Grenze International Journal of Engineering and Technology, Jan Issue

Face Recognition at Varying Angles

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***Abstract*— A face recognition technology is used to automatically identify a person through a digital image. It is mainly used in security systems. The face recognition will directly capture information about the shapes of faces. The mail advantage of facial recognition is it identifies each individuals skin tone of a human face's surface like the curves of the eye hole, nose and chin, etc. this technology may also be used in very dark condition. It can view the face in different angles to identify. This report develops a socio-political analysis that bridges the technical and social-scientific literatures of FRT and addresses the unique challenges and concerns that attend its development, evaluation and specific operational uses, contexts and goals. It highlights the potential and limitations of the technology, noting those tasks for which it seems ready for developments, those areas where performance obstacles may be overcome by future technological developments. In face recognition the complete facial image is usually captured and a number of points on the face can then be mapped, position of eyes, nostrils and mouth as a example. As the heat pattern is emitted from the face itself without source of external radiation these systems can capture images despite the lighting conditions, even in the dark. The drawback is high cost as they are more expensive than the standard video CCTV cameras.**

***Index Terms*— Deep Learning, RBF Neural Networks, Locally Linear Embedding, Gabor Wavelet, Image classification, Face recognition.**

I. INTRODUCTION

The subject of face recognition is as old as computer vision, both because of the practical importance of the topic and theoretical interest from cognitive scientists. Despite the fact that other methods of identification such as fingerprints and iris scans can be more accurate, face recognition has always remained a major focus of research because of its non-invasive nature and because it is people's primary method of person's identification. Face recognition is a process with many applications for its nature of being non-intrusive, natural and passive. Especially, in applications such as surveillance systems, smart homes or any application which is dealing with identifying a person from image or videos. However, it is very much challenging task to detect, identify and recognize faces from real-time scenarios where the environment is susceptible to expression, occlusion or even pose variations. Among many applications, possible implementation areas for face recognition techniques are home safety applications, security surveillance, etc. face recognition and extraction of various face features without much error by using such system should be very accurate. But it is difficult task while dealing with face identification using side view or multi angled image. There might not be proper clarity or visibility of every facial component like eyes, nose, mouth corners etc. in a single side image of a person. If we use a system using only one side view image it is extremely difficult. So in efficient face identification system angle of face in image plays a vital role. Face recognition systems unobtrusively take pictures of people's faces as they enter a

Grenze ID:01.GIJET.9.1.630

defined area. There is no intrusion or delay and in most cases the subjects are entirely unaware of the process. Artificial intelligence is used to simulate human interpretation of faces. There are essential two methods of capture. One is video imaging and the other is thermal imaging. Video imaging is more common as standard video cameras can be used.

II. Related Work or Literature Studies

A. Face Frontalization for Cross-Pose Facial Expression Recognition

Authors: Engin Deniz, Ecabert Christophe, Ekenel Hazim Kemal, Thiran Jean Phiippe
Date of Conference: 3rd Oct, 2018 – 7th Oct, 2018
The authors have explored the effect of pose normalization for cross-pose facial expression recognition. The authors have first presented an expression preserving face frontalization method.

B. Fractional Discrete Cosine Transform Based Approach for Compensating the Effect of Light Variations of Robust Face Recognition

Authors: Vishwakarma Virendra P
Date of Conference: 2nd Aug, 2018 – 4th Aug, 2018
Illumination variations are due to non-frontal lighting source with varying distribution and positions, varying ambient lighting, along with 3D shape of human face.

C. Generating Thermal Image Data Samples Using 3D Facial Modeling Techniques and Deep Learning Methodologies

Authors: Farooq Muhammed Ali, Corcaran Peter
Date of Conference: 26th May, 2020 – 28th May, 2020
Methods for generating synthetic data have become of increasing importance to build large datasets required for Convolution Neural Networks (CNN) based deep learning techniques for a wide range of computer vision applications.

D. Visual Object Tracking in Drone Images with Deep Reinforcement Learning

Authors: Gozen D, Ozer S
Year of Conference: 2020
The authors gave much more importance on Object tracking, Visual object tracking, Deep reinforcement learning, Aerial images, UAV videos. The main focus was on pattern recognition.

