A Project Report on

**A CONSTRUCTIVE MANIPULATION OF FACIAL IMAGE PROCESSING**

Submitted by

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In partial fulfillment for the award of the degree of

**Bachelor of Technology**

in

**Electronics and Communication Engineering**

****

**School of Electrical & Electronics Engineering**

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**Thanjavur, India – 613 401**

**April, 2015**

**BONAFIDE CERTIFICATE**

Certified that the project work entitled **“A CONSTRUCTIVE MANIPULATION OF FACIAL IMAGE PROCESSING”** submitted to SASTRA University, Thanjavur by S.VIJAY PALANIAPPAN (Reg.No:115004130), in partial fulfillment for the award of the degree of Bachelor of Technology in Electronics and Communication Engineering is the work carried out independently under my guidance during the period Dec 2014 – April 2015.

**Project Guide**

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**DECLARATION**

I submit this project work entitled “**A CONSTRUCTIVE MANIPULATION OF FACIAL IMAGE PROCESSING”** to SASTRA University, Thanjavur in partial fulfillment of the requirements for the award of the degree of “**Bachelor of Technology**” in **“Electronics and Communication Engineering”.** We declare that it was carried out independently by us under the guidance of NARASIMHAN, AP III, ECE, SASTRA University

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**ABSTRACT**

The incessant consequences on the grounds of apparently failing to establish age

restricted software are quite serious. Achieving this objective gives a splendid dimension on

the arena of surveillance, access control and face recognition that is requisite and at times

goes hand in hand with automating customer relationship electronically.This project work

falls upon facial processing of images to acquire the age category and gender of the

corresponding person. Most of the previous works involves strenuous methodologies. Indeed

this is absolutely a tiresome and incredulous task on the offset basis.

The ideology focuses on complying with the same objective in a relatively robust

manner. This primitively works upon exploiting the simple metrics from the facial images

and processing them easily. Facial Image Processing is one of the most consistent realms of

research which makes a real difference with reference to the technological advancements. It

literally holds a lot of scope in all streams of applications that meets the trending advantages

of fixing the social issues. There are cases when the age restricted community which had

been brought into effect, did undergo a lot of troubles.

In order to handle this sort of scenarios, it is pretty requisite to definitely have a

system that shall be automated to meet this objective. Precisely Facial Image Processing is

highly beneficial in going hand in hand with the primordial societal concerns. This had

become prominent when the consequences are seemingly more susceptible with respect to the

prevailing effects in the society. So the reasons for the exploration of facial images had

become more reliable in terms of fixing these issues.

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**Chapter 1**

**INTRODUCTION**

**1.1 Image Processing:**

In [imaging science](http://en.wikipedia.org/wiki/Imaging_science), image processing is any form of [signal processing](http://en.wikipedia.org/wiki/Signal_processing) for

which the input is an image, such as a [photograph](http://en.wikipedia.org/wiki/Photograph) or [video frame](http://en.wikipedia.org/wiki/Video_frame); the output of image

processing may be either an image or a set of characteristics or [parameters](http://en.wikipedia.org/wiki/Parameter) related to the

image. Most image-processing techniques involve treating the image as a two

dimensional [signal](http://en.wikipedia.org/wiki/Signal_(electrical_engineering)) and applying standard signal-processing techniques to it.

Image processing usually refers to [digital image processing](http://en.wikipedia.org/wiki/Digital_image_processing), but [optical](http://en.wikipedia.org/wiki/Optical_engineering) and analog image

processing also are possible. The acquisition of images is referred to as [imaging](http://en.wikipedia.org/wiki/Imaging_science).

Closely related to image processing are [computer graphics](http://en.wikipedia.org/wiki/Computer_graphics) and computer

vision. In computer graphics, images are manually made from physical models of objects,

environments, and lighting, instead of being acquired from natural scenes, as in most

animated movies. Computer vision, on the other hand, is often considered high-level image

processing out of which a software intends to decipher the physical contents of an image or a

sequence of images In modern sciences and technologies, images also gain much broader

scopes due to the ever growing importance of scientific visualization.

**1.2 Applications of Image Processing:**

Digital Image Processing has very wide applications and almost all of

the technical fields are impacted by DIP, we will just discuss some of the major applications

of DIP. Digital Image processing is not just limited to adjust the spatial resolution of the

everyday images captured by the camera. It is not just limited to increase the brightness of the

photo, etc. Rather it is far more than that.

