Title: DATA PROCESSING AND GENERATION OF AGGREGATED USER DATA

Abstract: A method, device and system are disclosed in which static user data of a user is acquired from a plurality of data provider sources, each data provider source providing a set of static user data. Dynamic user data is acquired from at least one user source. A processor identifies one or more similarities and/or one or more dependencies between the sets of static user data and one or more associations between the dynamic user data and the static user data. The one or more associations, similarities and/or dependencies, are aggregated within a user data structure along with at least a portion of the static user data and at least a portion of dynamic user data.
Data Processing and Generation of Aggregated User Data

Field of the Disclosure

The present disclosure relates to data processing, for example the processing of static user data and dynamic user data, and/or the matching of user data with online service content. For example, the data processing described in this disclosure permits the generation and processing of aggregated user data in the form of profiles which can be known as “portraits”.

Background

The provision of online user data services has grown very significantly in recent years. Users access multiple online services and store a multitude of different types of static data across these services. Such services are typically offered by an online portal hosted on one or more servers and provide access to large amounts of service content data stored in vast databases. For certain types of service, users are able to register individually for each service by providing certain user information to the service; this information is individual for each user, is custom to each service, and is static, i.e. it does not change unless updated manually by the user. This static data may contain basic information about the user, including their characteristics, and additionally user preference information. One advantage of registration-type services is that service content data which is particularly relevant to individual users can be surfaced to each of those users. Examples of such services are search engines, social media/network websites, e-commerce sites, review websites, travel portals, etc.

In addition, over recent years a large quantity of additional, dynamically changing data has become available to “connected” user equipment containing or connected to a vast array of data generation, data input and data storage components. This user equipment is integrated or connected to devices which enable communication of components of the equipment to electronic devices which may include mobile phones, such as smartphones, tablet devices, laptops etc. Moreover, there is now a vast array of other user-associated electronic devices which fall within the definition of “connected” user equipment, for example: televisions, media players, even household equipment such as heating control devices, proximity sensors, vehicle control systems, refrigerators etc. The data generation and data input components of this user equipment may include dynamic data sources obtained from, for example, location determination components or sensors, orientation and movement sensors, light sensors, image and video generation devices, such as cameras, pressure sensors, temperature sensors, touch-sensitive input devices or displays, keypads, machine-readable code readers etc.
The user equipment is typically associated with one user and has the capacity to create and dynamically change data corresponding to its associated user at particular times of day, e.g. user location and movement, user activity, user health data, environmental data, such as weather data, user interactions with other services, user communications, such as emails, social messages, etc..

With each user now accessing and registering with very many services, each requiring their own static user data, there are a number of problems. The large number of services means that it is very difficult for users to ensure that their static data across their various services is continually kept up to date with the most recent and relevant user information. As a result, the data which is surfaced to users by each service is not necessarily the most relevant for the user at a particular time or location, particularly taking into account that the static data may be out of date, or does not contain a complete set of all relevant static data which may in fact be available from a given user. Additionally, the amount of dynamic data that can now be generated by user equipment is vast, and is generated continually. Furthermore, each individual service may have its own data processing and matching algorithms whereby the identical or similar user data is individually processed by each service; this can lead to identical or similar data processing taking place across multiple services which is wasteful on data processing, data storage and data transmission resources. With so much data, it has become very difficult to store, maintain and process user data efficiently, whether it be multiple sets of static user data corresponding to multiple services, or large amounts of dynamic user data which is being constantly generated from multiple components of user equipment.

The disclosure provided herein aims to solve the aforementioned problems.

Summary of the Invention

The present disclosure discloses a computer-implemented method of processing user data which comprises acquiring static user data of a user from a plurality of data provider sources, each data provider source providing a set of static user data; acquiring dynamic user data from at least one user source; identifying with a processor one or more similarities and/or one or more dependencies between the sets of static user data; identifying with a processor one or more associations between the dynamic user data and the static user data; aggregating within a user data structure the one or more associations, similarities and/or dependencies, along with at least a portion of the static user data and at least a portion of dynamic user data; and storing the aggregated user data structure in memory.
The static user data of the present disclosure may comprise one or more of user identifying information, user characteristics, user preferences, user contact information, or user generated content, such as image and/or video data. Meanwhile, the dynamic user data may comprise one or more of environmental data obtained from user equipment of the user, location data of user equipment of the user, communication data obtained from user equipment of the user, message data obtained from user equipment of the user, and sentiment data obtained from user equipment of the user.

The present disclosure also discloses computer implemented methods for acquiring the dynamic user data and/or acquiring the static user data. In particular, the dynamic user data and/or the static user data may be acquired by pushing the static and/or dynamic user data to the processor, or by transmitting the static and/or dynamic user data to the processor based on a request from the processor. Furthermore, dynamic user data may be pushed from the user equipment to the processor and acquired continuously or at predetermined intervals. The data contained within the aggregated user data structure, which is stored in memory, may be dynamically updated following changes in the dynamic user data.

In another aspect, the present disclosure discloses a computer method of processing dynamic user data from ill-defined data content such as emails, text messages, internet browsing histories, social media messages and feeds from user equipment. The method comprises acquiring dynamic user data from at least one user source corresponding to a user; identifying context data of the user derived from the dynamic user data; identifying with a semantic processing engine semantic components of the dynamic user data; and storing the context data and semantic components in an aggregated user data structure in memory. The disclosed method may also comprise identifying with a processor one or more associations between the semantic components and context data and storing said associations in the aggregated user data structure. The method may also be repeated as updated dynamic user data is acquired. Furthermore, one or more of sentiment components, entity components, classifying components, personality components and affinity components may be identified from the dynamic user data. Identifying from the dynamic user data may be achieved by semantically analysing the aggregated user data structure with the semantic processing engine.

Particular methods are disclosed for determining affinity components and personality components of the dynamic user data. The disclosed method for determining one or more affinity components comprises acquiring dynamic user data from at least one source and determining if it is relevant for the aggregated user data structure (e.g. does it relate to the user). If the dynamic user data is deemed to be relevant, an uncontextualised affinity component is determined based on a classifying data structure, which denotes a classification and is user-specific. The uncontextualised affinity
component is then combined with context data to determine an affinity component. Meanwhile, the
disclosed method for determining one or more personality components comprises acquiring dynamic
user data and identifying sentiment components of the dynamic user data, then determining one or
more degrees of similarity between the sentiment components and sentiment data structures. The
sentiment data structures may be predetermined, and one or more sets of multiplicative factors may
be applied to the degrees of similarity. The one or more personality components are then determined
based on the degrees of similarity.

In another aspect, the present disclosure discloses matching the user data in the aggregated user
data structure with corresponding service provider data in a corresponding aggregated service
provider data structure. To achieve this, the present disclosure discloses a method for generating
an aggregated service data structure by: acquiring static provider data of a service provider from a
plurality of data provider sources, each data provider source providing a set of static provider data;
acquiring dynamic provider data from each data provider source; identifying with a processor one or
more similarities and/or one or more dependencies between the sets of static provider data;
identifying with a processor one or more associations between the dynamic provider data and the
static provider data; aggregating within a provider data structure the one or more associations,
similarities and/or dependencies, along with at least a portion of the static provider data and at least
a portion of dynamic provider data; and storing the aggregated provider data structure in memory.

