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PERSONALIZED ONLINE MARKETING USING FACIAL AND EMOTION RECOGNITION

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Abstract: *Relying on the new technologies, marketers are more and more preoccupied in delivering a unique experience to the customers by using personalized dedicated ads campaigns, built on specific user's profile. Based on facial recognition and emotions interpretation, specialists are able to identify a certain user and what kind of ads will he be interested in responding to. This way, the ads can be customized without any intervention from the user.*

JEL classification: M31, M37

Key words: online marketing, personalized marketing, facial recognition, emotions recognition.

INTRODUCTION

Personalized online marketing is based on collecting data related to the customers and providing marketing experiences that target specific types of customers using specific instruments such as emails, social media, and blogs. The aim of personalization in marketing is to boost the sales and conversion by targeting specific audiences, creating a meaningful content for them, making better recommendations for customers. The most important advantage of personalized online marketing is that it helps deeper relations with customers. The technological advances allow marketing specialists to create much more personal experiences and for doing that, many of them are more interested in using facial recognition, location recognition and biometric sensors (Boudet et al, 2019).

But despite all the advantages seen by marketers in using new technologies for developing their business, they have to be aware of the customers' resilience for this new approach, because many of them consider that their privacy is invaded. One survey was conducted in 2017 which includes responses from over 3,500 consumers in the UK, US, France and Germany about the impact of technology to the in-store shopping experience. Consumers were asked also about facial recognition, which was considered rather 'Creepy' than 'Cool' (RichRelevance, 2017).

This paper focus on highlighting the advantages of using facial and emotion recognition, as a useful tool for providing meaningful experience to customers, considering and protecting their privacy. The first section of the paper explain the evolution of one-to-one marketing, from direct marketing to email marketing and then to personalized online marketing. The second part of the paper provides an example of how facial and emotion recognition works, using human subjects who agreed to participate in this experiment and have their personal data mentioned in this paper.

THE EVOLUTION OF PERSONALISED MARKETING

One-to-one marketing or **direct marketing** use any media channel that can send a direct message to a consumer. These media channels are "addressable", thus differentiating themselves from "mass" media, such as television, radio or billboards (Anshari et al., 2016), (Doya & Taniguchi, 2019), (Różewski et al., 2019).

The advantages of direct marketing are:

- Targeting - The most important aspect of this type of action is its ability to accurately target existing customers. If there is a list, it can also be used effectively to prospect the market. But with the advent of email, websites and cookies, organizations can have a dialogue with their customers via the Internet, in a much cheaper and easier way.
- Personalization - Direct actions (such as emails) can be addressed personally to the client and can be adapted to his needs based on previous transactions and data collected.

- Optimization - Due to its measurability, direct mail can be tested to get the optimal list; the optimal offer. Then the best results can be applied to a wider audience to get the best results.
- Data accumulation - The answer, as well as its lack, can be added to a database, allowing future shipments to be even better targeted.

The main disadvantage is the cost which is higher than any other form of "mass" promotion. However, the loss rate is much lower.

For the moment, the most used media channel in direct marketing is **direct mail**. Direct mail means sending advertising materials addressed using email services. One of the most visible forms, from the consumer's perspective, of the entire direct marketing activity of the organization, refers to the design, organization and development of direct mailing campaigns. (Lock, 2019), (Reisman et al., 2019)

The main reasons that determined the development of direct mail as a major way to implement the direct marketing campaigns of organizations are[1]:

- the high degree of orientation provided by direct mail campaigns allowing the organization to address an precisely defined audience, specified in relation to the mass of consumers according to its various geographical, demographic, psychographic or behavioral characteristics;
- its measurable nature, a feature associated with all direct marketing activities carried out by the organization, facilitating the assessment with a high degree of accuracy and precision of the reaction of targeted consumers through direct mail campaigns and thus contributing to the improvement of subsequent campaigns in terms of their results;
- the accuracy of communication with the target consumers through its specific campaigns, derived from its high degree of orientation, the organization having the opportunity to communicate quickly, concisely and efficiently with the public with which it wishes to come into contact;
- the efficiency of the specific campaigns, these can be oriented more and more precisely, as they unfold and redesign, eliminating the additional costs induced by communicating with consumers less or not at all receptive / interested in the

