NoTube
Networks and Ontologies for the Transformation and Unification of Broadcasting and the Internet

FP7 – 231761

D7b.3 Multi-lingual user identification for PPG

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EXECUTIVE SUMMARY

This deliverable presents the progress in Work Package 7 which focuses on the use case “Personalized TV Guide with Adaptive Advertising”. This use case illustrates the design and development of a Personalized Program Guide which can, next to providing personalized content, propose additional services like Multimodal support and personalized advertisements.

This particular deliverable deals with tasks T7b.4 (Personalized advertisement delivery for individuals and groups) and T7b.5 (Extension of current monolingual PPG for multilingual environment). In this deliverable we look in more detail at the relevant techniques and technologies to facilitate these tasks and explain the strategies being applied necessary to demonstrate the use case.

Further, we illustrate these technologies and combine them into a VOD portal demonstrator, showing a glimpse of the next generation interactive and personalized TV applications.
**Abstract (for dissemination)**

In this deliverable we report the status and progress made towards the goal of inserting personalized advertisements and a speech-based multimodal search interface.

**Keywords**

Personalized advertisement, ad insertion, Multimodal interaction

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1. Introduction

Previously, in deliverable D7b.2, we extensively discussed the technologies behind personalized advertisements, multimodal interaction as well as the insertion of ads in video content. Therefore, when in need of more information we would like to refer to this document. In this particular deliverable, we report on the continuation. On the one hand, we discuss the improvements of the technologies with respect to the previous deliverable, and on the other hand, we illustrate one of the final demos in which these technologies are presented.

The structure of this document is closely tied to the two tasks it describes:

- T7b.4: Personalized advertisement delivery (for individual and groups)
- T7b.5: Extension of current monolingual PPG for multilingual environment

In Chapter 2 we discuss a Video-On-Demand (VOD) portal running on iFanzy technology in which we demonstrate the insertion of ads as well as the workflow-driven process to generate those ads. Further, we also discuss the connection of different screens to the portal. In Chapter 3, we provide an update of the multimodal technology and how it leads to a multilingual environment, allowing the user to search for content in different languages. We conclude this deliverable in Chapter 4.

For more background information on the NoTube context and how this use case fits within that context, we would like to refer to previous deliverables.
2. Personalized advertisement delivery

2.1 A Video-On-Demand portal demonstrator

For the personal advertisement demo we have implemented a Video-On-Demand (VOD) portal running on top of the iFanzy architecture\(^1\). As previously explained in deliverable D7b.2, iFanzy is a personalized EPG developed by Stoneroos Interactive Television in collaboration with Eindhoven University of Technology (TU/e). Its main functionalities are to provide recommendations over and intelligent search through a large set of TV programs. While using iFanzy, users are able to sit back and relax watching TV programs of their interest, instead of zapping through all TV channels to find something interesting. Hence, iFanzy suggests TV programs to its users that are potentially interesting. In order to come up with suggestions, the recommender iFanzy uses is based on a content-based filtering approach. To cope with the cold start problem, demographic filtering techniques are applied. iFanzy consists of a client-server system with multiple clients operating on various devices.

The main advantage of constructing this demo on top of iFanzy, is that we can reuse the user profiles which already exist within iFanzy to feed the ad recommendation algorithm. When using the iFanzy website, connected TV and/or the iPhone app, people can rate programs, set favorites, set alerts, etc. which influences the user’s profile in the background. This user profile, reflecting the user’s taste from many different perspectives, serves as an invaluable source for a recommendation algorithm.

The start page of the VOD portal is shown in Figure 2.1. In this figure we see a set of favorite movies (when no user is logged in, we see the movies which are popular among all users) through which a user can browse. Every item displays some metadata including duration, description, actors and a rating. In the upper right corner of Figure 2.1, we see that no user is currently logged in. Therefore, if a user wants to watch a VOD element, he or she will have to pay to consume the content.

