

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

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

v.

NOKIA TECHNOLOGIES OY,
Patent Owner.

Case IPR2024-01390
Patent 9,390,137

**DECLARATION OF DR. DIRK GRUNWALD
IN SUPPORT OF PATENT OWNER'S PRELIMINARY RESPONSE**

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I, Dr. Dirk Grunwald, declare as follows:

I. INTRODUCTION

1. have been retained by Patent Owner Nokia Technologies Oy (“Patent Owner”) to provide expert opinions in connection with this *inter partes* review.

2. I am being paid at my standard consulting rate of \$600 per hour for my work in this matter. Additionally, I will be reimbursed for all expenses incurred. My compensation is not dependent on the outcome of this action, and I have no other interests in this matter or with any of the parties involved.

3. My opinions are also based on my education, training, research, experience, knowledge, personal and professional experience, and my investigation and study of relevant materials.

II. QUALIFICATIONS

4. My qualifications for forming the opinions set forth in this report are listed in this section and provided in my *curriculum vitae* (“CV”), attached hereto as Exhibit 2002. *See* Ex. 2002. My CV also includes a list of my publications.

5. In 1983, I received a Bachelor of Science in Computer Science from the University of Illinois, Urbana-Champaign. In 1985 and 1989 respectively, I received M.S. and Ph.D. degrees in Computer Science, also from the University of Illinois, Urbana-Champaign.

6. Since 1989, I have been on the faculty at the University of Colorado, Boulder, in the Department of Computer Science. I received tenure in 1996 and was promoted to Professor in 2005.

7. Since joining the University of Colorado, I have taught undergraduate and graduate courses in many topics in computer science and engineering, including computer system design, programming languages, operating systems, computer storage systems and networking. I have supervised more than thirty Ph.D. students as well as Masters students and undergraduate research students. Many of my former Ph.D. students work or have worked in computer architecture and design, storage systems for cloud providers; others work in related areas where they use their knowledge of computer system design. Some of my former students work at companies such as Google, Amazon, Microsoft, AMD, Intel, and IBM.

8. I have worked with companies including Digital Equipment Corporation, Inktomi, Compaq Computer, and Hewlett-Packard as a consultant on advanced computer system and software design and implementation.

9. I have received funding from federal agencies including the Defense Advanced Research Project Agency (DARPA), National Science Foundation (NSF), Department of Energy (DOE), and Department of Homeland Security (DHS) on topics related to computer system and software design.

10. The topic of the ‘137 Patent spans several areas of computer systems, including databases systems, analytical processing of data, context-aware data and mobile computing.

11. I have direct experience with computer storage, databases and mobile computing. In 2012, I have served as a Special Master in a federal case regarding “if the records keeping practice of the Police and the Internal Affairs Bureau (IAB) were deliberately impeding the discovery process in a trial involving the City of Denver police department or if the records keeping system could be improved.” Special Master Report, *Moore v. Miller et al.*, Case No. 1:10-cv-00651-JLK-MJW, Doc. No. 61-1 (D. Colo. 2012) that concerned analyzing the methods and practices of databases used by the Denver police. I have developed and taught undergraduate classes in database systems and mobile computing. I have also published papers that address the analysis of large amounts of data, including “A Streaming Analytics Languages for Processing Cyber Data” and “Streaming Temporal Graphs: Subgraph Matching” including papers on context-aware analysis “AnchorMF: towards effective event context identification” and “Identifying Event Context using Anchor Information in Online Social Networks.”

12. I have published numerous papers in the “ACM International Conference on Mobile Systems, Applications and Services,” the premier academic venue for work in mobile computing. I have also served on the Technical Program

Committee for that conference multiple times and been General Co-Chair of Mobisys in 2008.

13. Based on my work experience, described in my *curriculum vitae* and in more detail below, I am knowledgeable about databases, context-aware computing, and mobile computing, including the techniques analyzed in this report and disclosed in the '137 Patent.

A. Materials Considered

14. My opinions are based on my education, training, research, knowledge, and personal and professional experience. In connection with this report, I have reviewed the following:

- Ex. 1001 – U.S. Patent No. 9,390,137 (“the '137 Patent”);
- Ex. 1002 – File History of the '137 Patent;
- Ex. 1003 – Declaration of Mark E. Crovella (“Crovella” or “Ex. 1003”);
- Ex. 1004 – U.S. Patent Application Publication No. 2007/0219985A1 (“Aravamudan”);
- Ex. 1005 – G. Adomavicius et al., *Incorporating Contextual Information in Recommender Systems Using a Multidimensional Approach* (2005) (“Adomavicius”);
- Ex. 1006 – S. McNee, *Confidence Displays and Training in Recommender Systems* (2003) (“McNee”);

- Ex. 1007 – U.S. Patent Application Publication No. 2008/0214156A1 (“Ramer”);
- Ex. 1008 – Declaration of S. Delman re Adomavicius (“Delman Declaration”);
- Ex. 1009 – Declaration of S. McNee re McNee (“McNee Declaration”);
- Ex. 1010 – Declaration of P. Huizinga re McNee (“Huizinga Declaration”);
- Ex. 1011 – G. Adomavicius *et al.*, *REQUEST: A Query Language for Customizing Recommendations* (2011);
- Ex. 1012 – U.S. Patent Application Publication No. 2008/0301086A1 (“Gupta”); and
- Paper 1 – Petition for Inter Partes Review of U.S. Patent No. 9,390,137 (“Petition”).

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

15. I understand that the meanings of terms should be interpreted from the perspective of an individual with average skills in the relevant field.

16. I understand that the level of ordinary skill in the art may depend on factors such as: (A) the types of problems encountered in the field; (B) existing solutions to those problems; (C) how quickly innovations are made; (D) the complexity of the technology; and (E) the educational level of workers in the field. It's important to note that not every factor may be present in a specific situation, and some factors may be more significant than others.

17. Based on the materials and information I have reviewed and based on my experience in the technical areas relevant to the '137 Patent, a person of ordinary skill in the art at the time of the invention of the '137 Patent would have had at least a bachelor's degree in computer science or related field and at least two (2) years of experience designing database query systems. A person with a different degree but with additional relevant experience could still qualify if the additional experience compensates for the different educational background. A person with less experience designing database query systems could still qualify if the person has additional education that compensates for their lesser experience.

18. I understand that Petitioner takes the position that the field of the '137 Patent is database and query systems and that a person with ordinary skill in the art would have had a (1) bachelor's degree in electrical engineering, computer engineering, computer science, or a comparable field of study, and (2) approximately two years of practical experience with database or query systems. Additional experience can substitute for the level of education and vice-versa. Petition, pp. 18-19.

19. I acknowledge that the level of ordinary skill in the art for the '137 Patent that I propose is similar to the definition proposed by Petitioner. I have surpassed both the Patent Owner's and the Petitioner's levels of ordinary skill in the art as of the conception date of the '137 Patent. Therefore, regardless of which

level of skill in the art is applied, my analysis and conclusions in this report remain consistent.

IV. LEGAL STANDARD FOR PATENTABILITY

20. I use the legal principles below, of which counsel informed me, as a guide in formulating my opinions.

A. Claim Interpretation

21. My opinions concern what I believe the person of ordinary skill in the art would have understood the meaning of specific claim terms to be based on the patent documents.

22. I have learned that evaluating the legitimacy of a patent claim involves a two-step process. The first step entails interpreting the claim language accurately to establish its scope and significance. The second step involves comparing the properly interpreted claim to the alleged prior art to determine if the elements of the claim are satisfied by the prior art.

23. In order to understand the meaning of claim phrases, I began by carefully studying the patent. I focused on the claims themselves, followed by the background, detailed specifications, figures, and other patent content. After that, I examined the prosecution history to identify any clarifications or limitations that might be associated with claim terms. In certain cases, I also referred to other documents, such as references cited by the patent office.

24. I understand that during an inter partes review, claim terms should be interpreted based on their ordinary and customary meaning as understood by a person of ordinary skill in the relevant field, considering the entire disclosure at the time of the invention. It's important not to interpret a specific example from the written description as part of the claim if the claim language is broader. Additionally, any special definition for a claim term must be clearly, deliberately, and precisely stated.

25. I have been informed that this standard is the same as that used in United States district courts, in which claim terms are given their ordinary and customary meaning as would be understood by a person of ordinary skill in the art at the time of the invention having taken into consideration the language of the claims, the specification, and the prosecution history of record under the *Phillips* claim construction standard.

B. Prior Art

26. It has been explained to me by Counsel that information that satisfies one of the categories of prior art outlined in 35 U.S.C. § 102 (pre-AIA) may be used in an invalidity analysis under §§ 102 or 103. If information is not classified correctly as prior art under one of the subsections of § 102 of the Patent Code, it may not form the basis of an anticipation or obviousness determination.

C. Anticipation

27. It has been explained to me by Counsel that a patent claim is invalid due to anticipation under 35 U.S.C. § 102 if each and every element of the patent claim is disclosed in a single asserted prior art reference. I am informed that such disclosure may be either explicit or inherent. I also understand that a disclosure of an asserted prior art reference can be “inherent” if the missing element is necessarily present or is the inevitable outcome of the process and/or thing that is explicitly described in the asserted prior art reference.

28. I understand that for something to be considered as anticipatory prior art, it must also be enabling. This means that it should teach a person with average skills in that field how to create or execute the claimed invention without needing too much experimentation.

D. Obviousness

29. I have been informed that a patent claim is considered invalid under 35 U.S.C. § 103 (pre-AIA) if it would have been obvious to a person of ordinary skill in the relevant field in view of the prior art at the time the application was filed. In simpler terms, even if the claimed invention is not exactly described in a single prior art reference, a patent claim can be invalidated for obviousness if the differences between the claimed invention and the prior art are such that the overall subject matter would have been obvious at the time the invention was made to a person with ordinary skill in the relevant field.

30. I have been informed that when making a determination of obviousness, the following factors are considered: (i) determining the scope and content of the prior art; (ii) ascertaining the differences between the prior art and the claims at issue; and (iii) resolving the level of ordinary skill in the pertinent art.

31. I understand that whether there are any relevant differences between the prior art and the claimed invention is to be analyzed from the view of a person of ordinary skill in the art at the time of the invention. For purposes of this IPR proceeding, I have used an alleged date of invention for the challenged claims of no later than June 29, 2011.

32. In analyzing the relevance of the differences between the claimed invention and the prior art, I understand that I must consider the impact, if any, of such differences on the obviousness or non-obviousness of the invention as a whole, not merely some portion of it.

33. The person of ordinary skill faced with a problem can utilize their experience and abilities to solve the problem and may also refer to any available prior art to aid in the solution.

34. I understand that a reference may be modified and/or combined with one or more other references and/or with the knowledge of one of ordinary skill in the art if such person of ordinary skill in the art would have found the modification and/or combination obvious. In other words, I understand that I do not need to look

for precise teaching in the prior art directed to the subject matter of the claimed invention. I understand that I may take into account the inferences and creative steps that a person of ordinary skill in the art would have employed in reviewing the prior art at the time of the invention.

