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Development of a Face Recognition System with Deep Learning and Pytorch

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ABSTARCT - *Face Recognition is presently an emerging technology with numerous genuine uses, it has the ability to identify or verify human faces in a digital image. This research presents a face recognition system developed from deep learning algorithm and pytorch to extract relevant facial features. The extracted features permit the comparison of faces within a dataset in an efficient way. The system can recognize a set of faces and learn by integrating new face images, process and improve their predictions on the ones in the dataset. The result shows an accuracy of approximately 95%.*

Keywords: *Face recognition, digital image, deep learning, pytorch, facial features, dataset.*

1. INTRODUCTION

Face recognition is an interesting and significant recognition technique. The capacity for humans to apprehend faces and deduce intelligence from the facial look is very amazing. Human face is a very important part of the human body for recognition purpose. Humans tend to recognize hundreds of familiar faces they have seen at some points of their lifetime after years of separation from such faces (Lal et al., 2018). The major variance among familiar and strange faces is that familiar faces are stored in memory. Features that may be utilized for matching two faces provided concurrently, may not be used for matching an acquainted face to its representation in reminiscence (Abudarham, Shkiller, & Yovel, 2019). Human face recognition has previously created significant interest and attention from numerous researches to create an intelligent system that possess the ability to take decisions almost like the human brain (Nisha & Dahiya, 2015). The human recognition ability may be of no benefit if there are alterations in the faces as a result of old age, accidents, alterations in the style of hair, keeping of beards, and wearing of glasses. Obviously, human beings have a good ability for face recognition but encoding and decoding of faces by the human brain is not well understood. Human face recognition by a computer system has been considered a long time ago and various researches have been made for the creation of a system that can mimic humans to solve face recognition problems. The developed systems can perform visual sensing such as recognizing things. In this study, we have developed an automatic system to find neutral faces in images for face recognition using the deep learning algorithms and pytorch. A neutral face is a relaxed face without contraction of facial muscular tissues and facial movements. Precise proof of identity is required in the fields of finance, national security, justice, and e-commerce (Zhi & Liu, 2019). Presently, automatic face recognition is extensively utilized in applications such as duplication of identities and confirmation of mobile payments (Raut, Borkar, Student, & Kamlatai Gawai, 2018).

1.1 Deep learning

Deep Learning is an area of Machine Learning technique that instructs a computer system to do what comes naturally to humans. Deep learning offers a usual way of obtaining feature representations from data without depending on artificial descriptors. Its introduction was aimed at moving Machine Learning closer to one of its original goals which were Artificial Intelligence. In deep learning, a computer model learns to perform classification of tasks directly from images, text, or sound. Its models can achieve state-of-the-art accuracy, sometimes exceeding human-level performance.

2. SURVEY OF LITERATURE

Several methodologies and algorithms for recognizing a face in a useful and proficient way have been proposed by researchers (Lal et al., 2018). Gupta, Saxena, Sharma, & Tripathi (2018) proposed a new way of using a deep neural network for face recognition using extracted facial features as inputs. Azeta, Omoregbe, Adewumi, & Oguntade, (2015) designed and presented a face recognition system for security control. Agrawal & Singh (2015) evaluated face recognition methods using unconstrained environment. Mukherjee et al., (2019) developed a proposed system for energy efficient face recognition in the mobile-fog environment and the initial results obtained showed that an energy saving of about 93% in the mobile devices was achieved. Upadhyay & Sharma, (2017) presented an overview of face recognition and verification. Upadhyay & Sharma also included the applications, various techniques, advantages and the disadvantages of face recognition in their presentation. Witham (2018) presented face recognition in conjunction with face detection as a way of idenbtifying rhesus macaques visually without tagging them. Witham achieved about 90% to 96% accuracy of classification for rhesus macaques in four separate classes.

3. METHODOLOGY

The hardware required for the effective implementation of the developed learning environment consists of 64GB RAM and block based storage device. The software required are open CV (open source computer vision), python and Ubuntu (Linux Operating system) version 17.10 and Nvidia CUDA 8.0. Open CV is a library of programming function mainly aimed at real-time computer vision. Python is an interpreted high level programming language for general purpose programming. Ubuntu is a free and open-source Linux distribution based on Debian. For this study, we installed some python dependencies on our system, these dependencies are face recognition, imutils, and Dlib. The face recognition, imutils, and Dlib modules were installed by a simple pip command from terminal. This system was trained using a dataset that contains about 94 images, the dataset was created using 128-d embedding for every face in the dataset, the embedding was used to recognize the characters of the face images. After the dataset and folder structure was set, the faces in our training set was quantified using 128-d embedding. During classification, the k-NN model was utilized for the final face classification. For the construction of face embedding, we opened encode_faces.py under the project folder using visual studio. The required packages were imported. The command line arguments used are:

- dataset
- encodings
- detection-method

The path to our dataset file was initialized after our arguments were defined. The known Encodings and known Names lists were initialized before the loop. Face encodings and the names for each image in the dataset were contained in the Encodings and Names lists. There are 94 loop cycles, the is consistent with the 94 image faces in the dataset. A dictionary was constructed with two keys — "encodings" and "names". The names and encodings were dumped into disk for future recall. To create our facial embedding, a terminal was opened and the required command was executed.

