

Implicit Social Networking for Mobile Users: Data Monetization for Telcos through Context-Aware Services

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Abstract—Implicit social networking provides a goal-oriented platform for information retrieval and value-added interaction between telecom operators and their users. Implicit social networks can group users based on certain criteria by utilizing user preferences in a novel fashion, providing an innovative medium for upgrading existing, as well as developing new social networking services. This paper proposes the Ericsson Implicit Social Networking, a location-aware implicit social networking platform for mobile users. Using this platform, telcos can maximize their revenue potential by utilizing stored user data, an approach called data monetization. Mobile users equipped with a smartphone can use the Ericsson Implicit Social Networking platform through a myriad of context-aware services. After users install and activate a client application, they are able to receive personalized information, offers and content – e.g. movie recommendations, discounts for customer loyalty, songs and tickets for events by their favorite artist. One such service, the proof-of-concept application named the Focused Viral Marketing, is available for users possessing Android-based smartphones.

Keywords—implicit social networking; data monetization; context-aware service; context-aware ad-hoc social networking platform

I. INTRODUCTION

Implicit social networks (ISNs) [1][2] provide an alternative, seamless and goal-oriented medium for communication and interaction with users. Introduction of the ISN concept into telecommunication ecosystem benefits both users as well as telcos. For example, the ISN represents an innovative platform for handling ego-user's information retrieval, as well as provides an effective solution for information providers to utilize services without disturbing the user. Furthermore, the ISN concept is one possible solution for two big challenges of innately networked and social-aware information systems of the 21st century: i) how to process large amounts of heterogeneous data; and ii) how to monetize it.

The term “implicitness” implies that users are seamlessly clustered into groups characterized by similarities across various types of user data (in contrast to explicit social networking, which requires users' active participation in social network creation, such as various forums, blogs, fan-sites etc.).

To this end, various user data, which is dispersed across different nodes within the telco operator's network, is aggregated into specially designed user profiles. In this way, sheer knowledge on user's preferences, habits and communication context, inherent for the telco operator's network, is leveraged for bringing forward a novel value to provisioning of personalized content and services. These attempts characterize the *data monetization* approach, exercised extensively by the telco operators today.

Therefore, contribution of this paper is threefold: i) telcos maximize their revenue potential with data monetization, by combining 3rd party user data with the data available only to them; ii) end-users are provided with fully customized, context-aware social networking services tailored to their needs and preferences; and iii) telco infrastructure providers (e.g. Ericsson) get to deliver a platform and respective service back-ends to support telco's businesses.

For example, imagine a person walking downtown. This person is shopping, which deems him/her available for social interaction. Indeed, this person has interests in music and movies, which is where Ericsson Implicit Social Networking (EISN) kicks in. EISN enables applications that would recommend this person a new movie at a discount and would offer tickets for his/her favorite band playing downtown this weekend. EISN is a context-aware ad-hoc social networking *platform* that gives telco operators the ability to build a wide variety of applications upon it.

This paper is organized as follows. In the Section 2, related work gives an overview of state-of-the-art in the area of location-aware ad-hoc social networking. After that, Section 3 gives an answer to the question “*what is the EISN*”. Afterwards, Section 4 gives answers to questions “*how does the EISN work*” and “*what does the EISN offer to end-users*”. Finally, Section 5 concludes the paper and gives an overview of the planned future work.

II. RELATED WORK

A. Context-aware Services and Mobile Users

Definition of a *context* is given by Dey in [3] – “context is any information that can be used to characterize the situation of

an entity. An entity is a person, place or object that is considered relevant to the interaction between a user and an application, including the user and application themselves". Therefore, a *context-aware* system is "a system that uses context to provide relevant information and/or services to the user, where relevancy depends on the user's task". *Mobile users* are nowadays accompanied by their mobile devices, usually smartphones. As of October 2012, the biggest social network Facebook has had more than one billion monthly active users, out of which more than half (680 million) are mobile [4]. Clearly, the ability to go mobile gives social networks an advantage when it comes to usability and popularity among users [5].

B. Trends and Issues in Social Networking

The official number of users of social media worldwide surpassed 1 billion in May 2012 and most of them use social networking services from their mobile devices [6]. Obviously, social networking has become a great market with a lot of opportunities.

