Robust Face Recognition And Pose Estimation System

Yamini Chouhan[1], Rohit Raja[2],AnitaTantan[3]

Abstract— Behavioral characteristics of human can be used for the automated recognition system. Example of behavioral characteristic of human is finger prints, iris, palm prints and one of the most important characteristics is human face. Since human face having different head poses can be used for automated recognition system. All though the proposed system is not fully automated, it only compares the nearest common factor or characteristics and gives the result as closed set or open set identification. This system uses Parametric Linear Subspace Model (PPLS) model for estimating different 3D head poses, Gabor Wavelets for land mark extraction. Face recognition and pose estimation can be used for National security, home security and law enforcement and much more is use in crime branches for detecting the faces of unknown person's still image by comparing the database which comprises of known person's still images.

Index Terms—3D head pose, Parametric Linear Subspace Model (PPLS), Gabor Wavelets, and Face recognition, closed set identity, open set identity.

1. INTRODUCTION

Face recognition and pose estimation is key research area in biometrics. Biometric is the measure of behavioral characteristics of human which is unique for every person. In this paper the result of robust face recognition system is presented. Though the system is not fully automated, it is use in crime branches for detecting the faces of unknown person's still image by comparing the database which comprises of known person's still images. And the result of the system will be either closed set or open set identification. The system searches for the exact or nearest characteristics from the database if found it returns a corresponding identity, this identity is also known as closed set identity, where as if input image does not exist in database then the out coming will be photograph having nearest match it is also called open set identification.

Before estimating the head pose we have to know about the Degree of freedom of human head. Basically human head is limited to three Degree of Freedom (DOF) i.e yaw, pitch and roll. Yaw is the angle when moving the head left ↔ right (rotation around Y-axis). Pitch is up and down (rotation around X-axis). Roll, which we usually don't experience is when you tilt your head (rotation around Z-axis).For detection of head in any pose and locate land marks we have introduced Gabor land marking system in next topic.

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2. PROBLEM STATEMENT

To Compare and identify the given individual's still image with the templates stored in the system's database having different head poses of the same person and give the output as close set identity or open set identity.

3. METHODOLOGY

A. Land marking System

In any face recognition system or any other biometric security system, the characteristics of a person is compared with a database in order to identify that person. Land mark is a measurable biological and behavioral characteristics that can be use for automated recognition. Basically in face recognition system facial geometry is used as biometric characteristics and distance of specific facial features (eyes, nose, mouth) is used as **landmarks.** Since the head shape is based in a spherical harmonics; the human head grid is mapped into a sphere and then expanded in the basics or spherical harmonics. For face recognition, the relationship between various points such as the distance between the eyes is compared.

B. TECHNIQUE OF POSE ESTIMATION

The technique for pose estimation can be classified as Parametric Non Linear Sub Space method (PNLS) and Parametric Linear Sub Space method (PLS), PLS model extends Linear Principal Component Mapping (LPCMAP), again LPCMAP extends Parametric Piecewise Linear Subspace method (PPLS).

- **Multi-view approach**: This approach is based on the multi-view gallery, which consists of multiple views of various poses for each known person.[1]
- **Single-view approach**: The pose invariance is achieved by representing each known person by a facial I mage with a fixed canonical head pose and by transforming each test image to the canonical pose.[1]
- **Piecewise Linear Subspace Method:** This method describes an arbitrary facial image as a linear combination of a small number of orthonormal principal components (PCs) learned from training samples [1].
- **Biased Manifold Embedding (BME):** The **BME** framework is pivoted on the ideology of using the pose angle information of the face images to compute a biased neighborhood of each point in the feature space, before determining the low-dimensional embedding [5] .

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These are some of the methods which can be used for effective and efficient head pose estimation. In next section we are going to describe about the methodology which are used for development of Robust Face Recognition And Pose Estimation.

C. PARAMETRIC PIECEWISE LINEAR SUBSPACE

The parametric piecewise linear subspace (PPLS) model [19] extends the (LPCMAP) model by using the piecewise linear approach [20]. Basically two types of models are used for estimation of head pose :

- A model is called *personalized* when it is learned with pose-varying samples from a single individual.[1]
- A model is called *interpersonalized* when the training set contains multiple individuals. [1]

Image variation due to non-linear structure make difficult for us to compact the pose representation. In order to solve the compact pose representation problem we are using the Parametric Piecewise Linear Subspace Model. One of the advantage of using Parametric Piecewise Linear Subspace Model is that it consist of **Analysis-Synthesis chain.**

- **Analysis Mapping:** A mapping from face to pose is called analysis mapping.
- **Synthesis Mapping:** A mapping from pose to face is called synthesis mapping**.**

