

IN THE 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.

IPR2024-01390

U.S. Patent No. 9,390,137

PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 9,390,137

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EXHIBIT LIST

Exhibit No.	Description
1001	U.S. Patent No. 9,390,137 to Setlur et al. (“the ’137 patent”)
1002	Prosecution History for the ’137 patent
1003	Declaration of Mark E. Crovella
1004	U.S. Patent App. Pub. No. 2007/0219985A1 to Aravamudan et al. (“Aravamudan”)
1005	G. Adomavicius et al., <i>Incorporating Contextual Information in Recommender Systems Using a Multidimensional Approach</i> (2005) (“Adomavicius”)
1006	S. McNee, <i>Confidence Displays and Training in Recommender Systems</i> (2003) (“McNee”)
1007	U.S. Patent App. Pub. No. 2008/0214156A1 to Ramer et al. (“Ramer”)
1008	Declaration of S. Delman re Adomavicius (Ex-1005)
1009	Declaration of S. McNee re McNee (Ex-1006)
1010	Declaration of P. Huizinga re McNee (Ex-1006)
1011	G. Adomavicius et al., <i>REQUEST: A Query Language for Customizing Recommendations</i> (2011) (“Tuzhilin”)
1012	U.S. Patent App. Pub. No. 2008/0301086A1 to Gupta (“Gupta”)

Databases have long been used to store voluminous information, and facilitate searching for information of interest for users. Persons of skill in the art knew that the quality of search results could be improved by incorporating user and contextual information in the search. A user profile (also known as a persona) was used to store information about the user such as facts about a user, their preferences, or historic use. Context information can be information such as the user's current location or what they are doing. For example, if a user is searching for a restaurant, the user's stored preferences for cuisine and the user's current location can be included in the query to make the query user and context-sensitive.

Multidimensional databases were known and used to execute user and context-sensitive queries. A multidimensional database stores data relating to an item along multiple dimensions. Continuing the example, dimensions for a restaurant may include type of cuisine, location, and rating. A multidimensional database can execute queries using one or more of the dimensions to define the results.

The '137 patent does not purport to invent user or context-sensitive queries. Ex-1001, 1:8-26 (describing it how it was known that "network and content services rely on the context of the users...or the devices."). It also acknowledges that multidimensional databases were known (*see* Ex-1001, 5:29-38 (referring to well-known techniques for converting a 2-dimensional relational database into a

multidimensional database)) as well as context-sensitive databases. Crovella (Ex-1003), ¶¶7-8.

The '137 patent was only allowed because the Board credited the Applicant's argument that the art of record did not disclose using a user persona in a multidimensional query where the user persona is based on more than one person. *See, infra*, §II.B. The Avaramudan prior art discloses this feature. It describes a device (e.g., a TV set-top box) that captures the user's preferences (e.g., viewing preferences) as "signatures." Avaramudan expressly discloses that signatures generated by a single device shared by multiple users reflects the preferences of all the users (e.g., the members of a household sharing the TV). Avaramudan's signatures created for a group of users sharing a device renders obvious the claimed user persona that is based on more than one person.

I. BACKGROUND

Before 2011, information was retrieved from databases using queries that have search terms/parameters. *See, e.g.*, Ex-1011, ¶9; Ex-1007, ¶99, Fig. 2, ¶119. Common applications included presenting or recommending services or data. Ex-1011, Abs; Ex-1004, ¶¶15-21. Recommender/recommendation systems employing such query and database technology were widely used. *See, e.g.*, Ex-1011, Abs., ¶¶8-9; Ex-1006, Abs.; Ex-1007, Fig. 1, ¶102; Crovella, ¶3.

Known techniques to improve query response quality often used additional information. *See, e.g.*, Ex-1007, ¶327. It was well-known to personalize queries to the user. Ex-1011, ¶1; Ex-1005, ¶2; Ex-1006, ¶47, ¶2. This could be done with a user profile, that saved facts, preferences, and history of that user. Ex-1004, ¶19; Ex-1007, ¶120, ¶328. Profiles, which could also be called personas, collected data on individuals or groups using a single device or across multiple devices. *E.g.*, Ex-1004, ¶¶47-48; Ex-1012, ¶55.

The context of the user or device (e.g., time, location, companions, relationships, etc.) was also commonly used. Ex-1005, ¶82, ¶84; Ex-1007, ¶118, ¶122. Information that differed depending on such context was described as “context-sensitive.” *E.g.*, Ex-1004, ¶175. Context-sensitive or context-aware query systems and databases incorporated such contextual information. *E.g.*, Ex-1005, 000002 (“context-aware recommender systems”); Crovella, ¶4.

One way to use context was to refine/target queries by filtering or ordering the results of an initial query using the context, or alternatively incorporating context into multi-dimensional queries that consider more than one dimension. *E.g.*, Ex-1011, ¶¶7-8; Ex-1012, ¶71; Ex-1007, ¶¶136-137, ¶124, ¶118. For example, data was organized in N-dimensions (e.g., 3-dimensional cubes) to simplify the processing for multi-dimensional queries. *See, e.g.*, Ex-1005, Fig. 1 at 000013:

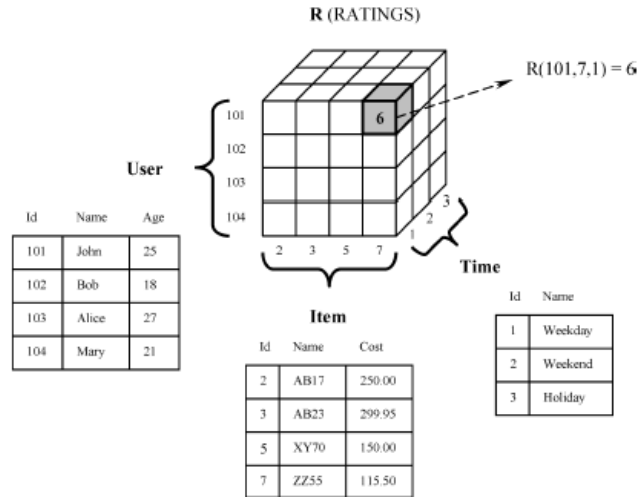


Fig. 1. Multidimensional model for the $User \times Item \times Time$ recommendation space.

Databases organized using data cubes and other multi-dimensional schemas were better suited for multi-dimensional queries than 2-dimensional (e.g., relational) databases. Ex-1011, ¶9; Ex-1012, ¶¶40-42; Crovella, ¶5.

Many such techniques to efficiently store, retrieve, and analyze large sets of data were known as Data warehousing and On-Line Analytical Processing (OLAP) technologies. Ex-1012, ¶¶5-6; Ex-1011, ¶¶11-13. Techniques were also known for effectively presenting/displaying query results effectively, including the use of graphical elements to provide metadata such as a confidence measure based on the accuracy of a rating presented to a user. Crovella, ¶6; e.g., Ex-1006, Fig. 2:

Recent DVDs	
1. Beautiful Mind, A (2001)	★★★★★
2. Red Beard (Akahige) (1965)	★★★★★ 
3. From Hell (2001)	★★★★★
4. Traffic (2000)	★★★★★
5. Horse's Mouth, The (1958)	★★★★★ 

Figure 2: Dice icons indicate that The Horse’s Mouth is risky, and that Akahige is very risky, because the system has few ratings for these items.

See also, e.g., Ex-1007, ¶373, ¶¶473-474; Ex-1012, ¶¶77-79, Fig. 8.

II. ’137 PATENT

A. Alleged Invention

The ’137 patent purports to solve the problem of “[s]ervice providers and device manufacturers...[needing to] provid[e] compelling network services and relevant content.” Ex-1001, 1:8-26. The patent proposes using “context based attribute ordering” as an ordering metric by “allowing the mobile user to provide additional information concerning relevant attributes for a data entity in a context aware database.” Ex-1001, 4:1-11, 3:35-47; Crovella, ¶8.

However, context-sensitive databases, multi-dimensional queries, and the use of user/device context to determine such queries and to order the results was already known in the art. *Supra* §I; *infra* §VI. Moreover, the patent does not describe or claim specific details of an ordering metric, merely outlining categories of attributes for query dimensions and applying known generic techniques such as

weighting. *See, e.g.*, Ex-1001, 22:48-25:21 (claims). Instead, the '137 patent was allowed for claiming a user persona (e.g., profile) based on more than one person for a single device. Ex-1002, 000435; *infra* §II.B. Creating and using profiles based on more than one user for a single device was also known in the art. *Supra* §I; *infra* §VI.A.1.[11b]; Crovella, ¶9.

B. Prosecution History

The '137 patent issued July 12, 2016 on appeal, following two office actions including §103 rejections. Ex-1002, 000434-000436, 000249-000255, 000352-000357; Crovella, ¶10.

To address §103 rejections, Applicant amended the claims to recite one or more personas “based, at least in part, on more than one person” (Ex-1002, 000267, 000270) and distinguished the prior art as being “only specific to a single user rather than **more than one person**” (Ex-1002, 000274-000275). Applicant further argued in response to a second office action that the cited prior art’s teachings related to “Internet interaction [] associated with a plurality of users or personas with more than one user device” instead of for a single user device. Ex-1002, 000376-000378; Crovella, ¶¶11-13.

Applicant repeated these arguments on appeal. Ex-1002, 000398, 000395-000396 (same) and emphasized that it had “defined the metes and bounds of the ‘one or more persona’ by reciting ‘one or more persona, based, **at least in part, on**

more than one person, associated with the at least one user device.’’ Ex-1002, 00397. The patent was allowed because the Board agreed that this limitation was not present in the cited prior art. Ex-1002, 000435, 000443; Crovella, ¶14.

C. Priority Date

This Petition demonstrates that the challenged claims are invalid based on prior art that predates the ’137 patent’s earliest application filed on June 29, 2011.

III. IDENTIFICATION OF CHALLENGE

A. Statutory Grounds

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

Ground	Claims	Statutory Basis	Prior Art
1	1-2, 6, 9-12, 16, 19-20	§103	Aravamudan and Adomavicius
2	1-6, 9-16, 19-20	§103	Aravamudan, Adomavicius, and McNee
3	1-2, 6-12, 16-20	§103	Aravamudan, Adomavicius, and Ramer

Grounds 1-3 render the challenged claims obvious because any differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a POSITA. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007); Crovella, ¶¶18-19.

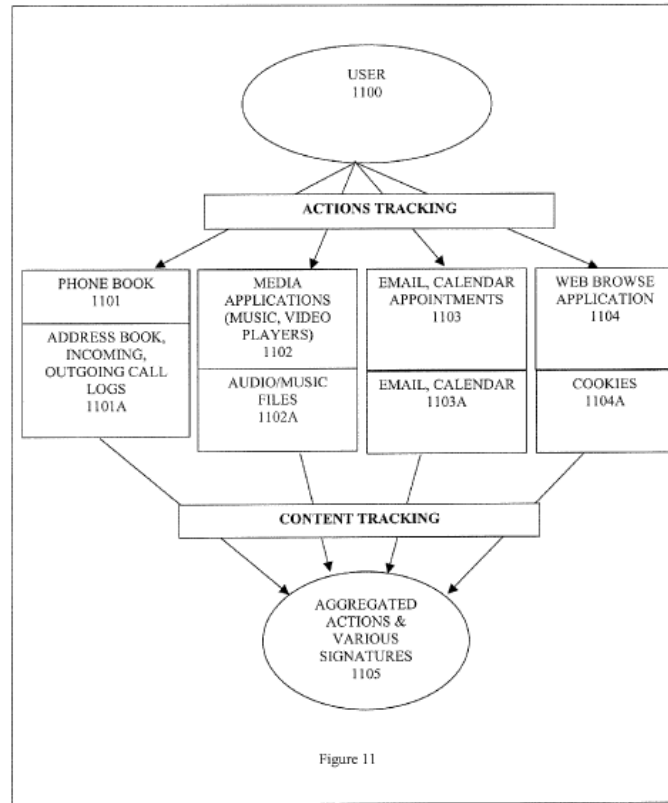
B. Relied-Upon Prior Art¹

1. Aravamudan (Ex-1004)

Aravamudan is prior art under pre-AIA §§102(a) and (b) because it was published (September 20, 2007) before the alleged invention and more than one year before the earliest filing date (June 29, 2011), and was not cited during prosecution. Crovella, ¶¶20-21.

Aravamudan is directed to “methods and systems for selecting and presenting content based on context sensitive user preferences.” Ex-1004, Title, ¶22. Aravamudan discloses a query-based recommender system that saves user preference signatures coupled with contextual information (e.g., “user activity,” “the type of dataspace being visited..., geographic location of the mobile device, etc.”). Ex-1004, ¶53, Fig. 11:

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



Aravamudan discloses these signatures “capture user preferences for a single user or a family of users” that share “a single interface device.” Ex-1004, ¶47 (emphasis added). The signatures are matched with context and combined with queries to “select and order” subsequent query results. Ex-1004, ¶23; Crovella, ¶¶22-23.

Aravamudan is analogous prior art because it is in the same field of endeavor: database and query systems. *Infra* §IV. Aravamudan’s “invention [] relates...specifically, to...interactions with content query systems.” Ex-1004, ¶15, Fig. 10. Aravamudan is reasonably pertinent to the problem addressed by the ’137 patent’s inventor, because it attempts to address the same issue of improving query

results with context and it is classified under the same international patent classification G06F 7/00 as the '137 patent. Ex-1004, (51); Ex-1001, (51); Crovella, ¶24.

2. Adomavicius (Ex-1005)

Adomavicius is prior art under pre-AIA §§102(a) and (b) because it was published (March 29, 2005) more than one year before the earliest filing date (June 29, 2011), and was not cited during prosecution. Adomavicius was also publicly accessible through the ACM Digital Library more than one year before the earliest filing date. Crovella, ¶¶25-27.