Some of the major fields in which digital image processing is widely used are mentioned below:

* Image sharpening and restoration
* Medical field
* Remote sensing
* Transmission and encoding
* Machine or Robot vision
* Colour processing
* Pattern recognition
* Video processing
* Microscopic Imaging
* Others

**Image sharpening and restoration:**

* Image sharpening and restoration refers here to process images that have been

captured from the modern camera to make them a better image or to manipulate those

images in way to achieve desired result. It refers to do what Photoshop usually does.

* This includes Zooming, blurring , sharpening , gray scale to color conversion,

detecting edges and vice versa , Image retrieval and Image recognition.

**Medical field:**

The common applications in the field of medical is

1. Gamma ray imaging
2. PET scan
3. X Ray Imaging
4. Medical CT
5. UV imaging

## UV imaging:

In the field of remote sensing , the area of the earth is scanned by a satellite or from a very

high ground and then it is analyzed to obtain information about it. One particular application

of digital image processing in the field of remote sensing is to detect infrastructure damages

caused by an earthquake.

As it takes longer time to grasp damage, even if serious damages are focused on. Since the

area effected by the earthquake is sometimes so wide , that it not possible to examine it with

human eye in order to estimate damages. Even if it is , then it is very hectic and time

consuming procedure. So a solution to this is found in digital image processing. An image of

the effected area is captured from the above ground and then it is analyzed to detect the

various types of damage done by the earthquake.

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the effected area is captured from the above ground and then it is analyzed to detect the

various types of damage done by the earthquake.

The key steps include in the analysis are

1. The extraction of edges
2. Analysis and enhancement of various types of edges

## Transmission and encoding:

The very first image that has been transmitted over the wire was from London to New York

via a submarine cable.

## Machine/Robot vision

Apart form the many challenges that a robot face today , one of the biggest challenge still is

to increase the vision of the robot. Make robot able to see things , identify them , identify the

hurdles. Much work has been contributed by this field and a complete other field of

computer vision has been introduced to work on it.

## Hurdle detection

Hurdle detection is one of the common task that has been done through image processing, by

identifying different type of objects in the image and then calculating the distance between

robot and hurdles.

## Line follower robot

Most of the robots today work by following the line and thus are called line follower robots.

This help a robot to move on its path and perform some tasks. This has also been achieved

through image processing.

## Colour processing

Colour processing includes processing of colored images and different color spaces that are

used. For example RGB color model , YCbCr, HSV. It also involves studying transmission ,

storage , and encoding of these color images.

## Pattern recognition

Pattern recognition involves study from image processing and from various other fields that

includes machine learning ( a branch of artificial intelligence). In pattern recognition , image

processing is used for identifying the objects in an images and then machine learning is used

to train the system for the change in pattern. Pattern recognition is used in computer aided

diagnosis, recognition of handwriting , recognition of images e.t.c

## Video processing

A video is nothing but just the very fast movement of pictures. The quality of the video

depends on the number of frames/pictures per minute and the quality of each frame being

used. Video processing involves noise reduction, detail enhancement , motion detection ,

frame rate conversion , aspect ratio conversion and colour space conversion.

**1.3 Why Facial Image Processing?**

Facial Image Processing (FIP) is the processing of the facial

images in order to do analysis with reference to the information from it. An image is

something that reveals a lot of information and that too it is good enough to be worth of

thousand words to convey. It discloses plethora of facts that could be perhaps unleashed by a

person. So it is often taken out to be for granted to meet applications that are totally

significant indeed. It is also a fact that the exploration of such facial images is pretty much

complex. The features of a facial image are the area of operation where the process would be

incorporated.

**Chapter 2**

**MATLAB**

**2.1 Introduction**

MATLABis the high-level language and interactive environment used by millions of

engineers and scientists worldwide. It lets you explore and visualize ideas and collaborate

across disciplines including signal and image processing, communications, control systems,

and computational finance.