In the field of social networking, Ericsson so far offered the Ericsson Social Media Portal¹ service, started in 2009. In principle, Ericsson builds social networking services upon the concept called Social Web of Things², comprised of terms "Social Web" and "Internet of Things". As it can be seen, the area of modern social networks and social networking services is somewhat new (Facebook, 2004 onwards) and for Ericsson it is even more recent (2009 onwards). It is a major part of Ericsson's general concept of the Networked Society³.

The SOMAR is an example of a social mobile activity recommender system that utilizes context information to modify ego-user's social graph [7]. Another knowledge-based recommender system [8], based on semantically empowered techniques, is proven to significantly improve the quality of recommended movies and cinematographic content.

In the summer of 2010 Facebook announced a new feature, namely a location based service, called Facebook Places. The idea was that a user could share his or her location by using their smartphone's GPS (Global Positioning System) data. This is useful if one tries to find friends using the same service for a night out in town, brag about attending a concert, having dinner in a restaurant or such. In May 2011, Places already had 1.8 million check-ins globally per day. In December 2012 Facebook Nearby was introduced, as a new Facebook service in this area [9].

As of April 2012, famous similar services are Foursquare, Google Latitude, Skout, Glancee and Highlight. These services give the user an opportunity to keep in touch with friends using location-based data. Glancee saw the acquisition by Facebook in May 2012. Pinterest, a service started in early 2010 went mobile in early 2011. It enables its users to share photographs in forms of collections/boards. From early 2012 it numbers more than 10 million users, a number which it achieved faster than any social network in history [10]. Another interesting service is Instagram, which enables its users to publish their

photos edited by digital filters that the service provides. Currently, it has more than 30 million users [11]. In April 2012, Banjo service hit 1 million users in just nine months [12]. It aggregates all geo-tagged updates of friends from major services like Facebook, Twitter, Foursquare, etc.

One would probably question the problem of privacy in location-aware social networking services [13] with 83 million accounts that are alleged spammers on Facebook [14]. On the other hand, fewer than 30% of large organizations will be blocking social networking services by 2014 [15]. When compared to 50% in 2010, there is a clear improvement in this area, probably due to increased control over published user information (e.g. Facebook's Activity Log) and the chance that users got accustomed to it. It is important to be specific about exactly what information users share, with whom and when, features which Facebook fully enables only until recently [16].

This global proliferation of social networking phenomenon is described in more detail in [17]. Facebook recently launched what is known as Facebook Exchange (FBX), where their new way of advertising called re-targeting, is in charge. The old way of making revenue through ads was to direct firms at certain types of customers they wanted to reach. The new way is to constantly monitor users using browser cookies and dynamically display them ads based on their preferences collected via usage history through the cookies⁴, hence the name "re-targeting" [18]. Instead of using the incredible amount of time its users spend online (viewing advertisements), Facebook will start using the incredible amount of stored user data in order to target users more easily [19].

C. Data Monetization

One could say that Web 2.0 companies, Facebook among them, base their revenue on data generated by their users – or more precisely, on processing that data in order to use it for e.g. advertising purposes. This field of *data monetization* [20][21], but with telecom operators included as customers, is what social networking services are currently built upon in the Ericsson Nikola Tesla and more importantly – what could distinguish them from the competition, establishing the Ericsson brand in this area, long-term. Current Ericsson's attempts on the global level in the context of data monetization are focused on: i) advanced user management and proactive customer care for better customer experience and churn prevention, and ii) identity management by exposing data assets and information brokering. Both attempts are based on efficient aggregation and processing of offline and online user data. As it will be shown, the idea described in this paper is in line with both of these endeavors.

III. ERICSSON IMPLICIT SOCIAL NETWORKING PLATFORM

Ericsson Implicit Social Networking (EISN) Platform embodies the ISN concept, brought forth in the Introduction section. It is to be employed in the 3G, as well as 4G telco networks.