35. In determining whether a piece of prior art could have been combined with other prior art or with other information within the knowledge of a person having ordinary skill in the art, it is my understanding that the following are examples of approaches and rationales that may be considered to support a conclusion of obviousness:

- Combining prior art elements according to known methods to yield predictable results;
- Simple substitution of one known element for another to obtain predictable results;
- Use of a known technique to improve similar devices, methods, or products in the same way;
- Applying a known technique to a known device, method, or product ready for improvement to yield predictable results;
- Applying a technique or approach that would have been “obvious to try” (choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success);
- Known work in one field of endeavor may prompt variations of it for use in either the same field or a different one based on design incentives or

- other market forces if the variations would have been predictable to a person having ordinary skill in the art; or
- Some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention.

36. I understand that if the claimed invention combined elements known in the prior art and the combination yielded results that were predictable to a person of ordinary skill in the art at the time of the invention, then this evidence would make it more likely that the claim was obvious.

37. I understand that an invention would be considered obvious if a person with ordinary skills in the relevant field would have recognized an obvious benefit to the solutions attempted by the applicant, given the wide range of needs arising from advancements in the field. When there is a need for a design or market pressure to solve a problem and only a finite number of identified, predictable solutions exist, it would be obvious to a person with ordinary skills to try the known options. If a technique has been used to improve one device, and a person with ordinary skills in the field would recognize that it could improve similar devices in the same way, using the technique would be considered obvious.

38. I understand that a key inquiry is whether any improvement allegedly achieved by a claimed invention is more than the predictable use of prior art elements according to their established functions.

39. I understand that a claimed invention may be obvious if some teaching, suggestion, or motivation exists that would have led a person of ordinary skill in the art to combine the invalidating references. I also understand that this suggestion or motivation may come from sources such as explicit statements in the prior art, or from the knowledge of a person having ordinary skill in the art. Alternatively, any need or problem known in the field at the time and addressed by the patent may provide a reason for combining elements of the prior art.

40. I also understand that when there is a design need or market pressure, and there are a finite number of predictable solutions, a person of ordinary skill may be motivated to apply both his skill and common sense in trying to combine the known options in order to solve the problem.

41. I understand that a reason to modify or combine prior art may support an obviousness determination, provided there is a reasonable expectation of success. I further understand that whether a proposed modification or combination of the prior art has a reasonable expectation of success is determined at the time the invention was made.

42. On the other hand, if the combination of known elements yielded unexpected or unpredictable results, or if the prior art teaches away from combining the known elements, then this evidence would make it more likely that the claim that

successfully combined those elements was not obvious. I understand that hindsight must not be used when comparing the prior art to the invention for obviousness.

43. I am also aware that before concluding a claim is obvious, secondary considerations of non-obviousness, to the extent they exist, must be considered, such as: long-felt need, failure of others, copying by others, praise by others in the industry, licensing of the claimed invention, departure from accepted principles, widespread recognition by those in the art of the invention's significance, and commercial success. I understand that there must be a demonstrated nexus between the claimed invention and these secondary considerations for them to be considered.

V. OVERVIEW OF THE '137 PATENT

44. The '137 Patent, titled "Method and Apparatus for Providing an Ordering Metric for a Multi-dimensional Contextual Query," relates generally to "providing an ordering metric for a multi-dimensional contextual query to provide context-aware querying, retrieval and presentation of results on, for example, a mobile interface." Ex. 1001, Cover; 1:30-33.

45. The '137 Patent recognized a need for "deliver[ing] value and convenience to consumers by, for example, providing compelling network services and relevant content." Ex. 1001, 1:8-11. The '137 Patent recognized that "device manufacturers and service providers face significant technical challenges to

providing rich, situational-aware, context-sensitive datasets in a mobile environment.” Ex. 1001, 1:23-36.

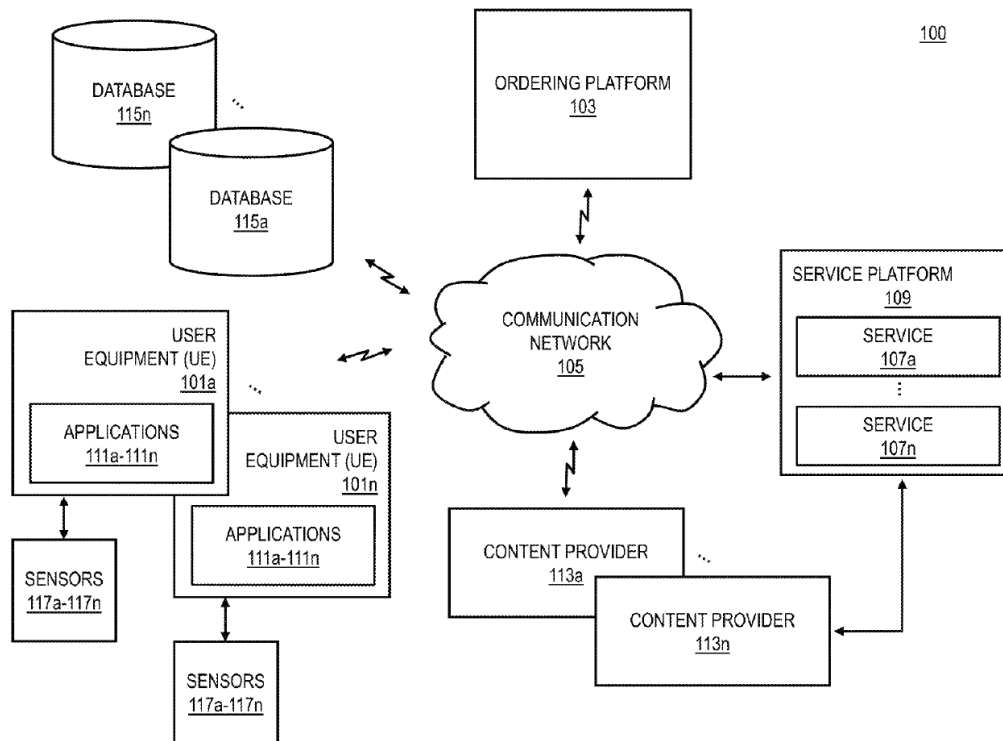
46. The ’137 Patent explained that “[s]ervice providers and device manufacturers” face challenges when attempting to deliver such value and convenience because, “[o]ften, such network and content services rely on the context of the users accessing the network services or the devices by which the users access the network services.” Ex. 1001, 1:11-14. The ’137 Patent explains that “[d]etermining the context becomes inadequate when multiple contexts and/or multiple users’ actions need to be analyzed over a period of time,” “particularly when the context is determined in conjunction with a mobile device that has limited processing power and/or bandwidth.” Ex. 1001, 1:14-19. The ’137 Patent thus recognized that there exists “a need to have rich, accurate datasets that span different context-aware situations to allow applications that utilize the datasets to be useful for multiple contexts and/or multiple users and provide access to such datasets to mobile devices in a practical manner.” Ex. 1001, 1:19-23.

47. The ’137 Patent presents solutions to the technical problem of providing rich, situational-aware, context-sensitive datasets in a mobile environment by “providing an ordering metric for a multi-dimensional contextual query to provide context-aware querying, retrieval and presentation of results on, for example, a mobile interface.” Ex. 1001, 1:30-33.

48. In FIG. 1, the '137 Patent depicts a “system capable of providing an ordering metric for a multi-dimensional contextual query.” Ex. 1001, 3:53-55, FIG. 1. The '137 Patent explains that the system 100 of FIG. 1 addresses the aforementioned problems by “enrich[ing] and enhance[ing] situational-aware, context-sensitive databases,” “allowing the mobile user to provide additional information concerning relevant attributes for a data entity in a context-aware database,” and “introduc[ing] context-based attribute ordering in the interface of, for example, a mobile device to provide more fluid and less intensive context-aware querying, retrieval and presentation of contextual attributes of objects stored in databases.” Ex. 1001, 4:1-11.

Ex. 1001, FIG. 1

FIG. 1



49. In FIG. 1 of the '137 Patent, the system includes user equipment (UE) 101 having connectivity to an ordering platform 103 via a communication network 104, where the UE 101 includes “one or more mapping applications, messaging applications, calendar applications, context applications, sensor applications, etc.” Ex. 1001, 4:12-20. The UE 101 are in communication with one or more sensors 117 “that acquire information regarding the context of the user and/or the UE 101.” Ex. 1001, 4:20-24. In communication with the ordering platform 103 and the UE 101 are databases 115. Ex. 1001, 4:30-36. The databases 115 can be multi-dimensional databases. *Id.* Also included within system 100 are one or more

content providers 113 that can provide content to one or more services 107 of the service platform 109, one or more UEs 101, one or more databases 115, and/or the ordering platform. Ex. 1001, 5:39-50.

50. The '137 Patent explains that the “databases store objects and information concerning the objects, such as object contextual attributes,” which “correspond to the context of the objects, such as, for example, the geographic location of the objects (e.g., address, city, country, etc.), the type of object (e.g., restaurants, schools, parks, and playgrounds)…” Ex. 1001, 4:37-44.

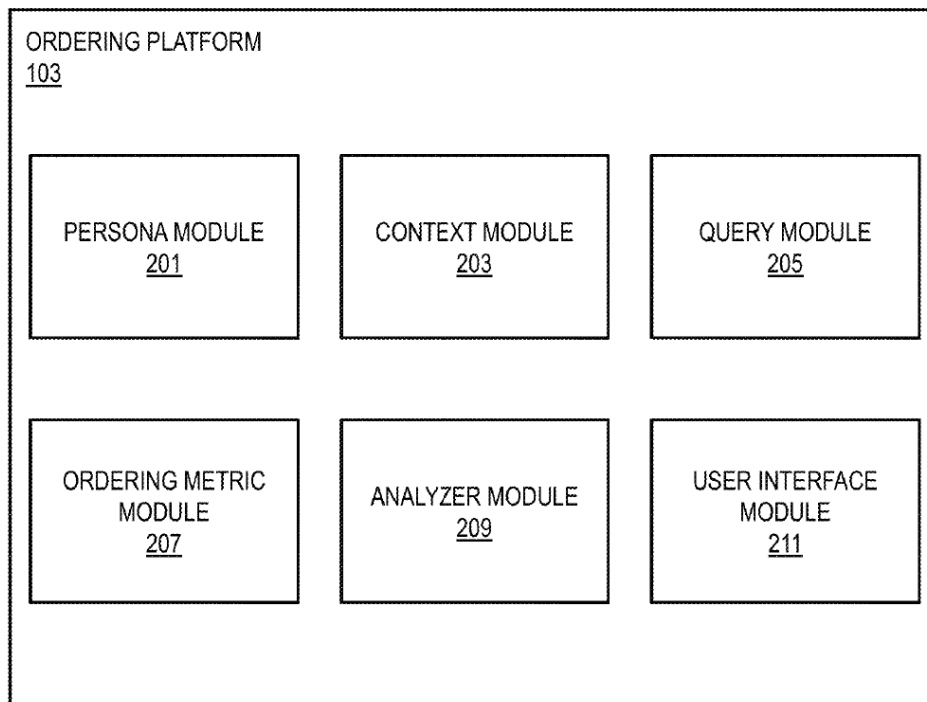
51. The '137 Patent explains, for “multi-dimensional databases, each dimension is defined over a dimensional schema, which is a set of dimensional attributes.” Ex. 1001, 5:10-12. The '137 Patent provides user preferences attributes as an example of a multidimensional schema, and identifies examples of “dimensional attributes of user preferences,” to include, for example, “users, location based preferences, context based preferences, behavior based preferences, etc.” Ex. 1001, 5:13-16. In this example, the '137 Patent explains, “the user dimensional attribute is terminal and belongs to the first category level, the location based preferences belongs to the second category level, the context based preferences belongs to the third category level, the behavior based preferences belongs to the fourth category level, etc.” Ex. 1001, 5:16-21. The '137 Patent also

notes that “each of these dimensional attributes can have further nested multi-dimensional attributes.” Ex. 1001, 5:21-28.

