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## RECENT TRENDS IN FACE DETECTION

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## ABSTRACT

Human perceive and sense the world around them by using their brains and eyes whereas computer vision is a science which provides all these capabilities to machines. It is a discipline in which a machine learns how to see and visualize environment around it. In this paper, we describe what Recent Trends in Face Detection are, their advantages and limitations.

**KEYWORDS**: Video Surveillance & Face And Its Geometric Features .

## INTRODUCTION

Humans have capabilities to visualize things (what is the shape and structure of objects), to recognize patterns (faces, voice, structure etc) to count things as well as to read expressions and emotions of facial appearance. According to Cavanagh," The goal of vision is to inform us the identity of objects in view and their spatial information." Another perception by Ballard and Brown is, "Computer Vision is the construction of explicit, meaningful descriptions of physical objects from images."

Some useful applications of Computer Vision are:

- Understanding image and restoration of images.
- Construction of 3D image from 2D images.
- Tracking of motion/motion estimation.
- Locating faces or Face Detection.
- Recognizing Characters, Fingerprints, Voice and Faces.
- Monitoring of traffic and Surveillance and Monitoring of Pollution.Medical Examination of brain as well as human body parts.
- Morphing of images.
- Video based Object Matching.
- Remote Sensing and Agriculture field.
- Robotics

In Biometric system, comparing face images, identifying individual from databases, retrieving personal information, prevention of identity theft, calculation of a person appearance are some major use of face recognition system. In this research work, system is developed which can identify an individual as well as count the appearance of a person in video. In this way, face recognition system is used as a part of image processing application which can be used to increase the security of a video surveillance system. Applied computer vision using real world surveillance video data is an extremely challenging research problem, independently of any information retrieval (IR) issues. Efficiently and reliably finding objects of interest in video data presented great challenges in this area.

## VIDEO SURVEILLANCE

Video Surveillance is currently a hot topic in Computer Vision and an important area in commercial sector as well. Surveillance is the monitoring of the activities of the people or other changing information, for managing them, directing or protecting them. Surveillance is a French word which means watching over. Video Surveillance is a way for improving the security of people, building and valuable things. Surveillance Cameras are already widely accepted in commercial establishment to improve security. Cameras output are being recorded. After a crime: a shop is robbed, a vehicle is stolen, fraud by a employee- investigators can go back for

investigation after the fact to see what happened but it's too late after crime has happened, so we need a continuous 24 hours monitoring and analysis of video data to aware security officers. As it is well known that Cameras are cheap but manpower required supervising them is expensive so the target of video surveillance system is to provide software in surveillance system which can continuously analyze human behavior and recognize faces automatically. Companies and public sector of government are facing a vital problem of security of its employees, clients and citizens. Video surveillance area has emerged as an innovative and integrated solution of security, by using the features provided by these researches; Government can reduce the fear of crime in public, to provide help in police investigation, to gather important information etc.

Usually in Surveillance of public sector, operators are only interested to monitor people within area. In Surveillance, Isolating each person in frame and tracking them is the problem of 'object detection, classification and tracking'. Major research issues of Video Surveillance are:

### Object Tracking and Analysis
Object tracking is an important task in the field of video surveillance. In this process, moving object is located over time using captured videos of surveillance cameras. The most general interest and a common surveillance activity is to track important people, as they move from camera to camera therefore person detection and tracking is a key component.

### Object Identification
Object Identification is the process to identify objects (people) in captured videos. In person identification, the tracked face is used to identify the identity.

### Human Motion Analysis
Human motion analysis has become a very important area of surveillance, in which sequence of static posture are statistically analyzed and compared to model movements. It is divided into 3 sections namely Human activity recognition, Human motion tracking and analysis of body parts movement (Wikipedia)

### Traffic Motion Analysis
Traffic Motion Analysis and Traffic monitoring is an important issue of surveillance to control the increasing traffic-flow on roads and highways for security and safely reasons.

### Human Behavior Analysis
Human Behavior Analysis is being more and more interesting topic for computer vision and surveillance researchers. In Video Surveillance, analysis and prevention of human behaviors like Anti-social activities, unauthorized access and illegal or unlawful photography are used to maintain social control.

In processing videos, several challenges are occurred as videos captured from surveillance cameras are of low resolution, noisy and varies as environmental conditions changes over time. Volume of data is too high which has to be processed. In video surveillance shadow detection and background modeling are the most challenging problems. Shadow Detection is critical for accurate objects detection in video stream from moving objects. Recognizing a person and drilling down the appearance of a subject is an important application for security monitoring. In such requirements system can produce the details of appearance of a subject in a video with exact frame, date and time. The human face is important in this scenario because facial features are the unique characteristics of a person and can easily be captured by cameras.

## FACE AND ITS GEOMETRIC FEATURES
Human Faces are different in appearance from one person to another. The physical characteristics of a face change from one to another. Gender, age, color complexion, race can change the appearance of a person. The geometry of a face is very difficult and complex and it's a challenging task to encode a human face in machine. Geometric features of a face are shape of eyes, nose and mouth, distance between pupils, Glabellas, root of nose, philtrum, chin boss and eye cover fold etc. Face Recognition/Detection approaches can be divided into two categories – holistic methods and Geometric features based methods. Using these Geometric features, one can develop an efficient and robust face authentication system

but the number of Geometric features selection is still a research issues.