Of course, the system becomes much more interesting whenever a user logs in with an existing profile. In this VOD portal prototype, a user can connect his profile by means of the iFanzy iPhone application. The iFanzy iPhone app, which can be seen in Figure 2.3a, was developed to bring iFanzy into the mobile world, as well as to have a means to carry your identity/profile. Besides providing a simple EPG, it can e.g. connect to the iFanzy Web portal to import as well as export an existing profile.

In the upper right corner of Figure 2.1, we see a link “Please connect with phone”. When clicking this link, we arrive on a new page which is shown in Figure 2.2. To connect, this page expects a unique code which is generated on the phone for this user’s account. Taking our iFanzy mobile application, we can find a “Connect profile” button under the ‘settings’-tab. When we press this button we see the screen as shown in Figure 2.3b. The mobile app sends a request for a connection code to the iFanzy server, which responds with a unique ID, in this case ‘4521’. When we enter this code on the VOD portal’s connection page (as shown in Figure 2.2), the VOD portal makes a connection to the iFanzy server to verify this code. However, before the user’s profile is connected to the portal, the user is asked for a final confirmation on his mobile. In Figure 2.4a we see the mobile asking the confirmation from the user, and in Figure 2.4b we see the confirmation from the server that the connection has been established.

\(^1\)Publicly available at http://adsdemo.stoneroos.nl/VOD
Figure 2.1: The iFanzy VOD portal.

Figure 2.2: Connecting your iFanzy profile to the VOD portal.
Figure 2.3: The iFanzy iPhone app.

Figure 2.4: Verification of the profile connection.
When the connection to the profile is finally established, the user is asked to further complete his profile if necessary. In Figure 2.5 we see the different fields in the user profile we would like to see completed because they have an important relevance in the ad recommendation algorithm. On this page, we for example ask for the year of birth (to deduce the user’s age), the gender, the educational level of the user and his lifestyle. Why these files are relevant will be explained further down this document. Once the user has finalized this page, he is again redirected to the VOD portal.

Being logged-in and his user profile connected, the user can again choose to watch a VOD content element. Whenever the user clicks an item, the screen, as depicted in Figure 2.6, is shown. In this screen a choice is presented to the user:

- **Watch free version:** By clicking this link the user can watch the content for free, but with the inclusion of ads.

- **Watch paid version:** Here the user pays for the content but is not bothered by advertisements.

![Figure 2.5: Completing your iFanzy profile.](image)

![Figure 2.6: Choice between free or paid content.](image)
This split is the basis of a potential business model: the user gets the choice to pay or not. With careful tweaking of the price of each content element, we believe we can draw enough people to the free version, such that advertisers can again make money from their spots. The technology to insert video ads in a movie clip is provided by Thomson Video Networks, on which we will elaborate further in Section 2.2.

If the user decided to watch the content element for free, ads will be inserted. On exactly this moment the ad recommendation algorithm kicks in and tries to find the best matching ad for the current user’s profile. This algorithm has been developed by Stoneroos within the NoTube project, and is based on the previous program recommender developed in iFanzy. The algorithm works as a property weighted algorithm, where different properties of the user profile and ad metadata have an influence on the final result. This influence can be adjusted by means of the weight, which tells the algorithm how heavy a certain property should be taken into account. Although the current VOD portal cannot deal with a group logging-in, the algorithm is devised in such a way that it can also discover the best matching ad given a set of user profiles. The properties that are taken into account by the algorithm can be classified in two groups:

- Demographical properties:
  - Age: The age of a user is a good predictor for the classification in a stereotype group (an ad usually comes with a stereotype for which this ad is effective). In the algorithm e.g. young children get ads about toys, older people get ads for cruises on the Nile.
  - Gender: The gender of a user is also a good predictor for the classification in a stereotype group. E.g. males get ads about cars and beer while females will be served with hair lotions and handbags.
  - Education: The education of a user is the third good predictor for the classification in a stereotype group. E.g. Highly educated people will have a higher interest in financial stock market products.
  - Lifestyle: The user’s lifestyle is a property which is a specific stereotype on itself. Possible values include e.g. ‘Single’, ‘Couple’, ‘Family with young children’, ‘Retired’, etc. If a user is classified in one of these stereotypes, fitting ads get an immediate bonus in their score calculation.
  - Location: If the current location, as part of the user’s context, is known, it lead to different ads. E.g. in the touristic ad department, an ad for a fun park could be useful if you happen to be nearby. Complication here, is that this feature only works if the user agrees to share his location.