52. In FIG. 2, the '137 Patent depicts “components of the ordering platform 103,” which include a persona module 201, a context module 203, a query module 205, an ordering metric module 207, an analyzer module 209, and a user interface module. Ex. 1001, 6:62-7:11, FIG. 2.

Ex. 1001, FIG. 2

FIG. 2



53. The “persona module 201 determines one or more personas associated with a user of a UE 101 and/or a UE 101,” by “a user or users of the UE 101

entering the information regarding the personas.” Ex. 1001, 7:12-16. The ’137 Patent explains that the “personas represent the possible different combinations of users that can be associated with a specific UE 101.” Ex. 1001, 7:17-22. For example, “a persona can represent the members of a family that are associated with the UE 101,” or “the members of a group of friends that are associated with the UE 101.” *Id.*

54. Personas, according to the ’137 Patent, “allow for the creation of situations associated with the UE 101 that correlate to user contextual attributes that form the multi-dimensional queries, in addition to, for example, context information, to generate a list of results from one or more databases 114 that can later be ordered according to an ordering metric.” Ex. 1001, 7:22-27.

55. The ’137 Patent explains that the “persona module 201 determines the specific users that are associated with the UE 101, and, therefore, associated with the query and/or the ordering metric, and creates the multi-dimensional query based, at least in part, on the user contextual attributes associated with the persona.” Ex. 1001, 7:45-53. The ’137 Patent explains that “certain user contextual attributes are associated with male parents, female parents, non-parent adults, teenagers, young children, infants, friends, disabled individuals, non-disabled individuals, etc.” Ex. 1001, 7:53-56. The ’137 Patent explains that, by “indicating the number and type” “of users associated with the UE 101 at the time of the

query,” “the ordering platform 103 automatically generates persona information and associates the persona information with user contextual attributes,” thus “allow[ing] the ordering platform 103 to have situational awareness over the users that are associated with the UE 101 and who are querying the databases 115.” Ex. 1001, 7:56-65.

56. The “context module 203” “determines the context associated with the user of the UE 101 and/or the UE 101 that is used to create the multi-dimensional query and/or used to create the ordering metric.” Ex. 1001, 7:66-8:2. The “query module 205 creates the multi-dimensional query based on, for example, one or more of the personas and the context acquired by the persona module 201 and he [sic] context module 203.” Ex. 1001, 8:22-27. The ’137 Patent explains that “one dimension can include a contextual dimension for comparing one or more user contextual attributes to one or more object contextual attributes of one or more objects stored in the databases 115,” and “one dimension can include a contextual relation dimension for evaluating one or more relations among the one or more user contextual attributes and the one or more object contextual attributes.” Ex. 1001, 8:28-65. The query module also executes the multi-dimensional query on the one or more databases. Ex. 1001, 9:17-18. Because the multi-dimensional query specified the one or more personas, the results from executing the multi-dimensional query are specific to the one or more personas.

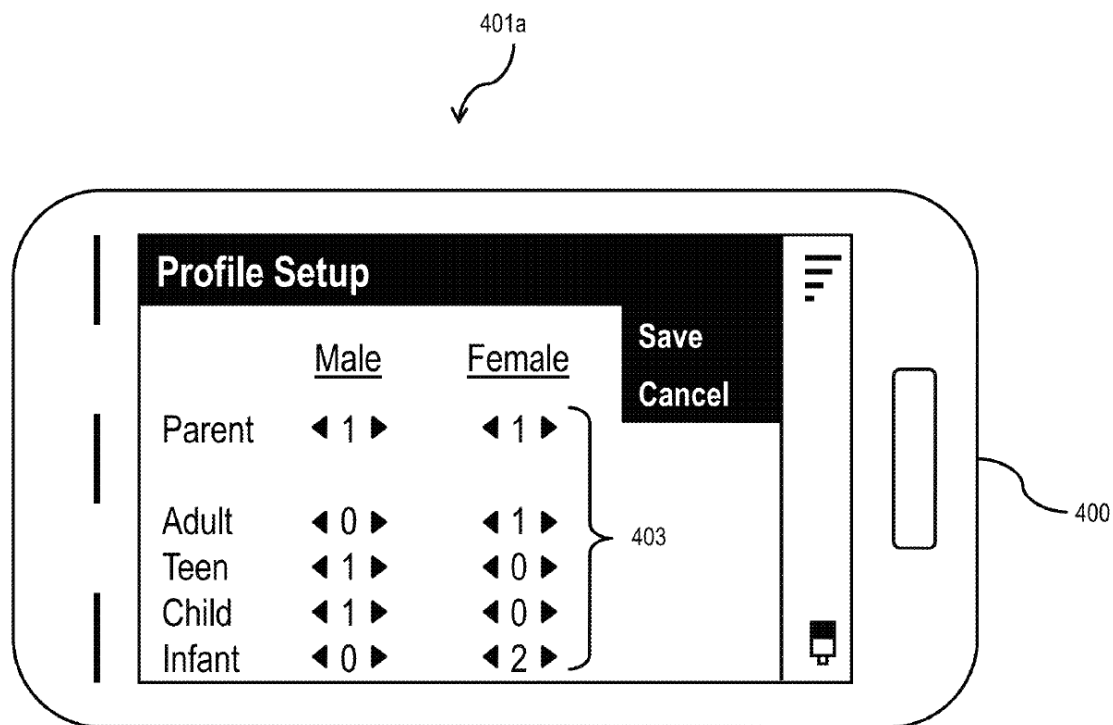
57. The “ordering metric module 207 creates the ordering metric that is used to order the results of the multi-dimensional query.” Ex. 1001, 9:18-21.

58. The ’137 Patent discloses several examples of user interfaces to depict initial setup of an application, beginning a query, contextual attributes, and an ordering metric. *See, e.g.*, Ex. 1001, 14:6-15:24; FIGs. 4A-4E.

59. FIG. 4A of the ’137 Patent illustrates a user interface “based on an initial setup of an application 111a interfacing with the ordering platform 103,” in which “the user interface 401a includes inputs 403 that allow a user to indicate, for example, the gender, type and quantity of individuals associated with the device 400 to setup the persona associated with the device.” Ex. 1001, 14:7-19. For example, “the persona associated with the device 400 includes one adult male parent, one adult female parent, an adult female non-parent, one teenage male, one child male, and two infant females.” *Id.*

Ex. 1001, FIG. 4A

FIG. 4A

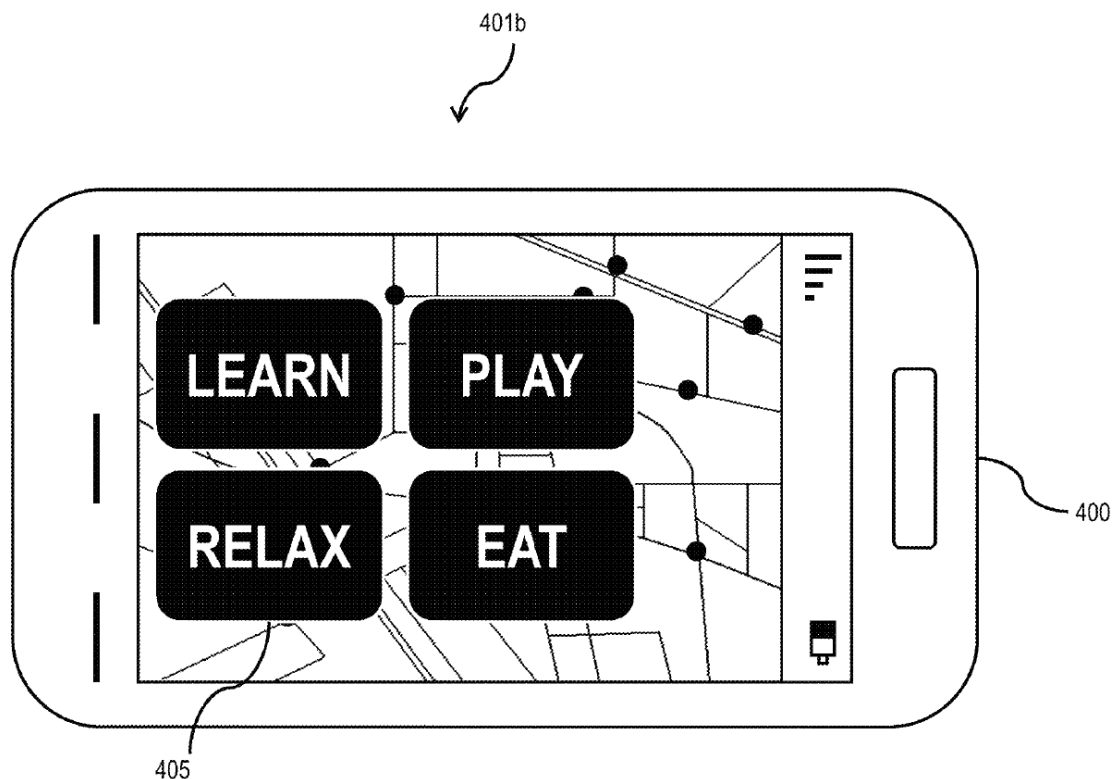


60. FIG. 4B of the '137 Patent illustrates a user interface 401b of an application 111a interfacing with the ordering platform 103, where the user interface 401b “includes one or more indicators 405 that allow a user to begin a query to determine, for example, points of interest that the user may wish to visit.” Ex. 1001, 14:20-31. For example, “the user may select the ‘EAT’ indicator 405 to find points of interest involving places to eat,” and, “[u]pon selecting one of the indicators 405, the user interface indicates for the ordering platform 103 to execute a multi-dimensional query on the databases 115 to generate a list of results (e.g.,

objects) that correspond to the persona and context of [sic] associated with the user and/or the device.” *Id.*