In a further aspect, the present disclosure discloses a computer program which, once executed by
a processor, causes a computing device to perform the steps of any one of the methods disclosed.
The computing device is in communication with user equipment and one or more computing devices
configured to operate as one or more of the data provider sources and/or user sources. Additionally,
the user equipment comprises means, for example an app, for registering with the computing device
to setup an intelligent user profile based on the aggregated user data structure.

**Brief Description of Drawings**

The present disclosure is made with reference to the accompanying drawings in which:

Fig. 1 is a diagram of a system implemented according to the present disclosure.

Fig. 2 is a diagram of an exemplary process for semantically analysing an aggregated user data
structure according to the present disclosure.
Fig. 3 is a data flow diagram according to the present disclosure.

Fig. 4 is a representation of an exemplary data component determination process according to the present disclosure.

Fig. 5 is a diagram of an exemplary process for determining affinity components according to the present disclosure.

Fig. 6 is a diagram of an exemplary process flow for determining personality components according to the present disclosure.

Fig. 7 is an exemplary ontological data structure (intelligent user profile) according to the present disclosure.

Fig. 8 is a diagram showing in exemplary form how user data can be profiled according to the present disclosure.

Fig. 9 is a diagram of an exemplary process flow showing how service content and user data can be matched according to the present disclosure.

Fig. 10 is a diagram of another exemplary process flow showing how service content and user data can be matched according to the present disclosure.

Fig. 11 is a diagram of an exemplary process implemented according to the present disclosure.

Fig. 12 is a diagram of various exemplary modules implemented according to the present disclosure.

Fig. 13 is a diagram of an exemplary process implemented according to the present disclosure.

Fig. 14 is an exemplary software layer diagram according to the present disclosure.

**Detailed Description**

Referring to Fig. 1, an exemplary system 100 according to the disclosure is disclosed. The system 100 comprises a computing device 102 which implements the method disclosed herein. The
computing device 102 may be a server device. The computing device 102 is connected to a network 101 via wired or wireless connections; the network may be a wide area network, such as the Internet. The computing device may comprise a processor 102a and memory 102b whereby the memory 102b contains a computer program of computer executable instructions which when executed by the processor 102a cause the processor to perform the disclosed methods.

The system 100 also comprises user equipment 104 configured for communication over the network 101 with the computing device 102. The user equipment (UE) is an electronic device which may include one of mobile phones, such as smartphones, tablet devices, laptops etc., televisions, media players, household or workplace equipment such as heating control devices, proximity sensors, vehicle control systems, refrigerators etc. Alternatively, the user equipment 104 may be a dedicated electronic device which can be in communication or integrated within the aforementioned devices. In the example shown in Fig. 1, the user equipment 104 is shown as a mobile computing device, such as a smartphone, comprising a touch sensitive user input/output (I/O) device 104a, e.g. a touch-sensitive display screen. Also included in the UE 104 and in communication with each other and the I/O device 104a, but not shown, is at least one processor, memory and a network transceiver, such as a wireless communications transceiver for communication with the network 101 and more particularly with the computing device 102. The UE 104 operating under control of a user is configured via its memory, in which executable instructions are contained, and the processor executing those instructions, to receive user input data via the I/O device 104a and output content data via the I/O device 104a. The user input data can be transmitted to the computing device 102 and one or more additional computing devices 106 (see below). The content data is received from the computing device 102 and/or the additional computing device 106 for display on the I/O device 104. The provision of user data and display of content data in this way can be via application software ("app") 104b which is provided by the executable instructions executing on the processor of the UE 104a.

The UE 104 also comprises or is in communication with dynamic data sources, such as location determination components or sensors (e.g. GPS), orientation and movement sensors (e.g. gyroscopic components), light sensors, image and video generation devices, such as cameras, pressure sensors, temperature sensors, touch-sensitive input devices or displays, keypads, machine-readable code readers etc. As such, the dynamic user data 130 provided via the UE 104 may comprises one or more of: environmental data obtained from user equipment of the user; location data of user equipment of the user; communication data obtained from user equipment of the user; message data obtained from user equipment of the user; and sentiment data obtained from user equipment of the user.
The system 100 also comprises one or more additional computing devices 106 (106a ... 106x) in communication with the network 101. The computing devices 106 may be server devices connected to the Internet. Each additional computing device 106a ... 106x can be configured to operate as data provider source and thereby also be a user data source. In this context, a user via the UE 104, e.g. via app 104b, can access one or more of the data provider sources and transmit a multitude of different types of static user data 131 from the UE 104 to the devices 106 for storage and processing. Services typically offered by the data provider sources may include an online portal hosted on one or more of the devices 106 providing access to large amounts of content data stored in vast databases accessible to the devices 106. For certain types of service, users are able to register individually, for example via UE 104, e.g. via app 104b, for each service by providing certain static user data 131 to the service; this static data is individual for each user, can be custom to each service, and is static, i.e. it does not change unless updated manually by the user. Content data is then generated by each data provider source which can be custom for each user. Each data provider can then provide upon request, the static user data 131 and content data back to the UE 104, and also to computing device 102 for real-time processing of an intelligent user profile. This intelligent user profile is formed by way of an aggregated data structure custom to each user; this in essence represents a "portrait" of each user's static 131 and dynamic user data 130, accessible to multiple registered data providers. In this respect, the aggregated data structure (or intelligent user profile) can be known as a user's custom portrait.

The user can also register via UE 104, e.g. via app 104b, with the computing device 102 to setup the intelligent user profile which is stored and updated in real-time by the computing device 102. During registration, or after, the user can define which data provider sources on computing devices 106a ... 106x should be accessible to the intelligent user profile and thus which static and content data is accessed by device 102.

In addition, during registration, or after, the user can define which data provider sources on computing devices 106a ... 106x should not be accessible to the intelligent user profile and thus which static and content data cannot be accessed by device 102. Furthermore, after registration, the user can delete via UE 104, e.g. via app 104b, the intelligent user profile stored by the computing device 102.

The device 102 is configured to identify dependencies, associations and/or similarities between the static user data 131 and dynamic user data 130 and aggregate both the static user data 131 and dynamic user data 130 within the intelligent user profile, i.e. a single aggregated data structure 110, in the memory 102b. An advantage of aggregated data structure 110 is that the volume of data required to provide an accurate and dynamically updated portrait of the user is minimised.
The aggregated data structure 110 is then accessible to registered data provider sources (which may be a subset of data provider sources 106a ... 106x) for supplying both static and dynamic user data 130 via push from the device 102 or upon a request being sent to the device 102 via one or more of the data provider sources 106a ... 106x. The device 102 can be configured by the user to permit access to the data structure for each provider source on a permanent or temporary basis. By temporary basis, it is meant that access can be configured for each provider source for a predetermined number of access requests made by each provide source, or be time-limited, e.g. until a certain future user-defined time of day and date, or between certain user-defined times and dates, or between certain times of day every day or on certain predefined days.