The main task of the EISN Platform is to deliver a set of users targeted for some content or service, according to criteria

¹ <http://www.youtube.com/watch?v=ykryCX813bI>

² <http://www.ericsson.com/uxblog/2012/04/a-social-web-of-things>

³ http://www.ericsson.com/thinkingahead/networked_society

⁴ A cookie is message given to Web browser by Web server and is usually stored locally at the user's computer.

provided by an EISN-supported application built on top of the Platform. One such application is the *Focused Viral Marketing*, a proof-of-concept application described in the next section. The implicit grouping capability is based on the business logics of the EISN Engine, the EISN Platform's core processing component, and carried out upon user profiles.

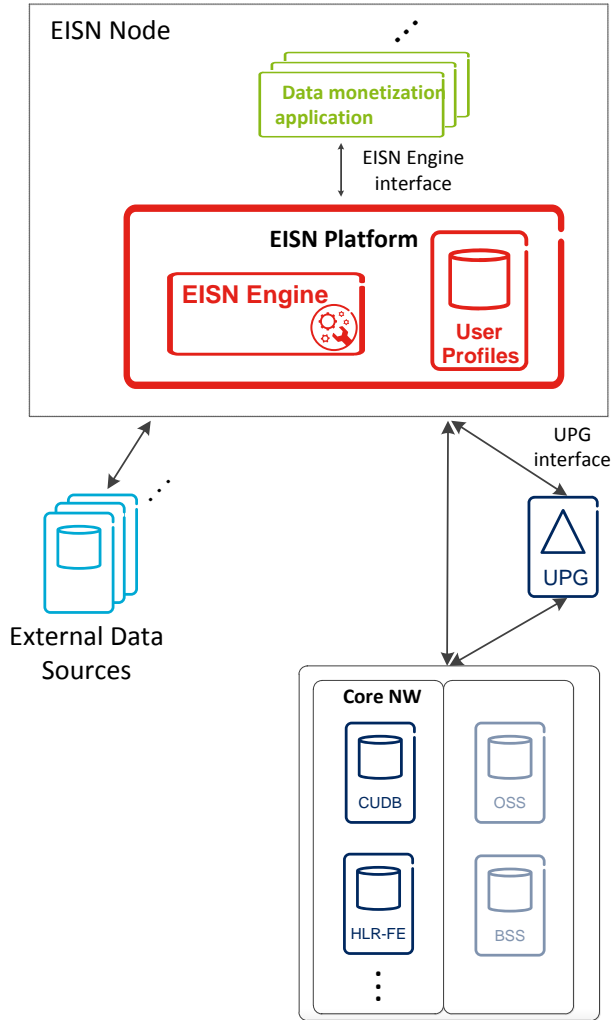


Fig. 1 EISN solution – basic architecture and network situation

The EISN Platform's general architectural overview and its network situation are depicted in Fig. 1. The EISN Platform and EISN-supported application back-ends built on top of the Platform are situated in the EISN Node, residing in the telco operator's network. It communicates with the operator's network nodes (e.g. CUDB⁵, HLR-FE⁶, ADC⁷, OSS⁸ and BSS⁹,

⁵ Centralized User Database – Ericsson's subscriber-centric database that supports the consolidation of subscriber data for several application front ends.

⁶ Home Location Register Front End – Ericsson's solution for subscription and service management for GSM/WCDMA networks according to the Data Layered Architecture principles.

⁷ Automatic Device Configuration – Ericsson's solution providing device detection information from the core network.

possibly via the data aggregating UPG¹⁰ node) as well as potentially with third-party data resources (e.g. content providers).

The Platform consists of two main components: *Dynamic User Profile Database* and *EISN Engine*.

A. Dynamic User Profile Database

Each end-user who is subscribed to an EISN-supported application is represented via a *Dynamic User Profile* (DUP) containing various information obtained from the pertaining network nodes and, potentially, external data providers. Any subset of the available user information is used by various EISN-supported data monetization applications, in order to select eligible and potentially interested users for a range of different offered applications and services. An example of a DUP is given in Fig. 2 (the screenshot from the database view).

