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Mask Detection Application

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Abstract: With covid-19 being on the Rise we needed an efficient way to take care of the growing coronavirus cases. Various Tools and techniques are used to curb the spread of the virus this project aims to develop an application that helps in detecting and identifying the individuals that are not wearing a proper face mask when out in public. The photograph is taken and uploaded there is a huge data base of individual's information for example their name, semester, identification number, university seat number, branch etc. the photographs are run through the database to identify the persons without wearing a mask using facial recognition in this application can be very effectively used to curb the cases of Corona since it identifies the mask defaulters and thus we can help in controlling the infection and the spread of the virus and save many lives.
Keywords: Mask detection, mask defaulters

I. PREAMBLE

A. Introduction

In the current situation of the world the face mask detection application will be very apt and useful.

In this project we aim to develop an application that helps in detecting and identifying the individuals that are not wearing a proper face mask when out in public places. In this project the facemask detection is done by capturing the people's faces. By comparing the captured pictures and existing pictures we conclude If the person is wearing a face mask or not this can be very effectively used to curb the cases of Corona since it identifies the mask defaulters and thus we can help in controlling the infection and the spread of the virus and save many lives in the early stages itself as it is proven that wearing a face covering such as a facemask can actively prevent the further spread of the corona virus.

B. Relevance of the Project

In the month of November of the Year 2019 the world was hit with the worst pandemic in a century since that the world has suffered immensely from going into Quarantine that last over a year and also in the spread of this disease the main attribute has been carrying by air as covid-19 is an airborne disease it was regulated by the w h o that all individuals must wear a mask or a face covering in order to protect themselves and others around them from coronavirus The Mask or the face covering stop the virus from traveling through the air and thus infecting other people and for this reason this project is the need of the hour as we have an application that help us find the mask defaulters and help us isolate them more effectively by doing so we stop the spread of the virus and can keep the spread of the virus to the minimum this project has the most relevant at this point of the time this process is also very easy compared to employing human beings to monitor other people wearing mask.

C. Purpose of Study

It is difficult to control a large amount of people especially with the current population of the world being over 7 billion and it is impossible for humans to monitor other humans all the time to see if they are wearing the mask or if their abiding by the rules and that's why we have this project where we humans don't have to worry about finding out mask defaulters it is extremely crucial to find out the mask defaulters as they are more likely to spread the virus and that is why they have to be identified first and isolated from the other people who are wearing masks and who are practicing an abiding by the rules this process becomes easy when its automated and when all the details of the mask defaulters are stored in our database the database contains there information such as name Identity Number etc.

D. Scope of the Project

The last few years have witnessed massive expansion of applications. Everything is getting digital in this era. In this era of digitization, it is best to use the digitalization to the benefit of humanity in the medical field. Especially in the current state of the world where the world has to rely on digitalization of everything including food deliveries cab booking etc by automating the process of weeding out of the mask defaulters we are saving a lot of time, man power and a very efficient in other parts which need our attention like finding of a hospital bed or finding an ambulance.

This process makes everything hassle-free and easy to perform it's also easy to store their details And information without using the traditional pen and paper method which is time consuming and a wastage of paper.

E. Problem Definition

The problem statement is to build an application which aims at creating an application to find out mask defaulters.

A few of the problems faced by the existing system are:

1) Wastage of resources, i.e., paper, ink for writing the defaulters details
2) No correction can be made if written manually
3) No backup if the list is lost
4) It is very tedious to manually write the details
5) High possibility of losing track of the people.

F. Problem Explanation

Manually entering a person's details or manually finding them out is a very difficult process that can be very tiring and overwhelming and it's physically impossible to track them all and keep their details in check and to keep their health in check but when they are automated we don't have such problems their details can be produced instantly

1) This process also helps us to efficiently use our resources it helps is curb the use of paper and it also it stop using physical attributes such as pen which can help in Spread of the virus which is dangerous.
2) In this application we just have to upload their pictures and then the comparing of the pictures take place
3) Where we compared pictures from our existing database to the pictures that we have just captured to conclude if the person is wearing a mask or not.

G. Objective of the Study

1) It is our major responsibility to help Earth Heal from the pandemic from the last two odd years.
2) Applications and projects such as the mask defaulters application help speed up this process and stop the spreading of this virus.
3) We can help get back to life which was normal.
4) The main objective of the system is to automate the process of finding the mask defaulters which will help us curb spread of the virus and help us rejuvenate the world sooner.
5) More specifically the project work is to achieve the following.
6) To reduce the usage of paper in order to jot down the defaulters names and their details.
7) To decrease the help of humans thus reducing the amount of spreaders.
8) The process of finding out the details becomes more hassle-free.
9) The details found out are permanently stored in the database so there is an easy access to them.
10) The process of finding out the mask defaulters is more easy now since it is automated..
11) It also helps us concentrate on the more important things as this process is achieved by the application.

H. Existing System

- Present system is a manual system where a person identifies the people that are not wearing their mask or a face covering and then this person tries to isolate that person who isn't wearing a mask or face covering then
- The human who is employed to check The Mask defaulters then identify them and take them to a separate room to be isolated from the rest of the people
- These people are then asked to give their details search as name, identification number, gender, health conditions etc
- But there are a number of problems with this existing system
- is it is very time consuming for one person to do all the checking and isolation
- it also would be very dangerous as human to human contact is known to spread the virus faster
- That is why using automatic process is more efficient and a smart thing to do the existing system also uses a lot of resources such as paper and pen and these resources are also physical resources as we know touching a lot of things is one of the reason for the spread of the virus and that's why the existing system is not very practical to use.

1) *Limitations:* The existing system happens to be a manual system this is a major limitation for we are having very limited amount of time and the work being more to do the

Following are the limitations faced by the existing system

- The cost of salary for the employees is very high .
- The amount of paperwork is very high .
- Tracking of these people manually is very difficult trying to get information of the people is not easy .
- Cost of physical things used to enter the identity and the information is very high such as pen, paper, binders and plastic covers to keep the information safe.
- Once the information is lost it cannot be recovered again .
- But if it was automated recovery of the Lost information is easy.
- There are no backups for loss information
- In the manual the paper used for this process becomes a waste product
- This process is not ecofriendly
- Searching for the information of a particular person becomes difficult in Manual as we have to see each and every page
- But when its automated we don’t have to go through each and every page
- We just have to type the keywords and the person's information is displayed

I. Proposed System

- First the picture are taken and stored into a database.
- Second we upload the taken pictures into our website
- Third the uploaded pictures are then compared to the database that is already present
- Finally if the person is a mask defaulter their information is taken from the website.

Some features of the project are:

- It is user friendly and easy to run.
- It can be remotely operated from anywhere
- All that we need is a smartphone
- It's very easy to use it doesn't require a lot of effort
- Doesn't require human interference
- Collecting of data is undemanding
- There is a great backup of information
- Can help large institutions
- Can help in the medical field

1) *Advantages*

- Decrease human efforts in calculating the number of people entering the institutions.
- Saves money and resources of organization by excluding of use of paper.
- Saves time.
- Helps reduce human contact
- Helps keep correct data
- Keeps an accurate tract of the people
- It provides accuracy and is faultless in no of defaulter’s calculations.
- Application has an attractive GUI and with detailed description.
- It is flexible and user-friendly.
- Enhanced and Efficient Technology
- Improves the productivity of process and personnel
- Inventory reduction

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II. LITERATURE SURVEY

A. *Introduction*

Mask detector is to make life easier for a hospital or institution. Helps in detecting and identifying the individuals that are not wearing a proper face mask when out in public places in this project the facemask detection is done by capturing the people's faces. The captured faces are run into a database. The database contains the information of the persons present in the institution. The photographs are run through the database to identify the persons without wearing a mask using facial recognition

B. *The Existing System*

Present system is a manual system where a person identifies the people that are not wearing their mask or a face covering and then this person tries to isolate that person who isn't wearing a mask or face covering then The human who is employed to check The Mask defaulters then identify them and take them to a separate room to be isolated from the rest of the people .These people are then asked to give their details search as name, identification number, gender, health conditions etc .But there are a number of problems with this existing system is it is very time consuming for one person to do all the checking and isolation it also would be very dangerous as human to human contact is known to spread the virus faster

C. Conclusion

This project was done to help increase productivity in the medical field and to help increase the Vigilance in other Institutions where a lot of people would enter and exit on a daily basis in this project be aimed at finding the mask defaulter entering the institution or the hospital and isolating them from the rest of the crowd this helps us in stopping the virus from spreading to more people and in declining the cases which in itself is half the battle won.