**Processing of static user data and dynamic user data**

One method of processing user data according to the disclosure comprises:

1. acquiring the static user data 131 of a user from a plurality of data provider sources 106, each data provider source providing a set of static user data 131;
2. acquiring dynamic user data 130 from at least one user source, e.g. via UE 104;
3. identifying with a processor, e.g. of the device 102, one or more similarities and/or one or more dependencies between the sets of static user data 131, and/or identifying with a processor one or more associations between the dynamic user data 130 and the static user data 131;
4. aggregating with the processor within a user data structure the one or more associations, similarities and/or dependencies, along with at least a portion of the static user data 131 and at least a portion of dynamic user data 130; and
5. storing the aggregated user data structure (e.g. the intelligent user profile) in the memory 102b.

The aggregated user data structure 110 contains both static and dynamic user data 130 stored in a defined structure which is then accessible to certain data provider sources which have been registered by the user within the intelligent user profile.

The identification of similarities and/or dependencies between sets of static user data 131 may involve looking for identical or similar fields, types or content of the user data so that when aggregating the data, a reduced set of static data which then includes pointers to the original data provider sources (those having the identical or similar fields, type or content of the user data) is formed. Thus, replicated fields, type and/or content of similar or identical data for multiple sources does not need to be stored in the intelligent user profile.
The identification of associations between dynamic user data 130 and static user data 131 may involve linking the dynamic user data 130 to the appropriate static user data 131 for the corresponding data source. For example, if the data provider source contains travel data associated with a static user data 131 profile, and the dynamic user data 130 of the user is the user's location obtain via the UE 104, then the dynamically changing location data is linked within the intelligent user profile to the corresponding static user data 131 and updated in real-time by the UE 104.

The aggregation within the user data structure involves storing one or more links between the different sets of static user data 131 and corresponding dynamic user data 130 such that each item of dynamic user data 130 is associated with: one or more links, or a plurality of static user data 131 items identifiable to one or more links, or a plurality of the data provider sources. In this way, each data provider source does not need to be updated individually with the dynamic user data 130 which may continuously or regularly change. Moreover, the static user data 131 which is similar or identical for multiple data provider sources can be stored in a consolidated form for all corresponding data provider sources within the intelligent user profile.

The method may comprise dynamically updating data contained within the aggregated user data structure 110 stored in memory 102b following changes in the dynamic user data 130.

The static user data 131 may comprise one or more of: user identifying information; user characteristics; user preferences; user contact information; user generated content, such as image and/or video data; and user sentiment data.

The dynamic user data 130 may comprise one or more of: environmental data obtained from user equipment of the user; location data of user equipment of the user; communication data obtained from user equipment of the user; message data obtained from user equipment of the user; and sentiment data obtained from user equipment of the user.

Acquiring the dynamic user data 130 may comprise continuously acquiring the dynamic user data 130; or acquiring the dynamic user data 130 at regular and/or predetermined intervals.

Acquiring the dynamic user data 130 and/or acquiring the static user data 131 may comprise pushing the static and/or dynamic user data 130 to the processor.

The dynamic user data 130 may be pushed from user equipment of the user to the processor.
Acquiring the dynamic user data 130 and/or acquiring the static user data 131 may comprises requesting by the processor and then transmitting the static and/or dynamic user data 130 to the processor.

**Dynamic user data processing from ill-defined content**

In addition to the method of processing user data described above, the disclosure provides a method for processing dynamic user data when the dynamic user data is from sources with variable, ill-defined content such as emails, text messages, internet browsing histories, social media messages and feeds obtain from devices 106, and/or UE 104. The method described below may be used in addition to, or as an alternative to, the methods for processing user data previously described.

The method of processing dynamic user data according to the disclosure comprises:

1. acquiring dynamic user data from at least one user source corresponding to a user;
2. identifying context data 190 of the user derived from the dynamic user data;
3. identifying with a semantic processing engine semantic components 193 of the dynamic user data 130; and
4. storing the context data 190 and semantic components 193 in the aggregated user data structure (intelligent user profile) in memory.

The semantic processing, by the semantic processing engine 102c of the processor 102a, of the dynamic user data 130 enables semantic components 193 of the dynamic user data 130 to be derived from sources with variable, ill-defined content such as emails, text messages, internet browsing histories, social media messages and feeds obtain from devices 106, and/or UE 104. These semantic components 193 can then be aggregated into a consolidated structure which can be accessed and interpreted by multiple data provider sources.

The context data 190 provides one or more contextual identifiers for the dynamic user data 130, for example identifiers of one or more of: environmental characteristics, time characteristics; location characteristics; and health characteristics derivable therefrom.

The method may comprise (3a) identifying with a processor one or more associations between the semantic components 193 and context data 190 and storing said associations in the aggregated user data structure 110.

The method may comprise (1a) storing the acquired dynamic user data 130 temporarily in memory 102b. By temporarily, it is meant that dynamic user data 130 is stored in memory 102b until it is
received by a processor for identifying context data 190. The acquired dynamic user data 130 may be stored in memory 102b in a time series database 102d such that the dynamic user data 130 is associated with a timestamp. The time series database 102d may be scalable to enable the database to increase its number of entries, or to enable the predetermined interval at which dynamic user data 130 is acquired to be adjusted. Adjusting the predetermined interval at which dynamic user data 130 is acquired provides, for example, a higher resolution of dynamic user data 130 when there are a greater number of changes expected in the dynamic user data 130 in a given time (e.g., when the user is outside) and a lower resolution of dynamic user data 130 for when there are a lesser number of changes expected in the dynamic user data 130 (e.g., when the user is asleep). The method may therefore optionally comprise step (1b) adjusting the predetermined rate for acquiring dynamic user data 130.

Step (2) may comprise identifying one or more of: location of the user source; date and/or time of day; and weather at the location of the user source, e.g. at UE 104 or from sources 106.

Step (3) may comprise identifying keywords, phrases, and/or other text-based components of the dynamic user data 130. The keywords, phrases and/or other text-based components may be indicative of an indexing term, a search term, etc. In addition or alternatively, step (3) may comprise identifying concept components 196 of the dynamic user data 130. Broadly speaking, the concept components 196 relate to the concept or concepts behind the dynamic user data 130. For example, if the dynamic user data 130 comprises the keywords “Big Ben” and “Thames”, the semantic processing engine 102c will identify the location “London, UK” as a concept component. Likewise, if the dynamic user data 130 comprises an image of Big Ben and the river Thames, the semantic processing engine 102c will identify the location “London, UK” as a concept.

Step (3) may further comprise identifying one or more of sentiment components 191; and entity components 197 in keywords, phrases and/or text-based components of the dynamic user data 130. Sentiment components 191 are generated components indicative of the likelihood of one or more of the user’s attitude, opinions or feelings of the dynamic user data 130 being processed. Sentiment components 191 may be based on keywords, phrases and/or other text-based components or on concept components 196. Meanwhile, entity components 197 may be indicative of one or more relationships between the keywords, phrases and/or text-based components of the dynamic user data 130. For example, the semantic processing engine 102c may identify the subject-action-object relations in a text-based component, and store the relations as entity components 197. The entity components 197 may be used to determine or consolidate the concept components 196.
Step (3) may further comprise classifying components 192 of the dynamic user data 130 according to the type of data. Classifying components 192 are indicative of a classification of the dynamic user data. For example, the classifying components 192 may indicate that the dynamic user data 130 is related to a location, or the weather. Classifying components 192 may be based on universal classifying data structures 115 stored in the memory 102b of the computing device 102. Universal classifying data structures 115 are data structures which store data indicative of a classification, which are applicable to all users; for example, a list of weather conditions, a list of locations, etc. Additionally or alternatively, the entity and/or concept components 196 may be used to determine or consolidate the classifying components 192.

