



HYPER PERSONALIZATION

POSITION PAPER

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1. INTRODUCTION

NEM, the New European Media initiative, is the European Technology Platform of Horizon 2020 dedicated to Content, dealing with Connected, Converging and Interactive Media & Creative Industries.

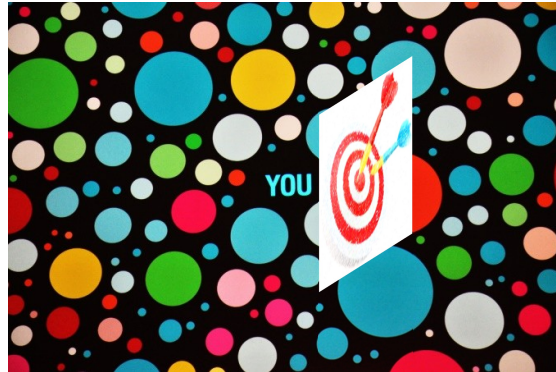
NEM focuses on an innovative mix of various media and creative content forms, delivered seamlessly over technologically transparent networks, to improve the quality, enjoyment and value of life. NEM represents the convergence of existing and new technologies, including broadband, mobile and new media, also considering creativity, across all sectors, to create a new and exciting era of advanced personalised services.

Following the update of the NEM Strategic Research and Innovation Agenda (SRIA) in 2016 [1], it has been decided to extract the most important research domains and objectives that have to be pushed in the next WP2018-2020, in line with the priorities identified by NEM community. Taking these priorities, NEM have prepared position papers tackling the main technical and business opportunities for the sector from a holistic view.

The position paper on **hyper-personalization** will consider the different aspects of maximizing opportunities to customize content to consistently target the right audience throughout the customer lifecycle. Thus it will create meaningful connections and drive engagement among audience. It can be applied to most of the media markets, and it also encompasses the ATAWAD (anytime, anywhere, any device) concept which provides the end user with the best format on the device they are using.

2. SCENE SETTINGS

Hyper-personalization is an advanced and real-time customization of offerings, content and customer experience at an individual level. Designed to perfectly match a customer's preferences, needs and expectation, hyper-personalization leverages Big Data and Artificial Intelligence technologies to deliver such tailor-made solutions in real time



NEM sectors' offerings have to adapt to customer expectations. Hyper-personalization considers each person as a unique individual. Each individual's demands, needs and constraints for potential content and services should be taken into account before providing a tailor-made solution to that person [2]. In particular such tailor-made solution should be provided in real time i.e. one can have different needs and expectations depending on the situational context (location, time, behaviour, mood, ...)

Consumers have transformed into very active "prosumers": they select offers that fit their requirements well, they opt for content, products or services that seem to have been designed for them, as well as producing and designing them whenever possible, and finally, even customizing them when required.

Hyper-personalization is much more than just adapting well-known segmentation techniques at an individual level. Thus, it goes beyond just improved or enriched clustering and segmentation techniques. Hyper-personalization aims to adapt a product, service or experience to a specific customer through a deep understanding of each individual context or hyper-contextualization. Consequently, consumption patterns can vary significantly and affect the customer relationship in real time which should be modified in terms of the service provisioning and the overall customer experience [3].

Hence topics as the capturing of user behaviour, identity management, content discovery and recommendation systems become key enablers that will define through their evolution the real application capability of this new paradigm. Customers will be able to give instant feedback on the consumed content or services, and will be gradually involved in defining

variants of a product. This will assist producers to improve their content, products and services [4].

Of course, the customer will still control the details he wants to share and privacy will remain an important issue.

3. HYPER-PERSONALIZATION ENABLERS AND KEY ASPECTS

3.1 USER BEHAVIOUR CAPTURING

Any substantial improvement in the personalization of services is through the development and consolidation of models of information capture of user behavior. Until now, this has often been done by the acquisition of explicit information, namely, from the information provided by the users about their preferences and interests. There are several problems associated with this type of approach. On the one hand, users are not always ready to express their preferences, as they may be conditioned by external factors, or simply may not know exactly what their preference is at some point, or the degree of interest that a certain service has for them. In addition, the continuous updating of preferences can become tedious and provoke inconsistency, which may detract from the validity of these preferences which have been explicitly stated.