III. SYSTEM REQUIREMENTS SPECIFICATION

A. *General Description of the System*

Face-mask detection application is an attempt to create an intuitive system application to make work easy, simple and digital. The idea is to design a system by keeping in the mind that shop owner has a computer with a webcam and customers have a smartphone with them.

The User Interface of the application has to be kept simple and spontaneous with not a lot of effort required to operate it. To make it simpler and easier to use, the application will start from choosing a image from the database that is been received. Then the image is resized to the dimensions mentioned. Once the image is resized plotting of facial corners is done. Now classification is done using jones viola algorithm. Then a message is displayed if the person is wearing a mask or not. Then a graph is plotted for performance determining specificity, sensitivity and accuracy.

1) *Overview of Functional Requirements:* Functional Requirement is an explanation of the service that the application offers. It describes a software system or its component. A function is inputs to the application, its performance, and outputs. Functional user requirements may be declarations of what the application should do. Functional system requirements should define clearly about the algorithm used to detect face mask.
2) *Overview of Data Requirements:* Data requirements are described directives or consensual agreements that describe the details and/or structure that establish high quality data instances and values. Data requirements can be specified by several different entities or groups of entities. They may be agreed upon or contrary to each other. However, data requirements are required as a precondition to measure data superiority. Hence, they serve as a standard that defines the anticipated state of data. First and foremost, the data required is the dataset containing masked and unmasked face. Then, the resizing of image is done. The application requires a cluster number as input. The application will then create a face will all facial coordinates hence determining if the person in that image is wearing a mask or not.

B. *Technical Requirements of the System*

A technical requirement relates to the technical aspects that an application must fulfill, such as performance-related problems, reliability matters, and availability concerns. These types of requirements are often called service-level requirements or non-functional requirements. System requirements define the quality of service a released application must provide to meet the business necessities arrived at. We use the convention analysis and use cases organized with the business requirements to develop application requirements.

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1) Hardware Requirements

Hardware requirements are the most common set of requirements defined by any operating system or software application. It is the physical computer resources, also known as hardware. A hardware requirements list is often complemented by a hardware compatibility list, especially for Operating Systems. The following are needed to efficiently use the application.

Processor	-	Intel Core i3 and above
Speed	-	2.5 GHz
RAM	-	8 GB (min)
Hard Disk	-	50 GB

A good processor and CPU speed is required to run MATLAB in an efficient manner. The RAM helps in faster execution of the application. The large storage is used for holding the IDE and the various components of the application..

3.2.2 Software Requirements

Software requirements define software resource fundamentals that need to be installed on a workstation to provide optimum working of a software. The following are required for optimal development and usage of the application.

Operating System	-	Windows 10
Programming Language	-	MATLAB
Compiler	-	MATLAB

We require the operating system to be Windows 10 to run MATLAB can run efficiently. This project is written in MATLAB.

C. *Input Requirements*

The input requirements are all input bundles required to produce at least a given level of outputs. Images taken from a databse.

D. *Language Specification*

MATLAB is a software/ programming language or a tool that can be used in multiple ways as preferred by the developer. Combining the parts of machine learning including clustering and math predictions, it is the perfect platform to develop complex solutions.

1) *MATLAB:* MATLAB an abbreviation of "matrix laboratory" is a proprietary multi-paradigm programming language and numeric computing environment developed by MathWorks. MATLAB allows matrix manipulations, plotting of functions and data, implementation of algorithms, creation of user interfaces, and interfacing with programs written in other languages. Although MATLAB is intended primarily for numeric computing, an optional toolbox uses the MuPAD symbolic engine allowing access to symbolic computing abilities. An additional package, Simulink, adds graphical multi-domain simulation and model-based design for dynamic and embedded systems. As of 2020, MATLAB has more than 4 million users worldwide MATLAB users come from various backgrounds of engineering, science, and economics. MATLAB can be used as a programming language/ software and a tool as suited with the project.

IV. SYSTEM DESIGN AND ANALYSIS

A. *System Design*

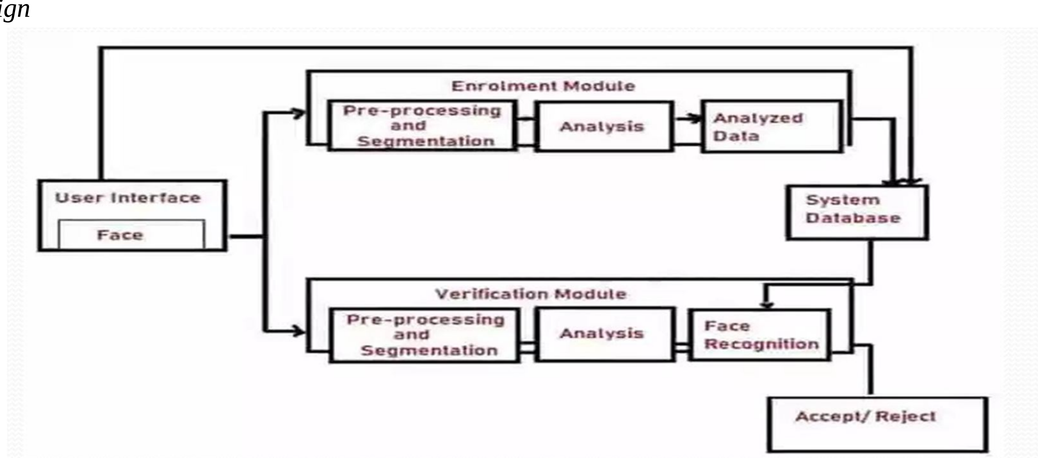

Fig 4.1 : System design 1

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The user interface is where the images are uploaded and the images are pre processed in the enrolment module. With in the enrolment module segmentation and processing is done leading to analysis and analyzed data sent to the system database.

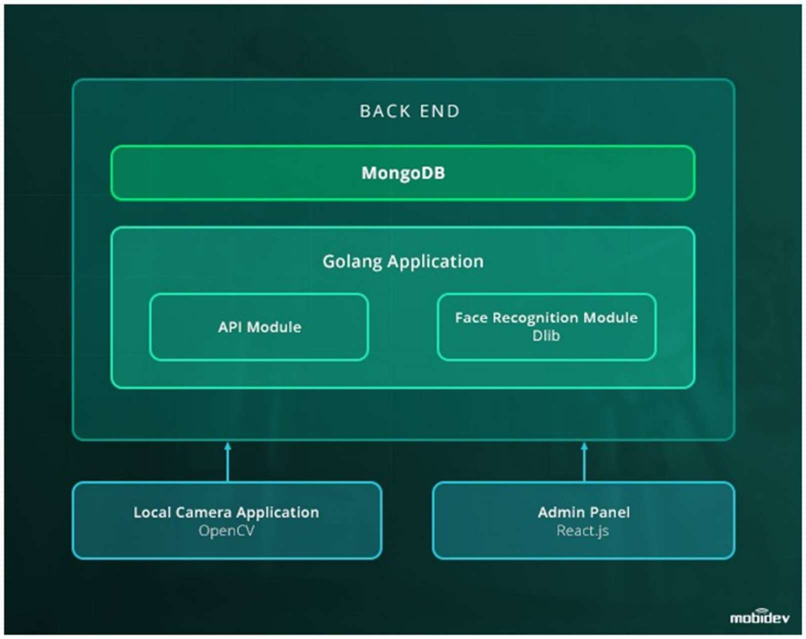

Fig 4.2 : Backend implementation.