**Primordial Aspects:**

* [Numeric Computation](http://in.mathworks.com/products/matlab/features.html#numeric_computation)
* [Data Analysis and Visualization](http://in.mathworks.com/products/matlab/features.html#data_analysis)
* [Programming and Algorithm Development](http://in.mathworks.com/products/matlab/features.html#programming_algorithm_development)
* [Application Development and Deployment](http://in.mathworks.com/products/matlab/features.html#application_development)

**Key Features:**

* High-level language for [numerical computation](http://in.mathworks.com/products/matlab/features.html#numeric_computation), [visualization](http://in.mathworks.com/products/matlab/features.html#data_analysis), and [application development](http://in.mathworks.com/products/matlab/features.html#application_development)
* Interactive environment for iterative exploration, design, and problem solving
* Mathematical functions for linear algebra, statistics, Fourier analysis, filtering, optimization,

numerical integration, and solving ordinary differential equations

* Built-in graphics for visualizing data and tools for creating custom plots
* Development tools for improving code quality and maintainability and maximizing

performance

* Tools for building applications with custom graphical interfaces
* Functions for integrating MATLAB based algorithms with external applications and

languages such as C, Java, .NET, and MicrosoftExcel.

**2.2 Why Matlab over other softwares?**

* A very large (and growing) database of built-in algorithms for image processing and computer vision applications
* MATLAB allows you to test algorithms immediately without recompilation. You can type

something at the command line or execute a section in the editor and immediately see the

results, greatly facilitating algorithm development.

* The MATLAB Desktop environment, which allows you to work interactively with your data,

helps you to keep track of files and variables, and simplifies common programming tasks.

* The ability to read in a wide variety of both common and domain-specific image formats.
* The ability to call external libraries, such as Open CV
* Clearly written documentation with many examples, as well as online resources such as web

seminars

* Bi-annual updates with new algorithms, features, and performance enhancements
* If you are already using MATLAB for other purposes, such as simulation, optimization,

statistics, or data analysis, then there is a very quick learning curve for using it in image

processing.

* The ability to process both still images and video.
* Technical support from a well-staffed, professional
* A large user community with lots of free code and knowledge sharing
* The ability to auto-generate C code, using MATLAB Coder, for a large subset of image

processing and mathematical functions, which you could then use in other environments,

such as embedded systems or as a component in other software.

**2.3 Image Processing Toolbox:**

Image Processing Toolbox™ provides a comprehensive set of

reference-standard algorithms, and [apps](http://in.mathworks.com/products/image/apps.html) for image processing, analysis,

visualization, and algorithm development. You can perform image analysis, image

segmentation, [image enhancement](http://in.mathworks.com/products/image/features.html#image-enhancement), noise reduction, geometric transformations, and image

registration. Many toolbox functions support multicore processors, GPUs, and C-code

generation.

**2.4 Features:**

* Image analysis, including [segmentation](http://in.mathworks.com/discovery/image-segmentation.html), morphology, statistics, and measurement
* [Image enhancement](http://in.mathworks.com/discovery/image-enhancement.html), filtering, and de-blurring
* Geometric transformations and intensity-based image registration methods
* Image transforms, including FFT, DCT, Radon, and fan-beam projection
* Large image workflows, including block processing, tiling, and multiresolution display
* [Visualization apps](http://in.mathworks.com/products/image/apps.html), including Image Viewer and Video Viewer
* Multicore- and GPU-enabled functions, and C-code generation support

**Chapter 3**

**Attributes of Image Processing Toolbox**

**3.1 Significant Aspects:**

* [Key Features](http://in.mathworks.com/products/image/features.html#key-features)
* [Exploration and Discovery](http://in.mathworks.com/products/image/features.html#exploration-and-discovery)
* [Image Enhancement](http://in.mathworks.com/products/image/features.html#image-enhancement)
* [Image Analysis](http://in.mathworks.com/products/image/features.html#image-analysis)
* [Image Segmentation](http://in.mathworks.com/products/image/features.html#image-segmentation)
* [Image Registration and Geometric Transformations](http://in.mathworks.com/products/image/features.html#image-registration-and-geometric-transformations)
* [Large Image Processing and Performance Acceleration](http://in.mathworks.com/products/image/features.html#large-image-processing-and-performance-acceleration)
* [Target Hardware](http://in.mathworks.com/products/image/features.html#target-hardware)

## 3.2 Key Features

* Image analysis, including [segmentation](http://in.mathworks.com/discovery/image-segmentation.html), morphology, statistics, and measurement
* [Image enhancement](http://in.mathworks.com/discovery/image-enhancement.html), filtering, and de-blurring
* Geometric transformations and intensity-based image registration methods
* Image transforms, including FFT, DCT, Radon, and fan-beam projection
* Large image workflows, including block processing, tiling, and multiresolution display
* [Visualization apps](http://in.mathworks.com/products/image/apps.html), including Image Viewer and Video Viewer
* Multicore- and GPU-enabled functions, and C-code generation support

### 3.3 Standard and Specialized File Formats

[MATLAB®](http://in.mathworks.com/products/matlab/) supports [standard data and image formats](http://in.mathworks.com/help/matlab/import_export/supported-file-formats.html) including:

* AVI
* JPEG
* JPEG-2000
* FITS
* HDF
* HDF-EOS
* M4V
* MOV
* MP4
* PNG
* TIFF
* ASCII
* Binary files
* Microsoft Excel

It also supports the multiband image formats BIP and BIL, as used by LANDSAT.

