. 1014 at 4:50-54.

C. A Person Skilled In The Art Would Have Been Motivated To Combine Ghias and Philyaw

113. It is my opinion that a person skilled in the art would have been motivated to combine Ghias and Philyaw.

114. Philyaw discloses a system for displaying advertisements related to broadcast content. *E.g.*, Ex. 1014 at Abstract, 1:66-2:8. To identify the broadcast

content, Philyaw requires both embedding identifying information in the content (*id.* at 15:47-16:2, 2:1-3, 5:47-52, 9:37-39) and subsequently extracting the identifying information (*id.* at 16:18-24, 4:30-33). By contrast, Ghias allows identification of content based on intrinsic characteristics alone, and therefore does not require the step of embedding identifying information into content. *E.g.*, Ex. 1010 at Abstract, 2:41-59. A person skilled in the art would have been motivated to combine Ghias and Philyaw to present advertisements related to content, without having to undergo the time consuming and expensive step of embedding identifying information in content.

115. It is further my opinion that the combination of Ghias and Philyaw would have yielded only expected results.

D. The Combination of Ghias and Philyaw Discloses Each and Every Element of Claims 1-3, 8, 10-14, 18-19, 21-27, and 29-30

116. It is my opinion that the combination of Ghias and Philyaw discloses all elements of claims 1-3, 8, 10-14, 18-19, 21-27, and 29-30 in the '441 patent, and therefore renders these claims obvious.

117. The combination of Ghias and Philyaw discloses all five elements of independent claims 1, 13, and 25 of the '988 patent.

118. First, it is my opinion that the combination of Ghias and Philyaw discloses "databases" containing "compact electronic representation[s] of one or more reference electronic works" and "electronic data related to an action . . .

corresponding to each of the one or more reference electronic works." Ghias discloses "a database of melodies each including a plurality of notes in a form of a sequence of digitized representations of relative pitch differences," which constitute compact extracted features, electronic representations, and/or feature vectors. Ex. 1010 at 1:59-62, 5:66-6:1 ("songs in the database 14 are preprocessed to convert the melody into a stream of the previously discussed U,D,S characters"). Philyaw discloses an Advertiser Reference Server ("ARS"), which contains "a database . . . of product codes and associated manufacturer URLs" (*id.* at 5:57-58, Abstract (describing "the advertiser reference server which contains a cross-referenced database of advertiser product identifier information and associated advertiser server URLs"))).

119. Second, it is my opinion that the combination of Ghias and Philyaw discloses "obtaining . . . a second digitally created compact electronic representation"—or, synonymously, "extracted features" or a "feature vector"—of an unknown work. Ex. 1001 at Claims 1, 13, 25. Ghias discloses extracting "a contour representation" of the melody. Ex. 1010 at 2:46-49. Specifically, "[u]ser input 12 (humming) to the system 10 is converted into a sequence of relative pitch transitions, as follows . . . To accomplish this conversion, a sequence of pitches in the melody must be isolated and tracked." *Id.* at 3:8-22.

120. Third, it is my opinion that the combination of Ghias and Philyaw discloses "identifying" the unknown work "using a non-exhaustive neighbor search." Ex. 1001 at Claims 1, 13, 25. Ghias discloses using a "query engine 24" which "searches the melody database 14" to locate a matching melody. Ex. 1001 at 2:50-59, Abstract ("A melody database is searched for at least one sequence of digitized representations of relative pitch differences between successive notes which at least approximately matches the sequence of digitized representations of relative pitch differences between successive notes of the melody."). Ghias further discloses that this search may be non-exhaustive. Specifically, Ghias teaches that "it is considered desirable to use an efficient approximate pattern matching algorithm" rather than an algorithm that is guaranteed to yield a match. Ex. 1010 at 6:7-11. Moreover, Ghias teaches that "Several Algorithms have been developed that address [this] problem" ranging from "brute force" to substantially faster algorithms. *Id.* at 6:23-35 ("Several Algorithms have been developed that address the problem of approximate string matching. Running times have ranged from $O(mn)$ for the brute force algorithm to $O(kn)$ or $O(n\log(m))$, where 'O' means 'on the order of,' m is the number of pitch differences in the query, and n is the size of the string (song).").