The backend application can be implemented as this. Instead of using the local files in the system, using a database like mongo db will more effective and resourceful.

B. Analysis

The following analysis is concluded from the project.

1) Face detection

Analysis of the face detection process:

- The input image is resized to the given measure by pre processing and segmentation.
- Taking the image and resizing to 256x256
- Using gaussian to resize the images [3 3],0.5
- The image is enhanced to show the features and brighten the image.
- Then segmented to identify the facial features.
- The forehead, eyes, nose and mouth is identified. This enhanced image is run through the processing and the classified value along with the weight values are stored in the machine.
- The classified image with a class label is stored by the machine.
- This is analysed and classified in the training process of the machine.
- During the testing phase of the machine similar images are fed into the machine to determine the accuracy of the outcome.
- The image is uploaded and goes through the pre processing and segmentation.
- Goes through analysis process.
- After the classification the weights are matched with the training images.
- The match weight is found and the images is classified.
- Thus the result is shown and the accuracy is measured in graph.
- More the training of different images more options to classify and weight, thus accuracy of the determination is more.

2) Working Modules

After the deep analysis of the working modules, the conclusion can be done as:

- The user interface provides easy usability for the team to determine the defaulters.
- The enrolment module is where the pre processing and segmentation of the image is done, segmentation is mostly identifying the face and segmenting along with re sizing the image to fit the dimensions.
- After the images are processed they are analyzed and the data is stored into the database with the image.
- This accounts for the training system of the machine to help it classify more accurately.
- After this is done the image is stored into the system database, this can either be a system local storage or a database like mongo db.
- The next step is the verification module, here the images are pre processed and segmented.
- In the verification module analysis and face recognition is done.
- This determines weather the images is accepted or rejected as in, if the person is wearing a mask or not.
- A graph is plotted showing the accuracy of the verification.

a) K- means Clustering for classification.

K means clustering is a method of vector quantization. It is a form of unsupervised machine learning methods. In this type of method the algorithm makes inference with the dataset using only input vectors. A cluster is a collection of data points aggregated together because of a certain similarity. K represents the target number of centroids in the dataset. The means refers to averaging of data.

K means algorithm in data mining begins with random selection of centroids which are referred as beginning points, then the performance iterative calculations to optimize the calculations.

The process comes to a stop when either of the two conditions are met:

- The centroids have stabilized.
- The definite number of iterations have been achieved.

b) Advantages of k means Clustering

- If the dataset is huge, then the algorithm most of the time computations faster if the value of k is small.
- This type of algorithm produces tighter clusters compared to other clusters.
- This algorithm can adapt to new examples faster.
- Generalize clusters into different shapes.

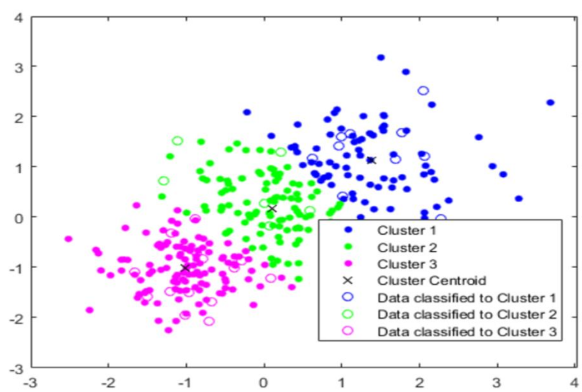

Fig 4.2.2.1 : K means clustering

3) Explanation

Training

1) Generate your own annotation file and class names file
2) Convert the pre-trained weights
3) Freeze all layers except the final layers and train for some epochs until Plateau (no improvement stage) is reached.

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V. IMPLEMENTATION

A. Different Modules of the Project

1) Taking The Pictures

The picture is taken from a database present.

2) Processing The Image

In the project we use uses facial coordinates In order to recognize if a person is wearing a face mask or not

B. Code Implementation

GUI and database module

```
function kappa1(varargin)
global m f x w alpha
args=cell(varargin);
nu=numel(args);
if isempty(nu)
    error('Warning: Matrix of data is missed...')
elseif nu>3
    error('Warning: Max three input data are required')
end
default.values = {[],0,0.05};
default.values(1:nu) = args;
[x w alpha] = deal(default.values{:});
if isempty(x)
    error('Warning: X matrix is empty...')
end
if isvector(x)
    error('Warning: X must be a matrix not a vector')
end
if ~all(isfinite(x(:))) || ~all(isnumeric(x(:)))
    error('Warning: all X values must be numeric and finite')
end
if ~isequal(x(:),round(x(:)))
    error('Warning: X data matrix values must be whole numbers')
end
m=size(x);
if ~isequal(m(1),m(2))
    error('Input matrix must be a square matrix')
end
if nu>1
    if ~isscalar(w) || ~isfinite(w) || ~isnumeric(w) || isempty(w)
        error('Warning: it is required a scalar, numeric and finite Weight value.')
    end
    a=-1:1:2;
    if isempty(a(a==w))
        error('Warning: Weight must be -1 0 1 or 2.')
    end
end
if nu>2
    if ~isscalar(alpha) || ~isnumeric(alpha) || ~isfinite(alpha) || isempty(alpha)
        error('Warning: it is required a numeric, finite and scalar ALPHA value.');
```

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```
    end
    if alpha <= 0 || alpha >= 1
        error('Warning: ALPHA must be comprised between 0 and 1.')
    end
end
clear args default nu
m(2)=[];
tr=repmat('-',1,80);
if w==0 || w==-1
    f=diag(ones(1,m));
    disp('UNWEIGHTED COHEN''S KAPPA')
    disp(tr)
    kcomp;
    disp(' ')
end
if w==1 || w==-1
    J=repmat((1:1:m),m,1);
    I=flipud(rot90(J));
    f=1-abs(I-J)./(m-1);
    disp('LINEAR WEIGHTED COHEN''S KAPPA')
    disp(tr)
    kcomp;
    disp(' ')
end
if w==2 || w==-1
    J=repmat((1:1:m),m,1);
    I=flipud(rot90(J));
    f=1-((I-J)./(m-1)).^2;
    disp('QUADRATIC WEIGHTED COHEN''S KAPPA')
    disp(tr)
    kcomp;
end
return
end

function kcomp
global m f x alpha km kpa
n=sum(x(:));
x=x./n;
r=sum(x,2);
s=sum(x);
Ex=r*s;
pom=sum(min([r';s]));
po=sum(sum(x.*f));
pe=sum(sum(Ex.*f));
k=(po-pe)/(1-pe);
km=(pom-pe)/(1-pe);
ratio=k/km;
sek=sqrt((po*(1-po))/(n*(1-pe)^2));
ci=k+([-1 1].*(abs(-realsqrt(2)*erfcinv(alpha))*sek));
```

