SUB-PROJECT 1

Experimental development of emerging technologies in the field of recommendation systems (deep learning on big data) at the level of online social networks and the study of their implact at the user level (AI Media)

Within Sub-project 1, which focuses on the use of complex analysis and recommendation systems (deep learning), the identification of potential users and their expectations regarding the AI Media application was carried out, a market analysis was carried out regarding the existing solutions similar to AI Media, a Good Practice Guide for the realization of the AI Media application was carried out, using Machine Learning algorithms, which use image recognition tools and identify the feelings caused by the posts in the different blocks of content analyzed, qualitative and quantitative studies were carried out among the potential users of the AI Media application, in order to identify the expectations regarding the capabilities of the application and determine the intention to use it, and the functional requirements of the AI Media application were formulated, being designed to provide the following services: identifying logos in images and video; recognition of geolocation; the social context in which an image and analysis of feelings is placed on a social network.

For the analysis of feelings, the Haar Cascade Classifier algorithm was used, based on machine learning in which a cascading function is trained from a lot of positive and negative images, clsifying emotions into several categories:

- Basic Emotions (BEs) – refer to six basic human emotions, i.e. happiness, surprise, sadness, anger, disgust and fear.
- Compound Emotions (CEs) – are combinations of two basic emotions.
- Micro Expressions (Micro Expressions - MEs) – represent more spontaneous and subtle facial movements that occur involuntarily.
- Facial Action Units (AUs) – units of facial action encode

The choice of characteristics for the classification of feeling is important in order to obtain the best possible accuracy. Examples of possible characteristics for classifying feeling would be: Lexicon Sentiment, Rules for Opinions, Emoticons, Frequency and Presence of Terms, etc.

Model testing is done on the basis of classification. For the classification of the text, *transfer learning* (learning by transfer) is used, where, in the first phase, the training is done on a large corpus. Then it ends on a target corpus. Finally, the classifier is trained using labeled examples. The following example illustrates the training process.

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Fig. 1 Classification text. Training process

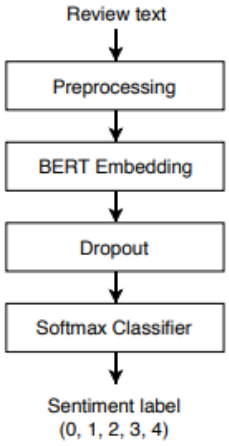
The model does not require labeled data for pre-preparation. Initially a model is pre-trained in an unattended manner, then it is adjusted to a domain-specific dataset. Thus, classification is done using much less data. This is important because in practice there are no large datasets to be labeled. The model is the combination of neural network architecture and specific settings (*hyperparameter*).

For implementation, the FastText library, launched by the Facebook AI Research (FAIR) team in 2016, was used, which is based on CPU processing and used for effective learning of word representations (word embeds) and text classification. It is written in C and supports multiprocessing during training. One of the goals of fastText is to allow the formation of models without the need for a GPU. FastText allows both supervised training and unsupervised training of word representations and for the classification of sentences, and is able to achieve very good performances for word representations and sentence classification.

For good efficiency on datasets with a very large number of categories, a hierarchical classifier is used instead of a flat structure, in which the different categories are organized into a tree (binary tree instead of list).

The BERT model is a two-way transformer trained on the task of masked language modeling (MLM) and the prediction task of the next sentence (NSP).