D.ALGORITHM

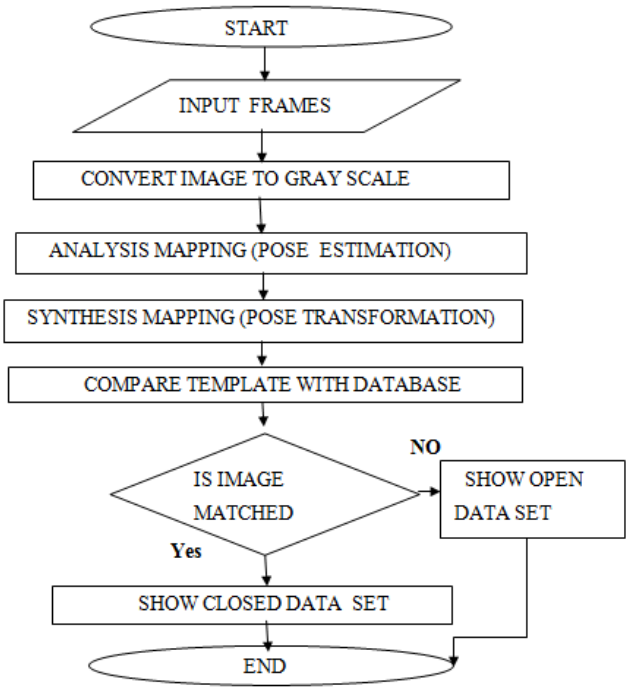

Fig 3.1 Flow Chart of Robust Face Recognition and Pose Estimation System.

The flow chart of Robust Face Recognition and Pose Estimation system is depicted in fig 3.1 in this the method of estimating pose and identification of face is given is simple steps

Developed Algorithm (PPLS)

The developed algorithm called PPLS(Parametric Piecewise Linear Subspace). Has been depicted below.

Main program {starts}

Step1. Read the known image.
Step2. Set the flag for best fit as fbest = 1
Step3. Do
If
Image is colored convert it into gray map
Else
Apply loss-less Compression
Compute Analysis Mapping

Compare the input template with database
Compute maximum matching of parameters
If
true then set the flag fbest = 0
End Do
Step4.DisplayResult as 'CLOSED SET' or 'OPEN SET'
Fig 3.2 Algorithm for PPLS model.

4. RESULT AND CONCLUSION

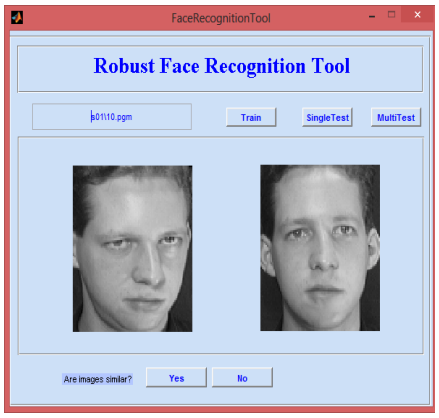

Fig. 4.1.Image detection having different pose.

Fig. 4.2Image detection having same pose.

Considerable amount of work has been done on image and pose estimation using different approach. The present work has carried out for recognition and estimation of face and different poses respectively using Parametric Piecewise Linear Subspace method (PPLS).The work has been divided into three phases that is train means we need to upload the required database on the tool next is single test, in single test the given image is uploaded to the tool and then the search engine searches for the image if available it give the closed set result else open set. And finally in multiple test single

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person having multiple posed image can detected and this is the semiautomatic system.

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REFERENCES

[1] Kazunori Okaday and Christoph von der Malsburg, *"Face Recognition and Pose Estimation withParametric Linear Subspaces*" Institutf Äur Neuroinformatik Ruhr-UniversitÄat Bochum Bochum, D-44801 Germany

[2] Yacov Hel_Or " *Model Based Pose Estimation from Uncertain Data* "Senate of the Hebrew University in Jerusalem

[3] Rama Chellappa ,Charels L. Wilson, Saad Sirohey "*Human and Machine recognition of face* " ieee Rama Chellappa ,Charels L. Wilson, Saad Sirohey

[4] Vineeth Nallure Balasubramanian "Biased Manifold Embedding: A Framework for Person- Independent Head Pose Estimation" Sethuraman Panchanathan Center for Cognitive Ubiquitous Computing Arizona State University,

[5] Teodora Vatahska, Maren Bennewitz, and Sven Behnke" Feature-based Head Pose Estimation from Images "University of FreiburgComputer Science InstituteD-79110 Freiburg, Germany

[6] Kazunori Okada and Shigeru Akamatsu "*Analysis and Synthesis of Pose Variations of Human Faces by a Linear PCMAP Model and its Application for Pose-Invariant Face Recognition System"* Human Information Processing Research Laboratories, ATR 2-2 Hikaridai Seika-cho Soraku-gun

[7] N.Kriiuger,M.Potzsch,C.vd.Malsburg "*Analysis and Synthesis of Pose Variations of Human Faces by a Linear PCMAP Model and its Application for Pose-Invariant Face Recognition System* "Institut f¨ur Neuroinformatik Ruhr-Universit¨at Bochum D-44870 Bochum

[8] Erik Murphy-Chutorian and Mohan Manubhai Trivedi" *Head Pose Estimation in Computer Vision: A Survey*" IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE

[9]K. Okada and C. von der Malsburg. Analysis and synthesis of human faces with pose variations by a parametric piecewise linear subspace method. In *Proc. the IEEE Conf. Computer Vision and Pattern Recognition*, volume I, pages 761{768, Kauai, 2001.

[10] S. Schaal and C. G. Atkeson. Constructive incremental learning from only local information. *Neural Computing*, 10:2047{2084, 1998.

[11]Rogerio S. Feris and Roberto M. Cesar Junior "*locating and tracking facial Landmarks using Gabor Wavelet Network"*Departmant of computer science, university of Sao Paulo

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