```
wbari=r'*f;
wbarj=s*f;
wbar=repmat(wbari',1,m)+repmat(wbarj,m,1);
a=Ex.*((f-wbar).^2);
var=(sum(a(:))-pe^2)/(n*((1-pe)^2));
z=k/sqrt(var);
p=(1-0.5*erfc(-abs(z)/realsqrt(2)))*2;
kpa=k;
fprintf('Observed agreement (po) = %0.4f\n',po)
fprintf('Random agreement (pe) = %0.4f\n',pe)
fprintf('Agreement due to true concordance (po-pe) = %0.4f\n',po-pe)
fprintf('Residual not random agreement (1-pe) = %0.4f\n',1-pe)
fprintf('Cohen''s kappa = %0.4f\n',k)
fprintf('kappa error = %0.4f\n',sek)
fprintf('kappa C.I. (alpha = %0.4f) = %0.4f     %0.4f\n',alpha,ci)
fprintf('Maximum possible kappa, given the observed marginal frequencies = %0.4f\n',km)
fprintf('k observed as proportion of maximum possible = %0.4f\n',ratio)
if k<0
    disp('Poor agreement')
elseif k>=0 && k<=0.2
    disp('Slight agreement')
elseif k>=0.21 && k<=0.4
    disp('Fair agreement')
elseif k>=0.41 && k<=0.6
    disp('Moderate agreement')
elseif k>=0.61 && k<=0.8
    disp('Substantial agreement')
elseif k>=0.81 && k<=1
    disp('Perfect agreement')
end
fprintf('Variance = %0.4f     z (k/sqrt(var)) = %0.4f    p = %0.4f\n',var,z,p)
if p<0.05
    disp('Reject null hypotesis: observed agreement is not accidental')
else
    disp('Accept null hypotesis: observed agreement is accidental')
end
return
end
function varargout = Main_GUI(varargin)
% MAIN_GUI MATLAB code for Main_GUI.fig
%      MAIN_GUI, by itself, creates a new MAIN_GUI or raises the existing
%      singleton*.
%
%      H = MAIN_GUI returns the handle to a new MAIN_GUI or the handle to
%      the existing singleton*.
%
%      MAIN_GUI('CALLBACK',hObject,eventData,handles,...) calls the local
%      function named CALLBACK in MAIN_GUI.M with the given input arguments.
%
%      MAIN_GUI('Property','Value',...) creates a new MAIN_GUI or raises the
```

```
%      existing singleton*.  Starting from the left, property value pairs are
%      applied to the GUI before Main_GUI_OpeningFcn gets called.  An
%      unrecognized property name or invalid value makes property application
%      stop.  All inputs are passed to Main_GUI_OpeningFcn via varargin.
%
%      *See GUI Options on GUIDE's Tools menu.  Choose "GUI allows only one
%      instance to run (singleton)".
%
% See also: GUIDE, GUIDATA, GUIHANDLES

% Edit the above text to modify the response to help Main_GUI

% Last Modified by GUIDE v2.5 01-May-2020 12:01:43

% Begin initialization code - DO NOT EDIT
gui_Singleton = 1;
gui_State = struct('gui_Name',       mfilename, ...
                   'gui_Singleton',  gui_Singleton, ...
                   'gui_OpeningFcn', @Main_GUI_OpeningFcn, ...
                   'gui_OutputFcn',  @Main_GUI_OutputFcn, ...
                   'gui_LayoutFcn',  [] , ...
                   'gui_Callback',   []);
if nargin && ischar(varargin{1})
    gui_State.gui_Callback = str2func(varargin{1});
end

if nargout
    [varargout{1:nargout}] = gui_mainfcn(gui_State, varargin{:});
else
    gui_mainfcn(gui_State, varargin{:});
end
% End initialization code - DO NOT EDIT


% --- Executes just before Main_GUI is made visible.
function Main_GUI_OpeningFcn(hObject, eventdata, handles, varargin)
% This function has no output args, see OutputFcn.
% hObject    handle to figure
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)
% varargin   command line arguments to Main_GUI (see VARARGIN)

% Choose default command line output for Main_GUI
handles.output = hObject;

% Update handles structure
guidata(hObject, handles);

% UIWAIT makes Main_GUI wait for user response (see UIRESUME)
% uiwait(handles.figure1);
```

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```
% --- Outputs from this function are returned to the command line.
function varargout = Main_GUI_OutputFcn(hObject, eventdata, handles)
% varargout  cell array for returning output args (see VARARGOUT);
% hObject    handle to figure
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Get default command line output from handles structure
varargout{1} = handles.output;


% --- Executes on button press in pushbutton1.
function pushbutton1_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton1 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

global I
%

[fn pn] = uigetfile('*.*');

if fn == 0

   msgbox('Cancelled... Try again...');

else

   I = imread([pn fn]);

axes(handles.axes1);

   imshow(I);

   title('Input Image');
end

% --- Executes on button press in pushbutton2.
function pushbutton2_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton2 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

global I IR Filt

   % ======= Preprocessing ======= %

   % -- Image Resize --
```

```
    IR = imresize(I,[256 256]);

axes(handles.axes2);

    imshow(IR);

    title('Resized Image');

    [row1 col1] = size(I);

    [row2 col2] = size(IR);

    disp('-------------------------')

    disp(['Input Row = ',num2str(row1)]);
    disp(['Input Col = ',num2str(col1)]);

    disp(['Resized Row = ',num2str(row2)]);
    disp(['Resized Col = ',num2str(col2)]);

    disp('-------------------------')

    % -- Noise Filtering -- %

    IM = fspecial('gaussian',[3 3],0.5);
Filt = imfilter(IR,IM);
pause(2);
axes(handles.axes2);

    imshow(Filt);

    title('Filtered Image');

% --- Executes on button press in pushbutton3.
function pushbutton3_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton3 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

global Filt segmented_images BB
    % =========== Segmentation ===========
    try
        faceDetector=vision.CascadeObjectDetector('FrontalFaceCART'); %Create a detector object
        BB=step(faceDetector,Filt); % Detect faces
        segmented_images = insertObjectAnnotation(Filt, 'rectangle', BB, 'Face'); %Annotate detected faces.
axes(handles.axes3);

    imshow(segmented_images,[]),
```

```
    title('Face');
    catch
    % -- K-means clustering -- %


    cform = makecform('srgb2lab');
    lab_he = applycform(Filt,cform);

    ab = double(lab_he(:,:,2:3));
    nrows = size(ab,1);
    ncols = size(ab,2);
    ab = reshape(ab,nrows*ncols,2);

    nColors = 3;
    % repeat the clustering 3 times to avoid local minima
    [cluster_idx cluster_center] = kmeans(ab,nColors,'distance','sqEuclidean', ...
        'Replicates',3);
    pixel_labels = reshape(cluster_idx,nrows,ncols);

axes(handles.axes3);

    imshow(pixel_labels,[]),
    title('Cluster index');

    segmented_images = cell(1,3);
    rgb_label = repmat(pixel_labels,[1 1 3]);

    for k = 1:nColors

        color = Filt;
        color(rgb_label ~= k) = 0;
        segmented_images{k} = color;

    end
    figure(1),
subplot(1,3,1);
imshow(segmented_images{1}),
    title('Cluster 1');

subplot(1,3,2);
    imshow(segmented_images{2}),
    title('Cluster 2');

subplot(1,3,3);
    imshow(segmented_images{3}),
    title('Cluster 3');
    end
% --- Executes on button press in pushbutton4.
function pushbutton4_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton4 (see GCBO)
```

```
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

global Filt LBP1

LBP1= mean(LBP(Filt,[3 2]));

set(handles.uitable1,'data',LBP1);

% --- Executes on button press in pushbutton5.
function pushbutton5_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton5 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

global LBP1
load Trainfea
Target(1:10) = 1;
Target(11:15) = 2;

Class = knnclassify(LBP1,Trainfea,Target)
if Class == 1
   msgbox('Person Identified without "Mask"');
   set(handles.text4,'string','Person Identified without "Masked"')

else
   msgbox('Person Identified with "Mask"');
   set(handles.text4,'string','Person Identified with "Masked"')
end

% --- Executes on button press in pushbutton6.
function pushbutton6_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton6 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

Main_GUI1

function edit1_Callback(hObject, eventdata, handles)
% hObject    handle to edit1 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of edit1 as text
%        str2double(get(hObject,'String')) returns contents of edit1 as a double


% --- Executes during object creation, after setting all properties.
function edit1_CreateFcn(hObject, eventdata, handles)
% hObject    handle to edit1 (see GCBO)
```

