

Clustering Consumer Photos Based on Face Recognition

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ARTICLE INFO

Article History:

Accepted: 05 April 2023

Published: 30 April 2023

Publication Issue

Volume 10, Issue 2

March-April-2023

Page Number

956-961

ABSTRACT

The main aim of this thesis was to detect the face in an image and its recognition using Python programming language along with OpenCV computer vision library. The practical framework of this research was mainly focused on face detection and recognition. The Haar Cascade algorithm was used for face detection purposes. For facial recognition, the Local Binary Pattern Histogram Algorithm was used. The rapid growth of artificial intelligence and machine learning technology in today's generation has taken the world to the next level. Furthermore, many impossible circumstances that are challenged by human beings can be solved with the aid of the latest technologies such as artificial intelligence and machine learning. Artificial intelligence and machine learning have wide applications in different fields. For example, computer vision, robotics, medical treatment, gaming, and industries. Data is essential for machine learning and artificial intelligence as well as in many projects. To understand artificial intelligence simply, it helps to unlock any devices like smartphones that recognize the face. Furthermore, the thesis explains the development trend of artificial intelligence as well as machine learning and the area of applications. Therefore, the thesis is a complete package of theoretical knowledge along with the practical implementation of artificial intelligence and machine learning application.

Keywords: Algorithm, Artificial intelligence, Data, Haar cascade, Machine learning, OpenCV, Python.

I. INTRODUCTION

In this age of intelligence, people are surrounded by modern advanced technologies. With a small device as small as a palm, AI applications have given the possibility to access all the information around the world. Artificial intelligent software makes human life simpler in many ways. Also, the self-learning algorithms and the availability of online data with low-cost computation have taken machine learning to the next level. The popularity of artificial intelligence has grown swiftly and has become part of everyday human life. The rapid development of modern intelligent technology has given hope for a better future for humanity. While the trend towards making intelligent machines had begun long before, the past few decades have been a dream about artificial intelligence for researchers and everyone around the world. The successes of AI have been demonstrated by increasing computing power and the ability to gather and store large amounts of data. The ability to understand and implement various kinds of knowledge in the real world is intelligence. Similarly, rather than being directed only by linear programming, a system that allows a computer system to learn from inputs is machine intelligence. Artificial intelligence is an interdisciplinary science also known as machine intelligence that mimics human intellectual behaviours and capabilities. In the present world, artificial intelligence is making life easier and simpler in many ways.

AI machines can react to inputs and they try to think like humans. Artificial intelligence is a vast topic on which there are many definitions. Artificial intelligence is a combination of the two words "Artificial" and "Intelligent". Artificial relates to something that is not natural but made by human beings. In other words, a negative form of real things whereas Intelligence is the ability to think or understand. Intelligence consists of numerous pieces of knowledge and uses this knowledge to solve problems. Artificial intelligence is a new technology and the proposed definitions of artificial intelligence

are different from each other. Moreover, there are a lot of works to be done. While looking at a broad scale, AI technology benefits society widely, better than humanity has ever seen.

Face detection and recognition is a well-known technology connected with computer vision and image processing that focuses on detecting human faces in digital images and videos. Face detection can be done either by using a specific face or multiple faces in an image. Face detection is a basic concept for tracking and recognition of faces. The main goal of this project is to detect a face in an image and recognize the image by using artificial intelligence and machine learning along with various technologies. Python programming language and OpenCV computer vision library are used in this project. Overall, the project starts with the detection of a single face and the recognition will be done using the same facial image dataset where the program recognizes the person having a facial image.

II. RELATED WORK

Feature selection, as an essential task in a face recognition system, could be considered the next step after the feature extraction process [1]. A good dimensionality reduction method can decrease the dimension of feature space, increase recognition accuracy, while maintaining the lowest level of classification errors. A feature selection method selects the best subset of the input feature set that properly describes the given problem with a minimum reduction in performance. Feature selection methods broadly fall into three models: filter, wrapper, and embedded [2]-[4]. The filter model evaluates features without involving any learning algorithm. The wrapper model requires a learning algorithm and uses its performance to evaluate the goodness of features. The embedded model incorporates feature selection as part of the learning process, and uses the objective function of the learning model to guide the process of searching for relevant features such as decision Manuscript received November 20, 2019; revised April 19, 2019.

Chi-Kien Tran is with the Faculty of Information Technology, Hanoi University of Industry, No. 298, Cau Dien Street, Bac Tu Liem district, Hanoi, Vietnam (e-mail: chikien.tran@hau.edu.vn). trees or artificial neural networks.

In a recent study, two feature selection and classification algorithms based on a filter model that named similarity feature-based selection and classification algorithms (SFSC) have been initially proposed by Tran et al. [5]. The goal of the algorithms is to retain similarity features of the training images in a class in order to minimize within-class differences, while maximizing between-class differences and to use this feature set for classification. They have been proven an efficient tool for improving the performance of face recognition systems using local binary patterns (LBP), local ternary patterns, and local directional pattern (LDP) features [6], [7]. However, SFSC algorithms still have a limitation as the value of threshold parameter is not automatically set, meaning that user needs to test many different values of threshold to find the best similarity feature set. To overcome this limitation, we propose a novel approach based on wrapper model, WSFSC, to find the optimal similarity feature set. Firstly, a face image set is divided into three subsets: training images, wrapper images, and testing images. Secondly, similarity feature-based selection algorithm (SFS) is conducted on two subsets (training images, wrapper images) to find the optimal similarity feature set. Finally, the best similarity feature set is used for classification. The experiments on the ORL database of faces (ORL) [8] and Georgia Tech face database (GTFD) [9], [10] showed that the proposed method was effective for performance improvement of face recognition system.