[1] https://administrare.info/domenii/economie/5585-campaniile-de-direct-mailing

organization's products or services and, no less, savings at the level of communication costs

New technologies have leaded the approach of customer to a new level and also the direct marketing techniques evolved based on the data provided by facial and emotions recognition.

CREATING PERSONALISED MARKETING USING FACIAL AND EMOTION RECOGNITION

Many companies have made the transition from a generalized business model to a customer centric one. After understanding the client's needs and orienting towards solving them, we reached the personalization stage. (Zaim et al., 2019), (Dai et al., 2019), (Bortko et al., 2019)

A very efficient personalization system in marketing is that of personalizing advertisements, through which each user has a unique experience, adapted to his profile. Based on facial recognition, possibly the state of emotions, we can identify the user and what ads he will respond with interest. In this way, the ads can be customized without any intervention from the user; it is not necessary to authenticate, to say a username or other identification elements.

Facial recognition involves identifying facial features, such as eyes, nose, and mouth, of different people in pictures or movies, and comparing these features with databases that contain similar information to accurately identify people or facial expressions. Today, this technology is widespread. It is found in Smartphones, web applications, security systems, which usually use it for authentication. (Taskiran et al., 2020)

Facial recognition, compared to other technologies, does not particularly require the cooperation of data subjects.

Before the facial recognition process, it is necessary to create an image gallery. Basically, the image gallery represents the set of biometric models based on which the features of individuals are identified, during the data comparison process.

The facial recognition process involves the following steps[2]:

[2] https://www.scientia.ro/tehnologie/39-cum-functioneaza-lucrurile/741-cum-functioneaza-recunoasterea-faciala.html

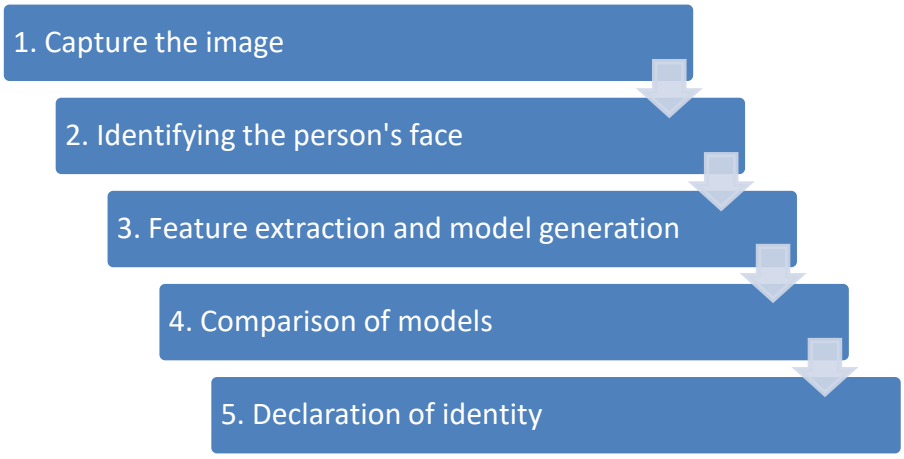

Fig. 01 - The steps for facial recognition process

1. Image capture - The first step is data collection (physical features). Image capture is done with a camera, which can save information in digital format.

2. Face identification - The identification process begins with identifying the face in the entire image that usually contains other objects, buildings, backgrounds or in some situations, other faces. If it is very easy for a person to distinguish between the face of an individual in a picture, the computer system decides which pixels belong to the face and which do not. The facial recognition system will standardize - as much as possible - the image so that it has the same dimensions, rotation, brightness as the images contained in the image gallery. This standardized image is processed by the facial recognition system.