Therefore, systems mostly function by capturing implicit information that comes from all those observable behaviours that can be collected by a system, without intrusion to the consumer. This information is processed using user models, which enable inferring the interest of the user in a given service, but also using artificial intelligence algorithms which are able to identify even more personalized and contextualized solutions, propositions and recommendations, in real time.

The current trend is to combine these two techniques, using both explicit and implicit information. In any case, it is key to have tools that allow the inclusion of both explicit and implicit information systems, so that this is not a restriction and the system designer can choose one of the two methods or a combination of both depending of their specific needs.

Good user behaviour information capture and management include:

1) **Transparency for the user.** Enabling users to understand how the personalization of the systems operates and even allowing them to scrutinize and control their models can promote user engagement, self-awareness, trust and confidence. But using implicit information avoids imposing active participation of the user as a prerequisite for the operation of the system. Implicit information allows the development of models which do not need the active participation of the user, and can lead to diverse types of systems that do not allow such participation.

2) **Objectivity.** An explicit capture of information is more easily controlled and manipulated by a user, who can even "trick" the system in one direction or another, for various reasons. By performing invisible capturing and modelling of the user, it could only alter the authentic information by modifying its behavioural habits. This feature may not have relevance to the user, but may have relevance for other actors in the value chain.

3) **Contextualization.** Fine tuning of user information should integrate contextual information such as geolocation, time slot, mood, etc so that real-time data could be combined with an in-depth analysis of customer behaviour. By recording and analysing historical data, the systems can then refine their algorithms so that targeting is based upon patterns, not just one-off interactions. It requires contextual intelligence on customers' interactions, robust content management, and omnichannel automation. Much of this information is strongly related to social media activity, and capturing information from customers by means of their social credentials provides insights about users. The data capture device determines the type of information that can be obtained, influencing in this way the modeling of the data in order to infer the degree of interest and the subsequent recommendation.

Additionally, new trends such as those incorporating psychological-based analysis and integrating information on the quality of the experience represent new opportunities in this area. Personalization systems have focused mostly on gathering information and updating user models to enable the effective delivery of relevant content to individuals. However, there is little research supporting user engagement by keeping individuals in the loop and enabling them to understand, engage with, and scrutinize their user models and the personalization process.

3.2 NOVEL RECOMMENDATION SYSTEMS

A recommendation is based on the combination of knowledge that is available from both the content, product and/or service to be recommended, and the user to whom it is recommended. Therefore, the success of a recommendation will depend both on gathering the appropriate information and managing it in a way that provides the best possible knowledge of each person's individualized preferences. Recommendation is built upon the most appropriate algorithms and metrics to generate predictions extrapolating, as precisely as possible, the previous knowledge of user preferences to items whose nature has been previously characterized.

One of the main constraints of recommendation systems is their dependence on the application scenario, since the algorithms may no longer be valid or may be ineffective in certain circumstances depending on both the available input data and the way it is collected or the computational requirements.

Recommendation is still an evolving discipline with many issues to be addressed; for the NEM community this is especially within the recommendation of multimedia content.

Four large blocks make up the biggest challenges for the recommendation systems.

Acquisition and modeling user information

It is important to investigate new and flexible formulas that make it possible to acquire as much information as possible from the users without being invasive and in the most transparent way possible. For this, it is necessary to take into account the type of platform in which the recommendation system is developed, and that serves as the access point to the user's information.

Already within the area of multimedia recommendation, it is especially interesting to consider content distribution platforms, where it is considered a fundamental challenge to characterize the preferences of users from their audiovisual consumption.

Another important line of research is the modeling of heterogeneous information by the user, integrating diverse sources and of a different nature. Consumption, explicit opinions about an item expressed through a valuation, actions executed on the item (either sharing, including in favourites, etc.), or implicit comments or opinions expressed in various media, such as social networks, can be taken into account. It can be seen that social media enriches the information provided by means of the types of relationship between different users and their strength.

Therefore, the main future challenge is to profile each user by integrating explicit and implicit information: the explicit information being that which the user supplies directly to the system, and the implicit information that the system infers from the habitual behaviour of the user, such as the consumption of content, activity or comments in a social network, etc.

Acquiring and modeling content information

On the other hand, to address the recommendation of media, it is important to improve the annotation and description of the content. The most common problem in the description of the content, especially in the case of annotation and automatic description, is the semantic dependence of the knowledge domain.