Adomavicius presents “a multidimensional (MD) approach to recommender systems that can provide recommendations based on additional contextual information.” Ex-1005, Abs., ¶33, ¶32. Adomavicius utilizes a multi-dimensional database to store data, including context and process queries for its multi-dimensional model. Ex-1005, ¶39, 000014 (Fig. 1):

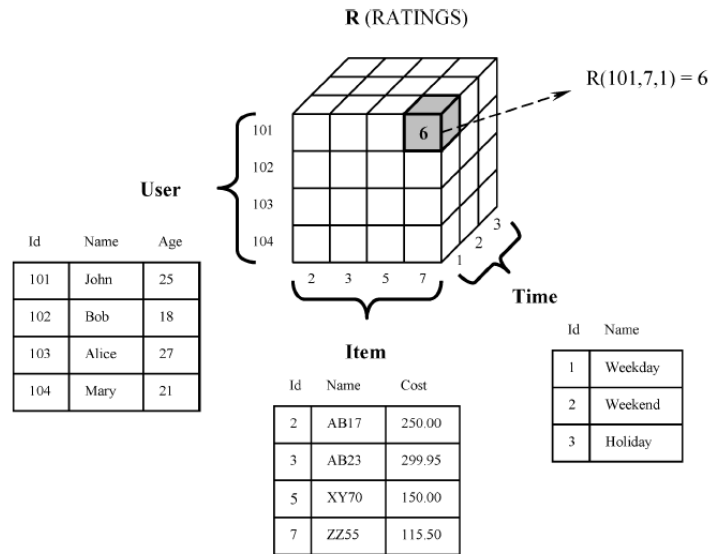


Fig. 1. Multidimensional model for the $User \times Item \times Time$ recommendation space.

Crovella, ¶¶28-29.

Adomavicius is analogous art because it is in the same field of endeavor as the '137 patent. *Infra* §IV. The Adomavicius paper lists among its subject matter categories: “H.3.3 [**Information Storage and Retrieval**]: Information Search and Retrieval—*Information filtering, Selection process.*” Ex-1005, 000002.

Adomavicius’ “multidimensional approach is based on the multidimensional data model used for data warehousing and Online Analytical Processing (OLAP) applications in databases.” Ex-1005, ¶30. Adomavicius’ research covers a “Recommendation Query Language” for carrying out queries in its recommender system. Ex-1005, ¶110. Adomavicius is reasonably pertinent to the problem addressed by the '137 patent’s inventor, because it attempts to address the same issue of improving query results using a similar solution: “provid[ing]

recommendations based on additional contextual information.” Ex-1005, Abs., ¶82; Crovella, ¶30.

3. McNee (Ex-1006)

McNee is prior art under pre-AIA §§102(a) and (b) because it was published (August 2003) in the proceedings for the conference Interact’03 more than one year before the earliest filing date (June 29, 2011), and was not cited during prosecution. Ex-1009, ¶2, ¶4; Ex-1010, ¶¶7-8; Crovella, ¶31-32. McNee was also presented at the conference by one of the co-authors and copies were disseminated at the conference and made available for sale to the interested public. Ex-1009, ¶¶4-6, ¶2; Ex-1010, ¶9; Crovella, ¶33.

McNee discloses a recommender system that provides movie content recommendations in response to user queries, accompanied by a user rating and confidence display. Ex-1006, Abs. McNee displays user ratings on a five-star scale, and the confidence measure with dice icons to convey the accuracy (e.g., riskiness) of the rating. Crovella, ¶34:

Recent DVDs	
1. Beautiful Mind, A (2001)	★★★★★
2. Red Beard (Akahige) (1965)	★★★★★ 
3. From Hell (2001)	★★★★★
4. Traffic (2000)	★★★★★
5. Horse's Mouth, The (1958)	★★★★★ 

Figure 2: Dice icons indicate that The Horse’s Mouth is risky, and that Akahige is very risky, because the system has few ratings for these items.

Ex-1006, Fig. 2.

McNee is analogous art because it is in the same field of endeavor as the ’137 patent. *Infra* §IV. McNee is directed to improvements to recommender systems that “help people find relevant information” (e.g., carry out queries). Ex-1006, ¶0001. McNee is reasonably pertinent to the problem addressed by the ’137 patent’s inventor, because it strives to improve user satisfaction in query results like the ’137 patent. Ex-1006, ¶44; Crovella, ¶35.

4. Ramer (Ex-1007)

Ramer is prior art under pre-AIA §§102(a) and (b) because it was published (October 30, 2007) before the alleged invention and more than one year before the earliest filing date (June 29, 2011), and was not cited during prosecution. Crovella, ¶¶36-37.

Ramer is directed to dynamically selecting content for mobile device users. Ex-1007, Abs. Ramer personalizes search query results based on user

characteristics and context such as locality and time of day. Ex-1007, ¶¶99. Ramer enhances queries to search multiple dimensions: explicit queries are “paired with additional information derived from a related implicit query” to search multiple dimensions. Ex-1007, ¶¶135, Fig. 2. Ramer uses weighting techniques to order and display the query results. Ex-1007, ¶¶166, ¶¶385. Context-sensitive databases that store contextual information in connection with user profile information are used to support such queries. Ex-1007, ¶¶60, ¶¶54; Crovella, ¶¶38-39.

Ramer is analogous art because it is in the same field of endeavor as the ’137 patent. *Infra* §IV. Ramer “relate[s] to the domain of mobile communication facilities and to the domain of searches for content.” Ex-1007, ¶¶36. Ramer describes a platform that refines and carries out queries on databases, and methods that operate on such a platform. Ex-1007, ¶¶39, Fig. 1. Ramer is reasonably pertinent to the problem addressed by the ’137 patent’s inventor, because it employs the context of mobile user devices to improve online search results. Ex-1007, ¶¶4; Crovella, ¶¶40.

IV. LEVEL OF ORDINARY SKILL IN THE ART

The field of the ’137 patent is database and query systems. A hypothetical person of ordinary skill in the art (“POSITA”) in the field of the ’991 patent 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. Crovella, ¶¶41-43.

A POSITA in 2011 would have known and had the skills necessary to:

- Design/implement systems to use query functions, sorting functions, personalization functions, recommendation functions, etc.;
- Design and use data structures according to multi-dimensional schemas, including multi-dimensional data models and data cubes;
- Use database warehousing and OLAP (On-Line Analytical Processing) tools and protocols;
- Implement known algorithms to process data (e.g., for filtering and sorting data); and
- Design/implement displays and interfaces.

Crovella, ¶44.

V. CLAIM CONSTRUCTION

A. “contextual dimension”

There is no such term of art in the field. “Contextual dimension” means “a dimension for comparing user contextual attributes and object contextual attributes” because the ’137 patent defines the term in this way. Ex-1001, claims 1 & 11, 8:28-31. An example from the specification illustrates the concept of

comparing user and object contextual attributes to see whether they are “matched.”

Ex-1001, 8:28-43; Crovella, ¶¶47-48.

B. “contextual relation dimension”

There is no such term of art in the field. “Contextual relation dimension” means “a dimension for evaluating relations among user contextual attributes and object contextual attributes” because the ’137 patent defines the term in this way. Ex-1001, claims 1 & 11, 8:44-47. For example, the relations can be evaluated using “weighting information, priority information, or a combination thereof” (Ex-1001, 8:47-51) and can specify whether the attributes are equivalent or are to be ordered in a specific relation. Ex-1001, 8:52-65; Crovella, ¶¶49-50.

C. “inclusion dimension”

There is no such term of art in the field. “Inclusion dimension” means “a dimension for determining whether to include query results” because the ’137 patent defines the term in this way. Ex-1001, claims 1 & 11, 8:65-9:2. Examples in the specification exclude/order the list of results based on attributes. Ex-1001, 9:2-17; Crovella, ¶¶51-52.

VI. CHALLENGED CLAIMS

A. Grounds 1, 2 and 3: Challenged Claims are Rendered Obvious by Aravamudan in view of Adomavicius, and further in view of McNee and Ramer

The challenged claims (*supra* §III.A) are obvious over the combination of Aravamudan and Adomavicius (Ground 1). Grounds 2 and 3 each teach these claims for the same reasons. Crovella, ¶54.

1. Independent Claim 11

Claim 11 is rendered obvious by Aravamudan and Adomavicius. Crovella, ¶¶55-100.

11[p]. An apparatus comprising:
--

The preamble is taught by Aravamudan by disclosing “methods and systems for selecting and presenting content based on context sensitive user preferences.” Ex-1004, ¶22. Aravamudan discloses apparatuses for carrying out its methods (Ex-1004, ¶86, ¶¶128-129, ¶170, Figs. 1, 10, and 15), which combined with Adomavicius comprises the elements recited in claim 11. Crovella, ¶¶56-58.

[11a] at least one processor; and at least one memory including computer program code for one or more programs, the at least one memory and the computer program code configured to, with the at least one processor, cause the apparatus to perform at least the following,

Aravamudan teaches limitation [11a] by disclosing computerized servers and client devices that comprise processors, memory, and computer program code. Crovella, ¶¶59-64. Aravamudan describes alternative arrangements where “the

learning system” is either hosted on a remote server, “locally resident on local persistent storage 1508” of the user device, or “distributed between local persistent storage 1508 and a server.” Ex-1004, ¶185, ¶58 (“[C]omputational module 110 resides in one or more servers.... [I]n some implementations, ...computational module 110 may reside in the client device.”). Figure 12 depicts the configuration for the first arrangement where the learning system is hosted on a remote server (personal preference service 1202). Figure 13 depicts the configuration for the second arrangement, where the learning system is included in the user device. Crovella, ¶59.

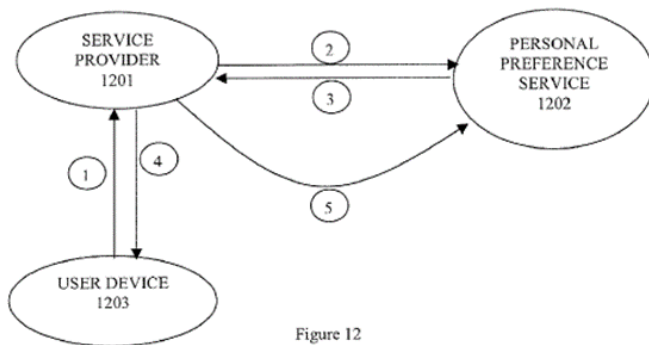


Figure 12

Ex-1004, Fig. 12.

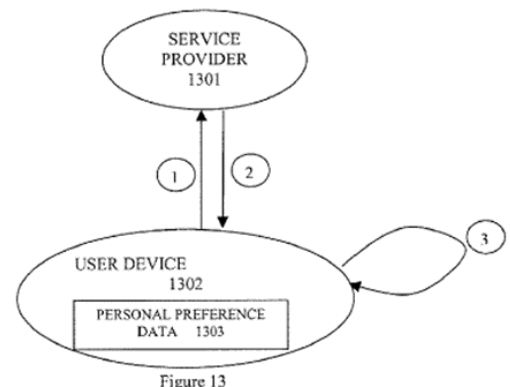


Figure 13

Ex-1004, Fig. 13.

First, in the arrangement of Fig. 12, Aravamudan discloses a learning system that analyzes user activity to compute user preference signatures and return those signatures in response to queries. Ex-1004, Figs. 12 and 1. This learning system is implemented on servers comprising **at least one processor; and at least one memory**. Ex-1004, ¶58 (“[C]omputational module 110 resides in one or more

servers, to exploit the computational power of larger processors.”). The servers have “computer memory” (Ex-1004, ¶119) to store “the learning system, personalization database, and signatures.” Ex-1004, ¶¶184-185. Because the learning system comprises a computational module, a POSITA would have understood the server storage to **include[] computer program code for one or more programs** that embody the computational module. It was well-known and customary for computer servers to store computer programs, including computer programs to provide the instructions for their operation. Crovella, ¶¶59-60.

Second, in the arrangement of Fig. 13, the “computational module 110 may reside in the client device.” Ex-1004, ¶158. Figure 15 of Aravamudan shows an exemplary configuration for client/user devices, which comprise **at least one processor; and at least one memory**. Ex-1004, ¶184 (“[U]ser device can have a processor 1503, volatile memory 1504, [and]...persistent storage 1508.”), Fig. 15:

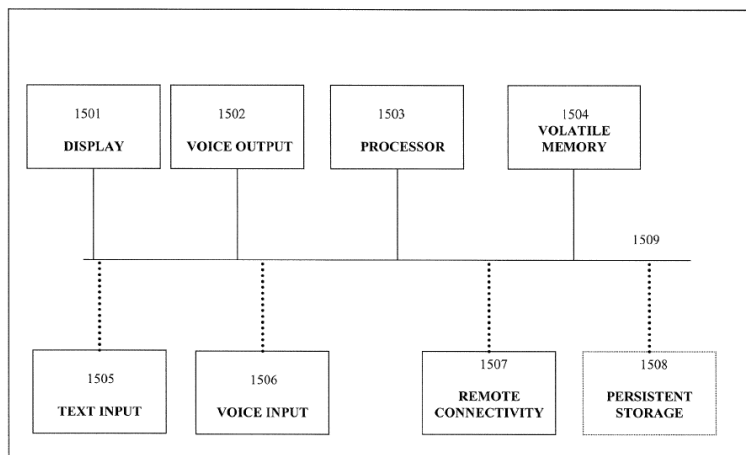


Figure 15

Persistent storage 1508 is memory **including computer program code for one or more programs**. Aravamudan gives some examples: “[p]ersistent storage 1508 can be a removable storage element, such as SD, SmartMedia, or a CompactFlash card.” Ex-1004, ¶185. A POSITA would have recognized this type of memory was used to store computer programs, because such storage was commonly known and used to store computer programs. Because the “computational module 110 may reside in the client device” for the arrangement of Fig. 13, a POSITA would have understood persistent storage 1508 to include computer program code embodying instructions for the computation model. Ex-1004, ¶58; Crovella, ¶61.