Steps (2) to (3) and (3a) may be repeated as updated dynamic user data is acquired from UE 104 or from sources 106. Steps (2) to (3) and (3a) may also be repeated as updated dynamic user data is acquired from memory in step (1a).

The method may further comprise semantically analysing the aggregated user data structure 110 with the semantic processing engine 102c to determine one or more of: personality components 194 and/or affinity components 195 of the dynamic user data 130. Personality components 194 are based on (and use) one or more of the sentiment components 191 and/or entity component identified step (3) to profile an entity, such as a person, a place, an item, etc. Whereas, affinity components 195 are based on (and use) context data 190 to profile actions or events associated with the dynamic user data 130. After determining one or more of the personality components 194 and/or the affinity components 195 of the dynamic user data (as explained in further detail below), the personality components 194 and/or affinity components 195 may be stored in the aggregated user data structure 110. Fig. 2 is an exemplary process diagram of semantically analysing the aggregated user data structure 110 with the semantic processing engine 102c to determine personality components 194 and affinity components 195 of the dynamic user data 130, the methods of which are further described below.

In Fig. 2, dynamic user data 130 is acquired from UE 104 in step 200, then stored in a time series database 102d. Following this, context data 190 is derived from the stored dynamic user data in step 201. Personality components of the dynamic user data are determined in step 203, whilst affinity components of the dynamic user data are determined in step 204. The affinity component and/or personality components are then stored in the aggregated user data structure 110 in step 205. In a final step 206, the aggregated user data structure 110 is used in matching with an aggregated provider data structure 120 via the semantic processing engine 102c, as is discussed further below.
Fig. 3 shows an exemplary data flow implementing the dynamic user data 130 processing method described above comprising determining each of: semantic components 193, affinity components 195, personality components 194, sentiment components 191, entity components 197, and classifying components 192, according to the methods described herein. In this exemplary data flow, the context data 190 is comprises contextual identifiers for the dynamic user data of the UE 104 including: location characteristic identifiers (“place”; “area”); time characteristic identifiers (“time”); and environmental characteristic identifiers (“weather”). The time characteristic identifier of the dynamic user data 130 of the UE 104 is based on the timestamp recorded for the dynamic user data from source 106. The location characteristic identifier of the dynamic user data of the UE 104 is based on the concept component, which has been determined based on the entity component.

Fig. 4 is an exemplary representation of a context data 190, personality component and affinity component determination process by the semantic processing engine 102c according to the present disclosure. In this exemplary representation, the context data 190 comprises contextual identifiers for the dynamic user data including: location characteristic identifiers (i.e., the user’s location, “Regent Park”); time characteristic identifiers (i.e., the approximate day and time the dynamic user data was sent by the UE 104, “Sunday/Morning”); environmental characteristic identifiers (i.e., the weather at the user’s location, “sunny/warm”); and health characteristic identifiers (i.e., the activity of the user, “long walk”). The affinity components 195 and personality components 194 of Fig. 4 are further discussed below.

**Determining affinity components**

An exemplary method for determining one or more affinity components 195 according to the disclosure comprises:

1. acquiring dynamic user data 130 from at least one user source corresponding to a user;
2. identifying context data 190 of the user derived from the dynamic user data 130;
3. identifying with a semantic processing engine semantic components 193 of the dynamic user data;
4. determining based on the semantic components 193 whether the dynamic user data is relevant to the aggregated user data structure (i.e., for the intelligent user profile);
5. if not relevant, ending the method without determining an affinity component;
6. if relevant, determining an uncontextualised affinity component 199 based on a classifying data structure, the classifying data structure selected based on the classifying component; and
7. determining an affinity component based on the uncontextualised affinity component 199 and the context data 190.
The method described above may be used in addition or as an alternative to the methods for processing user data previously described. If the method is used in addition to the method of the present disclosure for processing dynamic user data from ill-defined sources, steps (1), (2), and/or (3) of the method for determining one or more affinity components 195 may be omitted if the step has previously been performed during the processing dynamic user data from an ill-defined source.

The method may comprise step (3a) identifying from the dynamic user data one or more of: classifying components 192, sentiment components 191, entity components 197, and concept components 196. The classifying components 192, sentiment components 191, entity components 197 and/or concept components 196 may then be used in step (4) in determining whether the dynamic user data 130 is relevant for the aggregated user data structure 110. By relevant for the aggregated user data structure 110, it is meant that the dynamic user data should be considered in determining the intelligent user profile. For example, dynamic user data that does not relate to the user is not relevant for the aggregated user data structure 110.

In one example, the classifying component identified in step (3a) may be compared against one or more of the universal classifying data structures 115 stored in the memory 102b of the computing device 102. If the classifying component is not found within one or more of the universal classifying data structures 115, then the dynamic user data 130 is determined to be not relevant to the intelligent user profile. Additionally or alternatively, if the sentiment component identifies that one of the user’s attitude, opinions or feelings are neutral to negative, then the dynamic user data is determined to be not relevant to the intelligent user profile.

Step (6) may comprise step (6a) consolidating the semantic components 193, (6b) validating the consolidated semantic components 193 based on the classifying data structure 112 and (6c) determining an uncontextualised affinity component 199 from the validated semantic components 193.

Step (6a) may comprise decomposing the semantic components 193 and/or omitting a portion of semantic components 193 according to a predetermined criteria, to form consolidated semantic components 193. For example, if the semantic components 193 identified are one or more of: keywords, phrases, and/or other text-based components, then the semantic component may be decomposed into individual units of text; for example, words. The predetermined criteria may then be to exclude particular types of words; for example, words which are not nouns or adverbs. In the mentioned example, the resulting, consolidated semantic components 193 are a collection of nouns and adverbs.
Step (6b) may comprise one or more of: syntactic analysis of the consolidated semantic components 193, semantic analysis of the consolidated semantic components 193, and structural analysis of the consolidated semantic components 193. The syntactic and semantic analyses are based on a selected classifying data structure 112. Classifying data structures 112 are data structures which store data indicative of a classification, which is specific for a user; for example, weather conditions that the user experiences, locations that the user visits, etc. The classifying data structure 112 may be stored in the memory 102b of the computing device 102 and may be updated manually by the user or automatically via the method described below. A classifying data structure 112 is selected according to the classifying component of the dynamic user data 130. For example, the classifying component may indicate that the dynamic user data “rain” is classified as a “weather condition”. In this example, the classifying data structure 112 selected by the semantic processing engine 102c comprises data indicative of a number of weather conditions, including “rain”.