4. RESULTS

The outputs for the results of some recognized faces are as shown in figures 1 to 7.

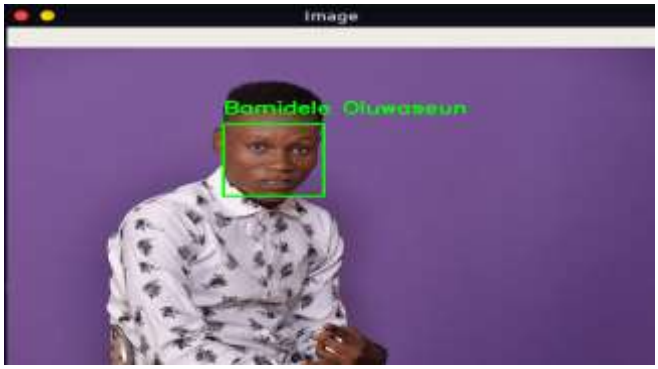

Figure 1: Result output 1

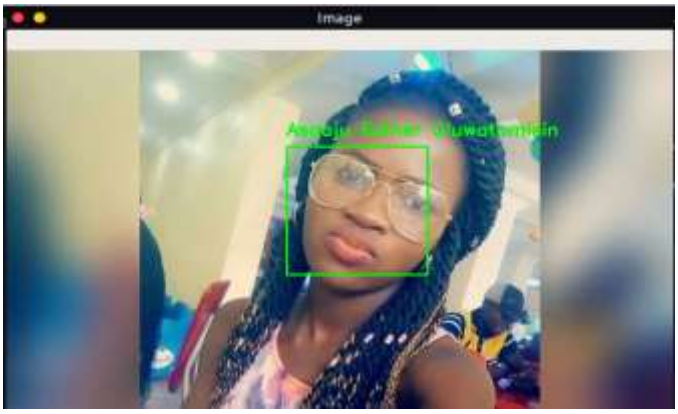

Figure 2: Result output 2

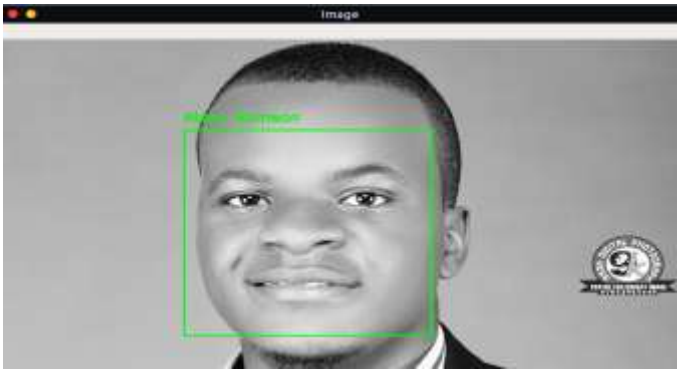

Figure 3: Result output 3

Figure 4: Result output 4

Figure 5: Result output 5

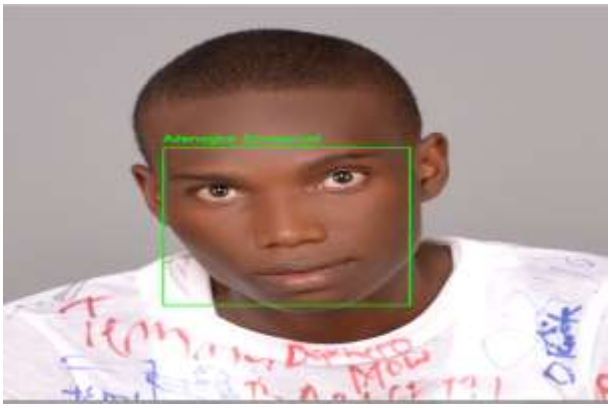

Figure 6: Result output 6

Figure 7: Result output 7

5. CONCLUSION

A deep learning algorithm based face recognition system has been presented in this study. The system achieved an accuracy of about 95%. It was able to recognize and display the names and face of people in an image. The system can recognize a face image included in a dataset that has been trained. The system can be incorporated with a timer and used in a work place to automatically record the time a worker reports to work.

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