3. Extracting features to create a model based on the data collected, assumes that in the process of extracting features a mathematical representation is generated, called a model (or biometric reference). This model is saved in the database, which is the basis of recognition. The biometric model is a facial recognition algorithm that transforms the face image (in the form of pixels) into a simplified mathematical representation.

Geometry and photometry (measuring the intensity of light sources) are the basis of facial recognition algorithms. The basic algorithms used in facial recognition use only geometry, identifying only the relationships between the main features (positioning of the eyes, nose and mouth). This method is dependent on the detection of all features which in some cases is very difficult due to the variations in brightness present in the image and especially the shadows and dark areas.

In practice, one of the most used algorithms is the Principal Component Analysis (PCA). The PCA technique converts each two-dimensional image into a one-dimensional vector and selects the features that differ the most from the rest of the image. After extracting the features, a unique model is generated that corresponds to each image. This model is associated with a score.

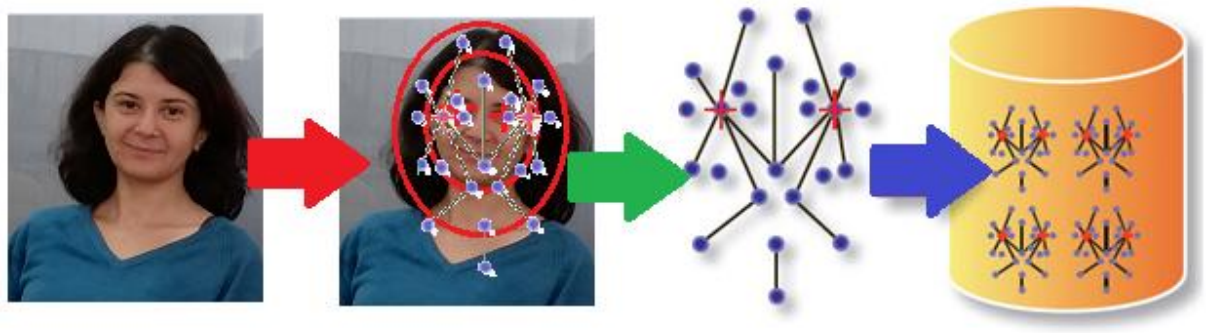

Fig.02 - The process of identifying facial features

4. Comparison of models - The next step is to compare the data collected with the image of the individual. The identification application compares the score obtained for the analyzed image with those of the images in the gallery.

5. The declaration of identification - The last step is determining whether the compared data matches the database. The closeness between the two scores is large enough to determine the matching of the two images. The declaration of identification is sometimes established with 100% certainty by the human factor (computer systems, no matter how efficient they are, currently have an error rate).

The performance of the facial recognition system depends primarily on the image quality. For high accuracy, the image must capture the individual in front and must have the right brightness and contrast. At the same time, the eyes must be open and the image has as few shadows as possible. The system is sensitive even to facial expression. Thus, a wide smile can lead to less effective recognition results.

Our study was based on the example of the other facial recognition algorithm developed as an Open Source project - "face_recognition"[3] by Adam Geitgey. This algorithm was created in the Pyton programming environment, and can be used for free by anyone.

Recognize and manipulate faces from Python or from the command line with the world's simplest face recognition library. Built using dlib's state-of-the-art face recognition built with deep learning. The model has an accuracy of 99.38% on the Labeled Faces[4] in the Wild benchmark. This also provides a simple face_recognition command line tool that lets to do face recognition on a folder of images from the command line.

Dlib[5] is a modern C++ toolkit containing machine learning algorithms and tools for creating complex software in C++ to solve real world problems. It is used in both industry and academia in a wide range of domains including robotics, embedded devices, mobile phones, and large high performance computing environments. Dlib's open source licensing allows you to use it in any application, free of charge.

