Project Report

Submitted in partial fulfilment of the

Requirements for the award of the degree

Of

**BACHELOR OF TECHNOLOGY (H)**

In

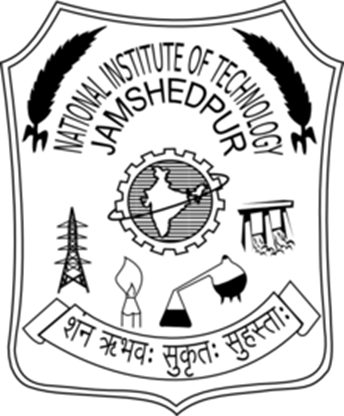
**COMPUTER SCIENCE AND ENGINEERING**

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**CANDIDATE‘S DECLARATION**

We hereby declare that the work ,which is being presented in the project entitled ‘Ear localization technique’ towards a partial fulfillment of the requirements for the award of the degree of Bachelor of Technology (H) in Computer Science and Engineering submitted in the department of Computer Science and Engineering .National Institute of Technology ,is an authentic record of our original work carried out during the academic session 2016-2017 under the esteem guidance of Dr. Koushlendra Kumar Singh, Department of Computer Science and Engineering, National Institute of Technology, Jamshedpur.

To the best of our knowledge, content of this project work has not been submitted or published anywhere.

Date -10/12/2016 Ayushi Rastogi(056/13)

Place –Jamshedpur Apoorva Maddela(083/13)

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**CERTIFICATE**

Certified that the B. Tech project work entitled **EAR LOCALISATION TECHNIQUE** has been done by abovementioned students under my supervision during the academic session 2016-2017.

Date:- 10/12/2016Dr. Koushlendra Kumar Singh

Place:- Jamshedpur AD Hoc Faculty Head Of Department

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Last but not the least we would like to thank other students of institutes whose valuable tips came handy in obtaining the correct results and will definitely be useful in days to come.

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**ABSTRACT**

Ear biometrics has been found to be a good and reliable technique for human recognition.

With the initial doubts on uniqueness of the ear, ear biometric could not attract much attention.

But after that it has been said that it is almost impossible to find two ear with all the parts identical, ear part has gained its pace. To automate the ear based recognition process, ear in the image is need to be localized automatically. This paper presents a technique for the same. Ear localization in the proposed technique is carried out by using the hierarchical clustering of the edges obtained from the side face image.

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**CHAPTER 1**

**INTRODUCTION**

Since human biometric system uses human traits for recognition which cannot be forgotten and stolen, they have become

very essential component in all security aspects. These systems perform the recognition of a human based on physiological and behavioral characteristics .Physiological characteristics are related to the shape of the body. Biometric traits such as face, fingerprint, iris, ear, hand geometry fall under this category. Behavior characteristics are related to the behavior of human.

Signature, voice, character stokes etc. are some of the biometric traits which fall under this category. Among the various physiological traits, ear has gained much attention in recent years as it has been found to be a good and reliable biometric for human verification and identification. Reason behind ear biometrics gaining popularity is that ears are remarkably consistent. Unlike faces, they do not change shape with different expressions or age, and remain fixed in the middle of the side of the head against a predictable background. To automate ear based recognition process, automatic ear localization is necessary but at the same time detection of the ear from an arbitrary side face image is a challenging problem. This is because of the fact that ear image can vary in appearance under different viewing and illumination conditions. In literature, there are a very few techniques available for automatic ear detection. These techniques are either semi-automatic and need some user intervention or fail to detect ears in many situations Hurley et al have used force field approach to get the ear location. Their approach is only applicable when a small background is present. Burge and Burger have used deformable contours for ear detection. Chen and Bhanu have presented a template based method for human ear detection from side face range images. The model template in this method is represented by an averaged histogram of shape index. This method works for 3D ear biometrics. Alvarez et al. have proposed have an ear localization from 2D side face image using ovoid and active contour model. Ear boundary is estimated by fitting the contour of an ear in an image by combining snake technique and an ovoid model. This method requires an initial approximate ear contours as input and cannot be used in fully automated ear recognition process. Yuan and Mu have proposed have proposed an ear detection method based on skin color and contour information. This method detects the ear by first roughly estimating the ear location and then improving the localization using contour information. This method detects the ear by first roughly estimating ear location and then improving the localization using contour information. This technique assumes the ear shape elliptical and fits ellipse to the edges to get the accurate position of the ear. The assumption is considering shape of the ear elliptical may not be true for all the persons and not help in detecting the ear in general. For example, boundary of an ear of a triangular shape cannot be detected in this approach. Yan and Bowyer have proposed skin segmentation and active contours based method for ear localization in 3D ear biometrics. Ear localization in their approach is carried out by first detecting the ear pit and then further using its boundary as initialization for the active contour. Ear pit detection uses the location of nose tip which is detected by heuristics. This heuristic may fail for the faces rotated along horizontal axis. Ansari and Gupta have presented an ear detection approach based on edges of outer ear helices. This method exploits the parallelism between outer helix curves of the ear and does not use any structural information present in the inner part of the ear, and hence fails if the helix edges are not proper. Moreover, finding parallel edges in an image is a computation intensive process. In, Sana et al have proposed an ear detection scheme based on template matching. To detect ears of different size, they maintain templates of various sizes and the pre estimated templates are not sufficient to handle all the situations. Further, detection of ear using templates of various sizes and then selecting best detection is a computationally expensive task.