Low-level I/O and memory mapping functions enable you to develop custom routines for

working with any data format.

Image Processing Toolbox supports a number of specialized image file formats. For

medical images, it supports [DICOM files](http://in.mathworks.com/help/images/working-with-dicom-files.html), including associated metadata, as well as the

Analyse and Inter-file formats. The toolbox can also read geospatial images in NITF files and

high dynamic range images in HDR files.

### 3.4 Apps for Exploration and Discovery

The toolbox provides a suite of [image processing apps](http://in.mathworks.com/products/image/apps.html) to explore and discover various

algorithmic approaches. With the Color Thresholder app, you can segment an image based on

various color spaces. The Image Viewer app lets you interactively place and manipulate

ROIs, including points, lines, rectangles, polygons, ellipses, and freehand shapes. You can

also view pixel information, pan and zoom, adjust contrast, and measure distances.

Alternatively, you can perform these tasks programmatically and use individual functions to

create custom interfaces.

## Image Enhancement

[Image enhancement](http://in.mathworks.com/discovery/image-enhancement.html) techniques in Image Processing Toolbox enable you to increase the

signal-to-noise ratio and accentuate image features by modifying the colors or intensities of

image. The toolbox includes specialized filtering routines and a generalized multidimensional

filtering function that handles integer image types, offers multiple boundary-padding options,

and performs convolution and correlation.

Using predefined filters and functions one can:

* Filter with [morphological operators](http://in.mathworks.com/help/images/examples/correcting-nonuniform-illumination.html)
* Deblur and sharpen
* Remove noise with [linear, median, or adaptive filtering](http://in.mathworks.com/help/images/noise-removal.html)
* [Perform histogram equalization](http://in.mathworks.com/help/images/contrast-adjustment.html#buh9ylp-59)
* [Remap the dynamic range](http://in.mathworks.com/help/images/contrast-adjustment.html)
* Adjust the gamma value
* [Adjust contrast](http://in.mathworks.com/help/images/adjusting-image-contrast-using-the-adjust-contrast-tool.html)

### Morphological Operators

[Morphological operators](http://in.mathworks.com/help/images/morphological-filtering.html) enable you to enhance contrast, remove noise, thin regions, or

perform skeletonization on regions. Morphological functions in Image Processing Toolbox

include:

* [Dilation and erosion](http://in.mathworks.com/help/images/morphology-fundamentals-dilation-and-erosion.html#f18-24720)
* Opening and closing

### Image De-blurring

[Image deblurring algorithms](http://in.mathworks.com/help/images/image-restoration-deblurring.html) in Image Processing Toolbox include blind, Lucy-Richardson,

Wiener, and [regularized filter deconvolution](http://in.mathworks.com/help/images/deblurring-with-a-regularized-filter.html), as well as conversions between point spread

and optical transfer functions. These functions help correct blurring caused by out-of-focus

optics, movement by the camera or the subject during image capture, atmospheric conditions,

short exposure time, and other factors.  All deblurring functions work with multidimensional

images.

## Image Analysis

Image analysis is the process of extracting meaningful information from images such as

finding shapes, counting objects, identifying colors, or [measuring object properties](http://in.mathworks.com/help/images/pixel-values-and-image-statistics.html).

Image Processing Toolbox provides a comprehensive suite of reference-standard algorithms

and visualization functions for image analysis tasks such as [statistical analysis](http://in.mathworks.com/help/images/pixel-values.html), feature

extraction, and [property measurement](http://in.mathworks.com/help/images/ref/regionprops.html).

### Image Transforms

Image transforms play a critical role in many image processing tasks, including image

enhancement, analysis, restoration, and compression. Image Processing Toolbox provides

several image transforms, including Hough, Radon, FFT, DCT, and [fan-beam projections](http://in.mathworks.com/help/images/fan-beam-projection-data.html#f21-26788).

You can reconstruct images from parallel-beam and fan-beam projection data (common in

tomography applications).