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```
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'), get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end


% --- Executes on button press in pushbutton7.
function pushbutton7_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton7 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

global segmented_images SEG BB
if length(segmented_images) == 3

VALS = get(handles.edit1,'string')


    INP = str2num((VALS))

    switch INP

        case 1
            SEG = segmented_images{1};

        case 2
            SEG = segmented_images{2};

        case 3
            SEG = segmented_images{3};

    end

axes(handles.axes4);
    imshow(SEG);

    title('Segmented image');

else
    SEG = imcrop(segmented_images,[BB]);
   axes(handles.axes4);
    imshow(SEG);

    title('Segmented image');

end
```

```
function LBP= LBP(inImg, filtDims, isEfficent)
if nargin<3
   isEfficent=true;
   if nargin<2
      filtDims=[3,3];
      if nargin==0
         error('Input image matrix/file name is missing.')
      end
   end
end

if ischar(inImg) && exist(inImg, 'file')==2 % In case of file name input- read graphical file
   inImg=imread(inImg);
end

if size(inImg, 3)==3
   inImg=rgb2gray(inImg);
end

inImgType=class(inImg);
isDoubleInput=strcmpi(inImgType, 'double');
if ~isDoubleInput
   inImg=double(inImg);
end
imgSize=size(inImg);

% verifiy filter dimentions are odd, so a middle element always exists
filtDims=filtDims+1-mod(filtDims,2);

filt=zeros(filtDims, 'double');
nNeigh=numel(filt)-1;

if nNeigh<=8
  outClass='uint8';
elseif nNeigh>8 && nNeigh<=16
   outClass='uint16';
elseif nNeigh>16 && nNeigh<=32
   outClass='uint32';
elseif nNeigh>32 && nNeigh<=64
   outClass='uint64';
else
   outClass='double';
end

iHelix=snailMatIndex(filtDims);
filtCenter=ceil((nNeigh+1)/2);
iNeight=iHelix(iHelix~=filtCenter);
```

```
if isEfficent
   %% Better filtering/concolution based attitude

   filt(filtCenter)=1;
   filt(iNeight(1))=-1;
   sumLBP=zeros(imgSize);
   for i=1:length(iNeight)
      currNieghDiff=filter2(filt, inImg, 'same');
      sumLBP=sumLBP+2^(i-1)*(currNieghDiff>0); % Thanks goes to Chris Forne for the bug fix

      if i<length(iNeight)
         filt( iNeight(i) )=0;
         filt( iNeight(i+1) )=-1;
      end
   end
   if strcmpi(outClass, 'double')
      LBP=sumLBP;
   else
      LBP=cast(sumLBP, outClass);
   end
else % if isEfficent

   %% Primitive pixelwise solution
   filtDimsR=floor(filtDims/2); % Filter Radius
   iNeight(iNeight>filtCenter)=iNeight(iNeight>filtCenter)-1; % update index values.

   % Padding image with zeroes, to deal with the edges
   zeroPadRows=zeros(filtDimsR(1), imgSize(2));
   zeroPadCols=zeros(imgSize(1)+2*filtDimsR(1), filtDimsR(2));

   inImg=cat(1, zeroPadRows, inImg, zeroPadRows);
   inImg=cat(2, zeroPadCols, inImg, zeroPadCols);
   imgSize=size(inImg);

   neighMat=true(filtDims);

   neighMat( floor(nNeigh/2)+1 )=false;
   weightVec= (2.^( (1:nNeigh)-1 ));
   LBP=zeros(imgSize, outClass);
   for iRow=( filtDimsR(1)+1 ):( imgSize(1)-filtDimsR(1) )
      for iCol=( filtDimsR(2)+1 ):( imgSize(2)-filtDimsR(2) )
         subImg=inImg(iRow+(-filtDimsR(1):filtDimsR(1)), iCol+(-filtDimsR(2):filtDimsR(2)));
         % find differences between current pixel, and it's neighours
         diffVec=repmat(inImg(iRow, iCol), [nNeigh, 1])-subImg(neighMat);
         LBP(iRow, iCol)=cast( weightVec*(diffVec(iNeight)>0),  outClass);   % convert to decimal.
      end % for iCol=(1+filtDimsR(2)):(imgSize(2)-filtDimsR(2))
   end % for iRow=(1+filtDimsR(1)):(imgSize(1)-filtDimsR(1))

   % crop the margins resulting from zero padding
   LBP=LBP(( filtDimsR(1)+1 ):( end-filtDimsR(1) ),...
```

```
    ( filtDimsR(2)+1 ):( end-filtDimsR(2) ));
end % if isEfficent


function varargout = Main_GUI1(varargin)
% MAIN_GUI1 MATLAB code for Main_GUI1.fig
%      MAIN_GUI1, by itself, creates a new MAIN_GUI1 or raises the existing
%      singleton*.
%
%      H = MAIN_GUI1 returns the handle to a new MAIN_GUI1 or the handle to
%      the existing singleton*.
%
%      MAIN_GUI1('CALLBACK',hObject,eventData,handles,...) calls the local
%      function named CALLBACK in MAIN_GUI1.M with the given input arguments.
%
%      MAIN_GUI1('Property','Value',...) creates a new MAIN_GUI1 or raises the
%      existing singleton*.  Starting from the left, property value pairs are
%      applied to the GUI before Main_GUI1_OpeningFcn gets called.  An
%      unrecognized property name or invalid value makes property application
%      stop.  All inputs are passed to Main_GUI1_OpeningFcn via varargin.
%
%      *See GUI Options on GUIDE's Tools menu.  Choose "GUI allows only one
%      instance to run (singleton)".
%
% See also: GUIDE, GUIDATA, GUIHANDLES

% Edit the above text to modify the response to help Main_GUI1

% Last Modified by GUIDE v2.5 04-May-2020 13:40:37

% Begin initialization code - DO NOT EDIT
gui_Singleton = 1;
gui_State = struct('gui_Name',       mfilename, ...
                   'gui_Singleton',  gui_Singleton, ...
                   'gui_OpeningFcn', @Main_GUI1_OpeningFcn, ...
                   'gui_OutputFcn',  @Main_GUI1_OutputFcn, ...
                   'gui_LayoutFcn',  [] , ...
                   'gui_Callback',   []);
if nargin && ischar(varargin{1})
    gui_State.gui_Callback = str2func(varargin{1});
end

if nargout
    [varargout{1:nargout}] = gui_mainfcn(gui_State, varargin{:});
else
    gui_mainfcn(gui_State, varargin{:});
end
% End initialization code - DO NOT EDIT