Ex. 1001, FIG. 4B

FIG. 4B

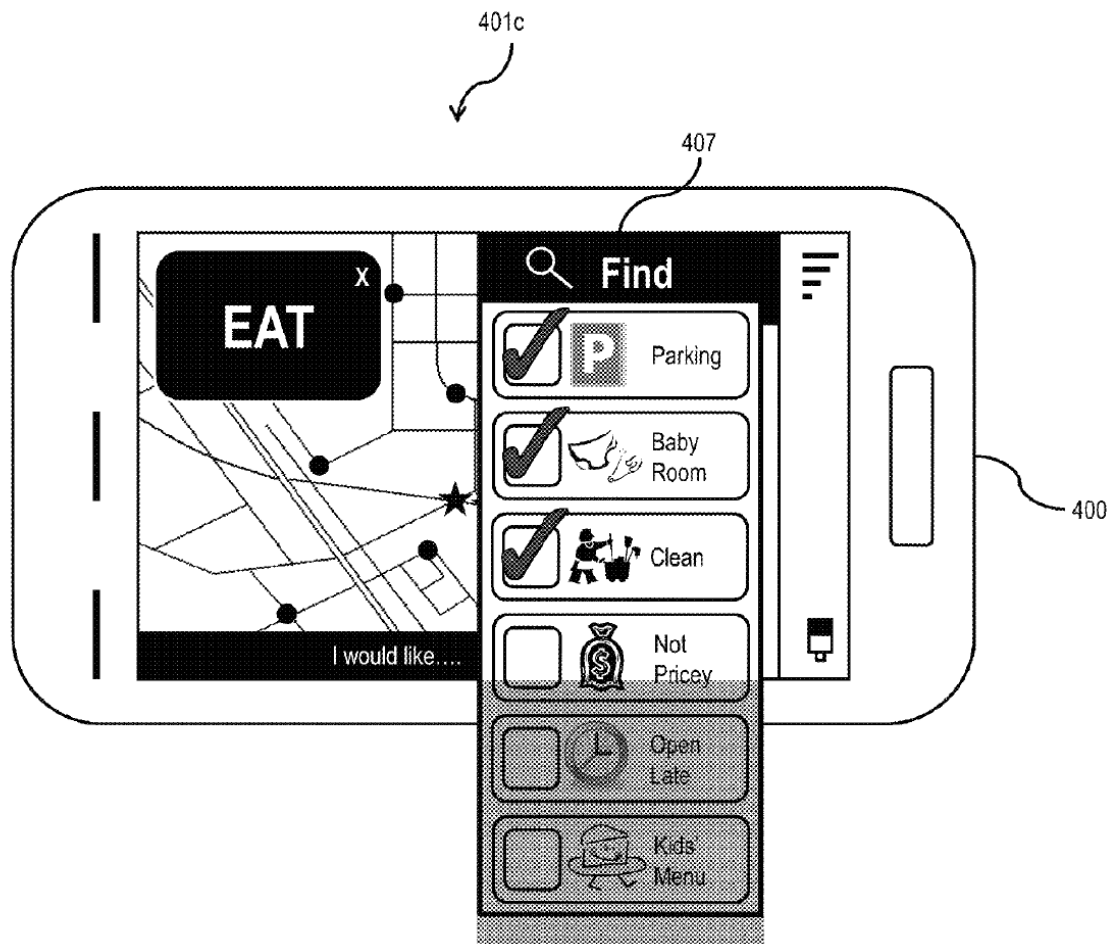


61. FIG. 4C of the '137 Patent illustrates a user interface 401c of application 111a “interfacing with the ordering platform 103 including user contextual attributes 407 (and correspondingly object contextual attributes) associated with the determined persona associated with the device 400 that aid the user in finding relevant points of interest.” Ex. 1001, 14:32-49. For example, “if the persona of the user device includes a mother with her infant child, the user contextual attributes associated with, for example, parking, a baby room and clean

points of interest are determined as the most relevant contextual attributes the user is interested [sic] based on the persona.” *Id.* That is, “[s]crolling down the list of contextual attributes 407 allows the user to select or de-select other contextual attributes, such as, for example, points of interest that are not pricey, points of interest that are open late, and points of interest that have a kids’ menu for modify [sic] the user contextual attributes associated with the user and/or the device to generate and/or modify the ordering metric.” *Id.*

Ex. 1001, FIG. 4C

FIG. 4C



VI. PROSECUTION HISTORY OF THE '137 PATENT

62. Below is a brief summary of the '137 Patent's prosecution history. This summary is not intended to address or summarize the '137 Patent's entire prosecution history. Rather, it is intended to summarize the parts that may be relevant to my analysis below.

63. The '137 Patent issued from U.S. Patent Application No. 13/172,425 (the "'425 application") filed June 29, 2011, with original claims 1-48. Ex. 1002, 1-59.

64. In response to a Notice to File Missing Parts dated July 19, 2011 (Ex. 1002, 66), the Applicant canceled claims 21-48 in a Preliminary Amendment dated September 19, 2011. Ex. 1002, 70-77.

65. A Non-Final Office Action was mailed July 12, 2012, in which claims 1-20 were rejected under 35 U.S.C. §103(a) over U.S. Patent Publication No. 2010/0094904 ("Jandhyala") in view of U.S. Patent No. 7,747,618 ("Zeng"). Ex. 1002, 245-257.

66. In response to the July 12, 2012, Non-Final Office Action, the Applicant amended independent claims 1 and 11 to recite that "the multi-dimensional query specifies, at least in part, one or more personas, based, at least in part, on more than one person, one or more contexts, or a combination thereof associated with the at least one user device." Ex. 1001, 261, 270 (mark up in

original to depict additions and ~~deletions~~). In conjunction with the amendments, the Applicant argued that “Jandhyala does not teach the claimed feature of ‘one or more personas, based, at least in part, on more than one person, associated with the at least one user device,’” and that “Jandhyala merely teaches modifying a search process to become more specific to each user (e.g. based on a single user’s browsing history.” Ex. 1002, 274 (referencing Jandhyala, ¶[0052]). The Applicant clarified that “Jandhyala’s search process is only specific to a single user rather than more than one person.” Ex. 1002, 275. The Applicant also indicated that Zeng did not cure Jandhyala’s deficiency. *Id.*

67. A Final Office Action was mailed January 11, 2013, in which the rejections of claims 1-20 under 35 U.S.C. §103(a) over Jandhyala and Zeng were maintained. Ex. 1002, 347-359.

68. In response to the January 11, 2013, Final Office Action, the Applicant traversed on March 7, 2013, arguing that “Jandhyala merely teaches determining a user’s browsing history, favorite web pages, or localization information to provide a more specific search process,” and that “Jandhyala’s search process is specific to only a single user rather than one or more personas based on more than one person.” Ex. 1002, 376 (referencing Jandhyala, ¶[0052]). The Applicant also argued:

In response to the above argument, the Final Office Action asserted that Jandhyala's "PageRank algorithm" is based on the "Hemholtz wave equation representation of Internet interactions" and the Internet interactions are deemed associated with a plurality of users or personas by more than one device. Final Office Action, pages 3-4. Applicants respectfully disagree. Because the Internet interaction is associated with a plurality of users or personas with more than one user device, the Internet interaction cannot teach, for example, one or more persona, based on more than one person, associated with the at least one user device.

Ex. 1002, 376-377.

69. The Applicant also argued:

Further, the PageRank algorithm cannot teach a multi-dimensional query because the Page Rank algorithm is merely an algorithm for calculating relevance or importance scores for web pages that are returned for a search that is carried out in response to a query entered by a user. Jandhyala, paragraph [0027]. Thus, the PageRank algorithm is not a query but merely an algorithm that measures results of a query. Further, as the Final Office Action pointed out, the use of Internet or other network devices are merely for determining adaptive Page Rank or other types of scores for web pages. Final Office Action, page 6. Thus, the Internet interaction does not teach a query. The Final Office Action correctly acknowledged that Jandhyala does not disclose a multi-dimensional query but failed to further acknowledge that the PageRank algorithm does not even disclose a query.

Ex. 1002, 377.

70. The Applicant also argued that “the Final Office Action asserted that Zeng cures the deficiencies of Jandhyala by disclosing a three-dimensional matrix with dimensions of users, queries, and documents, and the dimensions of users is deemed to comprise more than one person or persona,” “[h]owever, the dimension of user comprising more than one persona cannot teach, for example, one or more persona based on more than one person.” Ex. 1002, 377.

71. An Advisory Action was mailed March 15, 2013, in which the Examiner indicated the application was not in condition for allowance. Ex. 1002, 383-385.

72. The Applicant subsequently filed a Notice of Appeal on April 4, 2013. Ex. 1002, 387. The Applicant filed an Appeal Brief on June 3, 2013, in which the Applicant argued substantially similar arguments as presented in the March 7, 2013 Response. Ex. 1002, 393-401. The Examiner filed an Answer to the Appeal Brief, substantially repeating the rejections in the January 11, 2013 Final Office Action. Ex. 1002, 410-418.

73. The Applicant filed a Reply Brief on October 21, 2013, arguing, in response to the Examiner’s assertion that “appellant failed to specify the metes and bounds of the claimed ‘one or more persona,’” “Appellants define ‘one or more persona’ in paragraph [0040] of the Specification, which recites ‘[t]he personas

represent the possible different combinations of users that can be associated with a specific UE 101. By way of example, a persona can represent the members of a family that are associated with the UE 101,” also stating that “[a] person of ordinary skill in the art would know what ‘one or more personas’ means in light of the Specification.” Ex. 1002, 421 (citing Specification, ¶[0040]). The Applicant also highlighted that the Examiner listed an incorrect version of the pending claims and stated that the Examiner’s rejection is improper and based on the Examiner’s misunderstanding of the claim. Ex. 1002, 422.

74. On January 4, 2016, the Patent Trial and Appeal Board (“PTAB”) reversed the Examiner. Ex. 1002, 434-436. The PTAB “agree[d] with Appellants that the Examiner erred.” Ex. 1002, 435. The PTAB explained that “the Examiner construed the claimed ‘multi-dimensional query’ as ‘a personal context (or keyword) query specified by at least one network user device including some abstract data or information,’” and then stated that “the Examiner’s construction of ‘multi-dimensional query’ ignores that the claimed query ‘specifies at least in part, one or more personas, based, at least in part, on more than one person.” Ex. 1002, 435. The PTAB further stated that “the cited portions of Jandhyala and Zeng respectively teach information that affects a PageRank algorithm based on a single user’s data and a three-dimensional matrix used to augment click through data,”

“neither of which suggests the disputed limitation.” Ex. 1002, 435-436 (citing Jandhyala, ¶¶52, 61; Zeng, 2:46-58).

75. A Notice of Allowance was mailed March 10, 2016. Ex. 1002, 438.

VII. PRIOR ART REFERENCES

A. Aravamudan (Ex. 1004)

76. U.S. Patent Publication No. 2007/0219985 to Aravamudan (Ex. 1004, “Aravamudan”) is titled “Methods and Systems for Selecting and Presenting Content Based on Context Sensitive User Preferences.” Ex. 1004, Cover. Aravamudan relates generally to ordering query results for presentation to a user based on learned user preferences. *See* Ex. 1004, ¶[0015].

B. Adomavicius (Ex. 1005)

77. “Incorporating Contextual Information in Recommender Systems Using a Multidimensional Approach,” by Adomavicius *et al.* (“Ex. 1005, “Adomavicius”) is generally directed to “a multidimensional (MD) approach to recommender systems that can provide recommendations based on contextual information besides the typical information on users and items in most of the current recommender systems.” Ex. 1005, Abstract.

78. Adomavicius describes recommender systems that are “usually classified into collaborative, content-based, and hybrid methods,” and indicates “it may not be sufficient to consider only users and items – it is also important to

incorporate the contextual information of the user's decision scenario into the recommendation process." Ex. 1005, ¶[0002]¹.

VIII. CLAIM CONSTRUCTION

79. I understand from Counsel that the claims are to be construed in light of the specification as would be read by a POSITA at the time the application was filed. I understand that the claim terms are given their ordinary and customary meaning as would be understood by a POSITA in the context of the entire disclosure. In considering the meaning of the claims, however, I understand that one must consider the language of the claims, the specification, and the prosecution of record.