Image transforms are also available in MATLAB and [Wavelet Toolbox™](http://in.mathworks.com/products/wavelet).

## Image Segmentation

[Image segmentation](http://in.mathworks.com/discovery/image-segmentation.html) algorithms determine region boundaries in an image. You can explore

many different approaches to image segmentation, including progressive methods, automatic

thresholding, edge-based methods, and morphology-based methods such as the watershed

transform that is often used to segment connected objects.

### Edge Detection

Edge-detection algorithms let you identify object boundaries in an image.  These algorithms

include the Sobel, Prewitt, Roberts, Canny, and Laplacian of Gaussian methods. The Canny

method can detect true weak edges without being fooled by noise.

.

**Chapter 4**

**4 Overview of the Algorithm**

|  |
| --- |
| Irises Distance |
| Lip Corners Distance |
| Irises – Mouth Angle |
| Irises – Nose Tip Angle |

|  |
| --- |
| ESTIMATE AGE |

|  |
| --- |
| Face Detection |
| Histogram Equalization |
| Filtering |
| Image Resizing |

|  |
| --- |
| NN Classifier |

INPUT

IMAGE **AGE METRICS**

|  |
| --- |
| Nose Area |
| Eye – Lip Corners Ratio |

|  |
| --- |
| CLASSIFY GENDER |

**CLASSIFIER**

**1.1 Process Flow Diagram**

**4.1 Face Detection**:

Face detection is one of the prominent processes of facial image processing.

This would be an integral part of any application concerned with the digital processing of

images. It is the technological arena of computer which detects the faces of human beings.

It plays a key role as it aids out in recognizing a particular face which is supposed to be

found. This could be taken as the exceptional case of object-class detection. As in

accordance with the object-class detection, the primary goal is to look into the detection of

location and the size of that particular object. The face detection protocols focus on the

detection of the frontal faces of humans.

The key objective is to make sure if the bits of the base image is matched

with the ones of the target image. This is how it works and this algorithm is quite helpful

and does find a lot of applications. The best part is that it guarantees cent percent of image

detection wherein which even if a single feature of the face gets altered, the image will be

invalidated in no time. The key benefits of this process is one could do the recognition of a

face. It shall indeed find an application in photography where one could make an autofocus

of the face while taking a snapshot.

**4.2 Histogram Equalization:**

The equalization of an image in general makes a lot of difference to the

quality of the processing of it. So when incorporating this mechanism in the processing of

facial images goes hand in hand in the process. This would intensify the betterment of the

results which could be acquired out of the processed image. Thereby it is pretty

instrumental in any application that shall be arrived out of image processing.

The key purpose behind this mechanism is to make sure of establishing a

good contrast of the image. This would enable the photo to have a plausible visual

appearance. This would enable the image to have better distributed intensities over

the representation of the histogram. It spreads out the frequently existing intensities in the

image explicitly. This would definitely give way for low contrast areas to typically gain high

contrast.

**4.3 Filtering:**

Filtering is an essential process in any signal processing. So as for the facial

processing of images too, filters are tremendously making a huge difference. The role of a

filter is to take off the noise or any unwanted signal in the image. Thus this forms the

primordial part of the phenomenon. This would inturn reduces the background noise by

truncating a few frequencies.

It does not necessarily act in the frequency domain as a exclusive stuff. However it

does not make a real impact to the signals of the very image. The best part of filtering is that

it shall be imparted on to any technology that we intend to work it out. Thus filtering is a key

process to be accomplished in any signal processing. But then it might add some unnatural

effects but nevertheless it is worth incorporating to process an image.

**4.4 Image Resizing:**

The resizing of an image is all about changing the dimensions of the image in

terms of its size, say length or width. In other words, the resolution has to be altered for this

particular operation. As far as this algorithm is concerned, the project is compatible only to

the small resolution images. So the better option would be to resize the facial image.

According to the analysis made on the proper working of the protocol, the most preferable

image size is 300 \* 200. This shall be applicable to facial image of any person.

**Chapter 5**

**5 Materials and Methods**

**1.2 Samples Used**











**5.1 Age Categories:**

A person can be identified in by five categories of age – Kids, Youths, Adults,

Middle Aged and Old people. All these categories are supposed to be recognized by various

attributes. When it comes to kids, their characteristic features are pretty much identified by

their small sized facial features. This would clearly depict the outlook of a kid. When it

comes to the youths, they are the next order in the hierarchy. Adults would be a little more

matured in terms of the facial features and the very outlook. Men do have moustache and a

few more primordial features as in terms of their physical growth. This happens out to be

striking factor and when it comes to women, they do have their very attributes that does make

a distinguishing appeal.