III. PROPOSED SYSTEM

In This Chapter we will see how to detect the faces and extract the faces. The input of a face recognition system is always an image or video stream. The output is an identification or verification of the subject or

subjects that appear in the image or video. Some approaches define a face recognition system as a three step process as shown in Figure 1. From this point of view, the Face Detection and Feature Extraction phases could run simultaneously.



Figure 1. overview of the system

3.1 Face detection

The fundamental principle used here is the Viola Jones algorithm. This approach helps to detect the faces in each video frame. This method of detecting faces consists of four different stages as shown in Figure 3.1.

1. Haar like features
2. Integral image for rapid features detection
3. AdaBoost learning method
4. Cascade classifier



Figure 3.1 Viola Jones algorithm

3.1.1 Haar like features

Haar features are used for the detection of any features present in the image. There are many haar features as shown in the below figure below in Figure 2.1.1, Haar like features are used to detect variation in the black and light portion of the image. This computation forms a single rectangle around the detected face. Based on the color shade near nose or forehead a contour is formed. Some commonly used Haar features are:

1. Two rectangle feature.
2. Three rectangle feature.
3. Four rectangle feature.

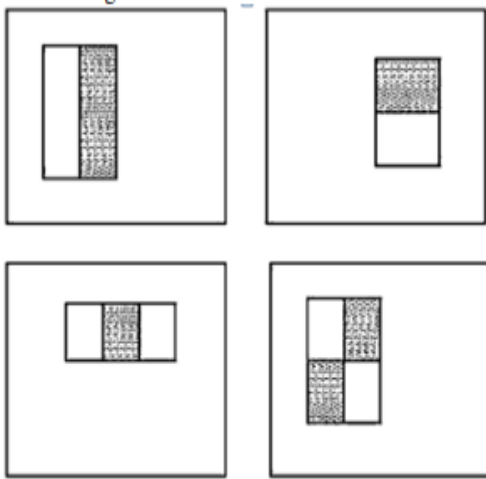


Figure 3.1.1 Haar like features

3.1.2 Integral image

They are also known as summed area tables. Integral image is used to facilitate quick feature detection. The meaning of integral image is the outline of the pixel values in the original images. The integral image at location (x, y) contains the sum of the pixels above and to the left of (x, y) .

3.1.3 Adaboost algorithm

AdaBoost algorithm helps to select small features from the face that facilitates fast and easy computation. Unlike other methods, AdaBoost algorithm gives desired region of the object discarding unnecessary background. The working model can be interpreted by using neural networks. AdaBoost learning process is fast and gives more number of desired data. This data can be classified into classifier.

3.1.4 Cascade classifier

The Viola and Jones face detection algorithm eliminates face candidates quickly using a cascade of stages. The cascade eliminates candidates by making stricter requirements in each stage with later stages being much more difficult for a candidate to pass. Candidates exit the cascade if they pass all stages or fail any stage. A face is detected if a candidate passes all stages.

3.2 Feature extraction

A feature extraction algorithm extracts features from the data. It creates those new features based on transformations or combinations of the original data. In other words, it transforms or combines the data in order to select a proper subspace in the original

feature space. On the other hand, a feature selection algorithm selects the best subset of the input feature set. It discards non-relevant features. Feature selection is often performed after feature extraction.



Figure 3.2. Feature extraction process

3.3 Face recognition

Face recognition is an evolving area, changing and improving constantly. Face recognition technology can be used in wide range of applications. Computers that detect and recognize faces could be applied to a wide variety of practical applications including criminal identification etc. Face recognition is used in many places nowadays, verifying websites and social networking sites.

IV. CONCLUSION

Artificial intelligence seems to be taking the world to the next level. The artificial intelligence and machine learning technology of the present generation have changed every area of society. Moreover, many impossible circumstances that are challenged by human beings can be solved with the aid of the latest technologies such as artificial intelligence and machine learning. The transformation of technology from the past couple of decades to the present has been skyrocketed effortlessly. In contrast, machine learning is also a branch of artificial intelligence that delivers systems the possibility to learn automatically and improve from experience by using data. Many companies for instance robotics, industries, health care, social media, computer vision, gaming, mobile phones, have been broadly synchronized with these technologies. Since the impact of technological change on the global economic structure is creating enormous transformations in the way in which new products are organized, traded, invested, and developed. Advanced manufacturing technologies have altered longterm patterns of productivity and employment as well. The rapid growth of innovation and the dynamics of technology flows have substantial advantages in terms of livelihood. Hence,

the transition in technology has enabled many developed and developing countries to connect technology more efficiently with the higher expectation of making higher living standards.

II. CONCLUSION

Counterfeiting products are growing exponentially with the enormous amount online. So, there is a strong need to detecting counterfeit products and blockchain technology is used to detect fake products. Furthermore, the information is encoded into a QR code. Customers or users scan the QR code and then they can detect the fake product. Digital information of product can be stored in the form of blocks in blockchain technology. Thus, in this paper we discussed the system and the solution to fight against the malpractices of counterfeiting of the products, and proposed the system which is useful for end user to detect whether the product is fake or not by checking the throughout history of the product in the supply chain. End user can scan QR code assigned to a product and can get all the information that has been put up throughout the supply chain in the blockchain on which end to end user can check whether the product is genuine or not.

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Cite this article as :

Dr M Sandhya Rani, Adina Maheen, T Madhavi, "Clustering Consumer Photos Based on Face Recognition", International Journal of Scientific Research in Science and Technology (IJSRST), Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 10 Issue 2, pp. 956-961, March-April 2023.

Journal URL : <https://ijsrst.com/IJSRST5231298>