Medcare: An Ambulance Routing System

Bassant Essam El-dine Mosallam , Salma Muhamad Ahmed Eman Abd El-fattah Ahmad, Gaser Abd El-hmid Farouk, Soha Mohamed

Faculty of Computers and Artificial Intelligence, Computer Science department, Helwan University – Cairo, Egypt

Bassant_20160109@fci.helwan.edu.eg, Salma_20160185@fci.helwan.edu.eg, eman_20160094@fci.helwan.edu.eg, gaserabdelhmid@fci.helwan.edu.eg, dr.soha@fci.helwan.edu.eg

Abstract—**Nowadays' road traffics are increasing at an incredible rate. This makes the transportation of patients from place to another harder, and makes their life in danger. Our application "Medcare" offers a solution to this problem by using Location detection technologies, such as the global positioning system (GPS), which are included as a standard feature in many new mobile telephones. The main idea of this project "Ambulance routing system" to help the ambulance drivers reach the patients faster, and provides connecting with the patient's family if he's found in a bad situation on his own on the street, we aim to use face recognition to identify patient's 3identity through his profile pictures.**

So, our scope will be face recognition, routing and position detection techniques; for Position detection we are going to use 'location-based services' (LBS) to be provided with patient's position in ambulance routing situation; the most suitable Routing API will be Google Maps API; and for Face recognition we have noticed by searching that the best algorithm for face detection is HAAR, for feature extraction and face classification phase we use LBP (Local Binary Pattern) technique.

Keywords—Face Recognition, LBPH (Local Binary Patterns Histogram), HAAR, Google Maps.

I. INTRODUCTION

We noticed that many people die every year around the world due to emergency delay, whether they face accidents or they have any disease problem like heart attack for example. According to the National Institute of Emergency Medicine (NIEM), in 2017, 20% of emergency patients' deaths were caused by traffic jams [1]. Traffic jam is one of the main factors that cause emergency delays. The solution that may help in decreasing this problem is to use routing techniques for the ambulance.

We used machine learning to help us in building our model to recognize the patient's identity, and we also attached it with our application so that the user can use it easily.

The main problem we face is the delay of the patient's arrival to the hospital due to traffic, because as we know this delay may lead to endangering the life of the sick person and the inability of people to help or transfer to the nearest hospital. We also aim to discover the identity of the sick person and contact his parents.

Our project "Medcare" mainly aims to help sick people or injured people that are lying down on the roadside on their own by facilitating recognition of their identity, contacting their family members, and reaching hospitals quickly to save their lives through avoiding traffic.

II. RELATED WORK

Face recognition seeks the face in an image. the image is imported by providing the location of the image. Then the picture is transformed from RGB to Grayscale because it is easy to detect faces in the grayscale. After that, the image manipulation is used, in which the resizing, cropping, blurring and sharpening of the images is done if needed. The next step is image segmentation, which is used for contour detection or segments the multiple objects in a single image so that the classifier can quickly detect the objects and faces in the picture [2].

HAAR is one of the face recognition algorithms. It's a feature-based cascade classifier, it is an effective object detection method, This algorithm is used for finding the location of the human faces in a frame or image. The HAAR-like algorithm is also used for feature selection or feature extraction for an object in an image, with the help of edge detection, line detection, center detection [3].

The feature-based or analytic approach computes a set of geometrical face features of eyes, a mouth, and a nose. In this representation, outline of the face and positions of the different facial features form a feature vector [4].

In Holistic or Appearance-based methods, the global properties of the human face pattern are considered. Holistic methods encode the pixel intensity array representation of faces without the detection of any facial feature. This class of face extraction is more applicable and easier to implement compared to geometric feature-based methods.[4]

Local Binary Patterns (LBP) is a non-parametric descriptor whose aim is to efficiently summarize the local structures of images. It is used particular for facial image analysis, including tasks as diverse as face detection, face recognition, facial expression analysis, demographic classification.[5]

Location detection technologies, such as the global positioning system (GPS), are included as a standard feature in many new mobile telephones. Location detection technologies and other wireless technologies allow 'location-based services' (LBS) to be provided to individuals. So, in this work we will use Google Maps" to be provided with patient's position in ambulance routing situation.