Based on a syntactic analysis of the consolidated semantic components 193, the semantic processing engine 102c is configured to determine whether the consolidated semantic components 193 match any of the data in the classifying data structure 112. When the consolidated semantic component and data in the classifying data structure 112 match exactly, then an uncontextualised affinity component 199 is generated from the consolidated semantic component. When the consolidated semantic component and data in the classifying data structure 112 do not match exactly, then another of semantic analysis and/or structural analysis may be performed. An uncontextualised affinity component 199 may be generated from the data in the classifying data structure 112 if the degree of similarity between the data in the classifying data structure 112 and the consolidated semantic component is above a predetermined threshold. Where the consolidated semantic component is based on keywords, phrases and/or other text-based components, the degree of similarity between the data in the classifying data structure 112 may be based on one of: Jaro-Winkler distance, Levenshtein distance, and Cosine distance. Furthermore, the predetermined threshold may be unique to each classifying data structure 112.

In semantic analysis of the consolidated semantic components 193, the semantic processing engine 102c is configured to determine a degree of similarity between the consolidated semantic components 193 and any of the data in the classifying data structure 112. Where the consolidated semantic component is based on keywords, phrases and/or other text-based components, the degree of similarity between the data in the classifying data structure 112 may be based on the distance on a WordNet graph. As in syntactic analysis, an uncontextualised affinity component 199 may be generated from the data in the classifying data structure 112 if the degree of similarity between the data in the classifying data structure 112 and the consolidated semantic component is above a predetermined threshold, which may be unique to each classifying data structure 112.
In syntactic or semantic analysis, when an uncontextualised affinity component 199 is generated from the data in the classifying data structure 112, the classifying data structure 112 may be updated to include the corresponding consolidated semantic component. In this way, the classifying data structure 112 stored in the memory 102b of the computing device 102 is updated automatically from the performed analysis outputs to better reflect the user. As a consequence of this continual updating, the extent of user data (both dynamic and static) required to initiate a classifying data structure for a user is minimal.

A structural analysis of the consolidated semantic components 193 may be implemented when the consolidated semantic components 193 are based on keywords, phrases and/or other text-based components. The structural analysis uses entity components 197 to validate the consolidated semantic components 193. For example, the entity component may indicate that the dynamic user data is not relevant to the user (e.g., the subject identified may be a person or a thing other than the user), in which case the consolidated semantic components 193 will not be validated, and no uncontextualised affinity component 199 is generated.

Step (7) may comprise establishing one or more links between the uncontextualised affinity component 199 and affinity components 195 and the context data 190. The context data 190 may be linked to all or a portion of the uncontextualised affinity component 199 and affinity components 195.

As previously discussed, Fig. 4 is an exemplary representation of a context data 190, personality component and affinity component determination process by the semantic processing engine 102c according to the present disclosure. In this exemplary representation, the affinity components 195 are based on sentiment components 191, concept components 196 and classifying components 192 identified by the semantic processing engine 102c. In particular, the sentiment component (i.e., user is “positive”) is identified by the semantic processing engine 102c based on a keyword (i.e., “likes”) in the dynamic user data 130; the concept component (i.e., user is “having coffee”) is identified based on a phrase (i.e., “having coffee”) in the dynamic user data 130; and the classifying component is identified based on the concept component.

Fig. 5 is diagram of an exemplary process for determining affinity components 195 according to the method described above, when the dynamic user data 130 is a text message from UE 104 or source 106.

In step 500, the dynamic user data 130, which is a text message, is acquired from source 106 or from UE 104. In step 501, a semantic processing engine 102c determines semantic components 193 of the text message. Following this, in step 502, classifying components 192, sentiment
components 191 and entity components 197 are also identified. In step 503, the relevance of the text message is determined based on the identified components 191, 192, 193 and 197. If the text message is found to be not relevant, then the message is excluded in step 504. However, if the message is found to be relevant, in step 505, an uncontextualised affinity component 199 199 is generated based on the classifying component 192 and the classifying data structure 112. Subsequently, in step 506, the uncontextualised affinity component 199 199 is contextualised via the context data 190. The resulting affinity component 195 is then stored in the aggregated user data structure 110 in step 507.

*Determining personality components 194*

As mentioned previously, personality components 194 use one or more of the sentiment components 191 and/or entity component to profile an entity, such as a person, a place, an item, etc. The sentiment components 191 may relate to one or more sentiment data structures 113. The sentiment data structures 113 comprise data based on a selected or predefined sentiment and may be stored in the memory 102b of the computing device 102. The selected and predefined sentiments each represent a likely emotional state of the user at a time corresponding to the initial generation of the dynamic user data 130. For example, each sentiment may represent one or more of the potential attitudes, opinions or feelings of the user. The sentiment data structures 113 may be updated manually by the user and/or a service provider, automatically via the Internet, or automatically via machine-learning.

An exemplary method for determining one or more personality components 194 according to the disclosure comprises:

1. acquiring dynamic user data 130 from at least one user source corresponding to a user;
2. identifying sentiment components 191 of the dynamic user data 130;
3. determining one or more degrees of similarly between one or more sentiment data structures stored in memory and the sentiment component;
4. determining one or more personality components 194 based on the one or more degrees of similarity.

Step (3) may comprise a degree of similarity scaled between 0 and 1, where 0 represents no similarity, and 1 represents a perfect match.

The method may comprise step (3a) applying one or more sets of multiplicative factors to the one or more degrees of similarity. This may result in a set of the one or more degrees of similarity for each of the one or more sets of multiplicative factors. The multiplicative factors may be based on
postulated underlying links between the sentiments. The multiplicative factors may be updated manually by the user and/or a service provider, automatically via the Internet, or automatically via machine-learning.

The method may optionally comprise determining one or more sentiment data structures 113, each based on a selected sentiment. Alternatively, the one or more sentiment data structures 113 may be predefined (i.e., prior to the method), each according to a predefined sentiment. Moreover, the number of sentiment data structures 113 may be predefined; for example, there may be seven sentiment data structures 113, each based on a different sentiment.

An exemplary method for determining a sentiment data structure according to the present disclosure comprises:

(1) selecting a sentiment;

(2) determining keywords, phrases and/or other text-based components based on the selected sentiment; and

(3) storing the text-based components in a sentiment data structure.

Step (2) may be based on the dynamic user data 130 and/or the static user data 131; however, the data does not need to be limited to a single user. Dynamic data and static data of multiple users may be used to determine a sentiment data structure 113. Sentiment data structures 113 may be unique to each classifying data structure 112.

The method may additionally comprise (4) updating the sentiment data structure 113 based on the determined text-based components and related dictionary components. For example, the sentiment data structure 113 may be updated to include synonyms of the text-based components for the selected sentiment. This may be performed by the semantic processing engine 102c using a bootstrapping algorithm.

Bootstrapping algorithms use estimates of statistics of a population from a limited amount of data, where the sampling distribution for those estimates is approximated by drawing new samples from the original data and then computing statistics from each sample. Thus, a bootstrapping algorithm as applied to the disclosed method draws new text-based components and related dictionary components based on the text-based components of the dynamic user data 130. The new text-based components and related dictionary components which are estimated to be similar to the prior text-based components stored in the sentiment data structure 113.
Fig. 6 is an exemplary process flow diagram for determining personality components 194 according to the method described above. In step 601, one or more sentiment data structures 113 are determined, each based on a sentiment selected in step 600 (the selected sentiments are also referred to as the “core set” of sentiments). Then, in step 603, based on the sentiment data structures 113 and sentiment components 191 of the dynamic user data 130, one or more degrees of similarly between one or more sentiment data structures 113 stored in memory 102b and the sentiment component are determined by the semantic processing engine 102c via a bagging algorithm.