Aravamudan’s servers and user devices teach memory including computer program code for one or more programs, the at least one memory and the computer program code configured to, with the at least one processor, cause the apparatus to perform at least the following limitations [11b]-[11d]. Crovella, ¶62.

Aravamudan confirms its teachings can be computer implemented. *See, e.g.*, Ex-1004, ¶164, Claim 16. By 2011, it was customary to implement data processing devices as computers with processors, memory, and computer programs comprising computer program code. Aravamudan’s servers and user devices comprise computers; a POSITA would have understood Aravamudan’s teaching to mean that the persistent storage on the server or user device contains computer

program code for one or more programs configured to execute Aravamudan's methods. Crovella, ¶63.

[11b] 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;

Aravamudan renders obvious limitation [11b] by disclosing queries that are personalized to user preferences and the context of the request, where the user preferences are based on a family's use of a device in the context. Ex-1004, Abs., ¶47; Crovella, ¶¶65-78. *First*, Aravamudan teaches **determin[ing] a multi-dimensional query associated with at least one user device**. For example, Aravamudan "uses [preference] signatures to personalize" queries to search over multiple dimensions. Ex-1004, ¶¶129-130 ("The server system uses the signatures to personalize search results provided to users of the system."). Aravamudan records users' context-based preferences in personalized signatures. Then, user queries are processed and personalized with the signatures. Ex-1004, ¶129 ("[T]he results obtained through a query are identified and reordered by promoting relevance values of individual search results based on the set of signatures."). The information in the signatures (e.g., context and genre) is used as additional search dimensions. *See, e.g.*, Ex-1004, ¶130 ("if the set of signatures indicates, given the particular time and day of the search, that it is likely the user is searching for a

program with the genre of news, the system will promote the relevance values of programs with a genre of news that match the user's query text.”). Crovella, ¶66.

Aravamudan's Figure 12/13 arrangements both disclose further details of query personalization. Figure 12 illustrates the query process with the server-based learning system:

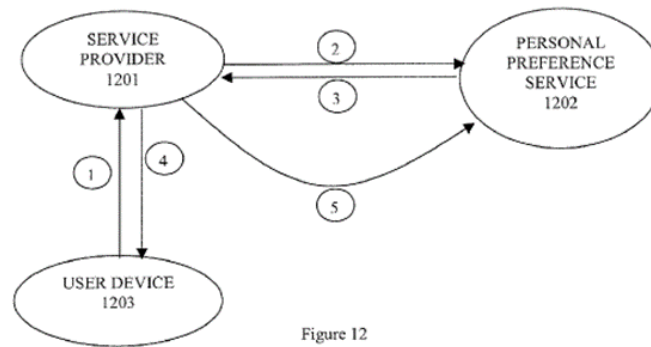


Figure 12

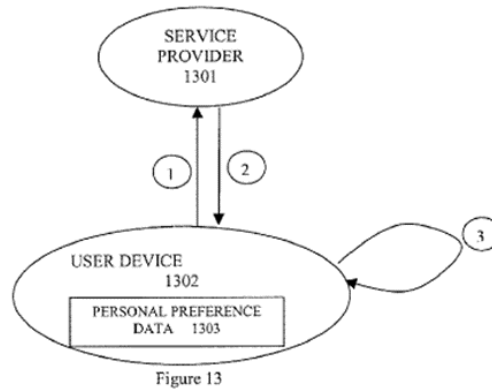
Ex-1004, Fig. 12.

At step 1, query requests are issued from user device 1203 to service provider 1201. Ex-1004, ¶174. Aravamudan discloses a query **associated with at least one user device** because it explains that the request “contains a unique identifier that identifies the user or the user device” and that “[t]he identity could be an anonymous yet unique identifier of the device.” Ex-1004, ¶174. “[T]he communication from user device 1203 to service provider 1201 contains information that describes the context of the request...[] includ[ing] the identifier of the user device currently being employed....” Ex-1004, ¶175; Crovella, ¶67.

At step 2, “service provider 1201 communicates the substance of the request and the additional context information to personal preference service 1202.” Ex-1004, ¶175. At step 3, the learning system hosted on the personal preference service “provide[s] context-sensitive personal preference information” that defines the contours of the query. Ex-1004, ¶175; Crovella, ¶68.

At step 4, “[t]he relevant personal preference information is used by the service provider 1201 to send a targeted response to the user device.” Ex-1004, ¶176. A POSITA would have understood that the system has determined a multi-dimensional query in between steps 3 and 4, at least by refining the query to search over the multiple dimensions specified in the user preference signature corresponding to the user device and context. This allows for “increasing the accuracy of the results of a user’s query for content and organizing these results so as to put the most likely desired content items at the top of the results list.” Ex-1004, ¶48; Crovella, ¶69.

Figure 13 illustrates a similar process for the arrangement with the user device-based learning system. Ex-1004, ¶¶179-180, Fig. 13:



Because the signatures are on the user device, “the context sensitive personal preference information is sent along with the request” to service provider in step 1. In like manner as for the server-based arrangement, a POSITA would have understood the query is determined to search multiple dimensions based on the context-sensitive personal preference information of the user preference signature. Crovella, ¶70.

Aravamudan provides examples of the dimensions used to search video content that go in preference signatures. Ex-1004, ¶84 (The vectors in FIG. 6 correspond to *three different vector spaces—channel, genre, and microgenre*. The dimensions of these vector spaces are the number of channels in the TV system, the number of genres defined in the learning system, and the number of microgenres dynamically created in the learning system, respectively.) (emphasis added), Fig. 6:

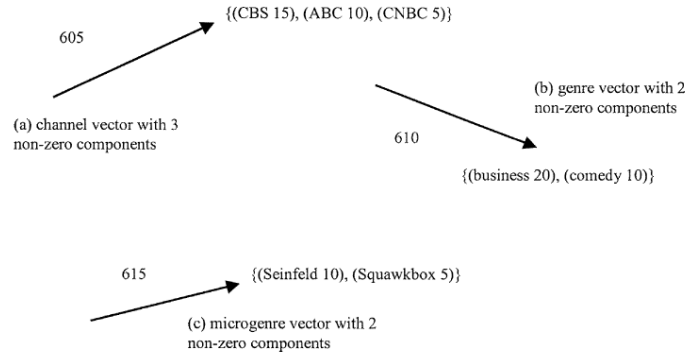


Figure 6

Crovella, ¶71.

Aravamudan tracks and reflects contexts including “geographic location,” “date, day, time, and the category” of content as search dimensions. Ex-1004, ¶23. The query “select[s]...content items from the set based on a comparison of the descriptive terms of the content items...with the learned content preferences of the user associated with the determined context....” Ex-1004, ¶23. The context (e.g., “the particular time and day of the search”) can be further used to disambiguate categories (e.g., channel, genre, microgenre) (Ex-1004, ¶130) or the dataspace subject to the search (e.g., “television, telephone, and web dataspace”) (Ex-1004, ¶88. Crovella, ¶72.

Aravamudan demonstrates an exemplary hierarchy to structure the preference information and contexts for signatures in Figure 2. Ex-1004, ¶62 (“[T]he 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”); Crovella, ¶73. Aravamudan also explains how these are captured in signatures. Ex-1004, ¶53; Crovella, ¶74. Ex-1004, Fig. 2:

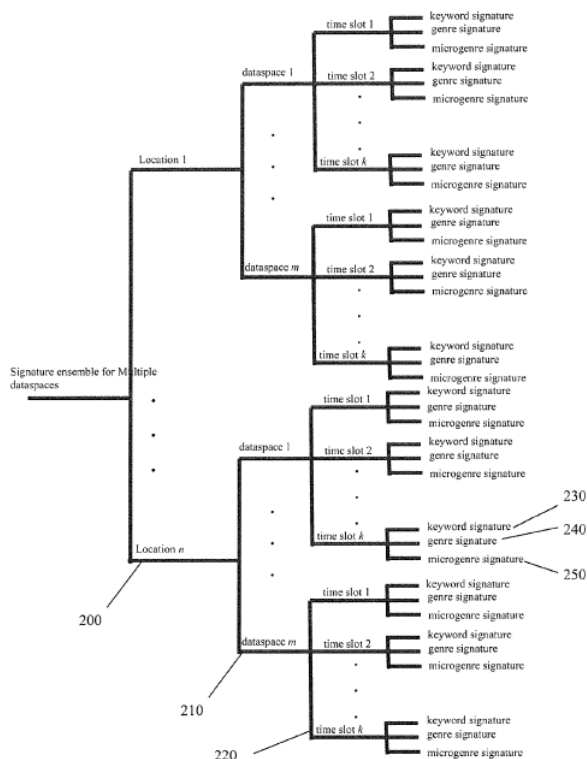


Figure 2

Second, Aravamudan teaches **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 by disclosing that it “will refer to signatures and activities of a single user, when in fact, the same applies to a group of users using a single interface device.”** Ex-

1004, ¶47 (emphasis added). For example, Aravamudan discloses signatures generated for “the users of the family [who] are members of a household using a single interface device.” Ex-1004, ¶47; ¶108 (“a signature s that collectively describes the viewing habits of the household”), ¶69 (“an illustrative family of three—husband, wife, and a child”); Crovella, ¶75

Aravamudan explains that the household persona signature is helpful for devices with limited input-capabilities by simplifying query input. Ex-1004, ¶51. Aravamudan’s query matches the context (e.g., time of day) with preferences deduced from historical activity to efficiently find preferred television programming. *See* Ex-1004, ¶69 (explaining viewing preferences will differ for different family members and their correlated tv viewing times) Aravamudan incorporates the signature to determine a multi-dimensional query that will return the results most likely relevant given the context. Ex-1004, ¶69; Crovella, ¶76.

Aravamudan further confirms that the household signature is **based, at least in part, on more than one person** by disclosing an algorithm for decomposing the household signatures into its constituent information. Ex-1004, ¶¶105-106 (“the number of family members in a signature, the gender of each family member, and the ages of the family members.”), 16:19-42. The algorithm’s pseudo code confirms the signature includes the signatures for individual family members. Ex-1004, ¶117:

Inputs:

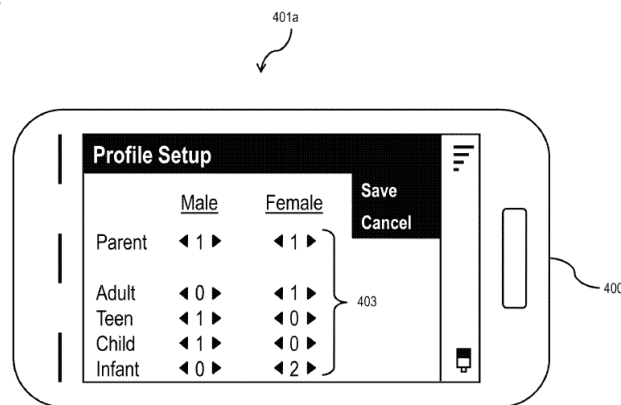
1. The historical probabilities $f_k^y(x)$
2. The family stochastic signature s

Outputs:

1. Number of family members
2. Sex of family members
3. Age of family members
4. Individual signatures of family members

This teaching is consistent with the '137 patent's description of information such as "the gender, type and quantity of individuals associated with the device 400 to setup the persona [(based on more than one person)] associated with the device 400." Ex-1001, 14:6-19, Fig. 4A:

FIG. 4A



Crovella, ¶77.

[11c] cause, at least in part, an execution of the multi-dimensional query on at least one context-sensitive database to generate one or more results; and

The combination of Aravamudan's teachings of personalized multi-dimensional queries (Ex-1004, Abs., ¶47) with Adomavicius' teachings of a context-sensitive database (*see* Ex-1005, [0034]-[0042], [0082]-[0096]) teaches limitation [11c]. Crovella, ¶¶79-92. A POSITA would have been motivated to implement Aravamudan's method and system using a database such as that taught by Adomavicius. Crovella, ¶79, ¶¶86-92.

First, Aravamudan teaches **caus[ing], at least in part, an execution of the multi-dimensional query...to generate one or more results** by executing the query, which has been personalized to search the dimensions based on "context sensitive user preferences," and generating search results. Ex-1004, (54), Abs., ¶15, Fig. 10:

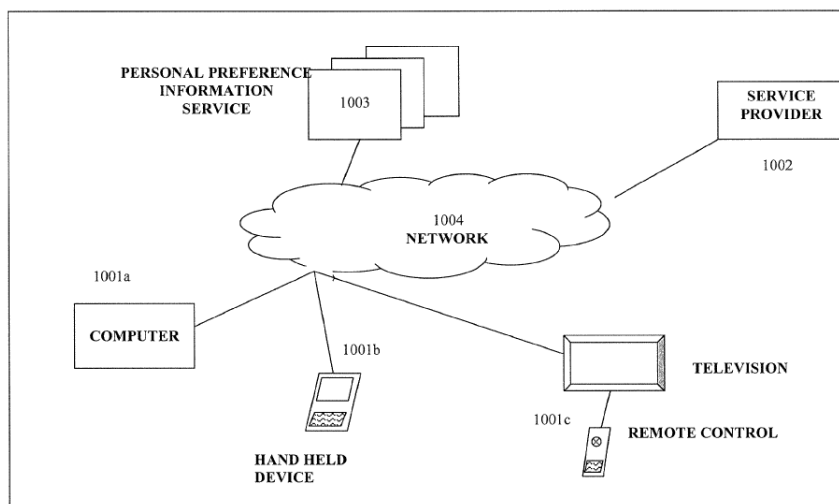


Figure 10

Crovella, ¶80.