For that reason, there are two fundamental areas of research in this area around the recommendation systems. The first of these is semantic analysis of the concepts involved in the content, through the use of ontologies and other semantic technologies. This line addresses the knowledge domains specific to the recommendation. The other seeks to find structural, morphological or other parameters that are transversal to the domain of knowledge and present features common to a given type of media.

Improved efficiency and accuracy of recommendation algorithms

In general terms, new systems tend to use hybrid recommendation techniques, which include the need to advance content-based recommendation algorithms, collaborative filtering techniques and hybridization methodologies. Artificial intelligence technologies should be also used in order to help in this objective but have to be adapted to this specific domain.

Presentation of results and generation of confidence in the user

New, apparently collateral aspects that promote predictive techniques, which had previously been left aside, are being progressively incorporated into systems. These aspects can be summarized as the presentation of results to the user and generation of confidence. This implies that the recommendations should be clear and transparent, allowing the user to know the reasons why a product or service is recommended, regardless of the technique used for this recommendation

In addition, the user must have the option to modify the parameters of the recommendation, so that it is always the user who decides its characteristics, such as generating a riskier but newer recommendation or a more conservative but safer one. The objective is to try to humanize the machine, so that the human-machine interaction is not only more pleasing to the human user, but also more effective in communicating the decisions made.

3.3 IDENTITY MANAGEMENT

Hyper-personalization systems need to reach the same customer across different channels and devices to provide a seamless, fully-connected cross-device user experience. This issue tackles cross-device identification and identity management uses and are closely related to the digital identity in the network.

Customers are no longer passive and now actively interact with services and content. Top-down communication from services is no longer sufficient. Users demand tailor-made solutions and a personalized customer experience independent of the context of consumption. In order to tackle this new phenomenon, service providers are required to improve information flows in order to achieve a successful cross-device and cross-channel identification.

Service providers will need infrastructure, a data repository of user identities and processes in order to manage the identity lifecycle for every user, related to any service on any device, with an easy to use interface. The solution should include not only complete, standards-compliant identity and access management function but should also include a group management and sharing capability, allowing users to create groups (e.g. families), roles and relationships (e.g. mother of), invite users, delegate and revoke access at a

granular level to their accounts and services. Capturing every single user interaction across any service or device provides insight on user behaviour and enables rich hyper-personalization of service experiences, seamlessly across services, within individual user privacy settings or established privacy standards.

Service providers should manage a unified user identity management layer across all services that they deliver in order to have a seamless and complete digital relationship with every user based on multidimensional identity and access, user-level data capture, personalization and privacy.

3.4 BIG DATA AND ARTIFICIAL INTELLIGENCE TECHNOLOGIES

Hyper-personalization requires leveraging a huge amount of high-quality and relevant data [6]. The volume of data has significantly increased, with datasets becoming more detailed and more diverse, so Big Data technologies have become critical for hyper-personalization.

Large-scale data collection combined with new methodologies for data processing and analysis, even in real-time, together with artificial intelligence technologies, has enabled systems to build new models, with an added predictive and prescriptive capability. The large volume of data which is collected, processed and analysed enables more statistical correlations to be found, improving the robustness of algorithms and if so desired, descriptive, predictive or prescriptive outcomes of analysis.

Artificial Intelligence includes time-tested technologies as text analytics, natural language understanding and processing, semantic, machine learning, and others which are relatively new such as deep learning based on artificial neural networks

The variety and diversity of data which is available and processed allows companies to relatively easily integrate new data sources into their analysis, which was previously very difficult to exploit and interpret as unstructured data (such as free text or videos). The analysis of unstructured data lets them take more qualitative data into account, which is required to carry out behavioural analysis [7].

Finally, the velocity of data collection and processing enables analysis to be performed in real time and supports targeting that can be updated depending on the customer's context and environment, in line with the principle of hyper-contextualization. The speed of data analysis also lets companies measure the return on investments and accelerate the reaction capacity.

Big Data and Artificial Intelligence technologies could transform the relationship between people on one side and systems and machines on another, improving how we live

and work as individuals and a society. Advanced and integrated analytics will run on large data sets, updating models and algorithms with data in real-time, and combining data from different sources in order to deliver new insights for hyper-personalized services.