121. Ghias notes that, in one embodiment, "songs in the database 14 are preprocessed to convert the melody into a stream of the previously discussed

U,D,S characters, and the converted user input (the key 23) is compared with all the songs." Ex. 1010 at 5:66-6:2 (emphasis added). However, this refers to preprocessing that occurs at the time new works are added to a database to facilitate later search, not search itself. As discussed above, it is my opinion that preprocessing is distinct from search. Thus, it is my opinion that this disclosure does not reflect an exhaustive search mechanism. Moreover it is my opinion that this disclosure represents a single embodiment of Ghias, and Ghias discloses other embodiments that employ non-exhaustive search, as explained above.

122. Ghias further discloses that this search locates a near or nearest neighbor by determining "a ranked list of approximately matching melodies, as illustrated at 26" or "the single most approximate matching melody." Ex. 1010 at 2:50-59, 6:60-63.

123. Fourth, it is my opinion that the combination of Ghias and Philyaw discloses "determining" an appropriate action based on the "electronic data related to an action." Ghias discloses using the results of a search to determine which potential matches (Ex. 1010 at 2:50-52, 7:4-5, 8:26-28, 8:61-63) and how many potential matches to display to a user (Ex. 1010 at 6:60-63 ("The number of matches that the database 14 should retrieve depends upon the error-tolerance used during the key-search."), 2:53-55 ("The query engine 24 may of course alternatively be programmed to output the single most approximate matching

melody . . ."). Ghias further discloses that "[i]f the list [of potential matches] is too large" the system may perform the additional action of allowing the user to perform a new query on a restricted search list consisting of songs just retrieved." *Id.* at 7:4-8. Additionally, Ghias discloses determining which song titles to display to the user based on the identity of the hummed song, which constitutes electronic data related to an action. *Id.* at 6:60-63, 2:50-52, 7:4-8, 8:26-28, 8:61-63.

124. Alternatively, Philyaw discloses determining the appropriate advertisement to display to a user by querying the ARS database. Ex. 1014 at 5:64-65 ("advertiser server address URL is obtained from the ARS database"), 7:4-7 ("product code information . . . is then compared with data contained within the ARS advertiser database 310 to determine if there is a 'hit.'"), 8:34-36 ("matching the product code with the appropriate advertiser server address located in the database"), 9:21-24.

125. Fifth, it is my opinion that the combination of Ghias and Philyaw discloses "associating . . . the determined action with the" identified work, which encompasses performing an action." Ex. 1001 at Claims 1, 13, 25. Ghias discloses that, after generating the list of matches, the system performs the action of "output[ting] the ranked list of approximately matching melodies." *Id.* at 2:50-52, 6:60-63, 7:4-5, 8:26-28, 8:61-63.

126. Alternatively, Philyaw discloses performing the action of "returning the URL of advertiser server 312 to the PC 302," which uses the URL to view the advertisement (*id.* at 8:10-18, Abstract, 5:23-27, 5:64-6:2), directly transmitting an advertisement to a user (*id.* at 7:43-56), or performing an interactive action, such as displaying "additional statistics associated with [a] sports program" (*id.* at 4:50-54).

127. Claim 27 of the '441 patent further requires that the "extracted feature is extracted using frequency based decomposition." Ex. 1001 at Claim 27. The specification explains that "frequency-based decomposition of the signal" can employ a wide variety of algorithms, "such as produced by the Fourier, Fourier-Mellin, wavelet and or discrete cosine transforms" Ex. 1001 at 19:47-50, 6:67-7:3. Ghias discloses that "[i]n order to improve the performance and speed and robustness of the pitch-tracking algorithm, a cubic-spline wavelet transform or other suitable wavelet transform may be used." Ex. 1010 at 5:13-16, 5:17-49, 8:37-39, 9:8-10:4.

128. Separately and additionally, a person skilled in the art would understand that the common characteristic of the '441 patent's examples of frequency decomposition ("the Fourier, Fourier-Mellin, wavelet and or discrete cosine transforms," (Ex. 1001 at 19:47-50, 6:67-7:3)) is that they evaluate the intensity of a signal at different frequencies, including different pitches (which

may be quantified as frequencies). It is my opinion that Ghias discloses such an extraction algorithm that evaluates a work at different pitches. Specifically, Ghias discloses extracting "a contour representation" of the melody. Ex. 1010 at 2:46-49. Specifically, "[u]ser input 12 (humming) to the system 10 is converted into a sequence of relative pitch transitions, as follows . . . To accomplish this conversion, a sequence of pitches in the melody must be isolated and tracked." *Id.* at 3:8-22.