% --- Executes just before Main_GUI1 is made visible.
```

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```
function Main_GUI1_OpeningFcn(hObject, eventdata, handles, varargin)
% This function has no output args, see OutputFcn.
% hObject    handle to figure
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)
% varargin   command line arguments to Main_GUI1 (see VARARGIN)

% Choose default command line output for Main_GUI1
handles.output = hObject;

% Update handles structure
guidata(hObject, handles);

% UIWAIT makes Main_GUI1 wait for user response (see UIRESUME)
% uiwait(handles.figure1);

% --- Outputs from this function are returned to the command line.
function varargout = Main_GUI1_OutputFcn(hObject, eventdata, handles)
% varargout  cell array for returning output args (see VARARGOUT);
% hObject    handle to figure
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Get default command line output from handles structure
varargout{1} = handles.output;


% --- Executes on button press in checkbox1.
function checkbox1_Callback(hObject, eventdata, handles)
% hObject    handle to checkbox1 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hint: get(hObject,'Value') returns toggle state of checkbox1
global acc1 sens1 spec1
Target(1:50) = 1;
Target(51:100) = 2;
Actual = Target;
Loc = [1 9 60 randi([1 100])];

    Predict = Target;
    Predict(Loc) = randi([1 2]);

    [cm,X,Y,per,TP,TN,FP,FN,sens1,spec1,precision,recall,Jaccard_coefficient,...
    Dice_coefficient,kappa_coeff,acc1] = Performance_Analysis(double(Actual(:)),double(Predict(:)));


%     figure('Name','Performance Table'),
%     colname = {'Accuracy','Sensitivity','Specificity'};
%     td = uitable('data',[acc1 sens1 spec1],'ColumnNames',colname);
```

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```
        set(handles.text2,'string',['=    ',num2str(acc1),' %']);



% --- Executes on button press in checkbox2.
function checkbox2_Callback(hObject, eventdata, handles)
% hObject    handle to checkbox2 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hint: get(hObject,'Value') returns toggle state of checkbox2
global sens1
        set(handles.text3,'string',['=    ',num2str(sens1),' %']);

% --- Executes on button press in checkbox3.
function checkbox3_Callback(hObject, eventdata, handles)
% hObject    handle to checkbox3 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hint: get(hObject,'Value') returns toggle state of checkbox3
global spec1 acc1 sens1
        set(handles.text4,'string',['=    ',num2str(spec1),' %']);
    Exist = [86.45+rand(1) 81.785+rand(1) 74.64+rand(1)];
axes(handles.axes1);
bar([acc1 sens1 spec1 ; Exist]);

    grid on;
        set(gca,'XTickLabel',{'Proposed','Existing'});
        legend('Accuracy','Sensitivity','Specificity');
        ylabel('Estimated Value');
        title('Performance Graph');
    axes(handles.axes2);
plot([acc1 sens1 spec1],'-*b');
    hold on;
plot([Exist(1) Exist(2) Exist(3)],'-*r');

hold off;
    grid on;


    legend('Proposed','Existing');

    ylabel('Estimated Value');

    title('Performance Graph');
    ylim([1 100]);
```

```
function [cm,X,Y,per,TP,TN,FP,FN,sens1,spec1,precision,recall,Jaccard_coefficient,...
    Dice_coefficient,kappa_coeff,acc1] = Performance_Analysis(inp1,inp2)
global kpa
truelabel = inp1;
Recognition = inp2;

[cm grporder1] = confusionmat(truelabel(:),Recognition(:));

kappa1(cm);
kappa_coeff=kpa;
measure=zeros(4,size(cm,1));
for i = 1:size(cm,1)-1
    measure(1, i) = cm(i,i); % TP
    measure(2, i) = sum(cm(i,:))-cm(i,i); % FP
    measure(3, i) = sum(cm(:,i))-cm(i,i); % FN
    measure(4, i) = sum(cm(:)) - measure(3, i) - measure(2, i) - measure(1, i);  % TN
end
TP=sum(measure(1, :));
FP=sum(measure(2, :));
FN=sum(measure(3, :));
TN=sum(measure(4, :));
fprintf('Sensitivity : %f%%\n', TP/(TP+FN)*100);
fprintf('Specificity : %f%%\n\n', TN/(TN+FP)*100);
fprintf('Correct Classification : %f%%\n\n', (sum(diag(cm))/sum(cm(:)))*100);
X=0;
Y=0;
% [X,Y] = perfcurve(double(truelabel'),double(Recognition),1);
precision = TP/(TP+FP)*100;
recall = TP/(TP+FN)*100;
Jaccard_coefficient=(TP+TN)/(TP+TN+FP+FN)*100;
Dice_coefficient=(2*(TP+TN))/(FP+(2*(TP+TN))+FN)*100;
disp(' ================================================= ');
per = zeros(size(cm,1),3);
s=1;
for i=1:size(cm,1)
    per(i,1) = (sum(cm([1:(i-1) (i+1):size(cm,1)],i))/sum(cm(:)))*100; % Percentage of FRR-%
    per(i,2) = (sum(cm(i,[1:(i-1) (i+1):size(cm,1)]))/sum(cm(:)))*100; % Percentage of FAR-%
    per(i,3) = (100-per(i,1)); % Percentage of GAR-%
end
  sens1=TP/(TP+FN)*100;
  spec1=TN/(TN+FP)*100;
  acc1=(sum(diag(cm))/sum(cm(:)))*100;
function iHelix=snailMatIndex(inMatDims)
if length(inMatDims)==1
   inMatDims=repmat(inMatDims, 1, 2);
end

nElemems=inMatDims(1)*inMatDims(2);
indMat =reshape(1:nElemems, inMatDims);
iHelix=[];
```

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```
while ~isempty(indMat)
  if size(indMat, 2)==1
    iHelix=cat( 2, iHelix, transpose(indMat(:, 1)) );
    indMat=[];
  else
    iHelix=cat( 2, iHelix, indMat(1, :) );
    indMat(1, :)=[];       % remove the current top row
    if ~isempty(indMat)
      indMat=rot90(indMat);   % rotate index matrix 90° clock-wise
    end % if ~isempty(indMat)
  end % if size(indMat, 2)==1
end % while ~isempty(indMat)
clear all
clc
close all

for ijkl = 1:15

   I = imread(['Dataset\Dataset\IMG (',num2str(ijkl),').jpg']);

   IR = imresize(I,[256 256]);
   IM = fspecial('gaussian',[3 3],0.5);
   Filt = imfilter(IR,IM);
   Trainfea(ijkl,:)= mean(LBP(Filt,[3 2]));

end
```

C. Flowchart of Proposed System

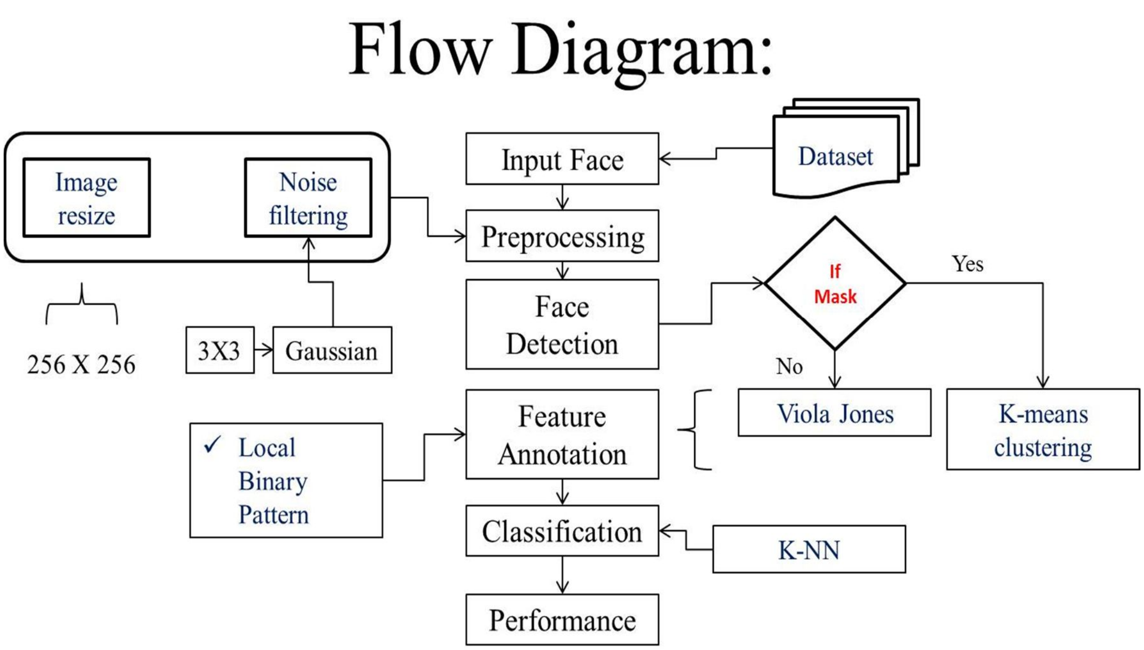

Fig 5.1: Flowchart of proposed system

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The flow diagram suggest that