(6) {..}	
ISNAApps {..}	
_id	50865b47d781d3a7b6510e41
charging {..}	
billing	postpaid
current	9
average	43,9104403127874
full	0,20496264523631
count	13
contextInfo {..}	
location {..}	
longitude	152
latitude	19
commuting {..}	
customerCare {..}	
nr	8
nc	2
fairness	0,25
hwInfo {..}	
screen {..}	
screenHorizontal	1920
screenVertical	580
preferences {..}	
music {..}	
boughtMusic {..}	
recommendedMusic {..}	
totalBought	0
totalCounter	0
totalPurchasesViaRec	0
tags {..}	
tagsRel {..}	
swInfo {..}	
userIdentity {..}	
name	mariliacobaina
surname	Florence + the Machine
MSISDN	0905555555
IMSI	245246542624
mail	mariliacobaina@Florence +
URL	www.mariliacobaina.com

Fig. 2 DUP example (some items collapsed due to space limitations)

⁸ Operations Support System.

⁹ Business Support System.

¹⁰ User Profile Gateway.

B. EISN Engine

EISN Engine is the processing core of the EISN Platform. It clusters users (subscribers) into ad hoc implicit groups¹¹.

The EISN Engine exposes a generic interface towards various data monetization applications. This interface exposes two methods – one for retrieving a list of users with respect to predefined criteria and one for updating user profiles.

The EISN Engine comprises a number of data modules, each holding knowledge of one particular domain. For example, there is a musical preference module, location module, charging data module, hardware specification module, customer care module, etc. An EISN-supported application may use criteria of any of the supported domains (e.g. there can be a data-monetization application requesting the list of users at a specified location and with certain spending habits; another may ask for users with a specific musical taste, with discounts granted to those who have had many network issues, thereby preventing their churn).

When the criteria reach the EISN Engine, it allocates various criteria components to the delegated domain modules. Each of them processes its own data independently and finally the EISN Engine delivers a set of user IDs, satisfying all defined criteria. The user IDs are fetched from the Dynamic User Profile Database.

IV. THE FOCUSED VIRAL MARKETING APPLICATION

The Focused Viral Marketing (FVM) application is a proof-of-concept application for the EISN Platform. It enables the Platform user (telecom operator) to target specific user-groups for content recommendation.

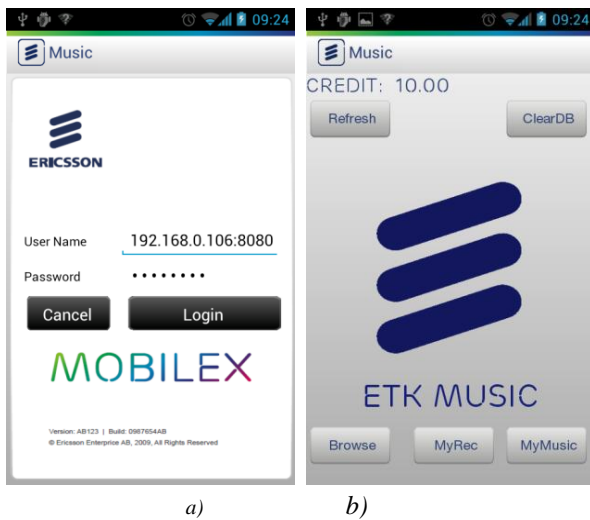


Fig. 3 Ericsson FVM client-side application interface

The application contains the *front-end* and the *back-end* part. The front-end is a client-side application, which end-users install on their Android smartphones in order to receive FVM information and content (Fig. 3). With it, a user can browse songs, purchase them and recommend the ones he/she likes. Also, he/she may view his/her recommendations and act upon them (e.g. preview the song and purchase it).

Fig. 4 shows what information FVM uses for the user scenarios described in the following subsections A, B, C and D. Physical context information (i.e. *location*) and users' personal information (i.e. i) *taste in music/movies/books*; ii) *hardware info*; and iii) *spending habits and subscription info*) make up context information used in the FVM application. User's taste in music/movies/books is defined through numbers representing shares of genres (e.g. music – 65% rock, 35% pop). Location is determined by geographical longitude and latitude. Hardware info is, among others, comprised of user's smartphone model, screen size, screen resolution and battery level. Spending habits and subscription info include, for example, monthly average spending and current amount spent. Again, it is important to notice that the FVM is just an exemplary proof-of-concept application for the EISN Platform, the latter being the focus of this paper.