In [6], the work explains the design and implementation of Android mobile operating system-based group communication and navigation system. By use of GPS and "Google Maps", the system implements a geographic location and route planning between the user and his friend. The system provides a convenient and efficient platform for users travel and connection between friends.

For routing, there is a study on 3 -routing methods: linear arc distance, Google Maps and ArcGIS Network Analyst. It's held on actual data owned by a hospital to calculate the time before delivering the patient to the hospital, in the study they assessed estimation error, defined as the absolute difference between observed and estimated transport time, and the proportion of estimated times that were within specified error threshold. Estimates were within five minutes of observed transport time for 79% of linear arc estimates, 86.6% of Google Maps estimates and 81.3% of ArcGIS estimates. Accuracy was similar between data sources for linear arc and ArcGIS methods; however, Google Maps estimation accuracy was greater.[7]
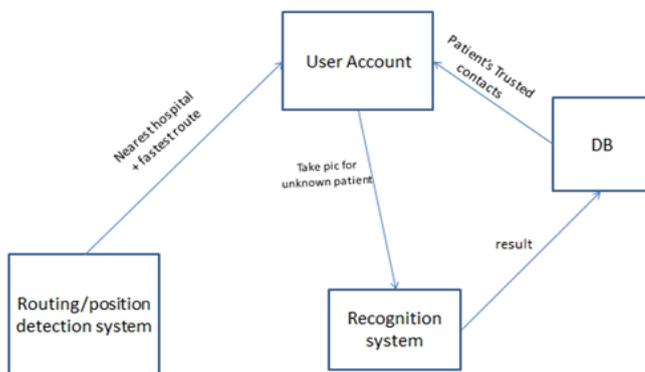
III. Proposed Model:

Fig. 1 Framework Diagram

Machine learning block:

Here, we run our face recognition model to detect and recognize a patient's picture to know his identity. We use HAAR algorithm for face detection phase, LBPH algorithm for feature extraction and face recognition phases.

This block takes the patient's picture from the firebase through the API, and recognizes it, then delivers to the API the patient's id if he already has an account on the application, or it delivers that he's not found if he has no account on the app.

Android block:

Users can create their accounts on the application; they provide their information and pictures. Any user can help any patient he found in the road by taking a photo of him and give it to the app to know his name and to be able to contact the patient's family, and the app will also suggest the best fastest road for ambulance routing to the nearest hospital by using position detection and Routing techniques [Google Maps].

Data will be saved in Fire Base which is connected to the android via "Jason" file after creating an account on the fire base .We use it for storing users data and the authentications.

API:

This block contains the API that connects the different parts of the project in one unit; it connects the machine learning model with the android application.

Workflow of the application:

User registration: user enters his data.

User profile: contains all information about him.

Face Recognition System:

It takes the picture of the unknown patient, finds his id or discovers that he hasn't an account, if he has an account the app extracts his trusted contacts phone numbers and delivers them to the user to contact the patient's family.

IV. Application

a) Proposed system features:
b) Register/Login module
c) GPS module [the user can track his friend/family member position that has any health problem and needs help or emergency support].
d) Data sharing and face recognition [share patients' pictures to identify him and help the application to contact his family].
e) Routing module [For routing techniques to help the ambulance drivers to get notified with the crowded roads to avoid, and recommend them faster road].

Implementation technologies:

a) Android (design and implementation).
b) API [flask] (routing like Google maps).
c) Database (firebase).
d) Used Programming languages:
e) Java programming language in Android.
f) Python programming language in machine learning model and flask API.

Data collection:

Dataset: pictures of real human faces are collected by our team, these pictures are taken by a life camera with RGB scale, their extension is jpg, and the size of dataset is 26 multiplied by the number of persons.

Constraints:

The user must provide his account on the application with 26 pictures for his face, and two contacts with his family.The application can't identify any patient unless he has an account on it.

Hardware requirements:

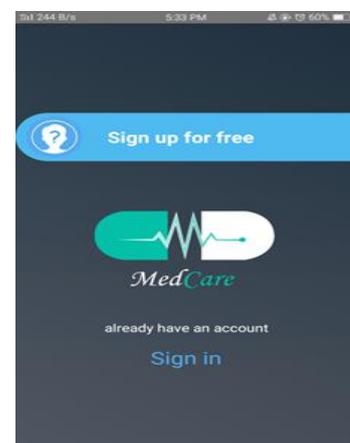The user needs to have a smartphone to install the application.