It is important to know how many faces are in the frame presented for which usually face detection algorithms are used which isolate/crop the human faces in frames, such available faces are compared with the subject face to recognize the true appearance either by using Geometric based approaches or by Appearance based approaches of Face Recognition. Geometric based features are not effective when there are changes in expressions and poses in faces. In face recognition the challenge remains to get the effective success rate with efficient computational resources (speed, storage and time). Further the issues of illumination pose and expressions added to the complexity in this research issues.

## FACE RECOGNITION
An attractive, popular and challenging research area, Face Recognition is used to identify a person from a given database of images and videos. It compares query image to the given dataset of images. You can classify a face either as a "known" or "Unknown". Face Recognition is a pattern recognition task to determine the identity of a person. Verification system authenticates a person's identity while Identification System identifies or search a person using whole existing database of images. As we all know that Face is a primary focus of attention when we try to recognize a person, it can play a major role in security systems, criminal identification, Human computer interaction etc.

Face Recognition is required in many application areas such as:
1. Face Recognition system can provide better security than Traditional system in ATM machines, airports, buildings, multimedia workstations, checkpoints etc.
2. In Surveillance system it can be used to look for criminal offenders and suspected people.
3. It can be used to reduce duplicate registration and to prevent voter fraud
4. By integrating with laptops and mobile phones, it can provide more securities than Text Password.

5. It can be introduced as general identification of a person by investigating image database.
6. It can be used to label faces in videos.

Challenges in Face Recognition are:
1. Angle of a face, tilt or head rotation.
2. Low resolution of images and videos
3. Sun glasses, long hair, partial covering of faces in videos and group of images
4. Illumination Problem and light intensity
5. Changes in Facial Expressions
6. Ageing and occlusion problems
7. Pose Variations and huge varying appearance of same subject in videos.
8. Similar imaging conditions in which different subjects chose in appearance.

## CURRENT SCENARIO AND NEED
From last few years, due to increase in use of security system Face Recognition system has emerged as an important issue. As far as it is known, people are using face recognition system as an identification system, as verification or authentication system in current situation but if people want to increase the security of the system they need an application which can count a subject appearance. Finding of periodicity of a person can tell how many times a subject appears in a video and in which time he/she is involved in criminal issues. It can be used in ATM, airports, surveillance areas etc. By using this application, companies can develop their automatic attendance system from which no employee can forge in company. Students can also deploy this application in computers for checking how many times a person used their computer systems

## RESEARCH OVERVIEW
Faces can be identified from a group of still images and videos by using face recognition algorithms. It is mainly used in human computer interaction, security systems, control systems etc. Comparison of extracted faces from videos or still images with an existing database is used to authenticate people. The Goal of the thesis work is to create or design a robust and effective face recognition system from videos which can count how many times a person appear in videos. Program source code

and simulation is executed in MATLAB. Using this project we can study a face recognition system too.

## DESIGN OF A APPEARANCE CALCULATION SYSTEM USING FACE RECOGNITION SYSTEM

Research papers on Face recognition and detection methodologies will be studied and reviewed in next chapter. Results of survey will guide us to design a system which can count periodicity of a subject in video data i.e. finding of appearance of a person in video. A throughout survey has revealed that various methods and combination of these methods can be applied to develop an efficient and effective face recognition system which lead us to develop an application by using this system.

### Input Step

Input part is a precondition for face recognition system. Frames are extracted from videos; this process is called Image Acquisition operation. These frames are preprocessed using image processing techniques and then these live captured images are sent to face detection system for face detection.

### Face Detection Step

Face Detection is a necessary step in face recognition system. The purpose of face detection step is to localize and extract face region from images and subtract unnecessary background from images. In computer vision face detection is not an easy task. It involves segmentation and extraction of faces from uncontrolled background. In this field a considerable amount of research has been done. Heljmas and Low (2001) has divided Face Detection approach into two categories namely Feature based and Image based approaches. Figure 1.1 illustrates the different approaches of face detection. According to them feature based methods are applicable for real time system and image based methods are more suitable for processing grey scale images.

### Face Recognition Step

Modified face image which is obtained by face detection methodology will be classified to identify the person from face database. Most of the face recognition methods either based on detecting geometrical facial features like eyes, nose, mouth etc or globally analyzed a face as a whole to recognize a person. Researchers have divided face recognition methods into three categories: Holistic Approaches, Feature Based Approaches and Hybrid Approaches. In Holistic approach the whole face region is taken as an input for face recognition system while in feature based approach, Geometric features such as nose, eyes, mouth, cheeks etc are taken to measure similarity between face images. Hybrid Approach is the combination of these two methods to recognize face. Traditional methods such as PCA, LDA and ICA are holistic methods while Elastic bunch graph matching, dynamic link matching are feature based methods. According to Li and Jain, Face Recognition usually consists of 3 steps namely Face Normalization, Feature Extraction and Feature Matching.