Figures 12 and 13 illustrate how queries are directed to remote service providers (step 1) and search results are sent back to the user device in Aravamudan’s two alternative arrangements. Ex-1004, Figs. 12 and 13 (steps 1 and 2):

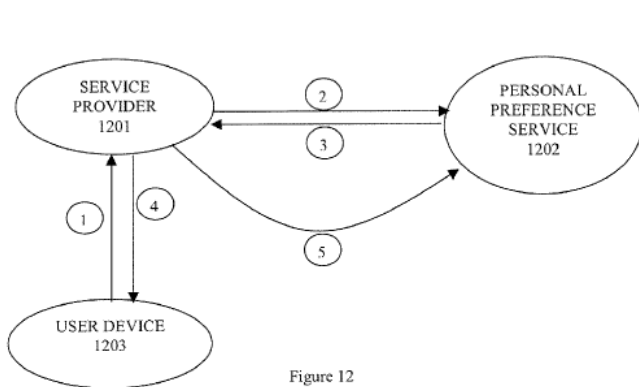


Figure 12

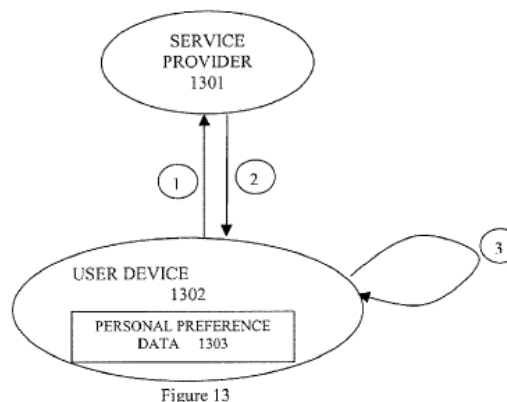


Figure 13

Aravamudan explains: “the search engines work by first gathering significant amounts of results matching the query, and filtering out low relevance results before applying a promotion technique.” Ex-1004, ¶159; Crovella, ¶81.

Aravamudan incorporates contexts such as time, location, and category of content, and the learned past activity of the user for such contexts in its query requests. Ex-1004, ¶23 (“geographic location of the user, date, day, time, and the category of the selected content items.”); *supra* §VI.A.1.[11b]. The results for the query are then generated by “selecting...a collection of content items from the set based on a comparison of the descriptive terms of the content items of the

collection with the learned content preferences of the user associated with the determined context....” Ex-1004, ¶23; Crovella, ¶82.

Second, Adomavicius teaches **a context sensitive database** on which to execute multi-dimensional queries, including for matching movies to user preferences based on the context. For example, Adomavicius follows the “multidimensional data model used for data warehousing and OLAP [(On-Line Analytical Processing)] applications in databases.” Ex-1005, ¶34. The database organizes data over multiple dimensions, including the context of place, time, and companion. Ex-1005, ¶39. Depending on the dimensions of the query, these dimensions can be organized as data cubes as seen in Figure 1. Ex-1005, 000014 (Fig. 1):

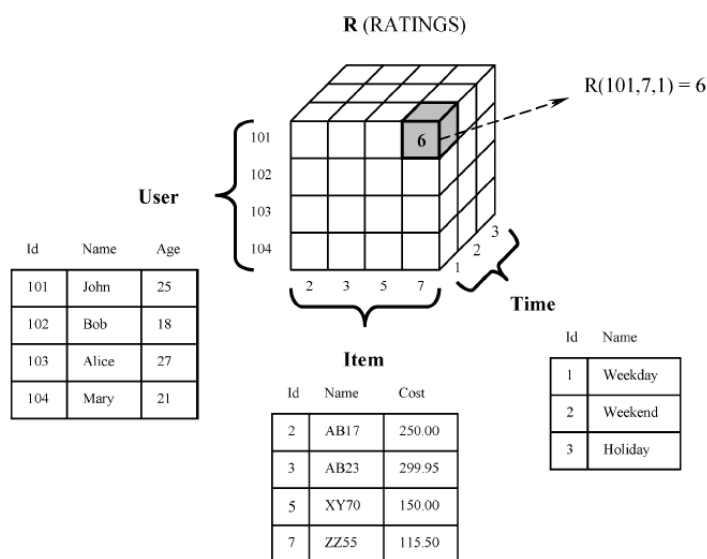


Fig. 1. Multidimensional model for the $User \times Item \times Time$ recommendation space.

Data cubes were a common and well-known technique for organizing, storing, and querying data over multiple dimensions. *Supra* §I. Specifically, Adomavicius discusses the database and rating and search algorithms implemented in an “Multidimensional Movie Recommender System.” Ex-1005, ¶¶82-96; Crovella, ¶83.

Adomavicius’ database is context-sensitive because it stores data that “take into consideration the contextual information about the viewing when recommending a movie, such as when the movie was seen, where, and with whom.” Ex-1005, ¶82. Adomavicius’ database includes information for the contextual dimensions of “time,” “place,” and “companion.” Ex-1005, ¶84. This teaching is commensurate with the ’137 patent that states context-sensitive/context-aware databases are those “storing any type of contextually based information.” Ex-1001, 3:48-52, 13:57-59; Crovella, ¶84.

Motivation to Combine

A POSITA would have been motivated to implement Aravamudan’s teachings of storing context-sensitive user signatures and carrying out personalized multi-dimensional queries to retrieve search results using Adomavicius’ teachings of a context-sensitive database for several reasons. Crovella, ¶¶85-91. *First*, a POSITA would have been motivated because the prior art combination yields predictable results. Aravamudan teaches querying over multiple dimensions based

on context-sensitive user preferences (Ex-1004, Abstract, ¶23) and Adomavicius teaches a multi-dimensional database that is adapted to store, query, and retrieve context-sensitive information (Ex-1005, ¶14, ¶¶82-96). The combination of prior art elements according to known methods yields the predictable results of storing, querying, and retrieving Aravamudan's context-sensitive query results on a context-sensitive database as taught by Adomavicius. Crovella, ¶86.

Second, this would be a simple substitution of one known element for another to obtain predictable results. Aravamudan and Adomavicius teach comparable query and personalization systems that share a similar purpose and architecture (multi-dimensional queries for querying and recommending content using context). Ex-1004, ¶23; Ex-1005, ¶39. Aravamudan does not limit storing its context-sensitive data in any particular type of database. Adomavicius provides supplemental and complementary teachings of specific details of a context-sensitive database. Therefore, a POSITA would have been motivated to implement Aravamudan's teachings using Adomavicius' database. Crovella, ¶87.

Third, A POSITA would have been motivated by the advantages of using established techniques for data warehousing, such as data cubes and OLAP, as well as the improvements Adomavicius teaches on such techniques. For example, multi-dimensional models were known to be faster and more efficient than relational databases in responding to multi-dimensional queries. *Supra* §I. The use of

known techniques and off-the-shelf implementations would save time and cost for development and maintenance. Crovella, ¶88.

Combining Aravamudan's and Adomavicius' teachings would not have changed either reference's principle of operation because it uses teachings from each according to their known principles, in the manner taught by each reference. Aravamudan's context-sensitive querying, preference learning, and multi-dimensional query teachings, when combined with Adomavicius' related teachings, would have still been applied in the manner taught by Aravamudan, just with straightforward changes or additional details disclosed by Adomavicius. Similarly, Adomavicius' teachings would have been applied to Aravamudan in the manner taught by Adomavicius, to implement a context-sensitive database within a recommendation system to provide search results in response to queries specifying context information. The two references teach analogous, compatible devices and methods, that set out to do the same thing using similar methods which a POSITA would have found obvious. Applying Aravamudan's multi-dimensional query teachings and implementing Aravamudan's recommender using Adomavicius' context-sensitive database would have been a simple matter of storing Aravamudan's data in Adomavicius' database and interfacing between the query system and the database, such as matching data formats. Crovella, ¶89.

A POSITA would have had a reasonable expectation of success when combining Aravamudan's and Adomavicius' teachings because they are combined in a conventional manner that does not change any principle of operation but instead simply involves tweaks or the addition of implementation details. The combination is based on compatible devices and techniques in query and recommender systems, the compatible devices themselves utilizing similar content-based approaches. Aravamudan's and Adomavicius' teachings, when combined, would each have been used for their known purposes in the conventional manner taught by each reference. A POSITA would have been more than capable of combining the two references because the combination would determine queries to search multiple dimensions; using the context to enhance the queries; and retrieve the query results from a context-sensitive database; these were well-known in the art. *Supra* §I; Crovella, ¶90.

A POSITA would have been fully capable of combining Aravamudan's and Adomavicius' teachings, including making necessary modifications that would have involved straightforward programming. Context-based recommender systems, multi-dimensional queries, and context-sensitive databases were all known in the prior art. *Supra* §I. The combination is directed to the simpler aspects of combining such known techniques, and integrating and interfacing their inputs and outputs to practice the techniques as taught. Crovella, ¶91.

[11d] determine at least one ordering metric for the one or more results based, at least in part, on one or more user contextual attributes of the at least one user device.
--

Aravamudan renders obvious limitation [11d] by ordering search results using the ordering metric of user preference signatures that are based on the user device's contextual attributes (e.g., location, time, and content category) and the user's past behavior in similar contexts. Ex-1004, ¶23 (“the presentation is ordered at least in part based on...the learned content preferences to select and order subsequent user content search results when the user is within the same context”), 2:66-3:11; Crovella, ¶¶93-100.

Aravamudan determines which user preference signature to use as an ordering metric based on the context of the user device when the query request is made. Aravamudan first determines the context of the query request. Ex-1004, ¶23. Next, preliminary results are generated “by first gathering significant amounts of results matching the query, and filtering out low relevance results.” Ex-1004, ¶159. The preliminary results are then compared to the content items recorded in “the learned content preferences of the user associated with the determined context.” Ex-1004, ¶23. Aravamudan's teaching and the '137 patent are alike in that “the ordering platform 103 determines one or more contexts” (Ex-1001, 11:51-67) and “[t]he at least one ordering metric is based, at least in part, on the current context associated with the device by ordering the object contextual

attributes of the one or more results based on the current context” (Ex-1001, 12:45-13:14); Crovella, ¶95.

Specifically, Aravamudan assigns base relevance values to each item in the search results based on the “popularity of the item in the overall population.” Ex-1004, ¶¶128-129. Next, the user signatures are used to promote the relevance of results that match the user’s preferences. Ex-1004, ¶130 (“[I]f the set of signatures indicates, given the particular time and day of the search, that it is likely the user is searching for a program with the genre of news, the system will promote the relevance values of programs with a genre of news.... Likewise, the system can use the channel and microgenre data...to promote the base relevance values.”); Crovella, ¶96.

Aravamudan provides an example using the “ruthless promotion technique” that always regards previously-accessed items in the signature as more relevant than never before accessed, new results. Ex-1004, ¶131. “The search items are then reordered using the new relevance numbers.” Ex-1004, ¶132. As seen in Table 2, the Cartoon Network and Comedy channels, which were the fourth and third results in Table 1, are reordered to the top of the list based on their past “signature probabilities of 0.7 and 0.3 respectively.” Ex-1004, ¶¶132-133 (Tables 1 and 2):

TABLE 1

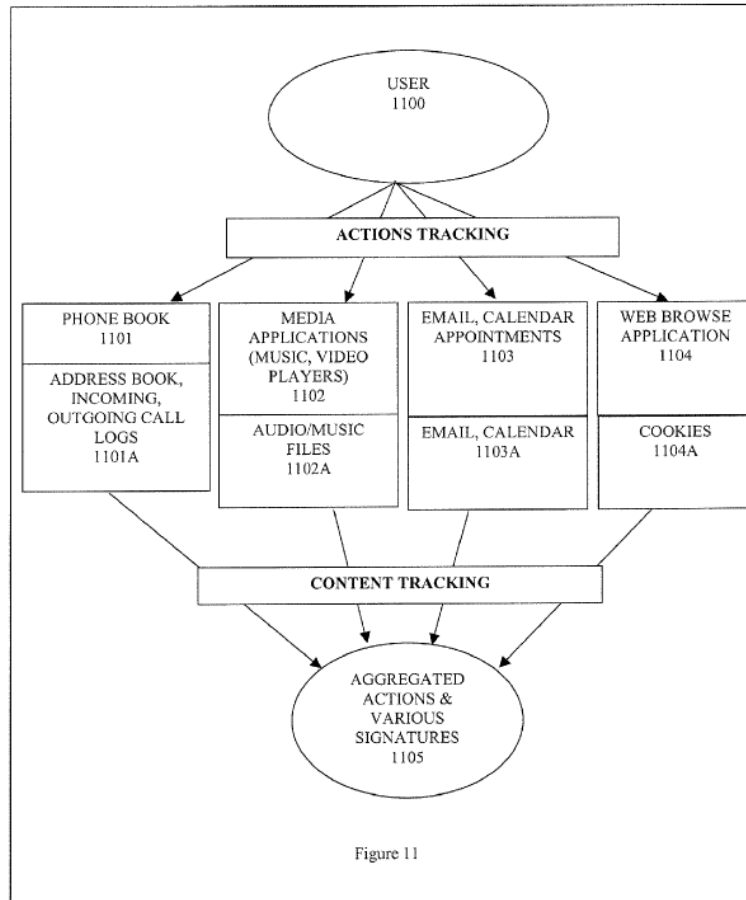
Channel	Relevance Number
CBS	500
CNBC	300
COMEDY	100
CHANNEL	
CARTOON	70
NETWORK	
	...

TABLE 2

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

Crovella, ¶97.

Aravamudan further teaches the user preference signatures are determined by “associating the *determined contexts* of the user selection actions with the user content preferences learned from the corresponding user selections.” Ex-1004, ¶23 (emphasis added). The signature is generated for data collected from, and therefore associated with, a user device. Ex-1004, ¶86 (“Thus, the channel, genre, and microgenre data can be gathered and processed locally by the client device, or this information can be sent to a remote server system for processing.”). Figure 11 illustrates how a user’s activity is tracked and incorporated into signatures. Ex-1004, ¶42, Fig. 11:



Therefore, the ordering metric (e.g., signatures) is **determine[d]...based, at least in part, on one or more user contextual attributes of the at least one user device**. The signatures are also determined from the dataspace context used to promote search results in a similar manner. Ex-1004, ¶87; Crovella, ¶¶98-99.