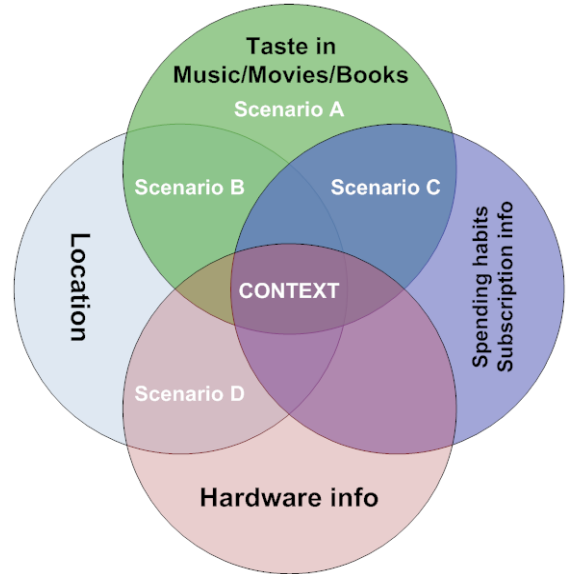


Fig. 4 Context information used in FVM and given scenarios

Fig. 5 displays the execution flow of the application's composite scenario, enriched with application management Graphical User Interface (GUI) extracts and with emphasized application execution steps corresponding to the scenario description over the following subsections (i.e. subsections A, B, C and D). In short, once the system selects the set of users applicable for a pending recommendation, the set is further filtered and partitioned according to the preset criteria. Such refinement enables highly personalized recommending.

¹¹ It should be noted that implementation and algorithm details may not be disclosed at this point due to ongoing patent application.