E. Sparse Representation Based Face Recognition Under Varying Illumination.

Authors: Cemil Turan, Ruslan Jantayev
Date of Conference: 29th Nov, 2018 – 1st Dec, 2018
The authors have used Steerable Gaussian Filter at the pre processing step for all training and testing samples. The performance of that approach was compared with that of the PCA algorithm in terms of Recognition Rates (RR).

F. Comparative Study of Face Detection Methods for Robust Face Recognition Systems.

Authors: Thilinda Edirisooriya, Eranda Jayatunga
Date of Conference: 6th Dec, 2021 – 7th Dec, 2021
This paper deliberates different methods of facial detection and contrasts them to find a better approach for a robust facial recognition system. Five methods of face detection where used in this comparison namely, Viola Jones, Histogram of Oriented Gradient with Support Vector Machine (HOG-SVM), Multi-task Cascaded Convolutional Network (MTCNN), Single Shot Multibox Detector (SSD) and Maxmargin Object Detection (MMOD).

III. Motivation

- Exact face acknowledgement over the long haul within the sight of changes in facial posture and appearance.
- Algorithm that performs better compared to current face recognition for pivoted faces.

different methods of facial detection and contrasts them to find a better approach for a robust facial recognition system. Five methods of face detection where used in this comparison namely, Viola Jones, Histogram of Oriented.

IV. PROBLEM DOMAIN

Every image in face recognition system is represented as superposition of dominant components, there are two transform domains proposed for. Discrete Wavelet Transform(DWT) and Discrete Cosine Transform(DCT) these are those two domains.

V. PROBLEM DEFINITION

Human face is recorded in a dataset used for future attempts to determine or recognize once face is created and to be match with dataset images, that activity is face recognition which is used to identify people while they scan, store and recognize their face. The feature base, image angle base and biometric methods that dealing with side-view face recognition. Objective of these methods is to train input image after performing basic transformation and match with target image that is previously kept in dataset. Major objective of this study is to recognize human face by the side view image given as input.

Our goal is to identify people even with their multi angles or side profile views. That requires efficient frame works that construct the frontal face construction from side view single face image. In this approach the image having a face without external accessories.

For face recognition there are two types of comparisons. The first is verification, this is where the system compares the given individual with who that individual says they are and gives a yes or no decision. The second is identification, this is where the system compares the given individual to all the other individuals in the database and gives a ranked list of matches.

All identification or authentication technologies operate using the following four stages:

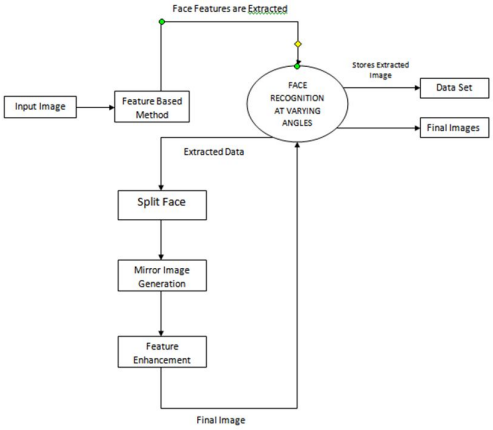
- Capture: Physical or behavioural sample is captured by the system during enrolment and also in identification or verification process.
- Extraction: Unique data is extracted from the sample and a template is created.
- Comparison: The template is then compared with a new sample.
- Match/No match: The system decides if the features extracted from the new sample are a match or a no match.

The feature based face recognition method is performed on human face. Input image can be in different face orientation where transformation of feature space is learned and applied on face for feature extraction. Objective is human's various face features like left eye, right eye, nose, mouth are to be extracted.