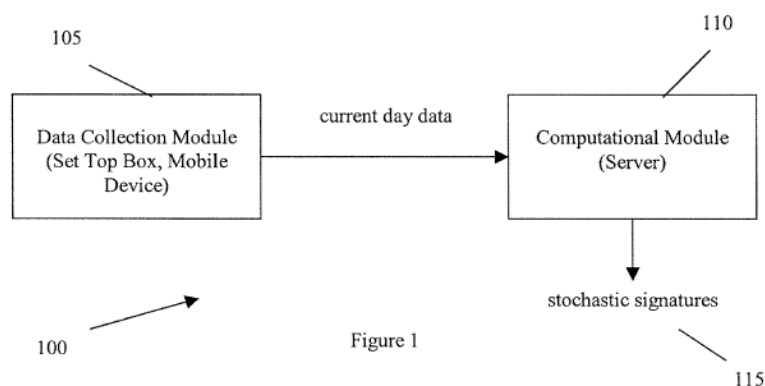
2. Independent Claim 1

Claim 1 is directed to a method of processing data with certain steps. Claim 11 is directed to an apparatus that contains a processor and memory that contains computer code for performing the steps of claim 1's method. Crovella, ¶101. Dr. Crovella provides a side-by-side claim comparison demonstrating the substance of

the independent claims are substantially similar. Crovella, ¶102. The Aravamudan-Adomavicius combination teaches the same limitations of Claim 1 for the same reasons. Crovella, ¶103.

1[p]. A method comprising facilitating a processing of and/or processing (1) data and/or (2) information and/or (3) at least one signal, the (1) data and/or (2) information and/or (3) at least one signal based, at least in part, on the following:

The combination of Aravamudan and Adomavicius teaches the preamble. Crovella, ¶¶104-106. Aravamudan’s **method compris[es]...processing data and/or information** by “selecting and presenting content based on context-sensitive learned user preferences.” Ex-1004, Abs., ¶¶22-30, ¶¶128-129. Aravamudan’s method further comprises **facilitating a processing of...data and/or information** by collecting user preference data and processing at computation module 110 to generate signatures that are used during the search. Ex-1004, ¶53, Fig. 1:



Crovella, ¶105.

The data and information Aravamudan processes and facilitates processing is **based, at least in part, on** the processing carried out by Aravamudan's apparatuses as discussed above and below for limitations [11b]-[11d]/[1a]-[1c]. Crovella, ¶¶105-106.

- [1a] 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;**
- [1b] an execution of the multi-dimensional query on at least one context-sensitive database to generate one or more results; and**
- [1c] a determination of at least one ordering metric for the one or more results based, at least in part, on one or more user contextual attributes of the at least one user device.**

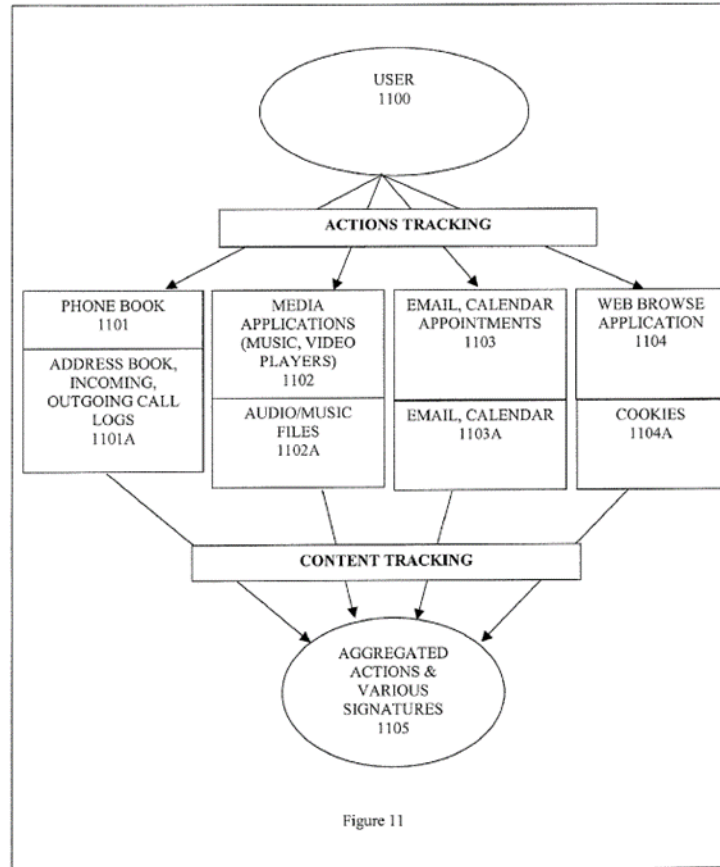
The combination of Aravamudan and Adomavicius teaches these limitations. As explained above, the combination of Aravamudan and Adomavicius teaches the shared substantive limitations of [11b]-[11d] (*supra* §§VI.A.1, incorporated here by reference) that correspond to limitations [1a]-[1c]. Crovella, ¶107.

3. Dependent Claims 2/12

Claims 1/11 were discussed above. The additional limitations of claims 2/12 are rendered obvious by Aravamudan, and further rendered obvious by Adomavicius. Crovella, ¶¶108-123.

- | |
|---|
| <p>2[a]. A method of claim 1, wherein the (1) data and/or (2) information and/or (3) at least one signal are further based, at least in part, on the following: a determination of one or more object contextual attributes associated with the one or more results,</p> <p>12[a]. An apparatus of claim 11, wherein the apparatus is further caused to: determine one or more object contextual attributes...,</p> |
|---|

First, Aravamudan teaches this limitation, by determining which “dataspace context” a search result is most likely to be in, so as to reorder the results based on their dataspace attributes. Ex-1004, ¶87. Aravamudan’s dataspace is related to the logical context of what the user was doing. Ex-1004, ¶172 (“(2) the nature of the action (e.g. tuning to a channel or the purchase of a book, DVD, or airline ticket)”). Content and other items have corresponding dataspace attributes based on the dataspace that they are used in. Ex-1004, ¶171; *e.g.*, Ex-1004, Fig. 11 (content 1101a-1104a corresponding to dataspaces 1101-1104 on a mobile device):



See also Ex-1004, ¶¶88-89 (examples of signatures with dataspace); Crovella, ¶¶109-110.

Second, the Aravamudan-Adomavicius combination further teaches this limitation. Crovella, ¶¶111-117. Adomavicius teaches object contextual attributes constituting the places and times that content can be seen. Ex-1005, ¶39. A POSITA would have found it obvious and would have been motivated to include Adomavicius' information on availability in Aravamudan's content entries. Aravamudan teaches a query process that compares the content items of the search results with the content preferences in user's signatures based on the context. Ex-

1004, ¶23; *supra* §VI.A.1.[11d]. The signatures include the contextual attributes of location, dataspace, and time slot as seen in Figure 2:



Figure 2

Ex-1004, Fig. 2. The combination would carry out a determination of the places and times that the search result contents can be seen in order to compare these with the context information in the user preference signatures. Crovella, ¶¶111-112.

Motivation to Combine

A POSITA would have found the combination obvious and been motivated to include Adomavicius' availability information in Aravamudan's recommender system for a number of reasons. Crovella, ¶¶113-117. *First*, combining Adomavicius' teachings of context of the availability in the data entries with

Aravamudan's context-sensitive queries would yield the predictable results of providing the contextual attribute of availability with the search results. The references teach similar multi-dimensional query-based recommender systems and both teach using context in queries. Ex-1004, Abs., ¶23; Ex-1005, ¶14, ¶¶82-96; Crovella, ¶114.

Second, the combination would use known techniques to improve similar devices and methods in the same way. Aravamudan and Adomavicius teach comparable query and personalization systems that share a similar purpose and architecture. Both teach multi-dimensional queries that are used to provide recommendations to users based on contextual information, and both illustrate their techniques with examples of querying and recommending content. Ex-1004, ¶23; Ex-1005, ¶39. Due to the similarities, a POSITA would naturally have looked to Adomavicius' teachings to include object contextual attributes such as the places and times that content is available to improve the search results of Aravamudan. Crovella, ¶115.

Third, a POSITA would have been motivated because the context of availability is important to the usability of search results. Adomavicius' teachings are applicable to Aravamudan's television content that is subject to scheduling and geographic restrictions. Providing this information and using it for ordering would be a simple way to provide more value to a user. A POSITA would have realized

similar benefits applied for other search items (e.g., products or restaurants).

Crovella, ¶116.

The combination would not have changed either reference’s principle of operation; a POSITA would have had a reasonable expectation of success in combining the teachings; and a POSITA would have been fully capable of combining the teachings. Similar reasons apply to adding Adomavicius’ availability context to Aravamudan’s set of content data, as they did to claim 11. *Supra* §VI.A.1.[11c] (motivation to combine, incorporated by reference); Crovella, ¶117.

[2b] wherein the at least one ordering metric is further based, at least in part, on the one or more object contextual attributes.

[12b]

First, Aravamudan teaches this limitation by reordering search results with relevance values based in part on the dataspace context. As discussed above, Aravamudan promotes the relevance value of a given search result as a function of the entry’s dataspace. *Supra* §VI.A.1.[11d]. The results are promoted proportionately to the dataspace fraction signature (“dfs”) that matches the dataspace context of a search result. Ex-1004, ¶89. Thus, the ordering metric is further based in part on the contextual attribute of dataspace. Crovella, ¶¶118-119.

Additionally, Aravamudan teaches calculating an “unconditional signature” for search results in a dataspace that do not match a historical signature. Ex-1004,

¶¶91-92. These search results are assigned “a measure of the probability of a user performing a given action outside of a particular dataspace” based on Equation 4. Ex-1004, ¶¶91-92, Equation 4. The ordering metric is further based, in part, on the contextual attribute of dataspace in this case. Crovella, ¶120.

Second, the Aravamudan-Adomavicius combination further teaches this limitation. As discussed above, the combination would compare the places and times that the search result contents can be seen with the context information in the user preference signatures. *Supra* §VI.A.3.[2a]/[12a]. The search results with corresponding places and times in the user preference signatures would then be assigned adjusted (promoted) relevance values that would determine their order as taught by Aravamudan. *Supra* §VI.A.1.[11d]. Because the user preference signatures corresponding to the current context are used, a POSITA would have understood the combination to prioritize the results with matching places and times that can be seen. Thus, the ordering metric (e.g., relevance values) is based, at least in part, on object contextual attributes (e.g., places and times the content can be seen). Crovella, ¶121.

Motivation to Combine

A POSITA would have been motivated to combine Aravamudan and Adomavicius. Crovella, ¶122. The same reasons discussed above for limitations [2a]/[12a] apply here because limitations [2b]/[12b] recite a specific application of

Adomavicius' availability attribute to order the query results, which improves the query results. *Supra* §VI.A.3.[2a]/[12a] (incorporated by reference).

The combination would not have changed either reference's principle of operation; a POSITA would have had a reasonable expectation of success in combining the teachings; and a POSITA would have been fully capable of combining the teachings. Similar reasons apply to adding Adomavicius' availability context to Aravamudan's set of content data, as they did to claim 11. *Supra* §VI.A.1.[11c] (motivation to combine, incorporated by reference); Crovella, ¶123.

4. Dependent Claims 6/16

- 6. A method of claim 2, wherein the at least one ordering metric is based, at least in part, on a weighted sum, a weighted average, or a combination thereof of one or more dimensions of the multi-dimensional query.**
- 16. An apparatus of claim 12, wherein the at least one ordering metric....**

The additional limitation of claims 6/16 are rendered obvious by Aravamudan's teaching of weighting the user preference signatures based on frequency, recency, and length of use. Ex-1004, ¶24 ("weighting the learned content preferences of the user according to...recency of selection..., number of selections..., and time of use of the content item...."); Crovella, ¶¶124-126. Aravamudan determines an ordering metric using the user preference signatures

that reflect user preferences based on past selection of content in a given context.

Supra §VI.A.1.[11d]; Crovella, ¶125.

Aravamudan further explains how the user preference signatures apply these weighted probabilities to one or more dimensions. For example, the combined probability used to calculate the relevance number for reordering the content items with the ruthless promotion technique are calculated using the “aggregated promotion formula” (Equation 25):

$$\tilde{r}_i = \left[\sum_{1 \leq k \leq 6} (M + 1)^k e^{p_i^{(k)}} \right]$$

Ex-1004, ¶134, ¶135 (“In Equation 25, the superscript on the probabilities, $p_i^{(k)}$ refers to time slot channel, microgenre, genre, followed by composite channel, microgenre, and genre signatures, with increasing values of k , respectively. Since they are being multiplied by powers of $(M+1)$, a natural relevance importance is implied.”). While further explaining the integration of periodicity of signatures in this calculation, Aravamudan states that “[i]n order to form an aggregate signature, the vectors from the overlapping signatures *are added together and renormalized.*” Ex-1004, ¶136 (emphasis added). That is, the probabilities are calculated using a weighted average of the probabilities for the dimensions of channel, microgenre, and genre. Because Aravamudan uses the composite, normalized probability as an ordering metric, a POSITA would have understood that Aravamudan’s ordering

metric is based, in part, on a weighted average of one or more dimensions of the multi-dimensional query. Crovella, ¶126.

5. Dependent Claims 9/19

Claims 1/11 were discussed above. The additional limitations of claims 9/19 are rendered obvious by Ground 1. Crovella, ¶¶127-137.