Bagging algorithms (also known as bootstrap aggregating algorithms) are machine-learning algorithms designed to improve the stability of the outputs of bootstrapping algorithms. Thus, determining the one or more degrees of similarity according to Fig. 6 comprises determining the similarity between one or more sentiment data structures and the sentiment component via a bootstrapping algorithm, and then applying a bagging algorithm.

In step 604, one or more sets of multiplicative factors to the one or more degrees of similarity. The degrees of similarity are then used by the semantic processing engine 102c to determine a personality component 194, which is used in step 605 to update the aggregated user data profile 110 stored in memory 102b. The aggregated user data profile 110 is subsequently used to refine the selected sentiments in step 606.

In one embodiment, a predefined number of sentiment data structures are permitted and thus defined. In a further preferred embodiment, seven sentiment data structures 113 are defined and permitted based on seven types of user sentiment. In this example, the seven permitted types of sentiments, which correspond to the likelihood of possible emotional states of the user, are: wonder, humour, inclusivity, sympathy, peace, excitement and romance.

In accordance with the above-mentioned example, Table 1 shows an exemplary result of the determination in step (3), where the degree of similarity is scaled between 0 and 1. Table 2 shows an exemplary result of step (3a), based on the degrees of similarity in Table 1, where two sets of multiplicative factors have been applied.

<table>
<thead>
<tr>
<th>Wonder</th>
<th>Humour</th>
<th>Inclusivity</th>
<th>Sympathy</th>
<th>Peace</th>
<th>Excitement</th>
<th>Romance</th>
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<td>0.1</td>
<td>0.1</td>
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<td>0.1</td>
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<p>| TABLE 1 |</p>
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<th>Sentiment</th>
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<th>Factor 2</th>
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</thead>
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<td>0.255</td>
</tr>
<tr>
<td>Humour</td>
<td>0.998</td>
<td></td>
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<tr>
<td>Include</td>
<td>0.896</td>
<td></td>
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<tr>
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<tr>
<td>Peace</td>
<td>0.569</td>
<td>0.403</td>
</tr>
<tr>
<td>Excitement</td>
<td>-0.996</td>
<td></td>
</tr>
<tr>
<td>Romance</td>
<td>0.693</td>
<td>0.259</td>
</tr>
</tbody>
</table>

**TABLE 2**

*Contextual user profiles*

As stated previously, the aggregated user data structure 110, comprising dynamic user data 130 and static user data 131 by the methods described in the disclosure, may be stored in memory 102b of the computing device 102. The aggregated user data structure 110 may also contain the context data 190 and one or more components determined by the processing methods described above. The one or more components include one or more of: semantic components 193, affinity components 195, personality components 194, sentiment components 191, entity components 197, and classifying components 192. The aggregated user data structure 110 may further contain the one or more links between the different sets of static user data 131 and corresponding dynamic user sources. In this sense, the aggregated user data structure 110 contains all the data about a user which updates dynamically, i.e., an intelligent user profile.

The aggregated user data structure 110 may be an ontological data structure. Fig. 7 is an exemplary ontological data structure according to the present disclosure. The exemplary ontological data structure comprises ontologies for: static user data 131 ("upo:BasicUserDimension"), which may be input by the user via UE 104, e.g., via app 104b; dynamic user data 130 ("upo:Portrait"); personality components 194 ("upo:Personality"); classifying components 192 ("upo:Domain"), which are based on classifying data structures 112; affinity components 195 ("upo:Affinity"); context data 190 ("upo:ContextDimension"). In this exemplary ontological data structure, the relationships between the components are depicted. For example, the context data 190 is derivable from the dynamic user data 130 and/or the affinity component 195.
The processor 102a of the computing device 102 is configured to receive the aggregated user data structure 110. The processor 102a enables querying, aggregation, and reasoning of the data contained in the aggregated user data structure 110. For example, processor 102a may derive or infer additional user data based on the data contained in the aggregated user data structure 110. The derived or inferred user data may optionally be stored in the aggregated user data structure 110. The aggregated user data structure 110, in addition any derived or inferred user data, may be processed by the processor 102a to determine a contextual user profile.

In one method of the present disclosure, the contextual user profile is a consolidated user data structure 111 formed from the aggregated user data structure 110 via querying, aggregation, and/or reasoning by the processor 102a based on a predetermined context. For example, if the predetermined context requires the name of the user and the aggregated user data structure 110 contains for a user the names “Clara” and “Cara”, with several links to sources associated to “Clara” and only a single link associated to “Cara”, the processor reasons that the user’s name is likely to be “Clara” rather than “Cara”. As a consequence, the name “Clara” will be stored in the consolidated user data structure 111, and the user name in the contextual user profile will be “Clara”. In another example, the predetermined context is related to when the user is located outdoors. In this example, the aggregated user data structure 110 may contain dynamic user data of the user’s location and the weather at the user’s location, in addition to affinity data based on the user’s message indicating the user’s view on the weather. The processor is therefore able to reason based on the data contained in the aggregated user data structure 110 whether the user is likely to be indoors or outdoors.

The predetermined context to generate the contextual user profile may be determined by one or more service providers. Alternatively or additionally, the predetermined context may be determined by the user via the UE 104, e.g. via app 104b. In this way, the user may define rules as to the availability of certain predetermined contexts for the one or more service providers. In particular, the user may grant access to the service provider to the predetermined contexts on a permanent or temporary basis. By temporary basis, it is meant that access can be configured for each service provider for a predetermined number of access requests made by each service provider, or be time-limited, e.g. until a certain future user-defined time of day and date, or between certain user-defined times and dates, or between certain times of day every day or on certain predefined days. Furthermore, the predetermined context may be viewed and edited by the user via the UE 104, e.g. via app 104b.

Fig. 8 is a diagram showing an exemplary method for profiling user data according to the method described above. In this exemplary method, the predetermined context is defined by the service
provider as specific dynamic and static data, as well as specific concept components 196. As the predetermined context complies with the defined user rules, a consolidated user data structure 111 has been determined based on the aggregated user data structure 110.

As shown in this exemplary method, it is possible for a user to have a plurality of intelligent user profiles, and therefore a plurality of aggregated data structures 110. Each of the plurality of aggregated data structures may be defined by which data provider sources on computing devices 106a ... 106x should and should not be accessible to the intelligent user profile and thus which static and content data can and cannot be accessed by device 102. The plurality of aggregated data structures may be considered in determining the consolidated user data structure 111.

Matching user data with online service content

The aforementioned methods may further comprise matching the user data in the aggregated user data structure 110 with corresponding service provider data, such as content from the providers 106 contained in a corresponding aggregated service provider data structure 120 stored in device 102. This way, service provider content can be mapped more readily and effectively to users.

Additionally or alternatively, the aforementioned methods may further comprise matching components of the user data in the aggregated user data structure 110 with corresponding service provider data, according to a predetermined context, via the intelligent user and provider profiles. This way, the extent of processing required by the processor 102a of computing device 102 for matching is reduced. Moreover, the extent of data stored and exchanged between the user and the service provider is less than typically is used in conventional exchanges of user data and provider data.