80. The '137 Patent defines the term "persona," reciting that "personas represent the possible different combinations of users that can be associated with a specific UE 101." Ex. 1001, 7:17-18. Indeed, "personas can represent the members of a family that are associated with the UE 101." Ex. 1001, 7:19-20. The '137 Patent states: "The personas allow for the creation of situations associated with the UE 101 that correlate to user contextual attributes that form the multi-dimensional queries, in addition to, for example, context information, to generate a list of

¹ References herein to paragraph numbers in Ex. 1005 are to those paragraph numbers appearing on Ex. 1005, presumably added by Petitioner.

results from one or more databases 115 that can later be ordered according to an ordering metric.” Ex. 1001, 7:22-27. The ’137 Patent states, as an example: “By associating a persona of a device with an infant and a mother, the ordering platform can associate the device situations involving an infant and the mother of the infant, such as whether a restaurant allows public breast feeding, whether a restaurant has private seating for mothers with infants, etc.” Ex. 1001, 11:25-34.

81. In a Reply Brief filed on October 21, 2013, the Applicant, arguing, in response to the Examiner’s assertion that “appellant failed to specify the metes and bounds of the claimed ‘one or more persona,’” explained that “Appellants define ‘one or more persona’ in paragraph [0040] of the Specification, which recites ‘[t]he personas represent the possible different combinations of users that can be associated with a specific UE 101. By way of example, a persona can represent the members of a family that are associated with the UE 101,’” also stating that “[a] person of ordinary skill in the art would know what ‘one or more personas’ means in light of the Specification.” Ex. 1002, 421 (citing Specification, ¶[0040]).

82. Accordingly, it is my opinion that a person of ordinary skill in the art would have understood “persona” to mean “represent[ing] the possible different

combinations of users that can be associated with a specific UE,”² as defined in the prosecution history and specification.

83. For the purposes of this report and the arguments made herein regarding institution, I have relied on the ordinary and customary meanings of the remaining claim terms. If instituted, I reserve the right to address constructions of the claim terms, if needed.

84. I understand that the Petition discusses possible constructions for the claimed “contextual dimension,” “contextual relation dimension,” and “inclusion dimension.” Petition, pp. 19-20. While I reserve the right to address the construction of these terms, if instituted, my analyses below do not change based on which interpretations of the claimed “contextual dimension,” “contextual relation dimension,” and “inclusion dimension,” are adopted.

² The ’137 Patent defines a UE as “any type of mobile terminal, fixed terminal, or portable terminal including a mobile handset, station, unit, device, multimedia computer, multimedia table, Internet node, communicator, desktop computer, laptop computer, notebook computer, netbook computer, tablet computer, personal communication system (PCS) device, personal navigation device, personal digital assistances (PDAs), audio/video player, digital camera/recorder, positioning device, television receiver, radio broadcast receiver, electronic book device, game device, or any combination therefor, including the accessories and peripherals of these devices, or any combination thereof.” Ex. 1001, 6:8-21.

IX. THE PETITIONER'S ARGUMENTS

A. Ground 1 – Aravamudan and Adomavicius do not render obvious Claims 1-2, 6, 9-12, 16, and 19-20 of the '137 Patent.

85. Petitioner asserts and Dr. Crovella opines that Aravamudan and Adomavicius render obvious Claims 1-2, 6, 9-12, 16, and 19-20 of the '137 Patent. Petition, p. 11; Ex. 1003, ¶54. I disagree for at least the following reasons.

1. Aravamudan fails to teach or suggest “determin[ing] a multi-dimensional query associated with at least one user device, wherein the multi-dimensional query specifies, at least in part, one or more personas, based, at least in part, on more than one person, associated with the at least one user device.”

86. Independent Claim 11 requires “determine a multi-dimensional query associated with at least one user device, wherein the multi-dimensional query specifies, at least in part, one or more personas, based, at least in part, on more than one person, associated with the at least one user device.” '137 Patent, Claim 11. Independent Claim 1 requires “a determination of a multi-dimensional query associated with at least one user device, wherein the multi-dimensional query specifies, at least in part, one or more personas, based, at least in part, on more than one person, associated with the at least one user device.” '137 Patent, Claim 1. The Petition and Dr. Crovella assert that Aravamudan renders these claim limitations obvious. Petition, pp. 25-32; Ex. 1003, ¶¶65-78. I disagree.

87. Aravamudan does not teach or suggest a multi-dimensional query that specifies, at least in part, one or more personas, based, at least in part, on more than

one person, associated with the at least one user device, as is required by the independent claims of the '137 Patent.

(a) **Aravamudan does not disclose “one or more personas.”**

88. The Petitioner and Dr. Crovella allege that “Aravamudan ‘uses [preference] signatures to personalize’ [user] queries to search over multiple dimensions.” Petition, p. 25 (referencing Ex. 1004, ¶¶[0129-0130]). Petitioner also alleges that “user queries are processed and personalized with the signatures,” and that “[t]he information in the signatures (e.g., context and genre) is used as additional search dimensions.” *Id.* That is, Petitioner appears to be alleging that Aravamudan’s signature is the specified “persona.” However, when “persona” is properly interpreted as discussed above – which Petitioner and Dr. Crovella fail to address -- Aravamudan’s signature cannot satisfy the “persona.” Rather than “represent the possible different combinations of users that can be associated with a specific UE,” Aravamudan’s signature merely captures the viewing habits of an entire household.

89. Aravamudan describes its signature as a “stochastic signature” that is “a normalized vector of probabilities” that “capture the historical patterns of the user’s behavior with respect to a particular set of activities.” Ex. 1004, ¶[0059]. Aravamudan further explains that the “the stochastic signature is a probabilistic model, and it is an identity that can be used for validation, prediction, etc.” Ex.

1004, ¶[0050]. According to Aravamudan, “[w]hile this type of signature can be used to identify a user according to his or her preference, it is distinguished from a unique signature that a user may employ to authenticate an item or guarantee the source of the item, for example.” *Id.*

90. Petitioner alleges that “signatures generated for ‘the users of the family [who] are members of a household using a single interface device’” satisfies the claimed persona. Petition, p. 31. However, Aravamudan describes that a signature collectively describes the viewing habits of the household. Ex. 1004, ¶[0108]. It is my opinion that having a single signature for all users of a device, such as a family, still fails to meet the recitations of the claims as it does not “represent the possible different combinations of users that can be associated with a specific UE.” That is, the correct interpretation of “persona” requires that it represent different combinations of users, which the signature of Aravamudan cannot do. To be clear, the signature, at best, is able to represent a single combination—all users of a device.

91. Unlike the signature of Aravamudan, the claimed persona enables the system to separate out the “different combinations of users,” which in a family might be a husband and wife or a husband and child. See Ex. 1001, 11:25-34 (“By associating a persona of a device with an infant and a mother, the ordering platform can associate the device situations involving an infant and the mother of

the infant, such as whether a restaurant allows public breast feeding, whether a restaurant has private seating for mothers with infants, etc.”). Aravamudan’s signatures do not and cannot enable such features. Instead, Aravamudan’s signature is the statistical viewing habits of the entirety of users using the device. Accordingly, the user of the Aravamudan device might be the whole family, but there is no way to separate out different combinations of users as is required by the proper definition of persona (for example, two specific family members such as a mother and an infant). In fact, Aravamudan confirms in that it states that the signatures are not “a unique signature that a user may employ to authenticate an item.” *Id.* Aravamudan’s signature would not be able “include[] representations of the type (e.g., gender, age group, disability, relationships, etc.) and quantity of the users that could possibly be associated with the UE.” Ex. 1001, 7:30-34.

92. While Petitioner argues that “the household signature is based, at least in part, on more than one person” because Aravamudan “disclos[es] an algorithm for decomposing the household signatures into its constituent information” (*see* Petition, p. 31), Aravamudan does not teach that its signature allows for “different combinations of users,” which is what is required by the claimed persona. That is, Aravamudan discloses breaking a signature down to approximate the number of family members in a signature, the gender of each family member, and the ages of the family members. Ex. 1004, ¶[0106]. Once broken down into its constituent

information, the signature is no longer available for use (i.e., as part of any alleged multi-dimensional query, as suggested by Petitioner, nor to re-order results). Moreover, neither Petitioner nor Dr. Crovella has argued or explained how a decomposed, and thus eliminated, signature would satisfy the proper definition of persona, let alone how or why a person of ordinary skill in the art would have thought any query of Aravamudan would have specified the decomposed, and thus eliminated, signature.

93. Aravamudan's signature does not and cannot "represent the possible different combinations of users that can be associated with a specific UE," nor can it "represent the members of a family that are associated with the UE." *See* Ex. 1002, 421. Accordingly, Aravamudan's signature cannot teach "one or more personas."

(b) Aravamudan's text query does not teach or suggest the elements of the claims.

94. First, and with regard to a first embodiment of Aravamudan related to a text query related to a television program, Petitioner alleges that "[f]or example, Aravamudan 'uses [preference] signatures to personalize' [user] queries to search over multiple dimensions" with references to paragraphs 129-130 of Aravamudan. Petition, p. 25. Petitioner then asserts that "user queries are processed and personalized with the signatures." *Id.* In fact, Petitioner alleges that "[t]he information in the signatures (e.g., context and genre) is used as additional search

dimensions.” *Id.* To be clear, Petitioner solely relies on the signature of Aravamudan for an alleged teaching of a multi-dimensional query and of the claimed persona. Petition, pp. 30-31. But Petitioner’s theory is incorrect—Aravamudan’s user queries are simple text queries that do not rely on signatures. Instead, Aravamudan is directed to simple text queries and then uses the Aravamudan signature not as an additional search dimension or as part of the query, but instead to reorder the results of a query prior to display to a user. To be clear, Aravamudan’s simple text query neither uses nor relies upon the signature. Accordingly, Aravamudan’s first embodiment fails to teach or suggest the elements of the claims.

(i) Aravamudan discloses a single dimensional text query.

95. In my opinion, the sole disclosed query in Aravamudan’s first embodiment is a single dimension text query based on a received set of input characters, such as including the letter “C” in a query once the letter “C” is received. Such a query is a single dimension in that it is comprised of text alone and is received, not “determined” by the system. In fact, as the text query itself is received, Aravamudan describes that the system (1) “begins searching for content results as the user enters letters of a text query,” (2) “identifies content items as candidates for presentation based on comparing the letters of the text query with descriptive terms associated with the content items,” and (3) reorders search results

based on relevance values associated therewith based on the set of user signatures.

Ex. 1004, ¶¶[0129-0131]. Aravamudan provides another example of a single dimension text query, explaining that “[t]hus, if the user enters a text query starting with the letter ‘S’, all results beginning with the letter ‘S’ would be presented to the user.” Ex. 1004, ¶[0089].

96. Moreover, the Applicant distinguished over Aravamudan’s system during prosecution. *See* Ex. 1002, 377, 398. That is, the Applicant distinguished the multi-dimensional query from an “algorithm for calculating relevance or importance scores for web pages that are returned for a search that is carried out in response to a query entered by a user.” Ex. 1002, 377, 398. The Applicant further explained that such an algorithm does not teach a multi-dimensional query. *Id.*

97. Similar to the system over which the Applicant distinguished (i.e., overcome on appeal), Aravamudan identifies content items as candidates for presentation based on comparing the letters of the text query with descriptive terms associated with the content items, and reorders search results based on relevance values associated therewith based on the set of user signatures (i.e., stochastic signatures used to promote relevance values of individual search results). Ex. 1004, ¶¶[0129-0131].