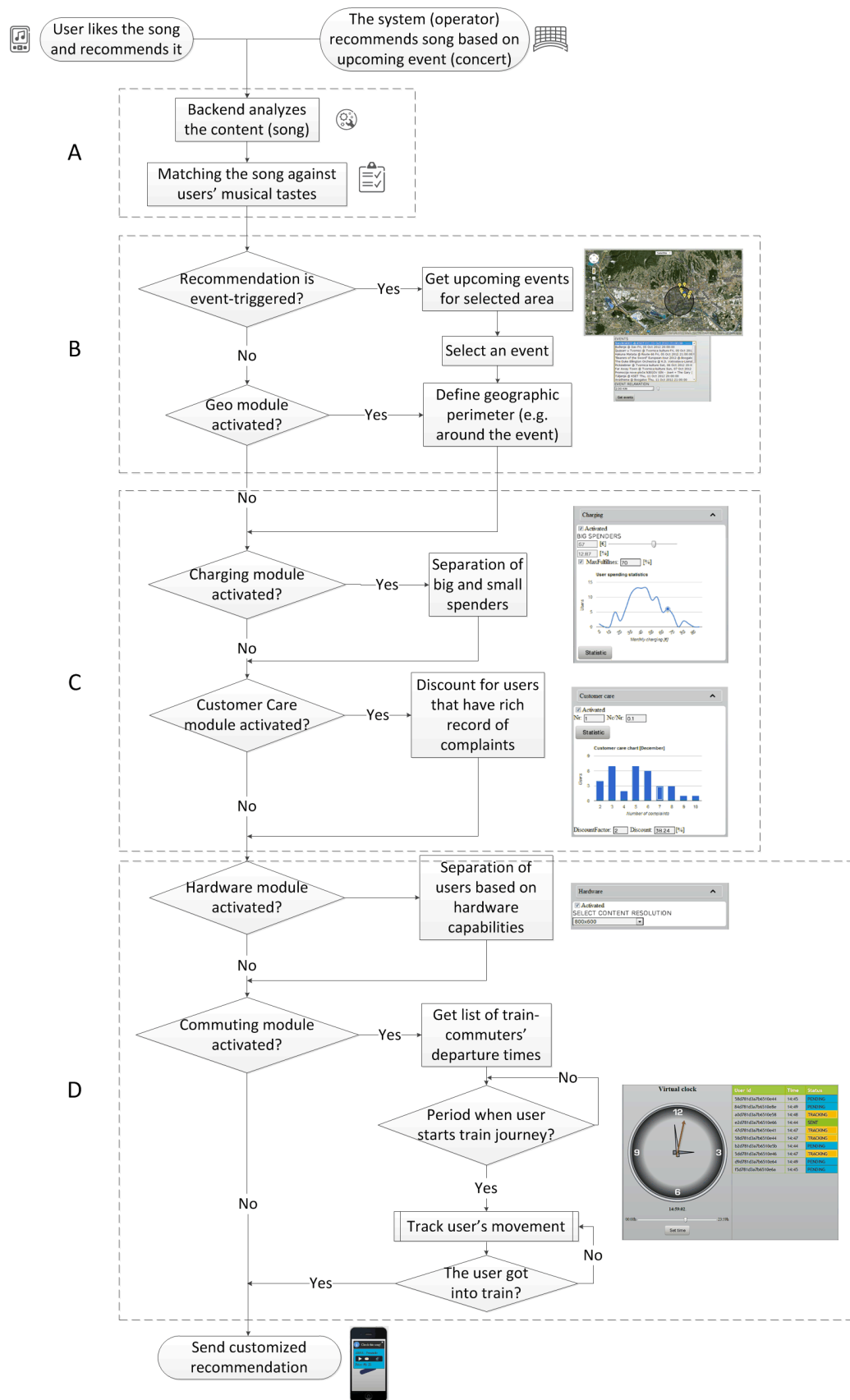


Fig. 5 The Focused Viral Marketing application scenario flow

A. Music Recommendation

"Ewan is a rock fan. While listening to a new album by his favorite rock band, he wishes to recommend a song, via his Android FVM application (Fig. 3), to all other users that might like it. He opens up the application on his smartphone and selects Recommend – the application takes care of the rest."

The FVM application uses the EISN Platform for generating a group of users that would like a specific song based on the criteria devised from an array of musical content analysis algorithms¹². Musical data is retrieved from LastFM¹³ and then analyzed by content analysis algorithms in order to provide a fine-grained description of musical content.

This user scenario is a typical user-generated recommendation, as opposed to an application-generated recommendation described in the next subsection (notice the two different origins of the flow in Fig. 5).

B. Event Recommendation

"Ewan is on a business-related travel in Stockholm. The weekend is coming up and, as he picks up his smartphone, he notices a notification saying that his favorite rock band is having a concert there this Saturday. Of course, he buys the ticket and proceeds happily with his work."

Again, the FVM application uses the EISN Platform to offer the recommendation based on user's musical taste and a list of events in that area, extending the previous scenario. This is an application-generated recommendation, for it can happen at any given time that is determined by the application itself. Concretely, the application fetches data on the upcoming events for a selected area from LastFM. An example for Zagreb is shown in Fig. 6. Just like in the previous scenario, the EISN Platform takes care of user groups receiving the recommendation.



Fig. 6 Upcoming concerts in Zagreb

The Focused Viral Marketing application's main idea is to provide customized recommendations. The following two use cases give examples of such customization, which is applicable for the two above described recommendation modes.

C. Customer Care, Churn Prevention and Boosting Content Sales

"Jennifer is at Vis, an island on the Croatian coast. She is losing her signal constantly for the past hour and, after some time, she reaches customer service. Woman on the other side lets her know they are working on the problem. Other users in the area get a notification that there's been a network problem that is being looked upon. Near the end of the month, an FVM subscriber recommends a song that the system assesses Jennifer would like. Since Jennifer is a big spender, spending more than 50€ per month and with 50% of her subscription amount more to go, she is offered a content bundle (4€) including also the single video and the wallpaper, instead of the single song (1€). As Jennifer has had network problems, she is granted a 30% discount for bundle purchase."

It is cheaper for a telco operator to keep old users than to constantly attract new ones. At the same time, it is important to maximize sales by diversifying small and big spenders. This user scenario shows an example of churn prevention and increasing content sales, involving context-aware customer care service and charging information, respectively. This is achieved by utilizing and combining two independent data types obtained from different data resources thereby bringing a new value to the operator and content provider that has a contract with the operator.