- Program/metadata properties:
  - Genre: Beside demographical properties (like age, gender, education, etc.), properties with respect to the metadata are also included. E.g. an ad with flashy action and Mission Impossible-like scenes will be appreciated more by people who already rated action programs highly (which led to a high liking of the genre ‘Action’ too).
  - Keyword: Ads as well as TV programs usually have a set of keywords or subjects associated. Comparing them gives a good similarity between a
certain program and an ad. Hence, if the user rated that program highly, the ad receives a better score in the algorithm.

- Semantic distance: In case both the ad and the program have descriptive metadata, we make a general comparison between the metadata descriptions. However, the condition is that both have a well-defined description which adheres to a metadata schema. If the two adhere to a different schema, we create a mapping between the them to link those properties expressing the same values. Afterward, we calculate the semantic distance (or Semantic similarity or semantic relatedness), a measure of how similar two different descriptions are, to discover the user's interest in a certain ad.

Considering all these properties and their respective weights, the algorithm calculates a score for every ad in the current valid batch. In Figure 2.7 we see a simplified representation of a user profile (on the left) and the ad (on the right). We see some of the properties of a user (including age, gender, education and one of his likings) and of the ad (e.g. the stereotypes for which the advertiser thinks that this ad is suitable). As the algorithm executes, for each of the properties listed above, it evaluates how well they fit the current setting. E.g. it checks the user’s age (which is ‘15’ in Figure 2.7) and gives a property score to every ad, where the property score is higher if the ad’s age group fits (in Figure 2.7 we see that the ad includes the stereotype ‘Children’, which is a good match with a person of age ‘15’). For a program/metadata property like ‘genre’, the algorithm checks the user’s liking of the ad’s genre (in this case ‘Action’) which has a value of ‘8’ on a scale from 0 to 10 in Figure 2.7. Afterward, it gives a property score to every ad, where the score is again higher in case the user’s liking in the genre is high (above 6 out of 10).

After considering the eight properties in the list above, every ad has received eight different property scores. To obtain the final score, every individual property score is multiplied with its specific property weight after which all the eight multiplication results are summed. This score is then in turn used to rank the ads, telling us which ad currently fits the user’s profile best. In Figure 2.8 we see the top five selected ads for the user who is currently logged-in on the VOD portal. Having here a single male user of 30 years old, the top ads include among others a beer commercial (1st), commercials about traveling (2nd and 3rd) and an insurance commercial (4rd). Optionally, the viewer can decide to watch the movie either on his main screen or on a 2nd screen (iPhone).

Looking at future work with respect to this algorithm, we suspect that much will depend on the metadata structures effectively used by big advertising companies. For this demonstrator, we captured a set of ads and annotated them ourselves using the egtaMETA description schema as explained in deliverable D7b.2. If those advertisers have very different metadata structures and/or stereotypes, the algorithm will need to be adapted accordingly. Secondly, it might prove that we have to consider even more properties outside of the eight properties listed above.
Figure 2.7: Metadata representation of a match between a profile and an ad.

Figure 2.8: Ad ranking for the current logged-in user.
2.2 Ad insertion technology

To insert an advertisement in an MPEG stream, the ad insertion technology based on ROI (Region Of Interest) is used. This technology tries to discover the best time and location to insert an ad such that it is still visible but not completely spoiling the user’s experience. At the best time, identified by the algorithm, an advertisement will be inserted within the content-element (picture in picture) without interruption of the content-element.