98. Aravamudan confirms that signatures are used to reorder results and are not part of the query itself. In particular, Aravamudan discloses that the

“generic relevance numbers of channels, based on popular opinion, are 500, 300, 100, and 70, for ‘CBS,’ ‘CNBC,’ ‘COMEDY CHANNEL’, and ‘CARTOON NETWORK’, respectively, with a maximum bound of 1000.” Ex. 1004, ¶[0132]. That is, the results shown in Table 1 are ordered based on the generic relevance numbers of channels.

Ex. 1004, ¶[0132], TABLE 1

TABLE 1	
Channel	Relevance Number
CBS	500
CNBC	300
COMEDY CHANNEL	100
CARTOON NETWORK	70
	...

99. Aravamudan then reorders the results, as shown in Table 2, based on a signature. Specifically, because the user watched the channels “CARTOON NETWORK” and “COMEDY CHANNEL” in the past, the signature probabilities for these channels are set at 0.7 and 0.3, respectively. Ex. 1004, ¶¶[1032-0133].

Ex. 1004, ¶[0133], TABLE 2

TABLE 2	
Channel	Relevance Number
CARTOON NETWORK	2015
COMEDY CHANNEL	1351
CBS	500
CNBC	300
	...

100. That is, just as what the Applicant distinguished during prosecution, Aravamudan merely returns results for a query that is carried out in response to a request entered by a user, and the results are reordered based on relevance values that are adjusted based on signatures. Aravamudan does not specify a signature as part of any query. Accordingly, Aravamudan does not disclose a multi-dimensional query.

(ii) Aravamudan's user queries are simple text queries that do not rely on signatures (i.e., do not specify a persona).

101. Even assuming, *arguendo*, Aravamudan's simple text query were multi-dimensional, Aravamudan's simple text query does not specify any alleged persona. Aravamudan, at best, provides a data structure, a stochastic signature or signature, that is configured to reorder retrieved query results based on learned user preferences. Ex. 1004, ¶[0019]. Aravamudan's "stochastic signature is a normalized vector of probabilities" that "capture the historical patterns of the user's behavior with respect to a particular set of activities." Ex. 1004, ¶[0059]. An "example of a signature for use with a television system is {(ABC 0.3), (CBS 0.2), (NBC 0.5)}," which "captures that over a given period time period, when the user was watching television, the user watched ABC 30% of the time, CBS 20% of the time, and NBC 50% of the time." *Id.*

102. FIG. 2 of Aravamudan “shows a sample signature hierarchy for the multiple dataspace learning model,” with n locations 200, m dataspaces 210, and k time slots 200.” Ex. 1004, ¶[0062], FIG. 2.

Ex. 1004, FIG. 2

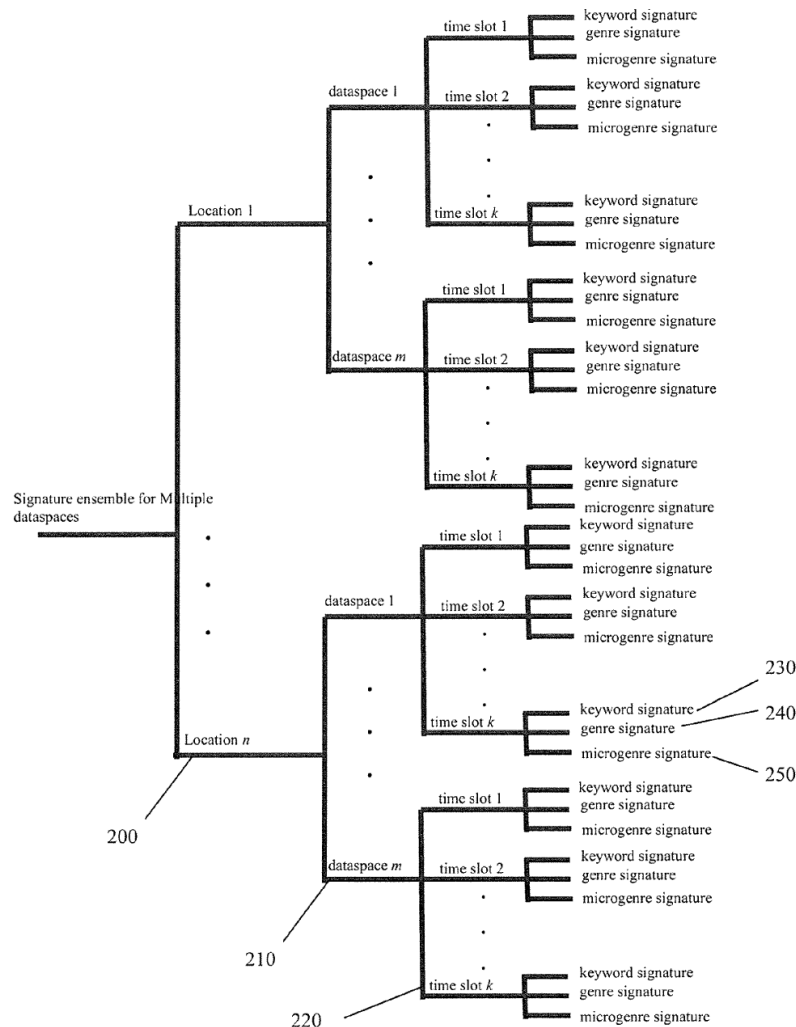


Figure 2

103. According to Aravamudan, referring to FIG. 2,

At the first level, the figure illustrates activities in each location 200.

Within each location 200, the system captures dataspace-specific

activities in individual signatures. Inside each dataspace 210, for each time slot 220, the system obtains a unique signature. Finally, the signature hierarchy captures the nature of the activity within the time slot by appropriate keyword 230, genre 240, and microgenre signatures 250 (or equivalent statistics depending on the dataspace, as described above).

Ex. 1004, ¶[0062].

104. Aravamudan describes a first embodiment in which “various individual, aggregate, and program signatures reside on a server system that contains a set of content items,” and the “server system uses the signatures to personalize search results provided to users of the system.” Ex. 1004, ¶[0129]. Aravamudan explains that query results are obtained and then “reordered by promoting relevance values of individual search results based on the set of signatures.” *Id.*

105. In operation, the signature is not part of the query at all. Instead, after a query returns a set of results or content items, “[e]ach of these content items is associated with a base relevance value that measures the popularity of the item in the overall population,” and the “system uses these base relevance values to rank which contents are likely sought by the user.” Ex. 1004, ¶[0129]. The system then “modifies the base relevance values based on the set of signatures,” and the “final relevance weights of each item determine if the item is included in the result set and help determine its position in a list of results.” Ex. 1004, ¶[0130]. That is, the

signatures simply change the relevance weights in order to change the order of the query results. The signature is thus never used to personalize the queries or alter the queries in any way.

(iii) Aravamudan's examples confirm that its query is a single dimensional text query and Aravamudan's signature, at best, is used for ordering.

106. Demonstrating that the queries of Aravamudan are simple text-based queries and signatures are used to reorder the query results (not the query itself), Aravamudan discloses that “the system begins searching for content item results as the user enters letters of a text query.” Ex. 1004, ¶[0129]. “Thus, if the user enters a text query starting with the letter ‘S’, all results beginning with the letter ‘S’ would be presented to the user.” Ex. 1004, ¶[0089]. As would be expected in a standard text query, “[t]he system identifies content items as candidates for presentation based on comparing the letters of the text query with descriptive terms associated with the content items.” Ex. 1004, ¶[0129].

107. Aravamudan discloses a specific example of a text query that includes the character “C” where Aravamudan simply relies on the received text query when executing its search. See Ex. 1004, ¶[0132]. In this disclosed example, a “user had watched the channels ‘CARTOON NETWORK’ and ‘COMEDY CHANNEL’ in the past, with the signature probabilities 0.7 and 0.3, respectively,” where the “generic relevance numbers of channels, based on popular opinion, are

500, 300, 100, and 70, for ‘CBS,’ ‘CNBC,’ ‘COMEDY CHANNEL’, and ‘CARTOON NETWORK’, respectively, with a maximum bound of 1000.” *Id.*

Then, based on the query “C” having been received and executed, query results are retrieved, and those retrieved query results are shown in Table 1. *Id.* In Table 1, the order of the query results is shown where the query results are not reordered based on any signature(s) (*see* Ex. 1004, ¶[0132]):

Ex. 1004, ¶[0132], TABLE 1

TABLE 1	
Channel	Relevance Number
CBS	500
CNBC	300
COMEDY CHANNEL	100
CARTOON NETWORK	70
	...

108. Continuing the example from above whereby Aravamudan discloses an example where the text query is the letter “C,” Aravamudan then depicts reordering the results from Table 1 using the Aravamudan’ signature(s). The reordered results are depicted in Table 2. That is, in Table 2, the same results based on the same text query as in Table 1 are shown but are shown in a different order as compared to Table 1 because the relevance values have been modified based on the user signature(s) (*see* Ex. 1004, ¶¶[0132-0133]):

Ex. 1004, ¶¶[0133], TABLE 2

TABLE 2	
Channel	Relevance Number
CARTOON NETWORK	2015
COMEDY CHANNEL	1351
CBS	500
CNBC	300
	...

109. Based on Aravamudan’s description that the user had watched CARTOON NETWORK and COMEDY CHANNEL in the past (i.e., a signature of historical viewing pattern(s)), it can be seen that the query results in Table 1 – query results retrieved based on the query “C” -- are reordered to what is shown in Table 2 so that CARTOON NETWORK and COMEDY CHANNEL are placed near the top of the results. *See* Ex. 1004, ¶¶[0129-0133].

110. In this first embodiment, Aravamudan’s system thus received a text query including the letter “C,” executed the query to retrieve the results “CBS,” “CNBC,” “COMEDY CHANNEL,” and “CARTOON NETWORK,” and then reordered the retrieved results based on a signature before displaying them to a user.

(iv) Aravamudan does not disclose the determination of a multi-dimensional query.

111. In each of the Aravamudan text queries, there is no determination of a query at all as the query itself is simply received. Moreover, the sole query that is

received is received is a single dimensional text query consisting of one or more letters. Worse still, any signature that is applied by Aravamudan is applied to reorder the results but is never applied to the query itself. As such, it is my opinion that Aravamudan fails to teach or suggest “a determination of a multi-dimensional query associated with at least one user device, wherein the multi-dimensional query specifies, at least in part, one or more personas, based, at least in part, on more than one person, associated with the at least one user device.”

(c) Aravamudan’s second embodiment does not teach or suggest the elements of the claims.

112. Next, and with regard to a second embodiment of Aravamudan related to Aravamudan’s learning system providing personalization information to a third-party service provider, even assuming Aravamudan’s signature satisfies the claimed persona, any alleged query of Aravamudan’s second embodiment fails at least because any query, even if assumed to be multidimensional, is not based on a persona.

113. Petitioner and Dr. Crovella allege that a “POSITA would have understood that the system has determined a multi-dimensional query in between steps 3 and 4” of FIG. 12 of Aravamudan’s second embodiment. Petition, p. 27; Crovella, ¶69. Specifically, Petitioner alleges that the system determines a multi-dimensional query in between steps 3 and 4 “at least by refining the query to search over the multiple dimensions in the user preference signature corresponding

to the user device and context.” *Id.* Petitioner and Dr. Crovella mischaracterize Aravamudan and ignore the explicit teaching in Aravamudan to the contrary. In Aravamudan’s second embodiment, the learning system provides personalization information to third-party service providers to improve users’ experiences with a third-party service. Ex. 1004, ¶[0166]. A service provider may request user signature information. Ex. 1004, ¶[0173]. For example, a service provider, such as a “video content search engine wishing to use the user’s signatures to order the results of a query may request specific information on which channels or program the user watched.” *Id.* That is, the second embodiment of Aravamudan is directed to sharing information about a user so that the user’s signature information can be used to curate order results in a new location, such as when a user enters a store. .