9[p]. A method of claim 1, wherein the multi-dimensional query specifies, at least in part, one or more contexts associated with the at least one user device, and the (1) data and/or (2) information and/or (3) at least one signal are further based, at least in part, on the following:

19[p]. An apparatus of claim 11, wherein the multi-dimensional query specifies, at least in part, one or more contexts associated with the at least one user device, and the apparatus is further caused to:

The Aravamudan-Adomavicius combination teaches claims 1 and 11, including the identical language (data/information/signal) between the preambles of claims 1 and 9. *Supra* §§VI.A.2.[1p], VI.A.1-2. The combination teaches the additional language of **wherein the multi-dimensional query specifies, at least in part, one or more contexts associated with the at least one user device**. As discussed above for limitation [11b], Aravamudan’s user device issues a request with “information that describes the context of the request...[] includ[ing] the identifier of the user device currently being employed, the location of the user device, if available, the time of the request, and general description of the action the user is performing.” Ex-1004, ¶175; *Supra* §VI.A.1.[11b]; Crovella, ¶128.

- | |
|--|
| <p>[9a] a processing of the one or more user contextual attributes to select from among the one or more personas, the one or more contexts, or a combination thereof,</p> <p>[19a] process and/or facilitate a processing of the one or more user contextual attributes to select...,</p> |
|--|

Aravamudan teaches **a processing of the one or more user contextual attributes to select from among...the one or more contexts** by determining the user contextual attributes of the user device to select the context to be associated with the user's query. Ex-1004, ¶175 ("Service provider 1201 communicates the substance of the request and the additional context information to personal preference service 1202 (step 2). The context information includes the identifier of the user device currently being employed, the location of the user device, if available, the time of the request, and general description of the action the user is performing..."), ¶23; Crovella, ¶¶129-134.

Aravamudan processes the user contextual attributes and the dataspace fraction signatures to select the context of the preferred activity, e.g., the user's preferred dataspace:

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. However, the matching results from the phone-space would be promoted over the results from the TV-space and the web-space because the dataspace fraction signature probability for the phone-space is the greatest. This is so even though the probability for the

lone TV-space item is greater than any of the phone-space items.

Within the phone space, the individual items would be sorted according to the keyword signature probability values. Therefore, the entry for Sally would be promoted over the other phone-space items.

Ex-1004, ¶89; Crovella, ¶130.

Aravamudan also **teaches a processing of the one or more user contextual attributes to select from among the one or more personas** by using the context of the time of day to distinguish between the preferences of different family members, such as wife, child, and husband. Ex-1004, ¶69 (“For example, in an illustrative family of three—husband, wife, and a child—mornings and afternoons are taken up by soap operas and talk shows; afternoons are taken up by cartoons and children's programming; and evenings are taken up by business, movies, and prime time shows.”). Aravamudan explains that “[t]he day is divided into time slots because each family of users has a recurring viewing behavior based on the time of day.” Ex-1004, ¶68. The learning system captures these behaviors in signatures as discussed above for limitation [11b]. *Supra* §VI.A.1.[11b]; Crovella, ¶131.

A POSITA would have found it obvious to categorize the signatures in the family user persona based on the individual user persona, because it was well-known to save and store individual user profiles (Ex-1004, ¶¶19-20) and Aravamudan teaches a hierarchical structure for maintaining signatures (*see* Ex-

1004, Fig. 2). Aravamudan builds on the prior art by teaching the use of group personas, not to supplant, but to complement the conventional use of individual personas. Ex-1004, ¶47; Crovella, ¶132.

A POSITA would have realized the advantages of classifying the signatures by the individual users that are part of the family persona. Indeed, Aravamudan proposes using the context of time slots to match query results with the preferences of the individual user that is most likely correlated with that time slot. Ex-1004, ¶68 (“Any queries for television content that originate in that time slot on a later day can use these preferences to identify and organize content by using that time slots signature.”). By classifying or categorizing the signatures by individual users, and then selecting the appropriate set of signatures by selecting the user persona based on the context, the learning system would be able to provide more pertinent results outside of the time slot. For example, the query results could recommend programming or content that is preferred by or relevant to the individual user, which is not directly tied to the current time context or even if the user has no habitual use pattern for the current time slot. A POSITA would have found it obvious from Aravamudan’s teaching and been motivated to use Aravamudan’s signatures in this manner. Crovella, ¶133.

Because Aravamudan teaches processing a user contextual attribute both to select from among the one or more personas, and to select from among the one or

more contexts, the combination of Aravamudan and Adomavicius satisfies this limitation in either way. Crovella, ¶134.

[9b] wherein the at least one ordering metric is based, at least in part, on the selected one or more personas, the selected one or more contexts, or a combination thereof.

[19b] wherein the at least one ordering metric....

Aravamudan teaches this limitation. Because Aravamudan teaches both wherein the at least one ordering metric is based in part on the selected one or more contexts, and wherein it is based in part on the selected one or more personas, the combination of Aravamudan and Adomavicius satisfies this limitation in either way. Crovella, ¶¶135-137.

First, Aravamudan teaches **wherein the at least one ordering metric is based, at least in part, on...the selected one or more contexts** by ordering search results using the selected context. Ex-1004, Abs. (“The method includes, in response to subsequent user input, determining a context of said subsequent input and selecting and ordering a collection of items based on comparing those items' descriptive terms with the user's learned content preferences associated with the determined context in which the user entered the subsequent input.”), 2:45-56, 2:61-3:11. Specifically, Aravamudan orders the results based on user category preferences associated with the context, e.g., a selected preferred dataspace. Ex-1004, ¶87 (“This two-coordinate signature is used to reorder the search results

space when a search across dataspace is performed....Therefore, when the user initiates a search across all dataspace, the system will reorder content items from the multiple dataspace according to the user's dataspace preferences based on the information contained in the dataspace fraction signature.”), 3:38-43. As discussed above for limitation [11d], Aravamudan bases its ordering metric on different contextual attributes and orders the query results. The same analysis applies here as to the selected context. *Supra* §VI.A.1.[11d] (incorporated by reference); Crovella, ¶135.

Second, Aravamudan also teaches **wherein the at least one ordering metric is based, at least in part, on the selected one or more personas**. As discussed above for limitations [9a] and [19a], Aravamudan teaches selecting a user persona out of the family members based on the context of the time of day. *Supra* §VI.A.5.[9a]/[19a]. In the same manner as discussed above for limitation [11d], Aravamudan orders the search results using the signatures of the user persona specified for the query. *Supra* §VI.A.1.[11d]. A POSITA would have found it obvious, based on Aravamudan’s teachings, and been motivated to specify the individual user persona with the query for the reasons discussed above for limitations [9a]/[19a]. *Supra* §VI.A.5.[9a]/[19a] (incorporated by reference); Crovella, ¶136.

6. Dependent Claims 10/20

Claims 1/11 were discussed above. The additional limitations of claims 10/20 are rendered obvious by Ground 1. Crovella, ¶¶138-146.

- 10[a]. A method of claim 1, wherein the (1) data and/or (2) information and/or (3) at least one signal are further based, at least in part, on the following: a determination of contextual information, interaction information at a user interface of the at least one user device, or a combination thereof associated with the at least one user device; and**
- 20[a]. An apparatus of claim 11, wherein the apparatus is further caused to: determine contextual...; and**

Aravamudan teaches this limitation. Because Aravamudan teaches a determination of both contextual information and interaction information at a user interface of the at least one user device, associated with the at least one user device, the combination of Aravamudan and Adomavicius satisfies this limitation in either way. Crovella, ¶¶139-142. Aravamudan teaches **a determination of contextual information...associated with the at least one user device** by determining the context associated with the user device at the time of the request. Ex-1004, ¶23 (“The method further includes, in response to receiving subsequent incremental input entered by the user, determining a context of said subsequent incremental input.”). The details of what kind of contextual information is determined and how it is used were discussed above for limitation [11d] and claims 2/12. *Supra* §§VI.A.1.[11d], VI.A.3; Crovella, ¶140.

Aravamudan teaches a **determination of...interaction information at a user interface of the at least one user device...associated with the at least one user device**. For example, Aravamudan's data collection module collects information about the user's interaction with the user interface of the user device. Ex-1004, ¶53 ("Data collection module 105 monitors the user activity for channel tuning, DVR recording, etc. and captures the relevant statistics of the activity. In the case of a mobile device, additional information is collected, such as the type of dataspace being visited (e.g., phone book, calendar, and downloadable media content), geographic location of the mobile device, etc."). This determination of the user's interaction is tracked across the interfaces of multiple devices. Ex-1004, ¶167 ("This comprehensive personalization across diverse user activities and devices is especially helpful to the user when the user interacts with the same service provider using different interface devices."). One example Aravamudan gives of such interaction information that is determined and saved is "the amount of time the user spends in each dataspace." Ex-1004, ¶87; ¶171 ("FIG. 11 illustrates the local tracking and strengthening of the personal preference signatures based on user activity and the content on a mobile device."); Crovella, ¶141.

- [10b] a processing of the contextual information, the interaction information, or a combination thereof to determine, at least in part, the one or more user contextual attributes.**
- [20b] process and/or facilitate a processing of the contextual....**

Aravamudan teaches this limitation. Because Aravamudan teaches a determination of both contextual information and interaction information at a user interface of the at least one user device, associated with the at least one user device, the combination of Aravamudan and Adomavicius satisfies this limitation in either way. Crovella, ¶¶143-146.

Aravamudan teaches **a processing of the contextual information...to determine, at least in part, the one or more user contextual attributes.** For example, Aravamudan determines the context associated with the user device at the time of the request. Ex-1004, ¶23 (“The method further includes, in response to receiving subsequent incremental input entered by the user, determining a context of said subsequent incremental input.”). Aravamudan processes the contextual information to assign contextual attributes (e.g., “descriptive tags” representing the context) to the various actions when saving signatures and to transmit the “descriptive tags” to retrieve the corresponding preference information from the learning system. Ex-1004, ¶175. The details of what kind of contextual information is collected and how it is used was discussed above for limitation [11d] and claims 2/12. *Supra* §§VI.A.1.[11d], VI.A.3; Crovella, ¶144.

These and related disclosures of Aravamudan also teach **a processing of...the interaction information...to determine, at least in part, the one or more user contextual attributes**. For example, Aravamudan discloses that the user's activities can be provided as context to third party services. Ex-1004, ¶169 (“The context-sensitive personal preference information service 1003 enables the external service provider 1002 to provide a targeted response to the user based on user's prior activity, data access history, and the learned user preferences.”), 29:13-24. Aravamudan gives an example where the user's recent interaction with the user device to book flights is processed to determine the “background context” to be provided to the automated voice response system of a travel agency. Ex-1004, ¶168; Crovella, ¶145.

B. Ground 2: Challenged Claims are Rendered Obvious by Aravamudan in view of Adomavicius, further in view of McNee.

Ground 1 was discussed above. Certain challenged claims (*supra* §III.A) are rendered obvious over the combination of Aravamudan, Adomavicius, and McNee. Crovella, ¶¶147-173.

1. Dependent Claims 3/13

Claims 2/12 were discussed above for Ground 1. The additional limitations of claims 3/13 are rendered obvious by Ground 2. Crovella, ¶¶148-162.

- 3[a]. A method of claim 2, wherein the (1) data and/or (2) information and/or (3) at least one signal are further based, at least in part, on the following: a determination of an accuracy, a precision, a resolution, or a combination thereof of the one or more object contextual attributes; and**
- 13[a]. An apparatus of claim 12, wherein the apparatus is further caused to: determine an accuracy...; and**

The Aravamudan-Adomavicius-McNee combination teaches this limitation.

A POSITA would have found it obvious and would have been motivated to use McNee’s confidence measure of user ratings in the combined content recommender of Aravamudan and Adomavicius. Crovella, ¶¶149-156.

McNee teaches **a determination of an accuracy, a precision, a resolution, or a combination thereof of the one or more object contextual attributes** by determining the accuracy of user ratings for content (e.g., movies) with the number of ratings as a “confidence” measure of the accuracy of the rating. Ex-1006, ¶18 (Figure 1 shows that movie predictions in MovieLens for movies with many ratings are more accurate than those with few ratings....The movies are grouped into bins of 20: 1-20 ratings, 21-40, etc.”), ¶19 (“This graph suggests that the number of ratings an item has can be used as a simple, non-personalized measure of confidence for predictions in a recommender system.”); Crovella, ¶150.

Depending on the number of ratings, McNee classifies the average rating as risky (likely inaccurate), very risky (highly inaccurate), or not risky (accurate). Ex-1006, ¶20 (“Movies recommended with few ratings were considered ‘risky’

movies.”). “[M]ovies with fewer than 40 ratings were considered very risky and were marked with two dice. Movies with 41 to 80 ratings were marked with one die [(risky)].” Ex-1006, ¶20 (emphasis added). A POSITA would understand that the movies with more than 80 ratings were considered not risky (meaning the rating is accurate), because McNee states that “29% of the movies would be considered risky, with two-thirds of these receiving two dice [(very risky)].” Ex-1006, ¶20. Therefore, the remaining 71% not rated risky were considered sufficiently accurate to not be risky. Crovella, ¶151.

McNee explains the number of ratings can be used as a measure for the accuracy of the ratings because a larger sample size results in more accurate information. Ex-1006, ¶17 (“more ratings for an item the system has, the better it knows that item. Thus, for an item with few ratings, it is plausible that a recommender system could make less accurate predictions.”); *see also*, Ex-1006, ¶4 (“Though MovieLens has over 70,000 users and 6 million ratings, many of its 6,000 films have few ratings. ...[S]ince the recommendation is based on little data, the recommendation is less likely to be correct.”). This relation between sample size and accuracy or precision was a well-known principle in statistics. Crovella, ¶152. McNee further presents empirical results that confirm this from the sample database used in the study:

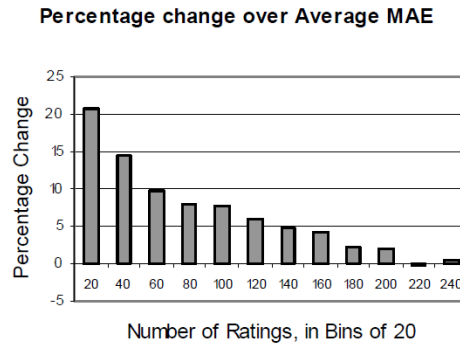


Figure 1: Percentage above average MAE in MovieLens recommendations, grouped by how many ratings the system has for each item recommended. The y-axis represents the percentage increase over the average, while the x-axis shows the number of ratings each movie had, binned into groups of 20. Movies with few ratings have higher error.