To realize this automatic ad insertion and demonstrate it at IBC or at any other public event, it was necessary to look for royalty-free videos. Five royalty-free videos and ten ads have been collected. Videos collected on the web were not in a format which could be processed by the ad insertion algorithm. Thus, a time consuming process was settled to manually re-encode these streams in the right format (MPEG2 video into MPEG2TS with constant bit rate and correct scene cuts encoding).

The implementation of the ad insertion algorithms on Thomson Video Networks equipment is based on the succession of two workflows. The first workflow (see Figure 2.9) processes the movie in order to extract the metadata describing the n “best sequences” available to insert the ad and writes these metadata in an XML file. The second workflow (Figure 2.11) inserts the ad in the video thanks to the metadata produced by the first workflow.

To accomplish these workflows, a simple and open software framework, based on a pipeline architecture, was developed. This framework allows the connection of modules, in order to realize complex video treatments such as ad Insertion.

2.2.1 Description of the 1st workflow (generation of metadata locating where the ad must be inserted)

As shown by Figure 2.9, the video analysis workflow is composed of:

- Three input modules (orange boxes) to get the TS input video and extract the Access Units:
  - In the “TS file input” module, the filename and file path of the TS file are specified. This module connects to the NFS server to get the TS file.
  - The ‘TSInput’ module reads the TS file and extracts the Packet Elementary Stream (PES) which corresponds to the PID specified in the properties of the ‘TSInput’ module. This module regularly sends the next packet to the ‘TSAuExtracter’ module.
  - The ‘TSAuExtracter’ module extracts, from the received packet, the Access Units. These Access Units are sent to the Video decoder module.

- The ‘Video Decoder’ module (yellow box) decodes the MPEG2 Access Units and then converts the compressed Access Units to uncompressed images.

- The ‘VideoAnalysis’ module (green box) analyses the images received from the ‘Video Decoder’ module in order to produce the video analysis metadata. This algorithm, which is the core of what was developed by TVN in NoTube for the automatic ad insertion application, is described in D4.3
The result of this first workflow is the generation of a metadata file that contains the n “best sequences” available to insert the ad (see Figure 2.10 where 3 “best sequences” were identified). These sequences are ranked, the first one corresponding to the best sequence the algorithm found.

![Metadata extraction during video analysis](image)

**Figure 2.10: Example of metadata extracted during the video analysis step.**

In the metadata XML (as seen in Figure 2.10), each found sequence is described as follows:

- “SOIPictBeg” and “SOIPictEnd” correspond respectively to the image number where the insertion of the ad must begin and the image number where it must stop.
• “CORNER” corresponds to the corner of the image chosen by the algorithm to insert the ad (x and y coordinates).

• “WINDOW” corresponds to the new size of the ad (width and height)

• “SEQ_SALIENCY” corresponds to the average saliency map of this sequence

2.2.2 Description of the 2nd workflow (insertion of the ad in the video)

As shown by Figure 2.11, the ad insertion workflow is composed of:

• Two times three input modules (orange boxes) to get the TS input video files and extract the Access Units (one branch, at the top, for the video movie, the other branch, at the bottom, for the ad):
  – In the “TS file input” module, the filename and file path of the TS file are specified. This module connects to the NFS server to get the TS file.
  – The ‘TSInput’ module reads the TS file and extracts the Packet Elementary Stream (PES) which corresponds to the PID specified in the properties of the ‘TSInput’ module. This module regularly sends the next packet to the ‘TSAuExctracter’ module.
  – The ‘TSAuExtracter’ module extracts from the received packet the Access Units. These Access Units are sent to the “Video decoder” module.

• The “Video decoder” module (yellow boxes) to decode the MPEG2 Access Units and then to convert the compressed Access Units to uncompressed images.

• The ‘VideoProcessing’ module (green box) to resize the ad (in order to insert it in a corner).