The aggregated service data structure can be generated by:

1. acquiring static provider data (e.g. content) of a service provider from a plurality of data provider sources, each data provider source providing a set of static provider data;
2. acquiring dynamic provider data from each data provider source;
3. identifying with a processor, e.g. of device 102, one or more similarities and/or one or more dependencies between the sets of static provider data;
4. identifying with a processor one or more associations between the dynamic provider data and the static provider data;
5. aggregating within a provider data structure the one or more associations, similarities and/or dependencies, along with at least a portion of the static provider data and at least a portion of dynamic provider data; and
(6) storing the aggregated provider data structure in memory, e.g. of device 102.

An intelligent provider profile is thus formed by way of the aggregated provider data structure 120, and can be custom to each provider; this in essence represents a "portrait" of each provider’s static and dynamic data. In this respect, the aggregated provider data structure 120 (or intelligent provider profile) can be known as a provider’s custom portrait.

The intelligent provider profile may be compared with the corresponding user profile in order to determine a degree of correlation. A degree of correlation between the user data in the aggregated user data structure 110 and service provider data in the aggregated provider data structure 120 is determined by the semantic processing engine 102c. In one example, the degree of correlation is determined by the semantic processing engine 102c by logistical regression. Fig. 10 is an example of a process flow diagram showing how service content and user data are matched by logistical regression. In step 1000, the aggregated provider data structure 120 and aggregated user data structure 110 are determined and stored in memory 102b. Subsequently, in step 1001, logistical regression is performed on the two data structures. As a consequence of the output of the logistical regression, match recommendations for the user and/or provider are determined in step 1002.

The degree of correlation may relate to a comparison of each of the one or more components of user data in the aggregated user structure and the corresponding components of provider data. Alternatively, the degree of correlation may relate to a comparison of the aggregated user data structure 110 and the aggregated provider data structure 120 as a whole. In this respect, the intelligent portrait of the user and of the provider will be compared in their entirety. Furthermore, the degree of correlation may be scaled between 0 and 1, where 0 represents no similarity, and 1 represents a perfect match. A degree of similarity greater than 0.7 may be considered a strong match. The degree of correlation may be stored in the aggregated user data structure 110 and/or the aggregated provider data structure 120.

Additionally or alternatively, a contextual provider profile may be formed from the intelligent provider profile. The contextual provider profile is a consolidated provider data structure 121 formed from the aggregated provider data structure 120 via querying, aggregation, and/or reasoning by the processor based on a predetermined context. The predetermined context to generate the contextual provider profile may be determined by the provider, or by a set of providers. Alternatively, the predetermined context may be determined by the user via the UE 104, e.g. via app 104b. Furthermore, the predetermined context may be viewed and edited by the user via the UE 104, e.g. via app 104b.
The contextual provider profile may be compared with the corresponding contextual user profile by the method previously described for the intelligent user and provider profiles. Comparing the contextual profiles is advantageous over comparing the intelligent profiles as the data stored in the consolidated user structure 111 and the consolidated provider data structure 121 is less than the aggregated user data structure 110 and aggregated provider data structure 120, since the data is specific to a predetermined context. As a consequence, the volume of processing performed by the semantic processing engine 102c is less when determining the degree of correlation.

Implementing the disclosed methods

It will be appreciated that the methods described in the present disclosure may be implemented in the computing device 102 in hardware or software, or a combination of the two. Preferably, the techniques are implemented in computer programs executing on the computing device 102 via the processor 102a, memory 102b readable by the processor (including volatile and nonvolatile memory and/or storage elements), and suitable input and output devices. Program code is applied to data entered using an input device, from UE 104 or one or more additional computing devices 106 to perform the methods described and to generate output information such as the aggregated user data structure 110. The output information may be applied to one or more output devices, such as UE 104, e.g. via the app 104b. Moreover, each program is preferably implemented in a high level procedural or object-oriented programming language to communicate with a computer system. However, the programs can be implemented in assembly or machine language, if desired. In any case, the language may be a compiled or interpreted language.

Fig. 11 is a diagram of an exemplary process implemented according to the present disclosure. In the exemplary process implementation, to initiate the disclosed methods for processing dynamic and static user data, and thus generating an aggregated user data structure, the user must first set up their intelligent user profile. The user may set up their intelligent user profile via the UE 104 which comprises means (e.g., app 104b) for registering with the computing device to setup an intelligent user profile based on an aggregated user data structure.

Fig. 12 is a diagram of various modules implemented in software or hardware according to the present disclosure for carrying out the disclosed methods. In Fig. 12, static user data 131 and dynamic user data 130 is acquired from UE 104 and via sources 106 into a data streaming module 120g on computing device 102. The processor 102a, including semantic processing engine 102c, processes the static user data 131 and dynamic user data 130 by the methods of the present disclosure to determine an aggregated user data structure 110. The aggregated user data structure 110 is stored in the semantic store module 102e of memory 102b. The stored aggregated user data
structure is then processed to determine a consolidated user data structure 111 based on a predetermined context determined by the user via app 104b. The data streaming module 102g and semantic store module 102e may be operatively connected to a platform module 102f, the platform module for interfacing the app 104b with the computing device 102. Fig. 13 is a diagram of the various modules implemented in Fig. 12, where an estimated volume of user data flowing through each module is depicted.

Fig. 14 is an exemplary software layer diagram implemented in computing device 102 according to the present disclosure for carrying out the disclosed methods. The depicted software layers diagram comprises a data source layer 103a, for acquiring the static user data 131 and dynamic user data 130 from the UE 104 and the additional computing device 106. The aggregated user data structure is determined from the static user data 131 and dynamic user data 130 in a data analysis layer 103b and a data aggregation and mapping layer 103c. The aggregated user data structure is then stored in memory 102b and accessible by a semantic profile layer 103d. The semantic profile layer 103d interfaces a profile consumption layer 103e, which is used for matching user data with service provider data. Fig. 14 also depicts an application layer 103f for app 104b of the UE 104, which interfaces the profile consumption layer.

In an exemplary implementation for matching user data with service provider data, depicted in Fig 9, the matching is implemented in software and through machine learning. In particular, steps 1, 3, A and C of Fig. 9 are processing tasks for the processor 102a that determine the required software architecture. Steps 2 and 4 / B and D are the machine learning tasks for the processor 102a that determine the required machine learning processes.

It will be appreciated that the present disclosure, which represents a disclosure of one or more inventions, has been described above only by way of example, and modifications may be made within the scope of the invention.
Claims

1. A method of processing user data comprising:
   acquiring static user data of a user from a plurality of data provider sources, each data
   provider source providing a set of static user data;
   acquiring dynamic user data from at least one user source;
   identifying with a processor one or more similarities and/or one or more dependencies
   between the sets of static user data;
   identifying with a processor one or more associations between the dynamic user data and
   the static user data;
   aggregating within a user data structure the one or more associations, similarities and/or
   dependencies, along with at least a portion of the static user data and at least a portion of dynamic
   user data; and
   storing the aggregated user data structure in memory.