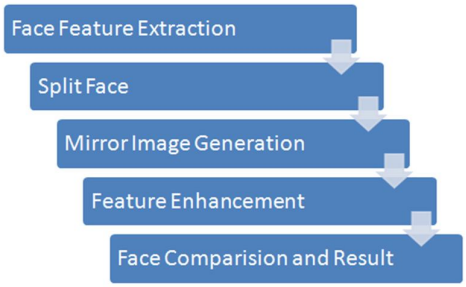
VI. PROBLEM STATEMENT

The main problem of face recognition is its high dimension space, which is to be reduced by any dimension reduction techniques. The pattern recognition approach then tries to match the facial features, which are extracted from all the images present in the database.

VII. SYSTEM DESIGN



VIII. System methodology



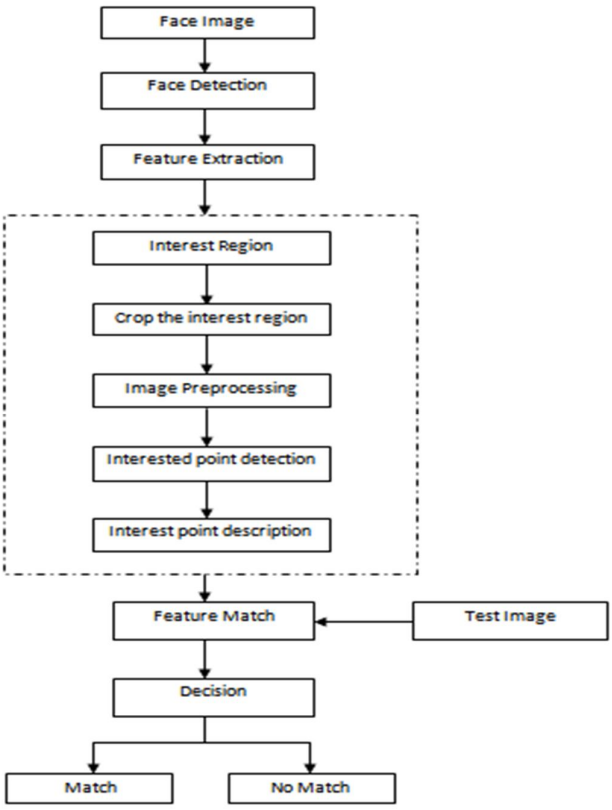
IX. Implementation of Face Recognition Technology

The implementation of face recognition technology includes the following main four stages:

- Data Acquisition.
- Input Processing.
- Face Image Classification.
- Decision Making.

Capturing of image by standard video camera's. The image is optical in characteristics and may be thought of as a collection of a large number of bright and dark areas representing the picture details. At an instant there will be large number of picture details existing simultaneously each representing the level of brightness of the scene to be reproduced. In other words the picture information is a function of two variables: time and space.

X. System implementation



XI. Comparison of Result

Our algorithm's were compared to face recognition and were recorded by the people and real time video recordings, algorithm have been trained on the precise observations sites, the observer would have basically high average accuracy. If there was no prior education on the unique statements there would have been untrained algorithm on normal decrease accuracy in face detection and face recognition. The loss of training facts with a digicam angle much like the most probable reason for this is very less detection accuracy. This lower in detection accuracy has to be seen in mild of the training of the set of rules. Consequently, reduction in the detection accuracy may not always be the end consequence. There were no duplicate entries allowed. The face recognition was working according to the design and accurate recognition was done. All the test cases were passed successfully.

XII. Conclusion

In this paper, we presented a review of the side view of various face recognition techniques. As it is very important task to recognize human from single side view image, particularly images fetched by surveillance systems that deals with identification of humans. There should be proper mechanism to adjust appropriate angle and orientation while capturing side view image so that all the facial features like eyes, nose and lips are clearly and completely visible. An effective mechanism that generates frontal face images from side view but with prior detection of presence of any defect on the either side and thereby maximizing the resemblance of both views in comparison to original one. Our method is useful for 2D face creation that increase success rate to match with reference image for human recognition from human face side view.

XIII. Future work

We can prepare CNN organizations to produce 3D facial surfaces that can be lined up with 3D lattice(matrix) for creating movements, different looks and facial feelings with shifting lighting conditions and impediments(occlusion).

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