• The ‘TSOffset’ module (purple box at the top) to allow waiting for the ‘SOIPict-Beg’ picture before inserting the ad as specified by the metadata file.

• The “Video processing (2)” module (green box) to insert the resized ad in the video (Picture in Picture). The position of the ad is given by parameters “POSITION X and Y”.

• The “H264 Encoder” module (blue box) to convert the pictures to compressed Access Units.

• The three outputs modules (purple boxes at the bottom) to packetize the Access Units, build the MPEG2 TS and generate the MPEG2 final file:
  – The ‘TSPacketiser’ module packetizes the Access Units in a packet (PES).
  – The ‘TsOut’ module creates an MPEG2 Transport stream (TS) and inserts the PES in the TS.
  – The ‘TSOverIpOut’ module creates a file with the MPEG2 TS and saves this file on the NFS server.
2.2.3 Output of the workflows

The royalty-free re-encoded streams have been processed with the ad insertion algorithm. 50 new streams have been generated for the 7B use case. The result on one stream is shown in Figure 2.12 (pictures of the movie with inserted ad).

2.2.4 Conclusion

In order to automatically insert personalized advertising in films, two main technologies were developed and integrated into the final 7b showcase: One to personalize the Ad to the target (by using iFanzy technology) and one to insert the Ad at the right location in the film (as described in this section).

A first evaluation of the Ad insertion technology was made on 5 videos with 6 testers (colleagues & relatives). The evaluation results highlight the globally good results of the Ad insertion algorithm. After the first Ad insertion technology evaluation, several solutions were studied to improve the efficiency of the Ad insertion algorithm. A second evaluation of the Ad insertion technology is scheduled in November 2011 with a larger panel (NoTube partners) in order to get a better confidence in the results.
Figure 2.12: Ad insertion result.
3. Extension of current monolingual PPG for multilingual environment

3.1 Search for Korean VODs in English

Currently, an IPTV service provided by kt is only accessible in Korean and since most customers of kt’s IPTV service are Korean, there has been no need for multilingual support. However due to a recent transiency, there is an increase demand of accessing this service in other languages such as English. For example, a person who immigrates into Korea might have a difficult time searching for VODs in Korean and prefer to use English which is more familiar language to him/her. To this end, kt has developed a translation service that aims at helping finding IPTV contents in English by using a KorLex system, i.e. a Korean WordNet.

KorLex has been developed by Pusan University and its current 1.5 version is based on WordNet 2.0 [2]. It has over 150,000 words and 130,000 synsets, and is structured into a relational database format. In order this resource to be easily accessible within the NoTube’s framework, it was necessary to convert it into a Web-based application. kt has re-structured this into a RDF/OWL file and provided an open API for a SPARQL query. The SPARQL query returns translated words based on an input of: 1) a word, 2) a synset id, and 3) word#pos#sense. The query also can be used for finding hyponym or hypernym relations. Using the SPARQL query, it is possible to find corresponding English words for a Korean word.

As above, we proposed that such multilingual interface would be useful for finding Korean contents for an English-only speaker. We have not done a user trial for demonstrating such suggestion for two reasons: 1) it is rather difficult to find an English-only speaker in Seoul; and 2) it seems rather unnecessary to test whether a user prefers his/her native language over foreign languages when searching for TV contents on mobile. However, we expect that once this interface is released to public, we get and analyze search logs which might indicate whether such multilingual interface is actually preferred by some users.
OllehTVNow is an iPad application of the kt’s IPTV service and contains over 5000 VODs and 30 live channels. It is currently available for free. Figure 3.1 shows the icon image of the OllehTVNow application and its first loading page.