129. A claim chart² detailing how the combination of Ghias and Philyaw renders claims 1-3, 8, 10-14, 18-19, 21-27, and 29-30 obvious, consistent with the above discussion, is provided below:

'441 patent	Ghias (Ex. 1010) and Philyaw (Ex. 1014)
1. A computer system comprising:	Non-limiting preamble.
one or more electronic communications devices;	Ghias discloses a general purpose computer that can contain a database or be configured to communicate with a database. 2:27-40.
one or more processors operatively connected to the one or more electronic communications devices; and	Ghias discloses a general purpose computer that has at least a processor. 2:27-40.
one or more computer readable media operatively connected to the one or more processors and having stored thereon computer instructions for carrying out the	Ghias discloses a general purpose computer that includes a computer readable media connected to the processor. 2:27-40.

² Unless otherwise indicated, citations in this claim chart are to Ghias (Ex. 1010).

'441 patent	Ghias (Ex. 1010) and Philyaw (Ex. 1014)
steps of:	
(a) maintaining, by the computer system, a database comprising:	Ghias discloses "a database of melodies." 1:59-62, 5:66-6:1. Philyaw discloses an Advertiser Reference Server ("ARS") (Ex. 1014 at 5:52), which contains "a database . . . of product codes and associated manufacturer URLs" (5:57-58, Abstract).
(1) first electronic data related to identification of one or more reference electronic works; and	Ghias discloses "a database of melodies each including a plurality of notes in a form of a sequence of digitized representations of relative pitch differences between successive notes" (1:59-62, 5:66-6:1).
(2) second electronic data related to action information comprising an action to perform corresponding to each of the one or more reference electronic works;	Philyaw discloses an Advertiser Reference Server ("ARS"), which contains "a database . . . of product codes and associated manufacturer URLs" (Ex. 1014 at 5:57-58, Abstract) used to determine the appropriate advertisement (or other content) to display to a user (<i>id.</i> at 5:64-65 ("the advertiser server address URL is obtained from the ARS database"), 7:4-7, 8:34-36, 9:21-24).
(b) obtaining, by the computer system, extracted features of a first electronic work;	Ghias discloses obtaining extracted features in the form of "a contour representation" of the melody. 2:46-49. Specifically, "[u]ser input 12 (humming) to the system 10 is converted into a sequence of relative pitch transitions, as follows . . . To accomplish this conversion, a sequence of pitches in the melody must be isolated and tracked." 3:8-22.
(c) identifying, by the computer system, the first electronic work by comparing the extracted features of the first electronic work with the first electronic data in the database using a non-	Ghias discloses "search[ing] the melody database 14" to identify a matching melody. 2:50-59, Abstract ("A melody database is searched for at least one sequence of digitized representations of relative pitch differences . . . which at least approximately

'441 patent	Ghias (Ex. 1010) and Philyaw (Ex. 1014)
exhaustive neighbor search;	matches the sequence of digitized representations of relative pitch differences . . . of the melody."). Ghias further discloses that this search may be non-exhaustive: "it is considered desirable to use an efficient approximate pattern matching algorithm" rather than an algorithm that is guaranteed to yield a match. 6:7-11. Moreover, Ghias teaches that "[s]everal Algorithms have been developed that address the problem of approximate string matching. Running times have <u>ranged from</u> 0(mn) for <u>the brute force algorithm to</u> O(kn) or O(nlog(m), where 'O' means 'on the order of,' m is the number of pitch differences in the query, and n is the size of the string (song)."). 6:23-35. Ghias further discloses that this is a neighbor search that determines "a ranked list of approximately matching melodies, as illustrated at 26" or "the single most approximate matching melody." 2:50-59, 6:60-63.
(d) determining, by the computer system, the action information corresponding to the identified first electronic work based on the second electronic data in the database; and	Philyaw discloses determining the action information, i.e., the appropriate advertisement (or other content), to display to a user (Ex. 1014 at 5:64-65, 7:4-7, 8:34-36, 9:21-24) based on the second electronic data in the ARS "database . . . of product codes and associated manufacturer URLs" (Ex. 1010 at 5:57-58, Abstract).
(e) associating, by the computer system, the determined action information with the identified first electronic work.	Ghias discloses associating the action with the identified electronic work by "output[ting] the ranked list of approximately matching melodies." 2:50-52, 6:60-63, 7:4-5, 8:26-28, 8:61-63. Alternatively, Philyaw discloses associating the determined action, i.e., the advertisement, with the identified first electronic work by "returning the URL of