(i) Aravamudan does not disclose the determination of the request.

114. Aravamudan’s second embodiment is further disclosed and depicted with respect to FIG. 12, in which “a user device 1203 makes a request to a service provider 1201,” where the “request contains a unique identifier that identifies the user or the user device.” Ex. 1004, ¶[0174]. A person of ordinary skill in the art would understand that a request of a service provider would be a request for recommended products upon entering a store or a request for recommendations for a media provider.

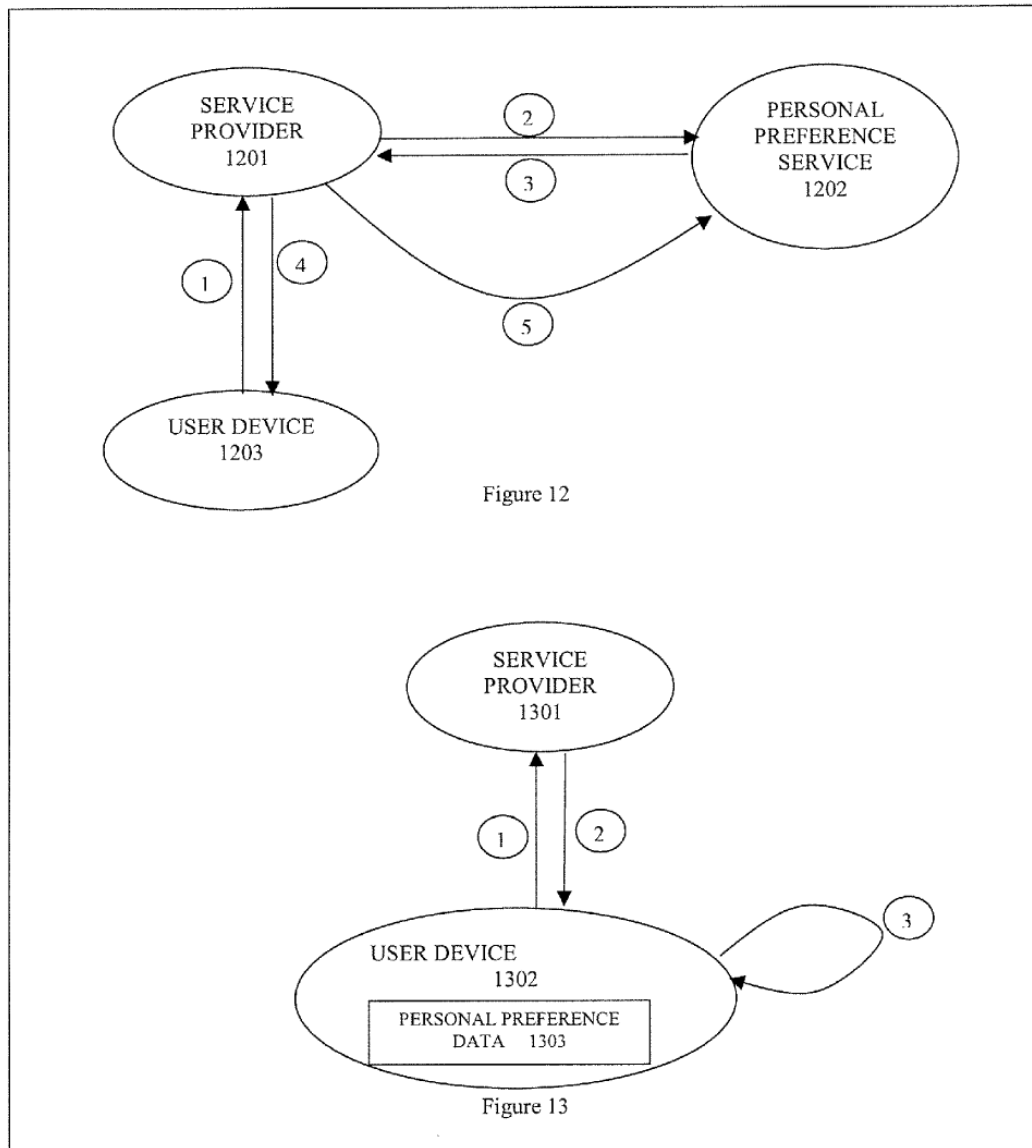
115. Similar to the first embodiment, in Aravamudan's second embodiment, the request is thus received and is not determined by the system.

(ii) Aravamudan does not disclose a multi-dimensional query.

116. Aravamudan does not disclose a multi-dimensional query. As I note above, the Applicant distinguished over Aravamudan's system during prosecution. *See* Ex. 1002, 377, 398. That is, the Applicant distinguished the multi-dimensional query from an "algorithm for calculating relevance or importance scores for web pages that are returned for a search that is carried out in response to a query entered by a user." Ex. 1002, 377, 398. The Applicant further explained that such an algorithm does not teach a multi-dimensional query. *Id.*

117. Similar to the system over which the Applicant distinguished, Aravamudan merely reorders results that are returned for a query that is carried out in response to a request entered by a user, and the results are reordered based on relevant preference information.

Ex. 1004, FIG. 12



118. In step 2 of FIG. 12, “[s]ervice provider 1201 communicates the substance of the request and the additional context information to personal preference service 1202.” Ex. 1004, ¶[0175]. This additional context information can include the location of the user device, the time of the request, and general description of the action the user is performing (e.g., the fact the user is currently

using a telephone versus playing media). Ex. 1004, ¶[0175]. The context information passed from the service provider to the personal preference service assists the personal preference in retrieving relevant preference information to send back to the service provider so that the service provider can order results based on the relevant preference information.

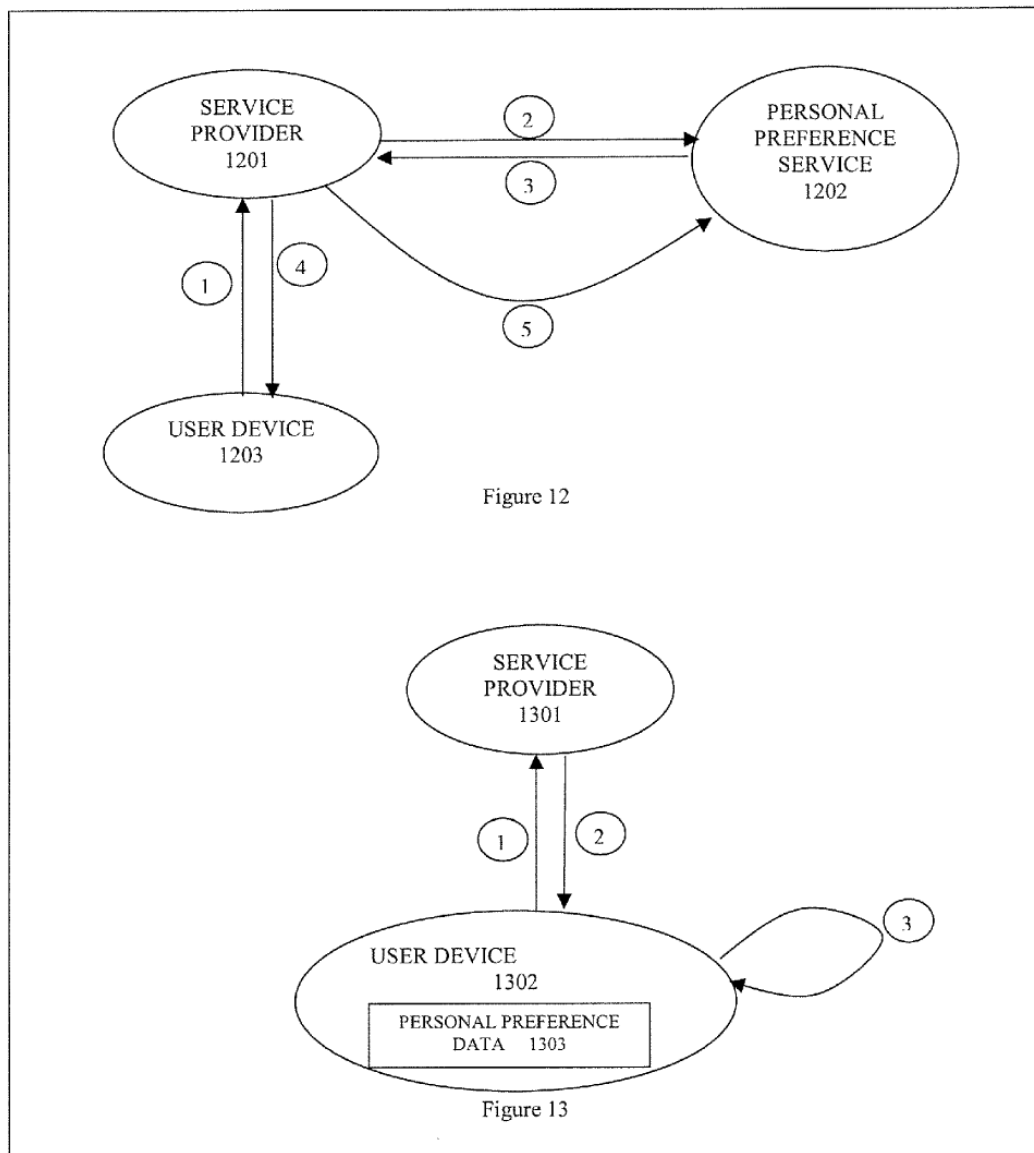
119. This is just the type of system Applicant distinguished over in prosecution. That is, The Applicant distinguished over a system such as disclosed in Aravamudan's second embodiment, arguing that "an algorithm for calculating relevance or importance scores for web pages that are returned for a search that is carried out in response to a query entered by a user" cannot teach a multi-dimensional query. Ex. 1002, 377, 398. The Applicant further clarified that the distinguished algorithm "is not a query but merely an algorithm that measures results of a query." Ex. 1002, 377, 398. Just as the distinguished algorithm, Aravamudan merely reorders results, based on relevance values, returned for a search that is carried out in response to a request entered by a user.

120. Accordingly, Aravamudan does not disclose a multi-dimensional query.

(iii) Aravamudan's request does not specify signatures (i.e., any alleged persona).

121. Even if the request in Aravamudan's second embodiment were considered multi-dimensional, the request is based on a sole user (thus not based

on more than one person associated with a device), and the request only contains a unique identifier and again does not specify the signature (i.e., Petitioner's alleged persona). This is consistent with Aravamudan's description of a desire for "the personal preference service 1202" to "only have a set of unique device identifies that share signatures for each user," and "there would be no identity information beyond the identifiers" so that "the user's identity is maintained anonymous, yet responses matching user's preferences can be delivered." Ex. 1004, ¶[0174].

Ex. 1004, FIG. 12

122. Next, in step 2 of FIG. 12, the service provider, not the user device, communicates with a personal preference service. For example, “[s]ervice provider 1201 communicates the substance of the request and the additional context information to personal preference service 1202.” Ex. 1004, ¶[0175]. The additional context information provided by the service provider includes “the

location of the user device, if available, the time of the request, and general description of the action the user is performing (e.g., the fact the user is currently using a telephone versus playing media).” Ex. 1004, ¶[0175]. The actions are described using descriptive tags that are assigned to the various actions by the system. *Id.* Here, the context information passed from the service provider to the personal preference service assists the personal preference in retrieving relevant preference information to send back to the service provider so that the service provider can order results based on the relevant preference information.

