Machine Learning Assignment 3

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Project Title
Keys-less going

Aims

At present, face recognition is used in all kinds of ways like cellphones and security insurance. The aim of this project is to develop an approach to recognize the residents face and unlock the door for the host while it can also recognize the face from who is breaking into the house and call the police automatically. This overall aim is broken into four objects:
1. Collect data of face and give every face with a nickname.
2. Build classifier using Python and some libraries.
3. Evaluate and improve the model.
4. Validate and deploy the developed approaches.

Background

Presently, there are several ways to open the door in their house, for example, we can unlock the door by keys, by the fingerprint, by apps. However, there is just one way to unlock the left in the apartment that is using the key. If we lost the key or left the key in home when hanging out, on the one hand, it poses a threat to the safety of the family, on the other hand, it will cost, including the money and time, a lot to rematch the key. For this project, we want to use the facial recognition to identify who is living in this house and unlock the door automatically and will call the police when a home burglary happens.

So far, facial recognition technology is being matured. Essentially, there are two steps performing in the process of face recognition, feature extraction and selection, and the classification of objects. In order to complete the procedure, varying algorithms are produced. Some face recognition algorithms recognize face features by extracting features from face images. For example, an algorithm could extra the size, relative position, shape of the eyes, nose and mouth, and use such information to search who is matching the features.

Other algorithms normalize face image database and compress face data, and then save the data in the image which is only useful for facial recognition. After that, a probe image is used to compare with the face data. One of the first successful systems, which providing a compressed representation of the face, was a template matching technique applied to a set of prominent facial features.

Traditional recognition algorithms are classified into two broad categories: one is based on some essential features on the face and another is based on a holistic model. The first one

is used to recognize and classify the features into components such as analyzing each part according to its features and analyzing its spatial position according to other features while the other one analyzes the face in the entity. Moreover, there are several approaches promoted in recent years, like template matching approach, 3-Dimensional recognition and Skin texture analysis.

Actually, most state-of-the-art face recognition systems were based on hybrid methods which combine techniques from feature-based methods and template based approaches before deep learning became widespread (Daniel et. al. 2018). For this project, convolutional neural networks(CNN), which is the most common approach in deep learning method for face recognition, would be used to train the dataset and implement this project.

Research project

1. According to BudgetDirect (2019), In 2017 there were 225,900 recorded burglaries in Australia, or one every 3 minutes. Australia had the world's fifth highest rate of burglary in 2015. All four countries with a higher rate of burglary than Australia in 2015 are in Europe and have much smaller populations. Such a situation means that the home burglary is quite a major problem for Australia.
2. For this project, the face recognition system can detect the face in the house automatically and the host can control the whole system by an app.
For every stranger went into the house, the system will recognize the face and take a photo of the stranger. When the system sent the photo by the app, the host can decide whether this is a relative or a friend to him. If so, the host can put him in a blank list, if not, the system will call the police automatically and sent the location information to the police.
For the host, every time he came back, when he stood at the front of the house, the system will unlock the door or the garage automatically. At the same time, when the host leave the house, the system will lock the door.
The innovation of this project is that when the host adds one person into a blank list, the system will take several photos of him and store them. Because of the change on human face did by time, the system would update the face every week.
3. The breakdown of the project:
    a. Pre-environment configuration.
    b. Using the OpenCV to implement face detection.
    c. Build Training model by using Python and some libraries like TensorFlow and Keras.
    d. Train and improve the model by using MegaFace dataset.
    e. Using the model to implement Face recognition.
    f. Develop the App collaborating with the system.
    g. Test the whole system by some volunteers.
    h. Improve the system refers to feedbacks from volunteers.
    i. Build a firewall to Protect users' privacy from being disclosed
4. Timelines:

	1	2	3	4	5	6	7	8	9	10	11	12
Pre-environment configuration	■											
Face detection		■										
Build the model		■	■									
Train and improve the model				■	■							

Task														
Develop the app								■	■					
Pilot test the system										■	■			
Test the system by volunteers												■		
Develop the firewall system.												■		
Improve the system by feedback													■	
Bring the whole system online														■

5. In this project, we want the outcome to be a camera, like CCTV, which can connect to the internet. Moreover, the system uses the cloud computing to handle all the information and recognize the face. After all, the system will transmit the data to the app.
    The benefit would come from selling the camera with the system.

Budget

Suggested Component	$A (millions)
"Keys-less going" project Implementation	0.2
Hardware and network infrastructure and security components (cloud computing, purchase & implementation)	0.8
Database (purchase & implementation)	0.2
Digital Rights Management (research, design & implementation)	0.2
Project staff costs	1
Marketing strategy	0.2
Contingency	0.4
Total	3

Personnel

Project Manager: Manage all the project.
Programmer: Develop the system.
Volunteers: Test the system.
Marketing Manager: Manage the market strategy.
Customer Service Manager: Collect feedback from volunteers.
Sales Manager: Focusing on how to sell the system.

Reference:

[1]Archana, T. & Venugopal, T. 2015, 'Face recognition: A template based approach', pp. 966-9.

[2]Bronstein, A.M., Bronstein, M.M. & Kimmel, R. 2005, "Three-Dimensional Face Recognition", *International Journal of Computer Vision,* vol. 64, no. 1, pp. 5-30.

[3]Daniel Sáez Trigueros, Li, M. & Hartnett, M. 2018, *Face Recognition: From Traditional to Deep Learning Methods*, Cornell University Library, arXiv.org, Ithaca.

Link:

Youtube: https://youtu.be/2XqUQxUEieE