'441 patent	Ghias (Ex. 1010) and Philyaw (Ex. 1014)
	advertiser server 312 to the PC 302," which uses the URL to view the advertisement (Ex. 1014 at 8:10-18, Abstract, 5:23-27, 5:64-6:2), facilitating direct transmission of an advertisement to a user (<i>id.</i> at 7:43-56), or performing another action, such as displaying "additional statistics associated with [a] sports program." (<i>id.</i> at 4:50-54).
2. The computer system of claim 1, wherein the step of obtaining comprises receiving the first electronic work and extracting the extracted features from the first electronic work.	Ghias discloses receiving a hummed user input from which it extracts "a sequence of relative pitch transitions, as follows . . . To accomplish this conversion, a sequence of pitches in the melody must be isolated and tracked." 3:8-22, 2:42-49, 4:31-5:59, 8:29-40, 8:64-10:4.
3. The computer system of claim 2, wherein the first electronic work is received from at least one of a set-top-box, a video recorder, a cell phone, a computer, or a portable device.	Ghias discloses that, "database 14 may be located apart from the computer 16 and suitably connected thereto for communicating between the computer and database," in which case the database receives the extracted features or the entire electronic work from the computer. 2:34-40.
8. The computer system of claim 1, wherein at least one of the first electronic work or the extracted features of the first electronic work is obtained from at least one of a set-top-box, a video recorder, a cell phone, a computer, or a portable device that stores commercial transaction data, and wherein the action information comprises a commercial transaction, and the one or more computer readable media have stored thereon further computer instructions for carrying out the additional step	Ghias discloses that "database 14 may be located apart from the computer 16" in which case the database receives the extracted features from the computer. 2:34-40, Fig. 1 at 16, 3:8-22. Philyaw further discloses that the computer may contain commercial transaction data in a "profile database" (Ex. 1014 at Fig. 13 at 1302) that "store[s] a profile of the user" (<i>id.</i> at 10:54-55), including "job, income level, general family history, demographic information, and more" (<i>id.</i> at 11:64-67). Philyaw further discloses that the action information may comprise a commercial transaction wherein, when a user views an advertisement, the "user's profile information is uploaded to the [advertiser]

'441 patent	Ghias (Ex. 1010) and Philyaw (Ex. 1014)
of:	node 1312" and "billing information is generated for that [advertiser] 1312 which is stored in a billing database 1316. Therefore, the ARS 308 has the ability to . . . bill for those transactions . . ." <i>Id.</i> at 11:30-43.
electronically performing the commercial transaction using the stored commercial transaction data.	Philyaw discloses performing the commercial transaction of billing using the stored commercial transaction data in a user's profile information. Ex. 1014 at 11:30-43.
10. The computer system of claim 8, wherein the stored commercial transaction data comprises at least one of a purchaser's name, a purchaser's address, or credit card information.	Philyaw discloses "profile database" (Ex. 1014 at Fig. 13 at 1302) "store[s] a profile of the user" (<i>id.</i> at 10:54-55) including commercial transaction information such as "job, income level, general family history, demographic information, and more" (<i>id.</i> at 11:64-67).
11. The computer system of claim 1, wherein the action comprises at least one of directing a user to a website related to the first electronic work, initiating an e-commerce transaction, or dialing a phone number.	I incorporate my above discussion of Ghias and Philyaw regarding Claim 8. Additionally, Philyaw discloses that "the computer web browser . . . is automatically redirected to the advertiser server containing the advertiser product information." Ex. 1014 at Abstract, 5:25-28, 7:25-29, 8:13-17, Fig. 8.
12. The computer system of claim 1, wherein the action comprises providing and/or displaying additional information in association with the first electronic work.	Ghias discloses "return[ing] a list of songs." 6:60-63, 2:50-52, 7:4-5, 8:26-28, 8:61-63. This list includes additional information regarding the song, such as a ranking of the strength of the match. 6:60-63 ("the database 14 returns a list of songs ranked by how well they matched the query"), 2:50-52, 8:26-28, 8:61-63. Alternatively, Philyaw discloses that "the computer web browser . . . is automatically redirected to the advertiser server containing the advertiser product information." Ex. 1014 at Abstract, 5:25-28; 7:25-29, 8:13-17, Fig. 8. Philyaw further discloses displaying "additional statistics