3.5 PRIVACY

Hyper-personalization can bring great benefits to users' daily lives by making their domestic activities easier and time-efficient, yet it is important to note the underlying risks. The main thing is that through these networks and devices large amounts of data are generated and transmitted whose confidentiality, authenticity and integrity can be exposed and escape from the control of their owners, endangering information, privacy and, in some cases, the physical integrity and patrimony of the people.

There are still some basic problems to solve: security in passwords, encryption or access permissions, and mobile device applications that do not encrypt communications.

Thus, one of the most important challenges facing the new technological scenarios is the protection of users' privacy and personal data. This is because the collection and analysis of the information generated through the interaction of the various devices and services, has a high commercial value within this scheme of hyperconnectivity, which makes it attractive to obtain illicitly.

On the other hand, even actually when customers are more willing to share his/her personal information, there are serious concerns on the way interaction is made and personal data is transferred. Many may see this as an intrusion and might feel harassed and may refuse to interact.

Therefore, it is necessary to reiterate the need to respect the rights of people over their personal sphere in the digital environment [8]. For this it is required that all the actors involved in the exploitation of the hyper personalization inform the users of all of the aspects concerning the treatment of the information that will be obtained, as much of the personal data as of the patterns of consumption and behaviour. It is necessary to support user engagement by keeping them in the loop and enabling them to understand and engage with personalization process.

Consumers demonstrate they are keen to give away much personal data in exchange for free services. Users should be aware of the level of privacy they get in accessing a given service. The challenge is how to improve user/consumers awareness and participation in process of management and exploitation of personal data in personalized service provisioning. There could be different approaches to private data and profile data management:

- the user profile managed by the user himself - user provides access to the profile to authorised service providers on demand; in such way it is possible to have a single personal data description managed and owned by the user himself and accessible by service providers
- the user profile managed by service provider - user profile is developed and managed by different service providers (several profiles for a single user) and should be validated by end users.

3.6 ACCESSIBILITY

Hyper-personalization can bring great benefits to users' daily lives thanks also to the personalized media services according to users' needs and preferences, particularly including those with special needs, older people and other vulnerable population.

It is important to support the promotion of accessibility across Europe in a digital single market of media services through hyper-personalization and adoption of principles "Designed-for-All". "Design-for-All" improves the quality of service for all users, without discrimination, and means no specialized services for particular groups, therefore not making it perceptible. Consequently, older and disabled consumers do not need to look for specific products and services, as their individual and personal needs are taken into account from the concept to the production and eventually to the delivery of services.

The European society is based on diversity and only by giving a broad and flexible response will this diversity be a resource and not a restriction.

Hyper-personalized services should be appropriate, commensurate with the capabilities and performance of the individual, including the needs of everyone. Capabilities and performances of the individual could be reduced, permanently or just temporary.

In order to maximise the usage of media services by persons with some functional limitations, including persons with disabilities, the service should be available through more than one sensory channel and should be accessible in a consistent and adequate way for users' perception, operation and understanding, including the adaptability of content presentation and interaction, when necessary providing an accessible electronic alternative and or augmentation.

4. STRATEGIC IMPORTANCE OF HYPER-PERSONALIZATION

Content and Creative Industries, while locally, regionally, and/or nationally implemented or even governed, are moving to a worldwide framework, thanks to the digitisation of the whole value chain, from creation through distribution to consumption. These industries are updating the whole process by paralleling a lot of actions all along that value chain and reducing the production time from capture to access. This diversity often challenges established businesses and their business models, requiring them to be involved in the latest technology research and innovation activities of their sector.

This process opens the sector to apply new paradigms as hyper-personalization bringing new opportunities and challenges technological, infrastructural and regulatory by means of disruptive and focussed approaches.

The European society is based on diversity and only by giving a broad and flexible response, with the assistance of the hyper-personalization paradigm, will this diversity be a resource and not a restriction.

The global trend towards the extreme differentiation of offerings in products and services cannot be foreign to the sector, from the recommendation of content to the integration of the final consumer in the design processes. Hyper-personalization through very precise targeting not only ensures the best potential impact but in parallel increases the added value of products and services.

Hyper-personalization technology will allow the gap between providers' business needs and consumers' desires to be closed, allowing consumers to enjoy an increasing range of products whilst service providers battle against the fragmentation of retailing and media across multiple channels and platforms.

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