VODs can be searched either by a keyword-based or semantic-based query. A keyword search retrieves documents where terms in a user query occur. It does not take into account the meanings or context of the terms in documents or queries. Terms in the documents are the main means of indexing and retrieving related documents. On the other hand, semantic search tries to improve search accuracy by understanding the searcher’s intent and contextual meanings of query terms when retrieving related documents. The system uses domain knowledge modeled as an ‘ontology’ which is predefined by human experts and allows reasoning in contexts. An ontology is a formal and explicit specification of a shared conceptualization and models a domain in terms of objects, properties and relations. kt uses the Owlim framework of Saltlux company as an underlying reasoning engine [1].

kt uses a keyword search for retrieving contents based on titles and a semantic search for retrieving other information such as actors, directors, plot keywords, and genres. Search results are presented with detailed information such as Korean/English titles, directors, actors, subtitles, synopses, series information, production companies, production year, producing countries, viewer rates, run times, images, and release dates.

Using a web-based KorLex openAPI, we made a SPARQL query for over 400 semantic words and got a list of corresponding English words. We extended the OllehTVNow interface with a translation button that converts English words in a user query into Korean words and queries with these words for finding VOD contents.
3.2 Demo Scenario

This demo is to demonstrate how an English-Korean translation interface in OllehTVNow is useful for finding Korean contents for those who are not familiar with Korean. Imagine the following use case. A child who is in primary school has homework of surveying cultural and social artifacts of Korea. Since he does not have any knowledge about Korean, he decides to use the OllehTVNow application especially its translation service. First, he types ‘history’ (or by using a speech button, he can instead sound the word), and clicks a ‘translation’ button as shown in Figure 3.2a. The KorLex openAPI is called and the Korean word for ‘history’ is returned, as shown in Figure 3.2b. The system parses all queries in Korean for both the keyword as well as the semantic search. Using an auto completer, it returns two VOD genres: 1) ‘history’ documentary; and (2) ‘history’ film. Figure 3.2c shows the search results of ‘history’ documentary. Selecting one of the search results would bring detailed information of that content as shown in Figure 3.2d. By looking at the title and synopsis, the child got interested in Korean courts in Chosun dynasty and by following the same steps above, the Korean word for ‘court’ is used for searches and the results are shown in Figure 3.3a. Figure 3.3a also shows there are two semantic matches with ‘court’: 1) court documentary and 2) court movie. Figure 3.3b shows the search results of court movie and Figure 3.3c shows the detailed information of one of the court movies.
Figure 3.2: The OllehTVNow interface.
Figure 3.3: The OllehTVNow interface continued.
4. Conclusions

In this deliverable we presented the progress in Work Package 7 which focuses on the use case “Personalized TV Guide with Adaptive Advertising”. This particular deliverable deals with tasks T7b.4 (Personalized advertisement delivery for individuals and groups) and T7b.5 (Extension of current monolingual PPG for multilingual environment). In this document, we have introduced the design of a new Video-On-Demand portal, which is connected to the iFanzy system. Logging into this VOD portal, without losing any accumulated profile information, is possible by connecting the existing profile via the iFanzy mobile app.

Once connected, we can roll-out the new business model which allows the user to buy content, or obtain it for free but with the inclusion of ads. The ads are personalized based on the user’s profile and inserted via the video insertion technology of Thomson Video Networks. The ad insertion algorithms of Thomson Video Networks, are based on the succession of two workflows. The first workflow processes the movie in order to extract the metadata describing the n “best sequences” available to insert the ad, and writes these metadata in an XML file. The second workflow inserts the ad into the video based on the metadata produced by the first workflow. This combined effort of the personalization algorithm and the ad insertion technology provides an answer to Task T7b.4.

With respect to the evolution towards a multilingual PPG environment, we have presented a nice iPad demonstrator (which is actually almost market ready). In OllehTVNow, a originally Korean demonstrator, we have developed a translation service that aims at helping finding IPTV contents in English by using a KorLex system, i.e. a Korean WordNet. Through this automatic translation, Korean contents can be found for those who are not familiar with Korean. With this contribution, we deliver an answer to Task T7b.5.
REFERENCES