EMOTIONS RECOGNITION

The sentimental visualization function comes as a complement to the facial recognition function. Basically, after the person in an image is recognized with a person in the database, the facial features are analyzed. (Can et al., 2019)

Feelings of joy, sadness, neutrality and nervousness are recognized based on mathematical algorithms that analyze over 180 points of the face.

For each face, the system calculates percentages for these fundamental feelings that are then displayed.

Our study was based on the project *Emotion detection using deep learning algorithm* [6]developed by Atul Balaji (Research Engineer (AI) at Ola Electric) as an Open Source Project. This project also created in the programming environment Pyton, aims to classify the emotion on a person's face into one of seven categories, using deep convolutional neural networks. The model is trained on the FER-2013. This dataset consists of 35887 grayscale,

[3] https://github.com/ageitgey/face_recognition
[4] http://vis-www.cs.umass.edu/lfw/
[5] http://dlib.net/
[6] https://github.com/atulapra/Emotion-detection

48x48 sized face images with seven emotions - angry, disgusted, fearful, happy, neutral, sad and surprised.

Fig 03. – Example – Feelings recognition: Joy 55%, Sadness 15%, Neutrality 3%

The feeling identification algorithm works for absolutely all the faces identified in a picture.

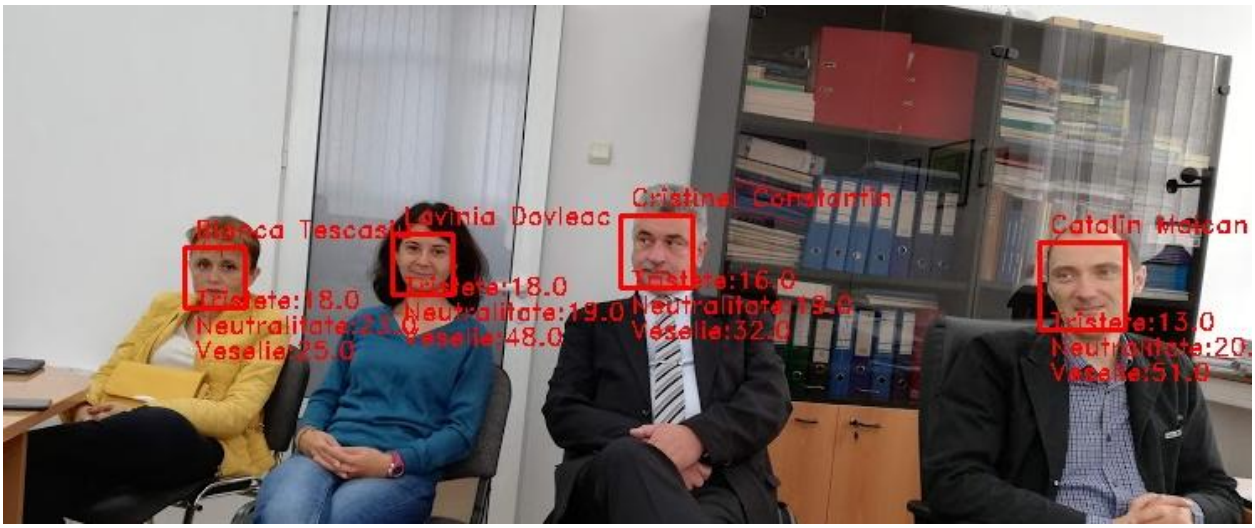

Fig 04. – Example – Identifying people and the feelings for several people in the same picture

CONCLUSIONS

In our study, we tried to combine facial recognition with emotion recognition (figure 06), proposing to marketers to obtain the identification of the person as well as the emotional state without any involvement of the person. Based on this information, to the identified user

can be offered a series of personalized ads that have a close connection with his preferences and especially with his emotional state at that time.

As a future direction of research, we find a very interesting possibility to customize ads for each individual based on other artificial intelligence algorithms.

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