Fig. 2 A screenshot of the android app

V. Results:

We used use LBP algorithm in face detection phase and compare its accuracy with HAAR algorithm.

Dataset size is 26 multiplied by the number of people pictures, the size of every picture is 13 kb, saved as gray scale, its extension is JPG, and dimensions are 278*278.

A. HAAR+LBPH:

Training phase results are saved in "training data.yml"; but the testing phase doesn't save its results, instead of that it extracts features from the image and compares it with the file "training data.yml". The accuracy of machine learning model range [55%-90%] and the average accuracy is 72.5%.

Performance of the model: its training time is 0.945 seconds, and test time is composed of detection which is done in 0.037s and prediction which is done in 0.018s.

B. LBP+LBPH:

It extracts features from the image and compares it with the file of training data. The accuracy of the machine learning model range [30%-70%] and the average accuracy 50%.

Performance of the model: its test time is composed of detection which is done in 0.017s, and prediction which is done in 0.013s.

These factors can also affect recognition accuracy from the life camera: illumination, quality of camera [resolution], position.

The following table shows a comparison between HAAR and LBP algorithms

Table 1: Comparison between HAAR and LBP algorithms

Algorithm	Advantages	Disadvantages
– HAAR	– High detection Accuracy: 72%	– Computationally complex and slow. – Longer training time. – Less accurate on black faces. – Limitations in difficult lightening conditions.
– LBP	– Computationally simple and fast. – Shorter training time. – Robust to local illumination changes.	– Low detection Accuracy: 50%

VI. Conclusion and future work

In this work, we compared two face recognition algorithms and deduced that HAAR algorithm is suitable for the face detection part due to its high accuracy even though it may have high computation time, but in emergency situations we prefer to be more accurate than to be more quick specially that the computation time is not so big and we can afford it. We also strongly suggest to anyone to use LBPH algorithm for face recognition due to its high performance; and for the routing part "Google Maps" helped us perfectly. We can add part for the kidnapped people or children, we can also add a hierarchy option to relate accounts to their families.

VII. References

[1] [Jan 16. 2017]. 20 per cent of emergency patient deaths blamed on traffic jam delays. Retrieved from https://www.nationthailand.com/national/30304268

[2] Anjali, Avinash Kumar, Mr. Ravi Ranjan, " An Algorithm for Face Detection and FeatureExtraction,"presented at the IJSETR, india, Volume 3, Issue 4, Apr. 2014

[3] [Author: Divyansh Dwivedi, Apr 27, 2018][Face Detection Methods, How the Face Detection Works]. Face Detection For Beginners. Retrieved from https://towardsdatascience.com/face-detection-for-beginners-e58e8f21aad9

[4] Zahraddeen Sufyanu, Fatma Susilawati Mohamad, Abdulganiyu Abdu Yusuf, Abdulbasit Nuhu Musa, and Rabi'u Abdulkadir, " FEATURE EXTRACTION METHODS FOR FACE RECOGNITION," presented at the IRAER,India, ISSN 2248-9967, Volume 5, Number 3 ,Oct. 2016, pp. 5658-5668

[5] D. Huang, C. Shan, M. Ardabilian, Y. Wang and L. Chen, "Local Binary Patterns and Its Application to Facial Image Analysis: A Survey," in IEEE Transactions on Systems, Man, and Cybernetics, Part C (Applications and Reviews), vol. 41, no. 6, pp. 765-781, Nov. 2011, doi: 10.1109/TSMCC.2011.2118750.

[6] Li Liu, YanfangJing, Zengxiao Chi, JianBangChen, ChaoMa, "Design and implementation of Android Phone Based Group Communication and Navigation System", 2nd International Conference on Consumer Electronics, Communications and Networks 2012, 21-23 April 2012, pp 3174-3177, ISBN:978-1-4577-1414-6,DOI:10.1109/ CECet.2012.6201807.

[7] Wallace DJ, Kahn JM, Angus DC, et al. Accuracy of prehospital transport time estimation. Acad Emerg Med 2014;21:9–16