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Detailed Survey Of Machine Learning Algorithms For Face Recognition

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Abstract: Digital Image processing is an algorithm used to perform operations on a digital image, in order to extract some useful information or process images to enhance information from it. Face recognition is a method of identifying or verifying the identity of an individual using their face. Face recognition systems can be used to identify people in photos, video in real-time or offline. Machine learning algorithms can be used to identify, collect, store and evaluate face characteristics so that they can be matched to photos of people in a database. The paper presents the contributions made by different researchers to understand the methodology, tools and applications of face recognition.

Keywords- Face, machine learning, Recognition

1. Introduction

Digital Image Processing algorithms can be classified in to different categories such as low level, mid level and high level processing depends on the output features. Face recognition systems use Image processing algorithms to pick out specific, distinctive details about a person's face. Face recognition systems vary in their ability to identify people under challenging conditions such as improper lighting, low quality image resolution, and angle of view (photograph taken from above looking down on an unknown person). It employs machine learning algorithms which find, capture, store and analyze facial features in order to match them with images of individuals in a pre-existing database. The four problems that a machine needs to solve in order to recognize a face are trace detection, face alignment, feature extraction, face recognition and face verification. As of late, the need for biometric security framework is elevated for giving safety and security against frauds, theft, and so on. Face recognition has gained a significant position among all biometric-based systems. It can be used for authentication and surveillance to prove the identity of a person and detect individuals, respectively. In this paper, a point-by-point outline of some imperative existing strategies which are accustomed to managing the issues of face recognition has been introduced along with their face recognition accuracy and the factors responsible to degrade the performance of the study. In the first section of this paper, different factors that degrade the facial recognition accuracy have been investigated like aging, pose variation, partial occlusion, illumination, facial expressions, and so on. While in the second section, different techniques have been discussed that worked to mitigate the effect of discussed factors. The facial recognition process normally has four interrelated phases or steps that help in accurate facial recognition, they are as follows: Face detection, Normalization, Feature extraction and Face recognition. The objective of face recognition is, from the incoming image, to find a series of data of the same face in a set of training images in a database. The great difficulty is ensuring that this process is carried out in real-time, something that is not available to all biometric facial recognition software providers.

1. LITERATURE SURVEY

The efforts are made in the paper to identify the contributions made by different authors related to identification and prediction of Heart related issues. The detailed discussion is made with respect to the approaches/methodology adapted and the outcome of the work.

The paper (1) titled “Facial Recognition with PCA and Machine Learning Methods” uses the facial recognition system is divided into two stages: PCA processing and Machine learning classification. The work proposes the model which uses KNN, SVM and LDA. KNN has the fastest running speed and SVM has the lowest running speed. LDA is a little slower than KNN but much faster than SVM. Thus, although SVM always has higher recognition accuracy the running speed is much slower than other two classifications.

The paper (2) titled “Multiple face detection based on machine learning” uses holistic and feature extraction methods. The author proposes a comparative study is being done between 4 methods. They are Haar-AdaBoost, LBP-AdaBoost, GF-SVM and GFNN. The first two are based on boosting algorithm which is used both for selection and for learning a strong classifier with a cascade classification. The rest two use Gabor filter to extract the characteristics. In terms of detection rates, the Haar-AdaBoost method is the best out of the four.

The paper (3) titled Design and Evaluation of a Real-Time Face Recognition System using Convolution Neural Networks uses Convolution neural networking approach. The Real time face recognition system using convolution neural network and AT&T datasets is being used. Maximum recognition accuracies of 98.75% using CNN method and the standard datasets

The paper (4) titled Design of face detection and recognition system to monitor students during online examinations using Machine Learning algorithms uses 1.Eigenface method 2.Principal Component Analysis 3.Convolutional Neural Network (CNN) and 4.Support vector machine. The proposed SVM-based face recognition system achieves a matching accuracy of about 61% with 50 real-time images in the dataset. Accuracy can further be improved by increasing the number of images in the dataset.