The proposed architecture for the classification of fine-grained feelings:



Feelings classifier using the pre-trained model BERT

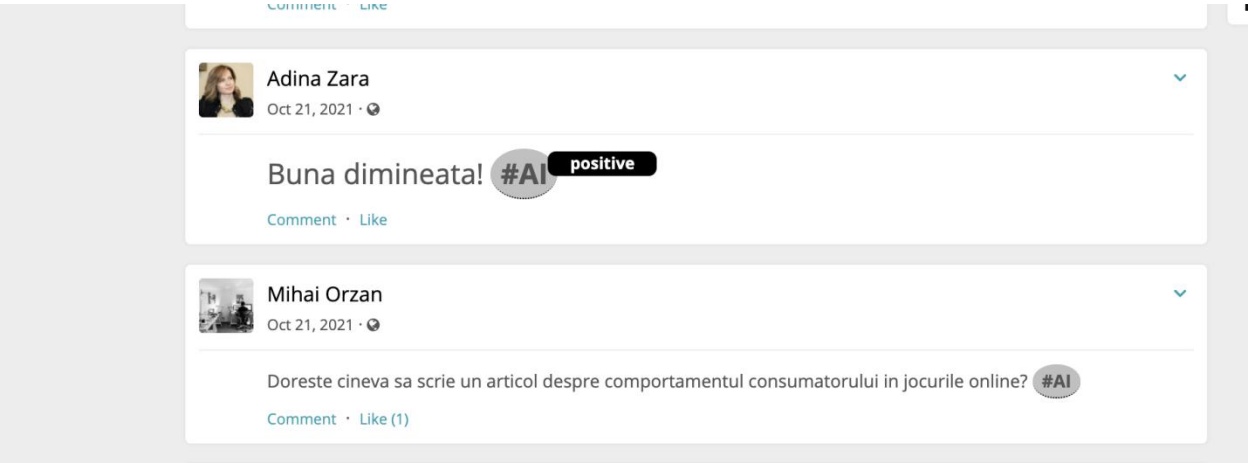
For the detection of feelings from the text, two models of deep learning networks were identified and tested that presented in the studied literature the best results, namely: fastText and BERT. Datasets have been identified for the detection of feelings from the text from which Large Movie Review Dataset, Amazon Reviews for Sentiment Analysis, and Amazon Earphones Reviews Kaggle have been selected. These sets are available for research and contain attitudes and feelings of customer users who have bought certain products and services and who express their opinion on various social networks. On the basis of selected sets was built a set of its own by combining them and presented in a unique format, set later used for training networks. The result was pre-trained network models with an accuracy of 88.10% on fastText and 95.38% on BERT.

During the reporting period, the implementation of the AI Media module and its integration in the futureweb common interface was completed and the structuring of the research and technological services offer and the presentation in the ERRIS platform with the study of the integration of deep learning services within an online social network was completed. 3 ways of integration were identified, which were tested alternately by the research team.

The first way involves *REST web services*. The integration of the AI Media subproject with the unitary application at the project level can be done through REST web services. At the level of the AI Media application, a number of REST services have been developed through which other applications can interconnect with the AI Media application. Based on these web services, the functions implemented at the level of the AI Media subproject can be used.

The second way involves making a *link to the existing application*. Within the AI Media subproject, a web interface has been developed to facilitate the operation and testing of the REST web services developed. This interface could be used as such. In order to access the web interface, in the unitary application that integrates all subprojects, a link can be reserved that will have as a reference the web interface of the AI Media subproject.

The third way – connecting to *the Iframe*, requires that the interface developed within the AI Media subproject could be used as such, the integration with the unitary application can be done by using the iframe nuni. Specifically, within the unit application, an iframe is used in one of the pages in which the AI Media application will run. Transparently the application seems to be run directly from the server of the unit application, in fact the AI Media application is only integrated into a page of it.



The message status analysis system was implemented using a more complex system, formed so that the text processing is done in the queue, and the processed message, for which there is also a result to attach a badge with the text #AI, which at mouse-over to display the result of processing.

Thus, at a first loading of a new message, be they title or commentary, the script in question sends a processing request, containing the md5 hash of the text and the text in question, which will be attached in a processing queue. An automated job runs on the server every 5 minutes, and will process the new texts stored in the queue. When the processing has taken place and the message has obtained a result of the processing, then upon further verification of the hash code related to the text, only the result will be returned.