This paper presents a novel technique for automatic ear detection from side face images. The proposed technique is based on hierarchical clustering and detects ear from side face images efficiently using the edge information. To reduce the search space for the ear, skin segmentation of the image is performed and only skin regions are used for the edge computation. Obtained edges are clustered using the hierarchical clustering and obtained clusters are used for ear localization.

**CHAPTER 2**

**2.1 PROPOSED METHODOLOGY**

Design and development of an efficient Ear Biometric system for automatic ear localization from side face image is done through a technique which will be rotation, scale and shape invariant. The ear localization technique faces several challenges because ear may vary in scale and pose due to in-plane and out-plane rotations. The technique involves a combination of several steps like:

**Color Based Skin Segmentation**:

An Image in the RGB color space not only gives information of color but also about luminance which may vary across a face due to ambient lighting conditions. In this case it becomes very unreliable measure for segmenting the skin and non-skin regions using RGB color space. We have thus adopted a method of using YCbCr color space which separates luminance and chrominance information from an image and we can hence use only the color information given by Cb and Cr components. An appropriate threshold is selected such that skin pixels can be denoted as white and the non-skin regions as black pixels after the image segmentation. All the detected skin regions will not contain the ear and hence we will need to perform the ear localization technique to locate ear in all the skin like segments.

**Skin-Region Edge Computation:**

The skin segmented image is then used for edge computation. A canny edge operator is used for this purpose. The edge list is obtained and the edges are computed by connecting edge points together into a sequence of pixel coordinate pairs. Wherever we encounter an edge junction, there we tend to terminate the edge and a separate edge point sequence is generated for each branch and then is added to the list. It generates a set of edges containing two end points and hence resulting into an edge list.

**2.2 ALGORITHM**

Algorithm for finding the segmented image

Algorithm 1:

Input: I, cb, cr, w, h

I: Original image

cb: blue difference

cr: red difference

w: width

h: height

Output: Segmented image

Begin

Read the original input file

Convert it into a double format

Convert rgb color space to hsv color space

Calculate cb = 0.148\*I(:,:,1) - 0.291\*I(:,:,2)+0.439\*I(:,:,3)+128

Calculate cr = 0.439\*I(:,:,1) -0.368\*I(:,:,2)-0.071\*I(:,:,3)+128

For i=1 to w

For j=1 to h

If 140<=cr(i,j) && cr(i,j)<=165 && 140<=cb(i,j) && cb(i,j)<=195 && 0.01<=hue(i ,j) && hue(i,j)<=0.1

Segment(I,j)=1

Else

Segment(I,j)=0

End if

End for

End for

ALGORITHM 2:

Input: Segmented image

segment: Skin segmented image

EI: Edge detected image

Output: Edge detected image

begin

EI = edge(segment, ‘canny’)

end

**2.3 EXPERIMENTS AND RESULTS**

**Original Images Segmented Images Edge Detected Images**

**CHAPTER 3**

**CONCLUSIONS AND FUTURE WORK**

The results of the experiments performed clearly show that the colored image is segmented into skin and non-skin regions. All detected skin regions do not necessarily contain ear but since ear is rich in edges and is the only part which shows much variations in pixel intensities in a side face image we have thus try to exploit this fact in our further steps.

We captured images of 5 different persons and applied skin segmentation and edge detection algorithm on all of them. With these data sets, we will perform approximation of edges using line segments, construction of convex edge map, curvature based edge pruning, edge candidate set generation, building edge connectivity graph, connected component computations, ear candidate set computation and hence ear localization, which will be scale, rotation and shape invariant.

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