'441 patent	Ghias (Ex. 1010) and Philyaw (Ex. 1014)
	associated with [a] sports program, etc." <i>Id.</i> at 4:50-54.
13. A computer system comprising:	Non-limiting preamble.
one or more electronic communications devices;	I incorporate my above discussion of Ghias regarding Claim 1.
one or more processors operatively connected to the one or more electronic communications devices; and	I incorporate my above discussion of Ghias regarding Claim 1.
one or more computer readable media operatively connected to the one or more processors and having stored thereon computer instructions for carrying out the steps of:	I incorporate my above discussion of Ghias regarding Claim 1.
(a) maintaining, by the computer system, one or more databases comprising:	I incorporate my above discussion of Ghias and Philyaw regarding Claim 1a.
(1) first electronic data comprising a first digitally created compact electronic representation of one or more reference electronic works; and	I incorporate my above discussion of Ghias and Philyaw regarding Claim 1(a)(1).
(2) second electronic data related to an action, the action comprising providing and/or displaying an advertisement corresponding to each of the one or more reference electronic works;	I incorporate my above discussion of Ghias and Philyaw regarding Claim 1(a)(2). Philyaw further discloses displaying an advertisement corresponding to the reference electronic work by querying the ARS database. Ex. 1014 at 5:64-65 ("the advertiser server address URL is obtained from the ARS database"), 7:4-7 ("product code information . . . is then compared with data contained within the ARS advertiser database 310 to determine if there is a 'hit.'"), 8:34-36, 9:21-24.

'441 patent	Ghias (Ex. 1010) and Philyaw (Ex. 1014)
(b) obtaining, by the computer system, a second digitally created compact electronic representation of a first electronic work;	I incorporate my above discussion of Ghias and Philyaw regarding Claim 1b. As explained above, the term "compact electronic representation" is synonymous with "extracted features."
(c) identifying, by the computer system, a matching reference electronic work that matches the first electronic work by comparing the first electronic data with the second digitally created compact electronic representation using a non-exhaustive neighbor search;	I incorporate my above discussion of Ghias and Philyaw regarding Claim 1c.
(d) determining, by the computer system, the action corresponding to the matching reference electronic work based on the second electronic data in the database; and	I incorporate my above discussion of Ghias and Philyaw regarding Claim 1d.
(e) associating, by the computer system, the determined action with the first electronic work.	I incorporate my above discussion of Ghias and Philyaw regarding Claim 1e.
14. The computer system of claim 13, wherein the action further comprises providing a link to a site on the World Wide Web associated with the advertisement.	Philyaw discloses that "the computer web browser . . . is automatically redirected to the advertiser server containing the advertiser product information." Ex. 1014 at Abstract, 5:25-28, 7:25-29, 8:13-17, Fig. 8.
18. The computer system of claim 13, wherein the action further comprises collecting competitive market research data related to the advertisement.	Philyaw discloses collecting competitive market data by "monitor[ing] the times when either the ads are or the products are purchased" for "a very current view of how a product is moving," "a very good idea as to how well the advertisement was received," or knowledge of "where the receptive markets were." Ex. 1014 at 13:16-41.