2. The method of claim 1, further comprising dynamically updating data contained within the
   aggregated user data structure stored in memory following changes in the dynamic user data.

3. The method of any one of the preceding claims, wherein the static user data comprises one
   or more of: user identifying information; user characteristics; user preferences; user contact
   information; user generated content, such as image and/or video data.

4. The method of any one of the preceding claims, wherein the dynamic user data comprises
   one or more of: environmental data obtained from user equipment of the user; location data of user
   equipment of the user; communication data obtained from user equipment of the user; message data
   obtained from user equipment of the user; and sentiment data obtained from user equipment of the
   user.

5. The method of any one of the preceding claims, wherein acquiring the dynamic user data
   comprises continuously acquiring the dynamic user data; or acquiring the dynamic user data at
   regular and/or predetermined intervals.

6. The method of any one of the preceding claims, wherein acquiring the dynamic user data
   and/or acquiring the static user data comprises pushing the static and/or dynamic user data to the
   processor.
7. The method of claim 6, wherein the dynamic user data is pushed from user equipment of the user to the processor.

8. The method of any one of the preceding claims, wherein acquiring the dynamic user data and/or acquiring the static user data comprises requesting by the processor and then transmitting the static and/or dynamic user data to the processor.

9. A method of processing user data comprising:
   (1) acquiring dynamic user data from at least one user source corresponding to a user;
   (2) identifying context data of the user derived from the dynamic user data;
   (3) identifying with a semantic processing engine semantic components of the dynamic user data; and
   (4) storing the context data and semantic components in an aggregated user data structure in memory.

10. The method of claim 9, further comprising:
    (3a) identifying with a processor one or more associations between the semantic components and context data and storing said associations in the aggregated user data structure.

11. The method of claim 9 or claim 10, wherein step (2) comprises identifying one or more of: location of the user source; date and/or time of day; and weather at the location of the user source.

12. The method of any one of claims 9 to 11, wherein step (3) comprises identifying one or more of sentiment components; and entity components in text-based components of the dynamic user data.

13. The method of claim 12, wherein step (3) further comprises classifying components of the dynamic user data according to the type of data.

14. The method of any one of claims 9 to 13, further comprising semantically analysing the aggregated user data structure with the semantic processing engine to determine one or more of: personality components and/or affinity components of the dynamic user data.

15. The method of claim 14, wherein determining one or more affinity components comprises:
    (5) determining based on the semantic components whether the dynamic user data is relevant to the aggregated user data structure;
    (6) if not relevant, ending the method without determining an affinity component;
(7) if relevant, determining an uncontextualised affinity component based on a classifying data structure, the classifying data structure selected based on the classifying component; and
(8) determining an affinity component based on the uncontextualised affinity component and the context data.

16. The method of claim 14, wherein determining one or more personality components comprises:
(5) identifying sentiment components of the dynamic user data;
(6) determining one or more degrees of similarly between the sentiment components and a predetermined number sentiment data structures stored in memory; and
(7) determining one or more personality components based on the one or more degrees of similarity.

17. The method of claim 16, further comprising:
(6a) applying one or more sets of multiplicative factors to the one or more degrees of similarity.

18. The method of any one of claims 15 to 17, further comprising:
storing the personality components and/or affinity components in the aggregated user data structure.

19. The method of any one of claims 9 to 12 when dependant on claim 10, wherein steps (2) to (3) and (3a) are repeated as updated dynamic user data is acquired.

20. The method of any one of the preceding claims further comprising matching components of the user data in the aggregated user data structure with corresponding components of service provider data in a corresponding aggregated service provider data structure.

21. The method of any one of claims 1 to 19 further comprising matching the user data in the aggregated user data structure with corresponding service provider data in a corresponding aggregated service provider data structure.

22. The method of claim 20 or claim 21, wherein the aggregated service data structure is generated by:
acquiring static provider data of a service provider from a plurality of data provider sources, each data provider source providing a set of static provider data;
acquiring dynamic provider data from each data provider source;
identifying with a processor one or more similarities and/or one or more dependencies between the sets of static provider data;
identifying with a processor one or more associations between the dynamic provider data and the static provider data;
aggregating within a provider data structure the one or more associations, similarities and/or dependencies, along with at least a portion of the static provider data and at least a portion of dynamic provider data; and
storing the aggregated provider data structure in memory.

23. A computer program comprising computer executable instructions which, when executed by a processor of a computing device, causes the computing device to perform the steps of any one of the preceding claims.

24. A computing device comprising a processor configured to perform the steps of the method of any one of claims 1 to 22.

25. A system comprising:
the computing device of claim 24;
user equipment configured for communication with the computing device; and
at least one additional computing device configured to operate as one or more of the data provider sources and/or user sources.

26. The system of claim 25 wherein:
the user equipment comprises means for registering with the computing device to setup an intelligent user profile based on the aggregated user data structure.
FIG. 7

Upper Portrait Ontology

110

SUBSTITUTE SHEET (RULE 26)
**FIG. 8**

User Profiling 102

access policy & rules

User Profile Ontology

access policy & rules

links to specific portraits / concepts

the AVATR machine continuously feed the User Profile Ontology with the **AI mechanisms** described in previous slides

by using APIs, service providers can query user profile ontology and obtain useful knowledge to create on-the-fly personalised user experiences
**Matching Process Flow 102**

**Step 1:** Scrape Sentiment and Geolocation Data

- Personality: based on Sentiment Analysis
- Context: based on Geolocation Data

**Step 2:** Cluster Scraped Data into User Portraits:

**Step 3:** Construct Pack from Portraits

**Step 4/D:** Affinity Discovery: When User grants supplier temporary access to PACK, data is decrypted and shared. Affinity matching is enabled

**Step C:** Construct Set of Portraits

**Step B:** Cluster Scraped Sentiment Data into Brand Personality Portraits

**Step A:** Scrape Sentiment and Proximity Data

**Supply Side**

- Tripadvisor

**Demand Side**

- Twitter
- Facebook

**POI**

**SUBSTITUTE SHEET (RULE 26)**
Main Workflow

104

User Registration Process

Minimal User Info
User selects data sources/portrait types
User sets Rules & Policies

Background Process

User message analysis
Automatic user profiling

Live Process

User message analysis
Context analysis (position tracking active)
Automatic user profiling

Feeding the system

User Profiles
- Portraits
- PACK

Profile Utilization

104

111

App

104b

User controls and manages his/her profile (dashboard)
User obtains service recommendations
- Live (serendipity)
- On demand
- Access to Service Providers machine-readable knowledge about a specific user or group of users
- Creation of more compelling, personalised user experiences (on-the-fly)
- Discounts and fidelity
**INTERNATIONAL SEARCH REPORT**

**A. CLASSIFICATION OF SUBJECT MATTER**

**INV.** G06Q30/02  
**ADD.**

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

G06Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

<table>
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<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
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[X] Further documents are listed in the continuation of Box C.  
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**Date of the actual completion of the international search**  
9 May 2017

**Date of mailing of the international search report**  
23/05/2017

**Name and mailing address of the ISA/ Authorized officer**

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Bohner, Michael
### DOCUMENTS CONSIDERED TO BE RELEVANT

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