D. Hardware Capability-aware Content Delivery based on Commuting Pattern

"Ewan is back in his hometown of Tampere and has awoken up in the morning to go to work to Helsinki as usual. Since it is a 2-hour drive by train, as soon as he enters the train, he receives a recommendation for a video that he might like and that his phone can render. Ewan decides to purchase it and makes his trip to work less monotonous."

Here, the FVM picks up user's commuting pattern (transportation means and approximate time) by tracking him during 30 days and employing classification algorithms based on machine learning. Fig. 7 shows the system that parameterizes the observed movement pattern (the parameters – x) average speed deviance; y) average deviance from linear movement; and z) average speed – represent the axes in the figure) and classifies it as a *pedestrian*, *car* or *train* (blue, green or red dots in the figure, respectively). As a result, users who travel to work by train on a regular basis receive recommendations at the most appropriate time, which is when they start their train journey.

Additionally, user's phone hardware requirements are taken into account to make sure that the recommended content may be rendered. This composite use case also illustrates the utilization of heterogeneous data as a means of stimulating user data monetization.

¹² The algorithm description is beyond the scope of this paper.

¹³ <http://www.last.fm>

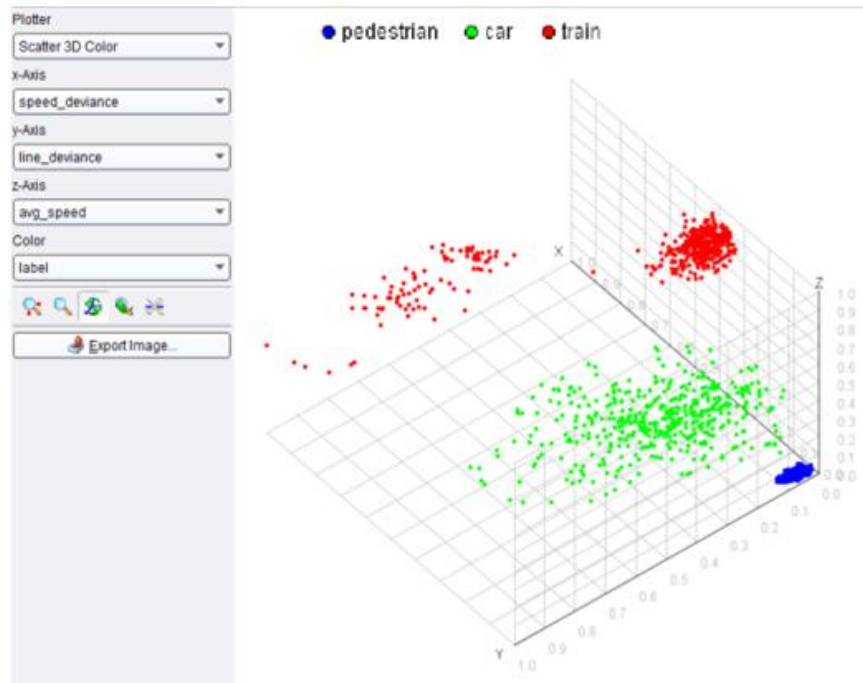


Fig. 7 Movement pattern classifier

V. CONCLUSION

Advances in ICT (*Information and Communication Technology*) during the last decade have enabled telecom operators and other providers to go mobile with a wide range of services and social networking services are not an exception. Context-awareness, such as being able to pinpoint the user geographically or know whether he or she is at work, in school or just shopping downtown, is critical for dynamic, goal-oriented and unobtrusive approach that implicit social networks assume. Users are no longer satisfied just with “being connected”, they need their personal computers, laptops and smartphones to be aware of where, when or how they are connected. They want their services personalized, aware of the things they like. The Ericsson Implicit Social Networking (EISN) makes use of those facts by making them the core user requirements of the platform services.

Future work will include adding more supported features to the EISN Platform and implementing additional proof-of-concept applications similar to the FVM. Integration with other social networking services and external personal information sources besides LastFM (e.g. LinkedIn, Facebook) is of importance for the future of implicit social networking services, ready to deliver social interaction for the user.

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