'441 patent	Ghias (Ex. 1010) and Philyaw (Ex. 1014)
19. The computer system of claim 13, wherein the action further comprises purchasing a product or service related to the advertisement.	Philyaw discloses that "the computer web browser . . . is automatically redirected to the advertiser server containing the advertiser product information." Ex. 1014 at Abstract, 5:25-28, 7:25-29, 8:13-17, Fig. 8.
21. The computer system of claim 1, further comprising the step of transmitting, by the computer system, the determined action as associated with the first electronic work.	Ghias discloses that the database "may be located apart from the computer 16 and suitably connected thereto for communicating between the computer and database" in which case the database transmits the action to the computer. 2:34-40. Alternatively, Philyaw discloses that, after determining the appropriate advertiser URL, the ARS "transmits the packet," which constitutes an action, "back to source PC." Ex. 1014 at 7:17-18, 8:39-41.
22. The computer system of claim 1, wherein the one or more electronic works comprise at least one of a video work, an audio work, or an image work.	Ghias discloses that electronic work is an audio work that is "hummed by a person 18 into a microphone 20" and "suitably digitized." 2:41-43, Fig. 1 at 21.
23. The computer system of claim 1, wherein the one or more computer readable media have stored thereon further computer instructions for carrying out the additional steps of:	Non-limiting preamble.
(f) obtaining, by the computer system, second extracted features of a second electronic work;	Ghias discloses obtaining extracted features in the form of "a contour representation" of the melody. 2:46-49. Specifically, "[u]ser input 12 (humming) to the system 10 is converted into a sequence of relative pitch transitions, as follows . . . To accomplish this conversion, a sequence of pitches in the melody must be isolated and tracked." 3:8-22.
(g) searching, by the computer system, for an identification of the second electronic work by	Ghias discloses "search[ing] the melody database 14" to identify a matching melody.

'441 patent	Ghias (Ex. 1010) and Philyaw (Ex. 1014)
comparing the second extracted features of the second electronic work with the first electronic data in the database using a non-exhaustive neighbor search; and	2:50-59, Abstract. Ghias further discloses that this search may be non-exhaustive: "it is considered desirable to use an efficient approximate pattern matching algorithm" rather than an algorithm that is guaranteed to yield a match. 6:7-11. Moreover, Ghias teaches that "[s]everal Algorithms have been developed that address the problem of approximate string matching. Running times have <u>ranged from</u> $O(mn)$ for the <u>brute force algorithm</u> to $O(kn)$ or $O(n\log(m))$, where 'O' means 'on the order of,' m is the number of pitch differences in the query, and n is the size of the string (song).". 6:23-35. Ghias further discloses that this is a neighbor search that determines "a ranked list of approximately matching melodies, as illustrated at 26" or "the single most approximate matching melody." 2:50-59, 6:60-63.
(h) determining, by the computer system, that the second electronic work is not identified based on results of the searching step.	Philyaw discloses that "[i]f there is no 'hit' indicating a match, then information is returned to the browser indicating such." Ex. 1014 at 7:7-8.
24. The computer system of claim 13, wherein the one or more computer readable media have stored thereon further computer instructions for carrying out the additional steps of:	Non-limiting preamble.
(f) obtaining, by the computer system, second extracted features of a second electronic work to be identified;	I incorporate my above discussion of Ghias and Philyaw regarding Claim 23f.
(g) searching, by the computer system, for an identification of	I incorporate my above discussion of Ghias and Philyaw regarding Claim 23g.

'441 patent	Ghias (Ex. 1010) and Philyaw (Ex. 1014)
the second electronic work by comparing the second extracted features of the second electronic work with the first electronic data in the database using a non-exhaustive neighbor search; and	
(h) determining, by the computer system, that the second electronic work is not identified based on results of the searching step.	I incorporate my above discussion of Ghias and Philyaw regarding Claim 23h.
25. A computer system comprising:	Non-limiting preamble.
one or more electronic communications devices;	I incorporate my above discussion of Ghias regarding Claim 1.
one or more processors operatively connected to the one or more electronic communications devices; and	I incorporate my above discussion of Ghias regarding Claim 1.
one or more computer readable media operatively connected to the one or more processors and having stored thereon computer instructions for carrying out the steps of:	I incorporate my above discussion of Ghias regarding Claim 1.
(a) maintaining, by the computer system, one or more databases comprising:	I incorporate my above discussion of Ghias and Philyaw regarding Claim 1a.
(1) first electronic data comprising a first digitally created compact electronic representation comprising an extracted feature vector of one or more reference electronic works; and	I incorporate my above discussion of Ghias and Philyaw regarding Claim 1(a)(1).
(2) second electronic data related to action information, the action information comprising an action	I incorporate my above discussion of Ghias and Philyaw regarding Claim 1(a)(2).