The paper (5) titled “Feature Based Face Recognition using Machine Learning Techniques” uses Convolution neural networking approach. In this paper discussed about different variations such as deviation in pose, illumination and different face contours. 2.To improve the accuracy and Scalability Proposed method uses machine learning based Haar Cascade technique for face detection and convolution neural network is used for feature extraction

The paper (6) titled “A Review: Facial Recognition Using Machine Learning” uses 1.Support Vector Machine 2. Neural Networks, 3.Convoluted Neural Networks(CNN), 4.Ensemble of classifiers 5. Extreme Learning Machine (E.L.M). The techniques work by first matching the facial characteristics picked from the image to the faces stored in the database. It is called a Biometric Identification based application that uniquely identifies each individual by analysing their voice, facial expression, face, or fingerprint. Machine learning has taken charge of artificial intelligence where deep learning algorithms and concepts such as SVM,, Neural Networks,, CNN, Ensemble of classifiers, ELM

The paper (7) titled Face Detection and Recognition Using Machine Learning Algorithm uses CLAHE, HOG, Haar Cascade, and SVM. In recognition process we are using CLAHE for pre-processing then using HOG for features extraction. HOG features are extracted for the test image and also for the training images. And finally for classification we are using SVM. Pre-processing technique is used to remove the noise, contrast enhancement, and illumination equalization.

The paper (8) titled Face Recognition using Machine Learning uses 1.SVM and 2.Viola-Jones algorithm. First face detection is done using a method called Viola-Jones algorithm. Once the face is detected feature extraction on the face is performed using histogram of oriented gradients (HOG). Lastly, training and classification of the facial databases is done using a multi-class SVM. The paper uses two sets of databases the AT & T face database and the YALE B face database.

The paper (9) titled Facial recognition using Machine Learning Algorithms on Raspberry Pi uses Haar Model and HOG model. The outcome of the work is .1. Haar-Cascade is one of the machine learning algorithms used widely to detect faces in an image. The overall detection process forms a degenerate decision and 2) HOG method offers advantages like being able to detect multiple faces in group images, being non sensitive to uniform change in luminosity and being a light weight model

The paper (10) titled The Neural Network Models Effectiveness for Face Detection and Face Recognition uses Neural networks approach. The work presented in this paper is Based on the analysis of the model performance, an algorithm was proposed that describes the choice of the model. Since each of the considered models has its own advantages and disadvantages, depending on the conditions of use and the type of problem being solved

2. MACHINE LEARNING ALGORITHMS

Face recognition algorithms classified as geometry based or template-based algorithms. The template-based methods can be constructed using statistical tools like SVM [Support Vector Machines], PCA [Principal Component Analysis], LDA [Linear Discriminant Analysis], Kernel methods or Trace Transforms.

The geometric based methods analyse local facial features and their geometric relationship. It is also known as a feature-based method

Facial detection via the viola jones algorithm is a common method used due to its high detection rate and fast processing speed. The algorithm can be summed up in four steps

- Feature selection
- Feature evaluation
- Feature learning to create a classifier
- cascading classifiers

Local Binary Pattern Histogram (LBPH) is a popular ML algorithm for face recognition delivering high accuracy in computer vision applications.

Machine learning algorithms used so far are:

- Eigenface method
- Principal component Analysis
- Convolutional Neural networking
- Support vector machine
- Local binary pattern histogram
- viola jones algorithm

3. TOOLS

Python is a programming language that supports wide range of applications. One such application is building and training a machine learning (ML) model. Most of the AI, ML and deep learning models are built using python. Python has libraries that can support and train ML models. Python libraries can process data, analyse data, and can also help us to visualize them. Below are few libraries that can help us to train ML models.

Tensor flow: Tensor flow is one of the most popular open-source libraries used to train and build machine learning and deep learning models. It was developed by Google Brain team. It offers powerful libraries, tools, resources. It helps us to build and train AI/ML models. It provides with various abstracts that lets us use the resources according to our requirement.

NumPy: NumPy is well-known general-purpose array processing package. It can process large multi-dimensional arrays and matrices. It is also useful for handling linear algebra, Fourier transforms etc. Other libraries like TensorFlow etc. use NumPy in the backend. It can easily integrate most databases.

SciPy: this library offers modules for linear algebra, image optimization integration, interpolation, FFT, signal and image processing, differential equation solutions. SciPy uses NumPy internally for data and array manipulations. It can handle classification, regression, clustering pre-processing, dimensionality reduction etc.

Theano:Theano is a python machine learning algorithm that can optimize compiler for evaluating and manipulating mathematical expressions and matrix calculations. It can automatically avoid bugs and errors when dealing with logarithmic and exponential functions.

Keras: It is an open source used for neural networks and ML. Keras works with networks to build layers, activation functions and optimizers.it runs alongside with TensorFlow and Theano .

Pandas:Pandas are one of the most popular python libraries that is mostly used to analyze data. It is fast, flexible, and expressive. It can work on both labelled and unlabeled data. It can process matrix data with homogeneous or heterogeneous type of data in rows and columns.