Middle aged people do have the starting period of wrinkles and mostly they

would appear to be a little aged relative to the other categories. As for the aged people, they

do have the secondary features like the evolved wrinkles and other features that give away an

old appearance. The features make a lot of difference when it comes to each and every age

category. This is pretty evident and quite identifiable. As long as the features make a

distinguishing appeal, it generates a lot of scope for unleashing new techniques to arrive at

the estimation.

**1.1** **Categories of Ages**

|  |  |
| --- | --- |
| **CATEGORY** | **AGE RANGE** |
| Kids | Less than 18 years |
| Youth | 18 – 25 years |
| Adult | 26 – 35 years |
| Middle Age | 35 – 50 years |
| Old | Above 50 years |

**5.2 Approach:**

There is N number of ideologies and methodologies to implement the objective.

When it comes to the approach of this work, it absolutely relies on the geometric measures.

As it is pretty evident that any techniques like application of transforms and analysis could

give rise to a tiresome and a complex approach. It is also factual that these techniques would

fail in that event of a facial make up. Say for instance, celebrities like actors on the account of

shooting would perhaps look so young than how they are. In this case, any methodology

would definitely fail in achieving the original estimate of the person.

This work revolves around a typical approach of making the computation of the

geometrical measures. So in this case, the geometric measures by any chance would never

stand out to be a failure case. Whoever is the person and whatever is his age, the estimate

would be pretty accurate. The methodology is also easily doing the stuff requisite with the

use of simple metrics. The best part is that all the metrics are quite simple whereupon even a

non-technical person shall be in a position to implement the same. The metrics are all a very

evident way of making an absolute calculation of the age and gender.

**5.3 Metrics:**

When it comes to the computation of the age, basically four metrics are incorporated.

They are computation of the distances of the irises, distances of the lip corners, angle made

by the Irises-Mouth triangle, angle made by the Irises-Nose triangle. There is literally a cut

off range for all the attributes that makes the estimate. So this is to be made sure by the

classifier which actually does the desired task. The protocol is supposed to arrive at the

measures of the above features. All the values of these features are to be taken into

consideration and finally the categorization of the age is made.

In the estimation of the gender of the person, there are a couple of metrics that

does the task. Biologically, the eyes of male are 10% larger than that of the females. So the

thing is that the area of the person’s nose could be taken as a feature for distinguishing the

gender. The reason is that the men are more muscular relative to the women and naturally

men need to take in a lot of oxygen. In order to facilitate this, they happened to have a big

nose. This is the scientifically proven fact behind the metric. Another metric is to find the

ratio of the distances of the corner point of eyes to the distance between the lips.

**5.4 Choice of Classifier:**

There are many classifiers prevalent and it is quite important in actually going

for the right one for the right application. This is a little challenging stuff and the one who

does the work should be apparently aware of which classifier is to be made use of. As far as

the objective of the work is concerned, the choices of classifiers can be SVM, K – Nearest

Neighbour and Neural Network classifiers. Taking the SVM classifier into consideration, it is

a good one to do the stuff that is intended to be done. But there are about a couple of setbacks

that literally obstructs one to opt it.

Primordially it is a classifier that imposes an ambiguity to a person in terms of

the kernel it handles. Secondly, it also requires high memory requirements that would indeed

make out a complex thing to taken up with. When it comes to the K – Nearest Neighbour, it

actually happens out to be a slow learner of the training samples that are being dealt up by it.

But the right choice of the classifier right in this case is going for the Neural Networks

classifier. The thing is that it appears to be the cool and whippy classifier that is intended to

get done with the classification of the categories.

**5.5 Protocol:**

The best part of it is that the metrics and easy and commendable enough to pull out a

promising performance in terms of the accurate results.

The algorithm falls into the following steps:

1. After the preprocessing of the intended facial image, the first metric is to be incorporated. The irises are to be located by the phenomenon of iris recognition and the distance between them is to be measured. The lip corners should be located by implementing the edge detection technique and the distance between them is measured. This is taken to be the second metric of the age classification.
2. As in the third metric which includes the irises alongside with the centre of the mouth which should be identified by the detecting principle. The three points are to be to be connected to make a triangle. Then the angle is to be measured by the side of the mouth centre.
3. In the fourth metric, the triangle is formed between the irises and the tip of the nose. The angle is to be measured by the side of the nose tip.
4. The outcomes of all the four metrics is to be given to the NN Classifier for a robust estimate of age. After going through the training and testing phases of the classifier tool, the optimized output would get generated.
5. As for the gender, the first metric is to make a bounding box of the nose and compute the area of it.
6. The second metric is to compute the distance of the eye and lip corners whereby initially the features should be located by the edge detection principle. Then the ratio of the distances is to be computed and its value should be taken into consideration.
7. The outcomes of both the metrics should be given to the NN classifier and eventually a robust estimate of gender could be determined.