### Output Step

This part is the final step of a face recognition system. Person name is determined with respect to the output of face recognition system. According to the results obtained from face recognition system, Frame no. will be extracted in which subject is present.

## RESEARCH OBJECTIVE

The aim of the research is to study and design a robust system in MATLAB which can recognize a periodic pattern of faces in videos i.e. which can count how many times a person appear in video. The objectives of project are:

- To design a model to calculate the appearance of a person.
- To develop a MATLAB program for designed module.
- To study different face recognition methodologies.
- To demonstrate the use of LBP method and its variants on video based face recognition.
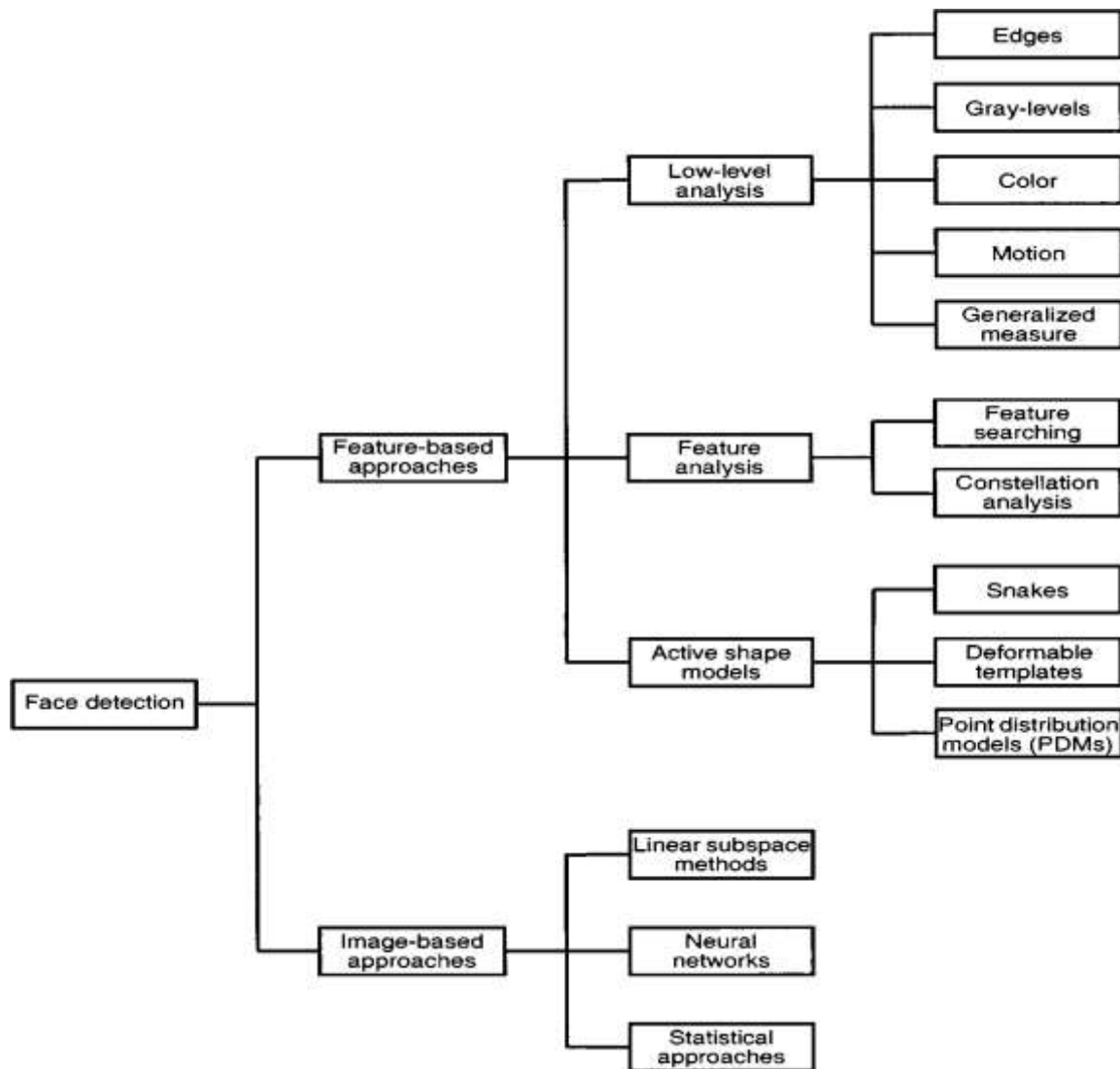- To validate and test the periodic pattern system for face.

*Figure 1.1: Categories of Face detection approaches according to Heljmas and low*

## CONCLUSION

This paper gives a brief overview about Recent Trends in Face Detection. There are lots of advancements going on in this specific domain. Continuous evolution in this area has added various dimensions in base atoms of concerned area. This study will be helpful for those working in the area of Periodicity of Facial Pattern.

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