Matplotlib:Matplotlib is a data visualization library that is used for 2D plotting to produce quality image plots and in different formats.

PyTorch: It has wide range of tools that can support computer vision, machine learning and NLP. It has smooth integration with python data science stack .It can perform computation on tensors.

4. APPLICATIONS

1. Security companies are using facial recognition to secure their premises.
2. Immigration checkpoints use facial recognition to enforce smarter border control.
3. Ride-sharing companies such as uber or ola can use facial recognition to ensure the right passengers are picked up by the right drivers.
4. IoT benefits from facial recognition by allowing enhanced security measures and automatic access control at home.
5. Retailers can use facial recognition to customize offline offerings and to theoretically map online purchasing habits with their online ones.
6. Facial recognition technology is used in hospitals. The software serves to keep track of everything that is going on within a hospital, ensuring patients are safe and the premise is secure.
7. It is used to track individuals' movements out in the world like automated license plate readers track vehicles by plate numbers.
8. Used in the area of biometrics, Information security, access control, law enforcement, smart cards and surveillance system.

6. REFERENCES

1. Pandey, I.R., Raj, M., Sah, K.K., Mathew, T. and Padmini, M.S., 2019. Face Recognition Using Machine Learning. IRJET April 2019.
2. Singhal, P., Srivastava, P.K., Tiwari, A.K. and Shukla, R.K., 2022. A Survey: Approaches to facial detection and recognition with machine learning techniques. In Proceedings of Second Doctoral Symposium on Computational Intelligence (pp. 103-125). Springer, Singapore.
3. Bhamare, D. and Suryawanshi, P., 2018. Review on reliable pattern recognition with machine learning techniques. Fuzzy Information and Engineering, 10(3), pp.362-377. Singapore.
4. Bhanushree, K.J. and Meenavathi, M.B., 2020. Feature Based Face Recognition using Machine Learning Technniques. Int. J. Recent Technol. Eng, 8(6), pp.1313-1317.
5. Geetha, M., Latha, R.S., Nivetha, S.K., Hariprasath, S., Gowtham, S. and Deepak, C.S., 2021, January. Design of face detection and recognition system to monitor students during online examinations using Machine Learning algorithms. In 2021 international conference on computer communication and informatics (ICCCI) (pp. 1-4). IEEE
6. Pranav, K.B. and Manikandan, J., 2020. Design and evaluation of a real-time face recognition system using convolutional neural networks. Procedia Computer Science, 171, pp.1651-1659.
7. Filali, H., Riffi, J., Mahraz, A.M. and Tairi, H., 2018, April. Multiple face detection based on machine learning. In 2018 International Conference on Intelligent Systems and Computer Vision (ISCV) (pp. 1-). IEEE
8. Chen, J. and Jenkins, W.K., 2017, August. Facial recognition with PCA and machine learning methods. In 2017 IEEE 60th International Midwest Symposium on Circuits and Systems (MWSCAS) (pp. 973-976). IEEE.
9. Dr. H S Prasantha, "NOVEL APPROACH FOR IMAGE COMPRESSION USING MODIFIED SVD", International Journal of Creative Research Thoughts (IJCRT), Volume 8, Issue 8, Page 2234-2243, Aug 2020
10. Dr. H S Prasantha, "IMPLEMENTATION OF IMAGE COMPRESSION USING FAST COMPUTATION OF SVD ON DM642", International Journal of Creative Research Thoughts (IJCRT), Volume 8, Issue 8, Page 2364-2368, Aug 2020
11. Prasantha, H, H Shashidhara, K N B Murthy, and M Venkatesh. "Performance Evaluation of H.264 Decoder on Different Processors." International Journal on Computer Science & Engineering. 1.5 (2010): 1768. Web. 7 Apr. 2013.
12. H. S. Prasantha, H. L. Shashidhara, and K. N. Balasubramanya Murthy. Image compression using SVD. In Proceedings of the International Conference on Computational Intelligence and Multimedia Applications, pages 143–145. IEEE Computer Society, 2007.
13. Gunasheela K S, H S Prasantha, "Compressive sensing for image compression: survey of algorithms", Proceedings of Emerging Research in Computing, Information, Communication and Applications, ERCICA, Springer publication, Bengaluru, 2018
14. K N Shruthi, B M Shashank, Y. SaiKrishna Saketh, H.S Prasantha and S. Sandya, "Comparison Analysis Of A Biomedical Image For Compression Using Various Transform Coding Techniques", IEEE, pp. 297-303, 2016