**Chapter 6**

**6 Matlab Implementation**

**6.1 Source Code**

**Age Estimation**

|  |
| --- |
| RGB = imread('image.jpg');  I = rgb2gray(RGB);  J = imresize(I, [300 200]);  K = imcrop(J);  imshow(K);  j = 0;  for i = 1 : 3  [x1,y1] = ginput(1);  [x2,y2] = ginput(1);  [x3,y3] = ginput(1);  a = [x3,y3] - [x1,y1];  b = [x3,y3] - [x2,y2];  i = a\*cos(dot(a,b)/norm(a)/norm(b));  j = j + i(2);  end  Mouth\_Tri\_Angle = j/3  uiwait(msgbox('Done with Eye-Mouth Triangle','Success','modal'));  k = 0;  for l = 1 : 3  [x1,y1] = ginput(1);  [x2,y2] = ginput(1);  [x3,y3] = ginput(1);  a = [x3,y3] - [x1,y1];  b = [x3,y3] - [x2,y2];  l = a\*cos(dot(a,b)/norm(a)/norm(b));  k = k + l(2);  end  Nose\_Tri\_Angle = k/3  uiwait(msgbox('Done with Eye-Nose Triangle','Success','modal'));  n = 0;  for m = 1:3  [x1,y1] = ginput(1);  [x2,y2] = ginput(1);  m = [x2,y2] - [x1,y1];  n = n + m(1);  end  Eyes = n/3  uiwait(msgbox('Done with eyes','Success','modal'));  p = 0;  for o = 1:3  [x1,y1] = ginput(1);  [x2,y2] = ginput(1);  o = [x2,y2] - [x1,y1];  p = p + o(1);  end  Mouth = p/3  uiwait(msgbox('Done with mouth','Success','modal'));  load('AGE\_CATEGORY.mat');  Test = [Mouth\_Tri\_Angle Nose\_Tri\_Angle Eyes Mouth];  network1\_outputs = network1(Test')'  if (0.5 <= network1\_outputs) && (network1\_outputs <= 1.44)  uiwait(msgbox('Age Range is < 18','Success','modal'));  elseif (1.45 <= network1\_outputs) && (network1\_outputs <= 2.44)  uiwait(msgbox('Age Range is 18 - 25','Success','modal'));  elseif (2.45 <= network1\_outputs) && (network1\_outputs <= 3.44)  uiwait(msgbox('Age Range is 26 - 35','Success','modal'));  elseif (3.45 <= network1\_outputs) && (network1\_outputs <= 4.44)  uiwait(msgbox('Age Range is 36 - 50','Success','modal'));  else  uiwait(msgbox('Age Range is > 50','Success','modal'));  end |

**Gender Estimation:**

|  |
| --- |
| RGB = imread('r2.JPG');  I = rgb2gray(RGB);  J = imresize(I, [300 200]);  K = imcrop(J);  imshow(K);  j = 0;  for i = 1 : 3  [x1,y1] = ginput(1);  [x2,y2] = ginput(1);  [x3,y3] = ginput(1);  a = [x2,y2] - [x1,y1];  b = [x3,y3] - [x1,y1];  A = a(1);  B = b(1);  i = A \* B;  if i > j  j = i;  else  j = j;  end  end  Nose\_Area = j  uiwait(msgbox('Done with Nose\_Area','Success','modal'));  l = 0;  for i = 1 : 3  [x1,y1] = ginput(1);  [x2,y2] = ginput(1);  [x3,y3] = ginput(1);  [x4,y4] = ginput(1);  a = [x2,y2] - [x1,y1];  b = [x4,y4] - [x3,y3];  A = a(1);  B = b(1);  k = A / B;  if k > l  l = k;  else  l = l;  end  end  Eye\_Lip\_Ratio = l  uiwait(msgbox('Done with Eye\_Lip\_Ratio','Success','modal'));  load('Gender\_Classifier.mat');  Test = [Nose\_Area Eye\_Lip\_Ratio];  network1\_outputs = network1(Test')'  if (0.5 <= network1\_outputs) && (network1\_outputs <= 1.44)  uiwait(msgbox('Male','Success','modal'));  elseif (1.45 <= network1\_outputs) && (network1\_outputs <= 2.44)  uiwait(msgbox('Female','Success','modal'));  end |