Ex-1006, Fig. 1. Figure 1 shows more deviation between smaller numbers of ratings, while average ratings with more ratings had less deviation, reflecting a higher consensus, and therefore a higher accuracy of the rating. Thus, the number of ratings is used as “a statistical measure of the confidence of a recommendation.” Ex-1006, ¶10. Crovella, ¶152.

Motivation to Combine

A POSITA would have been motivated to include McNee’s confidence measure of user ratings in the content recommendation results in the combination of Aravamudan and Adomavicius, for a number of reasons. *First*, McNee suggests using its confidence measure in all collaborative filtering based recommendation systems. Ex-1006, ¶¶16-17 (explaining the confidence measure is “a metric that all CF-based systems could employ. Ratings are at the core of all CF-based systems.”). Both Aravamudan and Adomavicius teach providing content

recommendations in response to search queries. Ex-1004, ¶15; Ex-1005, ¶110. Aravamudan teaches improvements to collaborative filtering and content reordering. Ex-1004, ¶¶22-30, ¶¶16-21. And Adomavicius teaches a multi-dimensional recommendation model that builds on hybrid content-collaborative filtering techniques. Ex-1005, ¶33, ¶¶41-42, ¶¶25-32. Adomavicius teaches a collaborative recommender system that is based upon a user ratings-based collaborative filtering scheme. Ex-1005, ¶¶15-24; Crovella, ¶¶153-154.

Second, a POSITA would have been motivated to use McNee's confidence metric because it increases user satisfaction at a very small additional cost. For example, it is simple to implement. As McNee states, "[t]his metric is extremely simple to calculate and can be easily implemented in any recommender system..." Ex-1006, ¶19. Indeed, it needs little more than keeping track of the number of user ratings that are stored in the database for each item. At the same time, it is "the simplest metric...that correlated well with actual error." Ex-1006, ¶21. Because it is correlated well with the error, a POSITA would have realized that McNee's confidence measure enhances the search results by providing useful information that would aid a user in evaluating search results. Crovella, ¶155.

As discussed above for claim 11, combining Aravamudan's and Adomavicius' teachings would not have changed either reference's principle of operation; a POSITA would have had a reasonable expectation of success in

combining the teachings; and a POSITA would have been fully capable of combining the teachings. *Supra* §VI.A.1.[11c] (motivation to combine). The combination with McNee merely adds another data item (the confidence measure), which is simple to calculate, to the combination's database. Similar reasons as for claim 11 apply here with respect to McNee's teachings. *Supra* §VI.A.1.[11c] (motivation to combine, incorporated by reference); Crovella, ¶156.

- [3b] **a display of one or more representations of the accuracy, the precision, the resolution, or a combination thereof.**
- [13b] **cause, at least in part, a display of one or more representations of the accuracy, the precision, the resolution, or a combination thereof.**

The Aravamudan-Adomavicius-McNee combination teaches this limitation. A POSITA would have found it obvious and would have been motivated to display the confidence measure of user ratings in the combined content recommender of Aravamudan and Adomavicius. Crovella, ¶¶157-162.

McNee teaches **a display of one or more representations of the accuracy, the precision, the resolution, or a combination thereof** by displaying the confidence measure using an icon of two dice, one die, or no dice. Ex-1006, Fig. 2:

Recent DVDs	
1. Beautiful Mind, A (2001)	★★★★★
2. Red Beard (Akahige) (1965)	★★★★★ 
3. From Hell (2001)	★★★★★
4. Traffic (2000)	★★★★★
5. Horse's Mouth, The (1958)	★★★★★ 

Figure 2: Dice icons indicate that The Horse's Mouth is risky, and that Akahige is very risky, because the system has few ratings for these items.

The dice icons represent the accuracy (e.g., confidence measure) of the user rating. As McNee puts it, the dice icon display is a “visual indication of risk.” Ex-1006, Fig. 3. As discussed for limitation [3a] above, McNee’s confidence measure based on the number of user ratings is a determination of the accuracy of the content’s rating. *Supra* §VI.B.1.[3a]/[13a]; Crovella, ¶¶158-159.

Motivation to Combine

As discussed above for limitations [3a]/[13a], a POSITA would have been motivated to use McNee’s confidence measure in the combined recommender system of Aravamudan and Adomavicius. The same reasons apply here because the advantages of using the confidence measure relate to displaying the information to users as McNee explains. *Supra* §VI.B.1.[3a]/[13a] (motivation to combine, incorporated by reference); Crovella, ¶160.

Indeed, McNee suggests using its confidence measure display in similar recommendation systems, because it allows users to “make better-informed

decisions” and “inspire[s] trust in the system.” Ex-1006, ¶5, ¶42. McNee states that “[a]dding a confidence display to a recommender system increases user satisfaction.” Ex-1006, ¶44, Abs. Aravamudan and Adomavicius each teach recommender systems that could benefit from the advantages of McNee’s confidence measure and display. A POSITA would have been motivated to use McNee’s confidence display in the combined recommender system of Aravamudan and Adomavicius in order to “improve user satisfaction and alter user behavior in a recommender system.” Ex-1006, Abs; Crovella, ¶161.

As discussed above for claim 11, combining Aravamudan’s and Adomavicius’ teachings would not have changed either reference’s principle of operation; a POSITA would have had a reasonable expectation of success in combining the teachings; and a POSITA would have been fully capable of combining the teachings. *Supra* §VI.A.1.[11c] (motivation to combine). The combination with McNee merely displays the confidence measured discussed above for limitations [3a]/[13a]. Similar reasons as for claim 11 apply here with respect to McNee’s teachings. *Supra* §VI.A.1.[11c] (motivation to combine, incorporated by reference); Crovella, ¶162.

2. Dependent Claims 4/14

4. **A method of claim 3, wherein the (1) data and/or (2) information and/or (3) at least one signal are further based, at least in part, on the following: a determination of the accuracy, the precision, the resolution, or a combination thereof based, at least in part, on sensor information, survey information, user update information, or a combination thereof.**
14. **An apparatus of claim 13, wherein the apparatus is further caused to: determine the accuracy....**

The additional limitations of claims 4/14 are rendered obvious by the Aravamudan-Adomavicius-McNee combination. Crovella, ¶¶163-168. McNee teaches **a determination of the accuracy, the precision, the resolution, or a combination thereof based, at least in part, on sensor information, survey information, user update information, or a combination thereof** by basing its confidence measure on user provided ratings. Ex-1006, ¶2 (“MovieLens (www.movielens.org) is a CF-based movie recommender where *users rate movies....*”) (emphasis added); Crovella, ¶¶164-168.

A POSITA would have understood McNee’s users to “submit ratings” in response to a survey. Ex-1006, ¶47. As evinced by Adomavicius, it was well-known and customary to provide users with surveys to rate content or other items, in order to “predict the rating of an item for a particular customer based on how other customers previously rated the same item.” Ex-1005, ¶15. *See also, e.g.,* Ex-1005, ¶84 (describing the process of collecting ratings from users of the website

imdb.com using a “Web survey”). Thus, the user ratings constitute survey information, and the confidence measure is **based, at least in part, on survey information**. Crovella, ¶165.

Additionally, McNee teaches its confidence measure is **based, at least in part, on user update information**. McNee explains that “CF works by having users rate items (e.g., books or movies).” Ex-1006, ¶2. Therefore, a POSITA would have understood the confidence measure (e.g., number of user ratings) to be based on user update information. The confidence measure is based on the number of ratings, which is updated every time another user provides a rating. As the number of ratings increases and crosses each threshold level, the confidence measure evolves from very risky, to risky, to not risky, as discussed above for limitations [3a]/[13a]. *Supra* §VI.B.1.[3a]/[13a]; Crovella, ¶166.

Motivation to Combine

A POSITA would have been motivated to combine McNee with Aravamudan and Adomavicius. *Supra* §VI.B.1.[3a]/[13a], §VI.B.1.[3b]/[13b] (motivation to combine, incorporated by reference). The same reasons apply here because the benefits of McNee’s confidence measure relies on users providing ratings in response to surveys and to update information. As McNee explains, “[r]atings are at the core of all CF-based systems. Whether explicitly entered or implicitly gathered, the more ratings the system has for a user, the better the

system knows the user.” Ex-1006, ¶17. This is because “CF works by having users rate items (e.g., books or movies) and then matching users who express similar preferences.” Ex-1006, ¶2; Crovella, ¶167.

As discussed above for claim 11, combining Aravamudan’s and Adomavicius’ teachings would not have changed either reference’s principle of operation; a POSITA would have had a reasonable expectation of success in combining the teachings; and a POSITA would have been fully capable of combining the teachings. *Supra* §VI.A.1.[11c] (motivation to combine). The combination with McNee merely determines the confidence measure using conventional means contemplated in Aravamudan and Adomavicius. Similar reasons as for claim 11 apply here with respect to McNee’s teachings and that analysis is incorporated here by reference. *Supra* §VI.A.1.[11c] (motivation to combine, incorporated by reference); Crovella, ¶168.

3. Dependent Claims 5/15

5. A method of claim 4, wherein the (1) data and/or (2) information and/or (3) at least one signal are further based, at least in part, on the following: an updating of the one or more object contextual attributes at the at least one context-sensitive database based on the determined accuracy, the determined precision, the determined resolution, or a combination thereof.
15. An apparatus of claim 14, wherein the apparatus is further caused to: cause, at least in part, an updating....

The additional limitations of claims 5/15 are rendered obvious by the Aravamudan-Adomavicius-McNee combination. Crovella, ¶¶169-174. The combination teaches **an updating of the one or more object contextual attributes at the at least one context-sensitive database based on the determined accuracy**. For example, McNee discloses presenting the aggregate, e.g., average user rating, as the number of stars along with the confidence measure display. Ex-1006, Fig. 2:

Recent DVDs	
1. Beautiful Mind, A (2001)	★★★★★
2. Red Beard (Akahige) (1965)	★★★★★ 
3. From Hell (2001)	★★★★★
4. Traffic (2000)	★★★★★
5. Horse's Mouth, The (1958)	★★★★★ 

Figure 2: Dice icons indicate that The Horse's Mouth is risky, and that Akahige is very risky, because the system has few ratings for these items.

A POSITA would have found it obvious to save the aggregate user confidence rating and confidence metric as an additional object contextual attribute in order to reduce the time to display the rating and confidence metric. A POSITA would have realized that it would be much more efficient to calculate the rating and the number of whenever a user rating was updated and to store this attribute for quick and easy retrieval. Crovella, ¶171.

Therefore, a POSITA would have found it obvious to update the contextual attribute of an average confidence rating and accuracy in the combined recommender system. How the confidence measure is updated as the user ratings are updated was discussed above. *Supra* §VI.B.1.[3a]/[13a]. The updated confidence measure stored as a contextual attribute would have to be updated to keep the display accurate when presented to a user. Crovella, ¶172.

Motivation to Combine

A POSITA would have been motivated to combine McNee with Aravamudan and Adomavicius. *Supra* §VI.B.1.[3a]/[13a], §VI.B.1.[3b]/[13b]. The same reasons apply here because the benefits of McNee's confidence measure relies on users providing ratings in response to surveys and to update information. Ex-1006, ¶17 (“[r]atings are at the core of all CF-based systems. Whether explicitly entered or implicitly gathered, the more ratings the system has for a user, the better the system knows the user.”), ¶2; Crovella, ¶173.

As discussed above for claim 11, combining Aravamudan's and Adomavicius' teachings would not have changed either reference's principle of operation; a POSITA would have had a reasonable expectation of success in combining the teachings; and a POSITA would have been fully capable of combining the teachings. The combination with McNee merely updates the confidence measure when data is updated. Similar reasons as for claim 11 apply here with respect to McNee's teachings. *Supra* §VI.A.1.[11c] (motivation to combine, incorporated by reference); Crovella, ¶174.

C. Ground 3: Challenged Claims are Rendered Obvious by Aravamudan in view of Adomavicius, further in view of Ramer.

Ground 1 was discussed above. Certain challenged claims (*supra* §III.A) are rendered obvious over the combination of Aravamudan, Adomavicius, and Ramer. Crovella, ¶¶175-188.

1. Dependent Claims 7/17

7. **A method of claim 6, wherein the one or more dimensions include, at least in part, (i) a contextual dimension for comparing the one or more user contextual attributes and the one or more object contextual attributes, (ii) 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, and (iii) an inclusion dimension for determining whether to include respective ones of the one or more results in a result list.**
17. **An apparatus of claim 16, wherein the one or more dimensions include, at least in part, (i) a contextual dimension....**

The Aravamudan-Adomavicius-Ramer combination renders the additional limitations of claims 7/17 obvious. Crovella, ¶¶176-185. *First*, Ramer teaches **wherein the one or more dimensions include, at least in part, (i) a contextual dimension for comparing the one or more user contextual attributes and the one or more object contextual attributes** by comparing user characteristics with object characteristics, including contextual attributes such as “a user transaction, a geographic location, geographic proximity, a user device, [or] a time,” to rank, order, or index search results, or to prioritize the relevance of the search results. Ex-1007, ¶109. For example, Ramer provides example contextual “parameters relating to a user may include age (27), sex (male), previous user transactions (purchase of a jazz recording), and geographic location (New York City).” And discusses matching contextual attributes to prioritize relevant results to the location and music preference of the user. Ex-1007, ¶109. A POSITA would have

understood the object's attributes to have been compared with the user's attributes, because that is the simplest way to find matches. Crovella, ¶177.