123. In step 3 of FIG. 12, “personal preference service 1202 sends relevant preference information based on the tags sent by user device 1203 to service provider 1201.” *Id.* Aravamudan provides an example of sending user preference information to a service provider, stating that a “service provider requesting the user’s signature information can designate the degree of specificity of user preferences desired.” Ex. 1004, ¶[0173]. Aravamudan discloses that, for example, a service provider, such as a “video content search engine wishing to use the user’s signatures to order the results of a query may request specific information on which channels or program the user watched.” *Id.* Here, at step 3, it appears that Aravamudan’s personal preference service sends a signature or signature information to the service provider for the purpose of ordering any results of a query.

124. In step 4 of FIG. 12, the “relevant personal preference information is used by the service provider 1201 to send a targeted response to the user device 1203.” Ex. 1004, ¶[1076]. As I noted above with regard to step 3, the target response is based on a set of results that was generated by a query and then reordered by any provided signatures.

125. While Petitioner and Dr. Crovella allege that the user preference information or signature is used between steps 3 and 4 to refine the query, Aravamudan provides no such teaching or suggestion and, in fact, discloses to the contrary. Continuing with the aforementioned example, Aravamudan’s video content search engine service provider uses the received relevant personal preference information, or signature(s), to order the results of a query before sending a targeted response to the user device. Aravamudan specifically states that a service provider, such as a “video content search engine *wishing to use the user’s signatures to order the results of a query* may request specific information on which channels or program the user watched.” Ex. 1004, ¶[0173] (emphasis added). In view of Aravamudan’s explicit disclosure that the signature is used to order the results, and not used to generate or refine a query, a person of ordinary skill in the art would not have understood that a multi-dimensional query was determined between steps 3 and 4 of FIG. 12. Nor would a person of ordinary skill in the art have thought Aravamudan’s query was refined based on the user

preference information. Neither Petitioner nor Dr. Crovella addresses this explicit disclosure in Aravamudan regarding the second embodiment and, in fact, they must ignore the disclosure for their flawed assertion to hold.

126. Accordingly, the request described with respect to Aravamudan's second embodiment, and relied upon by Petitioner and Dr. Crovella for an alleged teaching of the claimed "query," does not specify the signature (i.e., Petitioner's alleged persona), and Petitioner and Dr. Crovella fail to explain why a person of ordinary skill in the art would have understood the request to have specified the signature.

127. In step 1 of FIG. 12, there is no determination of the request at all as the request itself is simply received. Moreover, any signature that is applied by Aravamudan is applied to reorder the results but is never applied to the query itself. Accordingly, it is my opinion that Aravamudan fails to teach or suggest "a determination of a multi-dimensional query associated with at least one user device, wherein the multi-dimensional query specifies, at least in part, one or more personas, based, at least in part, on more than one person, associated with the at least one user device."

(d) **A person of ordinary skill in the art would not have used Aravamudan's signature both as part of both Aravamudan's query and to reorder Aravamudan's query results**

128. The Petition and Dr. Crovella rely on the Aravamudan signature for at least a purported teaching of the claimed “persona” and the claimed “ordering metric.” Petition, pp. 25, 30-31, 40. However, not only do the Petitioner and Dr. Crovella fail to explain how a person of ordinary skill in the art would have understood the distinct claim terms to have meant the same thing (i.e., such that they could both have been satisfied by Aravamudan's signature), a person of ordinary skill in the art would not have thought to use a signature as part of a query and then to reorder the results of that query.

129. For example, Aravamudan depicts returning results for the text character “C,” where the “generic relevance numbers of channels, based on popular opinion, are 500, 300, 100, and 70, for ‘CBS,’ ‘CNBC,’ ‘COMEDY CHANNEL’, and ‘CARTOON NETWORK’, respectively, with a maximum bound of 1000.” Ex. 1004, ¶[0132]. The results shown in Table 1 are ordered based on the generic relevance numbers of channels.

Ex. 1004, ¶[0132], TABLE 1

TABLE 1	
Channel	Relevance Number
CBS	500
CNBC	300
COMEDY CHANNEL	100
CARTOON NETWORK	70
	...

130. Aravamudan then reorders the results, as shown in Table 2, based on a signature. Specifically, because the user watched the channels “CARTOON NETWORK” and “COMEDY CHANNEL” in the past, the signature probabilities for these channels are set at 0.7 and 0.3, respectively. Ex. 1004, ¶¶[1032-0133].

Ex. 1004, ¶[0133], TABLE 2

TABLE 2	
Channel	Relevance Number
CARTOON NETWORK	2015
COMEDY CHANNEL	1351
CBS	500
CNBC	300
	...

131. If Aravamudan’s signature were part of Aravamudan’s original query then the Relevance Numbers of Table 1 would not be the generic numbers “500, 300, 100, and 70,” but instead would already include the signature probabilities in Table 2. If the signature probabilities were already applied as part of the query results and the results ordered accordingly, there would no longer be any need for

the reordering step. Thus, the additional application of the signature probabilities would not reorder the results at all – a person of ordinary skill in the art would consider an additional step to unnecessarily reorder (or not reorder at all) the results nonsensical and computationally wasteful. A person of ordinary skill in the art would not use Aravamudan’s signature in this manner.

2. A POSITA would not have been motivated to combine Aravamudan and Adomavicius as suggested by Petitioner.

132. The Petition and Dr. Crovella argue that the “combination of Aravamudan’s teachings of personalized multi-dimensional queries” “with Adomavicius’ teachings of a context-sensitive database” teaches “limitation [11c],” alleging that a “POSITA would have been motivated to implement Aravamudan’s method and system using a database such as that taught by Adomavicius.” Petition, p. 33, Crovella, ¶¶79, 86-92. I disagree.

133. The Petition states that Aravamudan teaches executing a query “which has been personalized to search the dimensions based on ‘context sensitive user preference,’” and generating search results, and that Adomavicius teaches a “context sensitive database” on which to execute multi-dimensional queries. Petition, pp. 34-35. The Petition then argues that “a POSITA would have been motivated to implement Aravamudan’s teachings using Adomavicius’ database.” Petition, p. 7; Crovella, ¶87. However, both Petitioner and Dr. Crovella fail to explain how a person of ordinary skill in the art would have combined the

references, let alone without eliminating the need for Aravamudan's signatures entirely.

134. First, contrary to the assertions made by Petitioner and Dr. Crovella, Aravamudan does not teach querying over multiple dimensions based on context-sensitive user preferences, as discussed above. That is, Aravamudan discloses receiving a text query, retrieving results based on the same, and reordering the results based on a signature or set of signatures. As such, the combination would not yield the alleged predictable results of "storing, querying, and retrieving Aravamudan's context-sensitive query results on a context-sensitive database as taught by Adomavicius" because Aravamudan has no need for a context-sensitive database. Aravamudan's queries are not context-sensitive – they are merely executed based on received input text and then the results are reordered based on signatures. A context-sensitive database would be of no use in the query of Aravamudan.

135. Moreover, it is unclear how the combination of Aravamudan and Adomavicius would be implemented without eliminating the signatures of Aravamudan. More specifically, it is unclear how the signatures of Aravamudan would be stored using the multidimensional model or cube of Adomavicius. For example, according to Petitioner and Dr. Crovella, Aravamudan uses its signatures as part of an alleged multi-dimensional query, and the signatures are made up of

contextual attributes (or dimensions, according to Petitioner and Dr. Crovella). Adomavicius' multidimensional model or cube stores values for multiple dimensions in a given space – for example, a recommendation space having dimensions user, item, and time. Combining Aravamudan's signatures with Adomavicius' multidimensional model or cube would result in the multidimensional model or cube storing the underlying values that make up the signature, rather than the signature itself, thereby eliminating the signature entirely. This would render Aravamudan inoperable for its intended purpose.

136. Neither Petitioner nor Dr. Crovella explains how Aravamudan's signatures would be used in conjunction with Adomavicius' multidimensional model. That is, it is unclear how a query of Aravamudan, executed using a multidimensional model or cube of Adomavicius, would then have the signature of Aravamudan applied thereto to reorder the results. For example, Adomavicius considers several dimensions and associated values as part of a multidimensional recommendation space - given all of the dimensions a model of Adomavicius considers as part of a recommendation space, it is unclear how or why the signature of Aravamudan, which also contains alleged dimensions according to Petitioner, would then need to be applied to any results received from the multidimensional recommendation space of Aravamudan.

137. Thus, it is my opinion that a person of ordinary skill in the art would not have combined Aravamudan and Adomavicius as argued by Petitioner and Dr. Crovella.

B. Ground 2 – Aravamudan, Adomavicius, and McNee do not render obvious Claims 1-6, 9-16, and 19-20 of the '137 Patent.

138. Petitioner asserts and Dr. Crovella opines that Aravamudan, Adomavicius, and McNee render obvious Claims 1-6, 9-16, and 19-20 of the '137 Patent. Ex. 1003, ¶147; Petition, p. 11. I disagree for at least the following reasons.

139. Petitioner and Dr. Crovella rely in Ground 2 on Aravamudan and Adomavicius for the limitations recited in independent Claims 1 and 11, and merely turn to McNee for purported teachings related to various dependent claims depending from independent Claims 1 and 11. Ex. 1003, ¶147. As I explain in detail above, Aravamudan and Adomavicius do not render obvious independent Claims 1 and 11 of the '137 Patent. *See* § IX.A *supra*. Thus, it is my opinion that Aravamudan, Adomavicius, and McNee do not render obvious Claims 1-6, 9-16, and 19-20 of the '137 for at least the same reasons. While I reserve the right to address Petitioner's specific arguments with respect to Ground 2 and McNee, if instituted, I do not reach them herein.

C. Ground 3 – Aravamudan, Adomavicius, and Ramer do not render obvious Claims 1-2, 6-12, and 16-20 of the '137 Patent.

140. Petitioner asserts and Dr. Crovella opines that Aravamudan, Adomavicius, and Ramer render obvious Claims 1-2, 6-12, and 16-20 of the '137 Patent. Ex. 1003, ¶175; Petition, p. 11. I disagree for at least the following reasons.

141. Petitioner and Dr. Crovella rely in Ground 3 on Aravamudan and Adomavicius for the limitations recited in independent Claims 1 and 11, and merely turn to Ramer for purported teachings related to dependent Claims 7-8 and 17-18, which depend from independent Claims 1 and 11 respectively. Ex. 1003, ¶176. As I explain in detail above, Aravamudan and Adomavicius do not render obvious independent Claims 1 and 11 of the '137 Patent. *See* § IX.A *supra*. Thus, it is my opinion that Aravamudan, Adomavicius, and Ramer do not render obvious Claims 1-2, 6-12, and 16-20 of the '137 for at least the same reasons. While I reserve the right to address Petitioner's specific arguments with respect to Ground 3 and Ramer, if instituted, I do not reach them herein.

X. CONCLUSION

142. In signing this declaration, I recognize that this declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I also recognize that I may be subject to cross-examination in the case.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Executed this 3rd day of January, 2025.

Respectfully submitted,



Dr. Dirk Grunwald