'441 patent	Ghias (Ex. 1010) and Philyaw (Ex. 1014)
to perform corresponding to each of the one or more reference electronic works;	
(b) obtaining, by the computer system, a second digitally created compact electronic representation comprising an extracted feature vector of a first electronic work;	I incorporate my above discussion of Ghias and Philyaw regarding Claim 1b. As explained above, the term "compact electronic representation comprising an extracted feature vector" is synonymous with "extracted features."
(c) identifying, by the computer system, a matching reference electronic work that matches the first electronic work by comparing the first electronic data with the second digitally created compact electronic representation of the first electronic work using a non-exhaustive neighbor search;	I incorporate my above discussion of Ghias and Philyaw regarding Claim 1c.
(d) determining, by the computer system, the action information corresponding to the matching reference electronic work based on the second electronic data in the database; and	I incorporate my above discussion of Ghias and Philyaw regarding Claim 1d.
(e) associating, by the computer system, the determined action information with the first electronic work.	I incorporate my above discussion of Ghias and Philyaw regarding Claim 1e.
26. The computer system of claim 25, wherein the one or more computer readable media have stored thereon further computer instructions for carrying out the additional steps of:	Non-limiting preamble.
(f) obtaining, by the computer system, a third digitally created	I incorporate my above discussion of Ghias and Philyaw regarding Claim 23f.

'441 patent	Ghias (Ex. 1010) and Philyaw (Ex. 1014)
compact electronic representation comprising an extracted feature vector of a second electronic work;	
(g) searching, by the computer system, for a matching reference electronic work that matches the second electronic work by comparing the third digitally created compact electronic representation of the second electronic work with the first electronic data in the database using a non-exhaustive neighbor search; and	I incorporate my above discussion of Ghias and Philyaw regarding Claim 23g.
(h) determining, by the computer system, that a matching reference electronic work that matches the second electronic work does not exist based on results of the searching step.	I incorporate my above discussion of Ghias and Philyaw regarding Claim 23h.
27. The computer system of claim 1, wherein the extracted feature is extracted using frequency based decomposition.	The '179 specification explains that "frequency-based decomposition of the signal" can employ a wide variety of algorithms, "such as produced by the Fourier, Fourier-Mellin, <u>wavelet</u> and or discrete cosine transforms" Ex. 1001 at 19:47-50, 6:67-7:3. Ghias discloses that "[i]n order to improve the performance and speed and robustness of the pitch-tracking algorithm, <u>a cubic-spline wavelet transform or other suitable wavelet transform</u> may be used." 5:13-16, 5:17-49, 8:37-39, 9:8-10:4. Additionally, Ghias discloses extracting "a contour representation" of the melody. 2:46-49. Specifically, "[u]ser input 12 (humming) to the system 10 is converted into a sequence

'441 patent	Ghias (Ex. 1010) and Philyaw (Ex. 1014)
	of relative pitch transitions, as follows . . . To accomplish this conversion, a sequence of pitches in the melody must be isolated and tracked." 3:8-22. Further, Ghias discloses extraction using a "Fourier transform" and a "wavelet," (5:13-49) both of which the '179 patent enumerates as examples of frequency-based decomposition (Ex. 1001 at 19:47-50, 6:67-7:3). It is my opinion that a person skilled in the art would understand this technique to be an example of frequency based decomposition.
29. The computer system of claim 1, wherein the extracted feature is extracted using temporal sequence of feature vectors.	Ghias discloses extracting "a contour representation" (2:46-49) wherein "[u]ser input 12 (humming) to the system 10 is converted into a [temporal] sequence of relative pitch transitions, as follows . . . To accomplish this conversion, a [temporal] sequence of pitches in the melody must be isolated and tracked." 3:8-22.
30. The computer system of claim 1, wherein the one or more computer readable media have stored thereon further computer instructions for carrying out the additional step of transmitting, by the computer system, the determined action information as associated with the first electronic identified work.	I incorporate my above discussion of Ghias and Philyaw regarding Claim 21.

XIV. CONCLUSION

130. For all of the reasons provided above, I offer the opinions reflected in this Declaration.



Dr. Pierre Moulin