Ramer provides additional detail as to how the contexts of location, time, and previous behavior may be used to filter search results. Ex-1007, ¶470. It was well known that the operation of filtering involved comparing parameters to include or reject items based on whether the parameters are equal or not. Ramer's teachings and use of user's and object's contextual attributes are commensurate to the '137 patent's example of a contextual dimension as "defin[ing] the most ideally matched object contextual attribute compared to a user contextual attribute." Ex-1001, 8:28-43; Crovella, ¶178.

Second, Ramer teaches including **(ii) 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** by weighting search results so that different attributes (e.g., aspects) have different weights. Ex-1007, ¶385 ("A mobile content rank may include any and all rankings of aspects of the mobile content....*Each aspect may be weighted such that all aspects may not contribute equally to the total rank.*"). Because the attributes are weighted and the weights are not equal, a POSITA would have understood the contextual attributes to be in mathematical relations. Crovella, ¶179.

Ramer discloses the relative weighting of attributes may be evaluated and determined in various manners, such as using “sponsorship algorithms, algorithms related to auctions, algorithms related to pay per click, algorithms related to pay per call, or other algorithms.” Ex-1007, ¶166. A user’s “interaction information is...stored and analyzed in the aggregate in order to derive weights...” Ex-1007, ¶882. Crovella, ¶180.

Ramer’s teachings of generating weighting information using context such as past behavior, subscriber characteristics, or the communication facility (geographic) characteristics are commensurate to the ’137 patent’s definition of a contextual relation dimension as “specif[ying] weighting information, priority information, or a combination thereof of the one or more user contextual attributes, the one or more object contextual attributes, or a combination thereof.” Ex-1001, 8:44-65. Crovella, ¶181.

Third, Ramer teaches including **(iii) an inclusion dimension for determining whether to include respective ones of the one or more results in a result list** by determining whether to include or exclude results. Ex-1007, ¶372 (“The additional information stored in these databases may form search parameters *that limit the search query and the display of result set(s) by omitting information, prioritizing information (...), highlighting a subset of the search result set, or ordering the display of information based upon a sponsor auction (...).*”) (emphasis

added). Specifically, Ramer provides the examples of using location or parental controls to determine whether to include or exclude results in the list to be presented to the user. Ex-1007, ¶300 (“The platform may [] omit entirely restaurants that are not in Boston (and, hence, of minimal relevance to the user)...”), ¶427 (“In embodiments, a search query may be disambiguated on a mobile communication facility 102 by ordering the results based, in part, on information relating to the mobile communication facility 102, such as mobile subscriber characteristics 112, a search algorithm facility 144, parental controls 150, carrier business rules 130, or sponsorship information.”) Crovella, ¶182.

Ramer’s teachings of including/excluding search results based on user contextual attributes are commensurate to the ’137 patent’s example of an inclusion dimension as “determin[ing] whether objects that include object contextual attributes that do not conform to the user contextual attributes are included or excluded in a list of objects presented to the user.” Ex-1001, 8:44-65. Crovella, ¶183.

Motivation to Combine

Combining Ramer’s weighting and filtering methods with Aravamudan’s recommender system and Adomavicius’ context-sensitive database would be the combination of prior art elements according to known methods to yield predictable results. A POSITA would have naturally looked to a reference like Ramer to

improve the query results of Aravamudan and Adomavicius, because Ramer discloses a search engine that utilizes context of the user device, like Aravamudan and Adomavicius, to enhance query results. *E.g.*, Ex-1007, ¶372. The combination would have yielded the predictable results of weighting Aravamudan's and Adomavicius' parameters and filtering the search results using Ramer's weighting algorithms and filtering methods. Crovella, ¶184.

Ramer, Aravamudan, and Adomavicius all teach similar recommender systems that operate on similar principles. Therefore, the combination would not have changed the principle of operation of any of these references. A POSITA would have had a reasonable expectation of success in combining such similar systems. Applying Ramer's techniques to Aravamudan, Adomavicius, or the combination of Aravamudan and Adomavicius would have been well within the knowledge and skills of a POSITA. *See supra* §IV; Crovella, ¶185.

2. Dependent Claims 8/18

- 8. A method of claim 7, wherein the contextual relation dimension specifies weighting information, priority information, or a combination thereof for the one or more user contextual attributes, the one or more object contextual attributes, or combination thereof.**
- 18. An apparatus of claim 17, wherein....**

The Aravamudan-Adomavicius-Ramer combination renders the additional limitations of claims 8/18 obvious. Crovella, ¶¶186-188. Ramer teaches this limitation by weighting search results so that different attributes (e.g., aspects)

have different weights to contribute to the rank. Ex-1007, ¶385 (“*Each aspect may be weighted such that all aspects may not contribute equally to the total rank.*”).

As discussed above, a POSITA would have understood the weighting information to define contextual relations between user contextual attributes. *Supra* §VI.C.1 (subsection discussing limitations [7(ii)/17(ii)]); Crovella, ¶187.

Motivation to Combine

As discussed above for claims 7/17, a POSITA would have been motivated to combine Ramer’s weighting, and filtering methods with Aravamudan’s recommender system and Adomavicius’ context-sensitive database. The same reasons and analysis apply here. *Supra* §VI.C.1 (motivation to combine, incorporated by reference). The combination would not have changed the principle of the references and a POSITA would have had a reasonable expectation of success. Crovella, ¶188.

VII. CONCLUSION

For the foregoing reasons, Petitioner requests *inter partes* review and that the challenged claims be canceled as unpatentable.

VIII. DISCRETIONARY ANALYSIS FOR REVIEW

Fintiv. Discretionary denial is not warranted because this Petition’s merits are compelling, which “alone demonstrates that the PTAB should not discretionarily deny institution under *Fintiv*.” *See* June 21, 2022 Memorandum, 3-

5. No case management conference has occurred and no case schedule has issued in the parallel district court case.

Advanced Bionics. Denial under §325(d) is likewise unwarranted because Aravamudan, Adomavicius, McNee, and Ramer were not cited or considered during prosecution. This is the only IPR filed against the challenged claims to date. *General Plastic* factors do not weigh against institution.

IX. MANDATORY NOTICES AND FEES

1. **Real Party In Interest:** The real parties-in-interest here are Amazon.com, Inc. and Amazon.com Services, LLC. No other parties directed, controlled, or funded this Inter Partes Review proceeding (IPR).

2. **Related Matters:**

- *Nokia Corporation and Nokia Technologies Oy v. Amazon.com, Inc. and Amazon.com Services, LLC*, Case No. 1-23-cv-01236 (D. Del.)

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

4. **Service Information:** Petitioner consents to service by electronic mail addressed to:

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CPonder@sheppardmullin.com;

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

5. **Fees:** The Office is authorized to charge fees for this Petition to Deposit Account 50-4561, Ref. 19AG-385608.

Respectfully submitted,

SHEPPARD, MULLIN,
RICHTER & HAMPTON LLP

/Harper Batts/
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Attorneys for Petitioner

CLAIM APPENDIX

1[p]. A method comprising facilitating a processing of and/or processing (1) data and/or (2) information and/or (3) at least one signal, the (1) data and/or (2) information and/or (3) at least one signal based, at least in part, on the following:

[1a] 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;

[1b] an execution of the multi-dimensional query on at least one context-sensitive database to generate one or more results; and

[1c] a determination of at least one ordering metric for the one or more results based, at least in part, on one or more user contextual attributes of the at least one user device.

2[a]. A method of claim 1, wherein the (1) data and/or (2) information and/or (3) at least one signal are further based, at least in part, on the following:

a determination of one or more object contextual attributes associated with the one or more results,

[2b] wherein the at least one ordering metric is further based, at least in part, on the one or more object contextual attributes.

3[a]. A method of claim 2, wherein the (1) data and/or (2) information and/or (3) at least one signal are further based, at least in part, on the following:

a determination of an accuracy, a precision, a resolution, or a combination thereof of the one or more object contextual attributes; and

[3b] a display of one or more representations of the accuracy, the precision, the resolution, or a combination thereof.

4. A method of claim 3, wherein the (1) data and/or (2) information and/or (3) at least one signal are further based, at least in part, on the following:

a determination of the accuracy, the precision, the resolution, or a combination thereof based, at least in part, on sensor information, survey information, user update information, or a combination thereof.

5. A method of claim 4, wherein the (1) data and/or (2) information and/or (3) at least one signal are further based, at least in part, on the following:

an updating of the one or more object contextual attributes at the at least one context-sensitive database based on the determined accuracy, the determined precision, the determined resolution, or a combination thereof.

6. A method of claim 2, wherein the at least one ordering metric is based, at least in part, on a weighted sum, a weighted average, or a combination thereof of one or more dimensions of the multi-dimensional query.

7. A method of claim 6, wherein the one or more dimensions include, at least in part, (i) a contextual dimension for comparing the one or more user contextual attributes and the one or more object contextual attributes, (ii) 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, and (iii) an inclusion dimension for determining whether to include respective ones of the one or more results in a result list.

8. A method of claim 7, wherein the contextual relation dimension specifies weighting information, priority information, or a combination thereof for the one or more user contextual attributes, the one or more object contextual attributes, or combination thereof.

9[p]. A method of claim 1, wherein the multi-dimensional query specifies, at least in part, one or more contexts associated with the at least one user device, and the (1) data and/or (2) information and/or (3) at least one signal are further based, at least in part, on the following:

[9a] a processing of the one or more user contextual attributes to select from among the one or more personas, the one or more contexts, or a combination thereof,

[9b] wherein the at least one ordering metric is based, at least in part, on the selected one or more personas, the selected one or more contexts, or a combination thereof.

10[a]. A method of claim 1, wherein the (1) data and/or (2) information and/or (3) at least one signal are further based, at least in part, on the following:

a determination of contextual information, interaction information at a user interface of the at least one user device, or a combination thereof associated with the at least one user device; and

[10b] a processing of the contextual information, the interaction information, or a combination thereof to determine, at least in part, the one or more user contextual attributes.

11[p]. An apparatus comprising:

[11a] at least one processor; and

at least one memory including computer program code for one or more programs,

the at least one memory and the computer program code configured to, with the at least one processor, cause the apparatus to perform at least the following,

[11b] 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;

[11c] cause, at least in part, an execution of the multi-dimensional query on at least one context-sensitive database to generate one or more results; and

[11d] determine at least one ordering metric for the one or more results based, at least in part, on one or more user contextual attributes of the at least one user device.

12[a]. An apparatus of claim 11, wherein the apparatus is further caused to: determine one or more object contextual attributes associated with the one or more results,

[12b] wherein the at least one ordering metric is further based, at least in part, on the one or more object contextual attributes.

13[a]. An apparatus of claim 12, wherein the apparatus is further caused to: determine an accuracy, a precision, a resolution, or a combination thereof of the one or more object contextual attributes; and

[13b] cause, at least in part, a display of one or more representations of the accuracy, the precision, the resolution, or a combination thereof.

14. An apparatus of claim 13, wherein the apparatus is further caused to:
determine the accuracy, the precision, the resolution, or a combination thereof based, at least in part, on sensor information, survey information, user update information, or a combination thereof.

15. An apparatus of claim 14, wherein the apparatus is further caused to:
cause, at least in part, an updating of the one or more object contextual attributes at the at least one context-sensitive database based on the determined accuracy, the determined precision, the determined resolution, or a combination thereof.

16. An apparatus of claim 12, wherein the at least one ordering metric is based, at least in part, on a weighted sum, a weighted average, or a combination thereof of one or more dimensions of the multi-dimensional query.

17. An apparatus of claim 16, wherein the one or more dimensions include, at least in part, (i) a contextual dimension for comparing the one or more user contextual attributes and the one or more object contextual attributes, (ii) 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, and (iii) an inclusion dimension for determining whether to include respective ones of the one or more results in a result list.

18. An apparatus of claim 17, wherein the contextual relation dimension specifies weighting information, priority information, or a combination thereof for the one or more user contextual attributes, the one or more object contextual attributes, or combination thereof.

19[p]. An apparatus of claim 11, wherein the multi-dimensional query specifies, at least in part, one or more contexts associated with the at least one user device, and the apparatus is further caused to:

[19a] process and/or facilitate a processing of the one or more user contextual attributes to select from among the one or more personas, the one or more contexts, or a combination thereof,

[19b] wherein the at least one ordering metric is based, at least in part, on the selected one or more personas, the selected one or more contexts, or a combination thereof.

20[a]. An apparatus of claim 11, wherein the apparatus is further caused to:
determine contextual information, interaction information at a user interface of the at least one user device, or a combination thereof associated with the at least one user device; and

[20b] process and/or facilitate a processing of the contextual information, the interaction information, or a combination thereof to determine, at least in part, the one or more user contextual attributes.

CERTIFICATE OF SERVICE

The undersigned hereby certifies that on September 18, 2024, true and correct copies of the foregoing Petition for *Inter Partes* Review of U.S. Patent No. 9,390,137 and Exhibits 1001-1012 were served in entirety on the Patent Owner at the following address of record as listed on PAIR, via Priority Mail Express®:

Ditthavong, Steiner & Mlotkowski
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Alexandria, VA 22314

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The undersigned certifies that true and correct copies of the Petition for *Inter Partes* Review of U.S. Patent No. 9,390,137 and Exhibits 1001-1012 were also sent via electronic mail to the attorneys of record for Plaintiff in the concurrent litigation matter(s):

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

1. This Petition complies with the type-volume limitation of 14,000 words, comprising 13,969 words, as counted using the Microsoft Word software that was used to prepare this paper, excluding the parts exempted by 37 C.F.R. § 42.24(a).

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

Respectfully submitted,

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