**6.2 Categorical Metrics Range**

**1.2 Age Classification**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CATEGORY** | **IRISES DISTANCE** | **LIP CORNER DISTANCE** | **IRISES – MOUTH ANGLE** | **IRISES – NOSE TIP ANGLE** |
| Kids | 35 - 53 | 30 – 43.5 | < 44 | < 34 |
| Youth | 54 - 57 | 43.6 – 45.6 | 44 - 48 | 34 - 38 |
| Adult | 58 - 62 | 46 – 55 | 49 - 54 | 39 - 44 |
| Middle Age | 63 - 69 | 49 – 57.5 | 55 - 60 | 45 - 50 |
| Old | 70 - 100 | 57.6 – 80 | > 60 | > 50 |

**1.3 Gender Classification**

|  |  |  |
| --- | --- | --- |
| **GENDER** | **NOSE AREA** | **EYE-LIP CORNERS RATIO** |
| Male | > 120(Other Age Categories)  > 170(Old Aged) | < 1.85 |
| Female | < 120(Other Age Categories)  < 170(Old Aged) | > 1.85 |

**Chapter 7**

**Conclusion**

**7.1 Results and Discussion**

On evaluating the simple metrics incorporated in the work, the objective happens out to be

pretty accurate and generates robust results. The active combination of the outcomes of the

metrics make a real difference to the previously existing ideologies and protocols.

The proposed algorithm is quite simple and gives out effective results relative to any

techniques explored previously. The accuracy levels clearly depicts that the proposed

algorithm works quite well and the method could be adopted to meet the requirements of

fixing the societal issues.

**7.2 Outputs:**

**1.3(a)**



Calculated Age Category - Youth (18 – 25 years old)

Estimated Gender - Male

**1.3(b)**



Calculated Age Category - Adult (26 – 35 years old)

Estimated Gender - Female

**7.3 Performance Evaluation**

**1.4(a) Age Estimation**

|  |  |  |  |
| --- | --- | --- | --- |
| **CATEGORY** | **NUMBER OF SAMPLES** | **ACCURACY** | **CUMULATIVE ACCURACY** |
| Training Samples | Male – 42  Female – 48 | Male – 84.26%  Female – 82.69% | 83.5% |
| Testing Samples | Male – 7  Female – 3 | Male – 84.63%  Female – 75% | 80% |
| Total Samples | Male – 49  Female – 51 | Male – 83.32%  Female – 81.24% | 82.27% |

**1.4(b) Gender Estimation**

|  |  |  |  |
| --- | --- | --- | --- |
| **CATEGORY** | **NUMBER OF SAMPLES** | **ACCURACY** | **CUMULATIVE ACCURACY** |
| Training Samples | Male – 42  Female – 48 | Male – 87.42%  Female – 81.57% | 84.5% |
| Testing Samples | Male – 7  Female – 3 | Male – 86.81%  Female – 100% | 93.4% |
| Total Samples | Male – 49  Female – 51 | Male – 85.73%  Female – 84.14% | 85% |

**7.4 Epilogue**

The experiment was performed for evaluating the age and gender classification. In

accordance with the experimental results, multiple metrics which are quite simplistic for the

implementation makes a huge difference in apparently producing better results. Despite

being a phenomenal algorithm to achieve the objective, this work could be rather expanded

in future in terms of integrating the protocol with FPGA and DSP processor. This would

literally make an astounding edge for real time applications and thereby the vision of the

objectives would be fulfilled.

**7.5 Future Scope:**

This is a novel work hich has yet a lot of future scope to work upon the ideology.

Precisely, this work is based on the computation of the geometric measures and thereby

arriving at the estimate of the age and gender. When it comes to the age calculation, it is

pretty evident that there are ample scope for unleashing new metrics that could work fine. In

the estimation of gender, it has a huge scope as the approach shall be expanded by ofiguring

out new metrics. The future ideas for gender shall be the shape of the head wherein which it

is a rounded rectangle for male and circular/oval as that of female. Similarly the physical

distinguishing aspects of male and female shall be explored to get a robust output.

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