1) The image is resized and the noise is filtered by the Gaussian method to give and image of 3X3.
2) This is done in the pre processing stage of the module.
3) The face is identified and detected if mask is present K- means clustering is applied and the features are annotated, if the mask is not present Viola jones is applied and the features are anootated.
4) After annotation they are classified with the help of K-NN.
5) The performance is calculated and shown in the form of a graph.

VI. EXPERIMENTAL RESULTS

A. Outcome of Proposed System

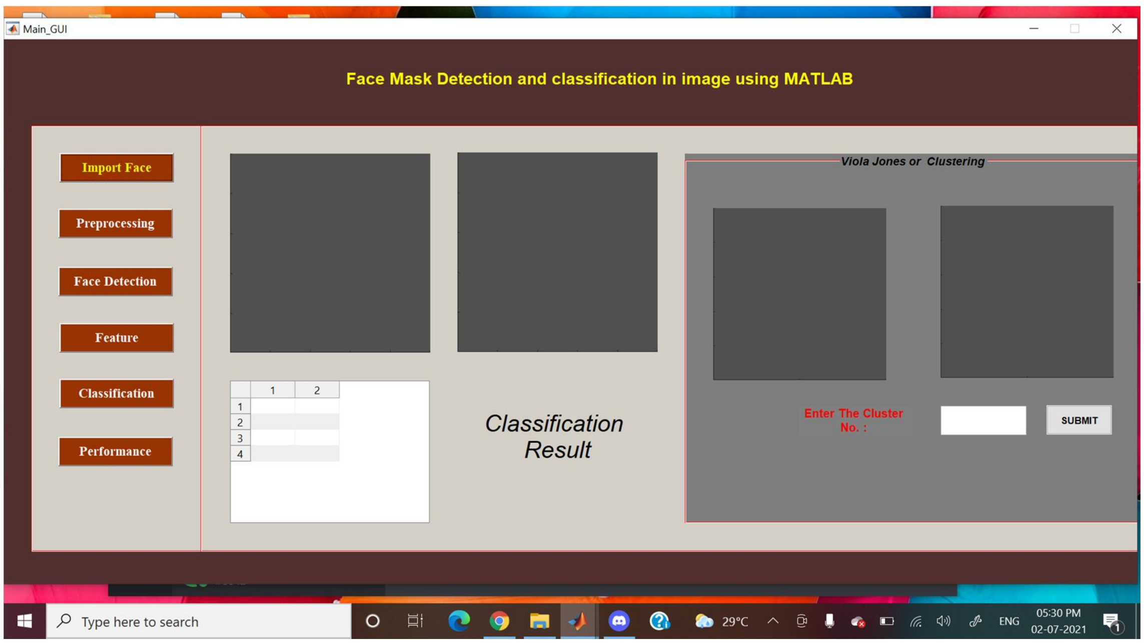

Fig 6.1 Initial screen

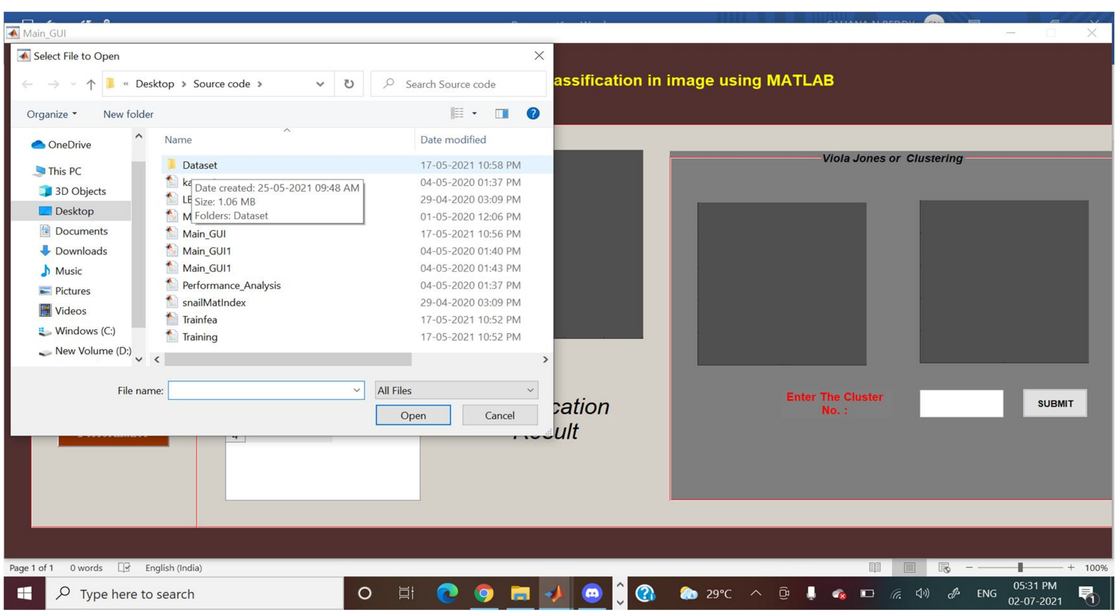

Fig 6.2: Selecting data base

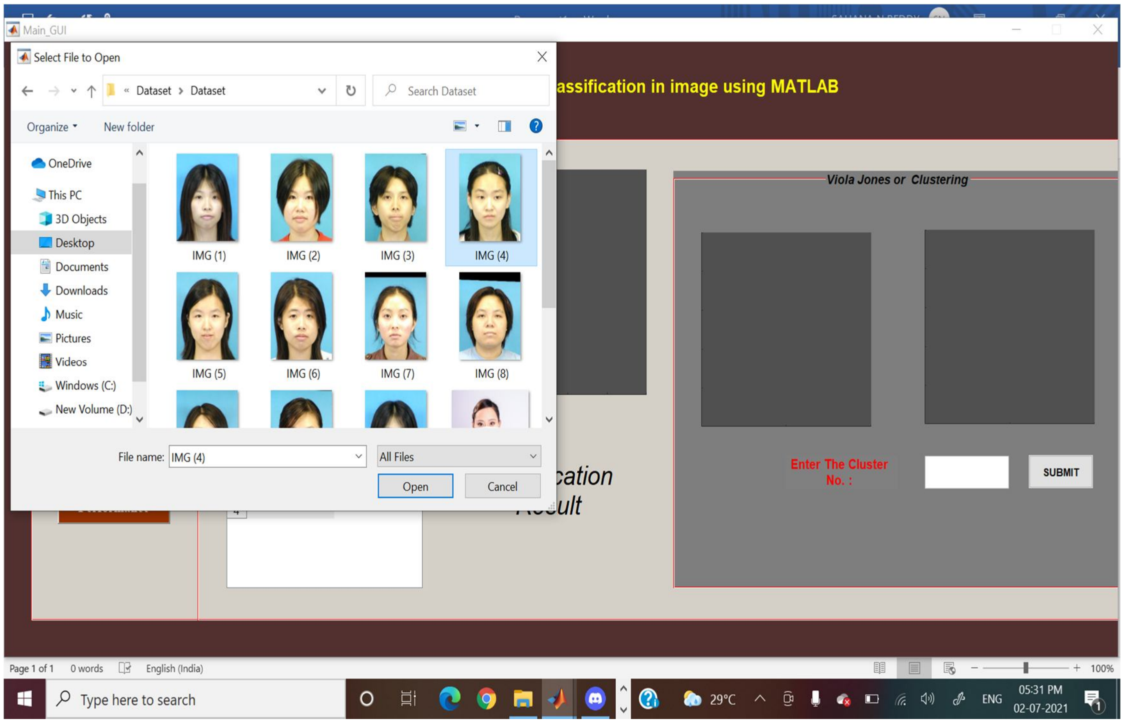

Fig 6.3: choosing image

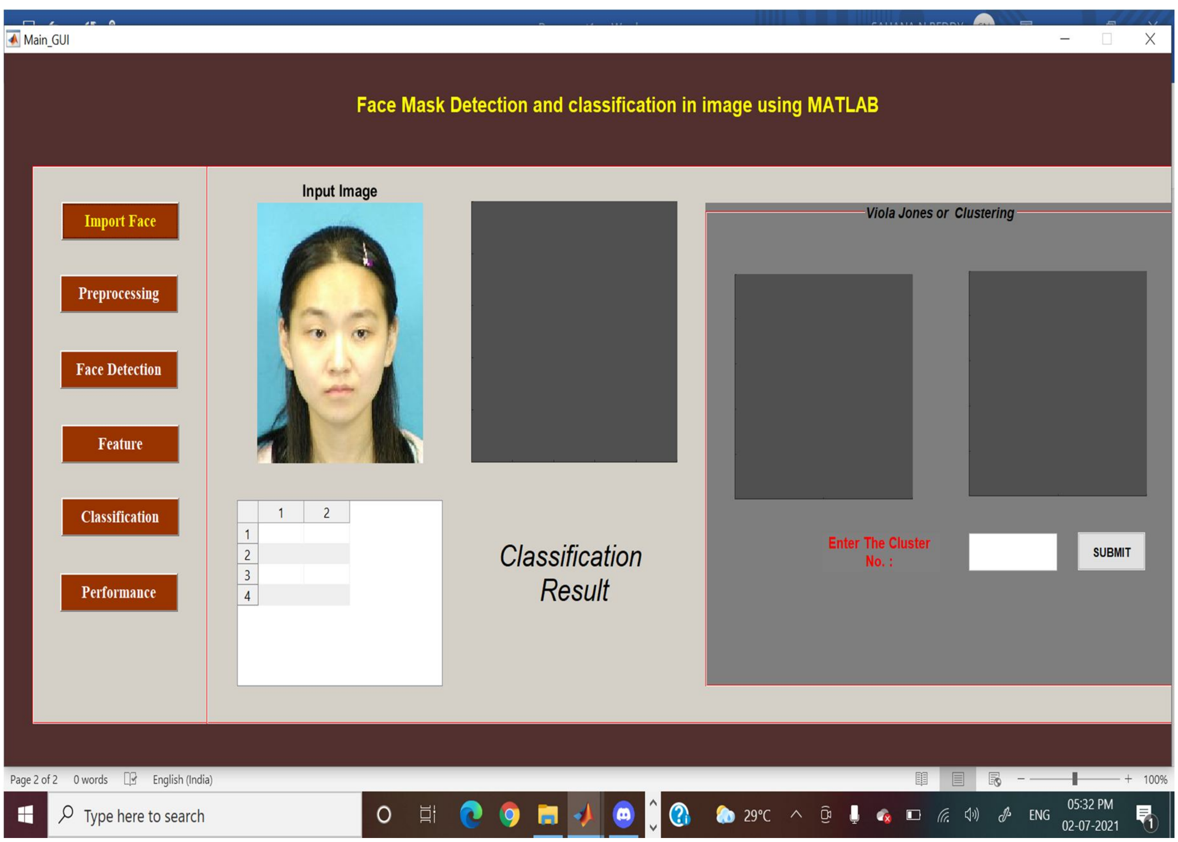

Fig 6.4: Inserting image

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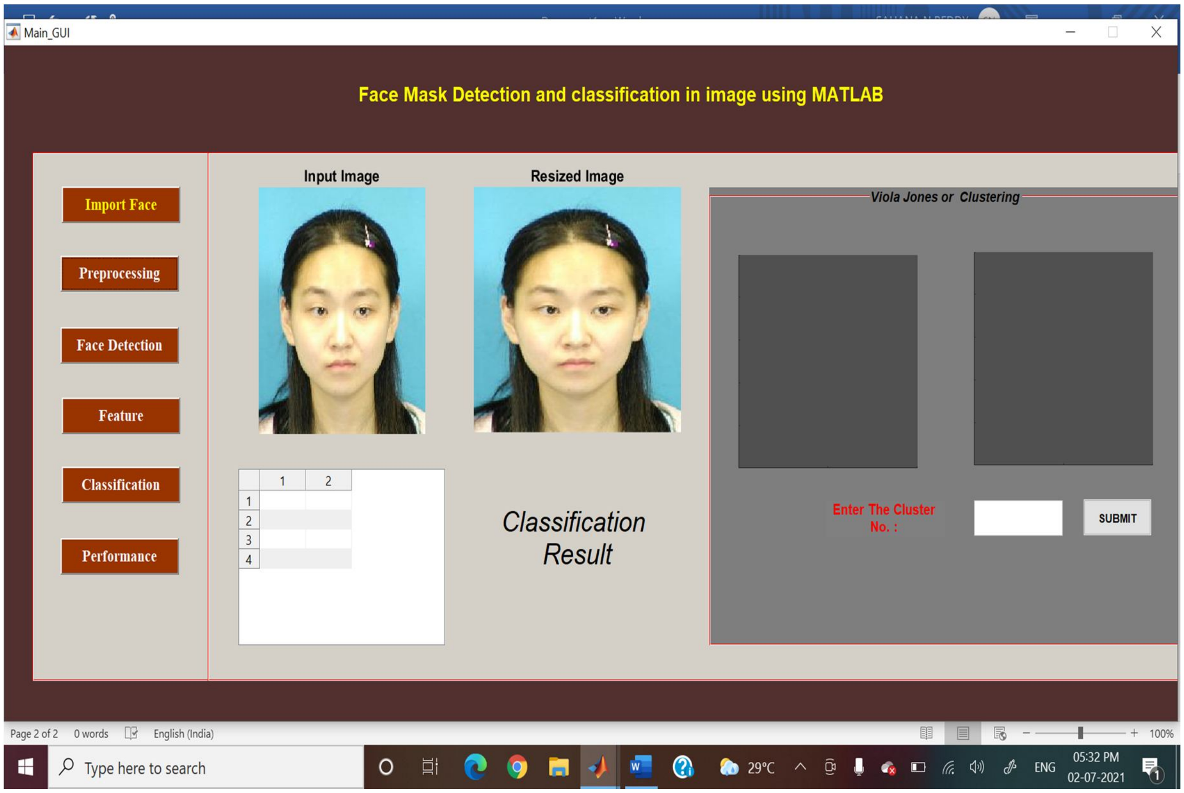

Fig 6.5: Resize image

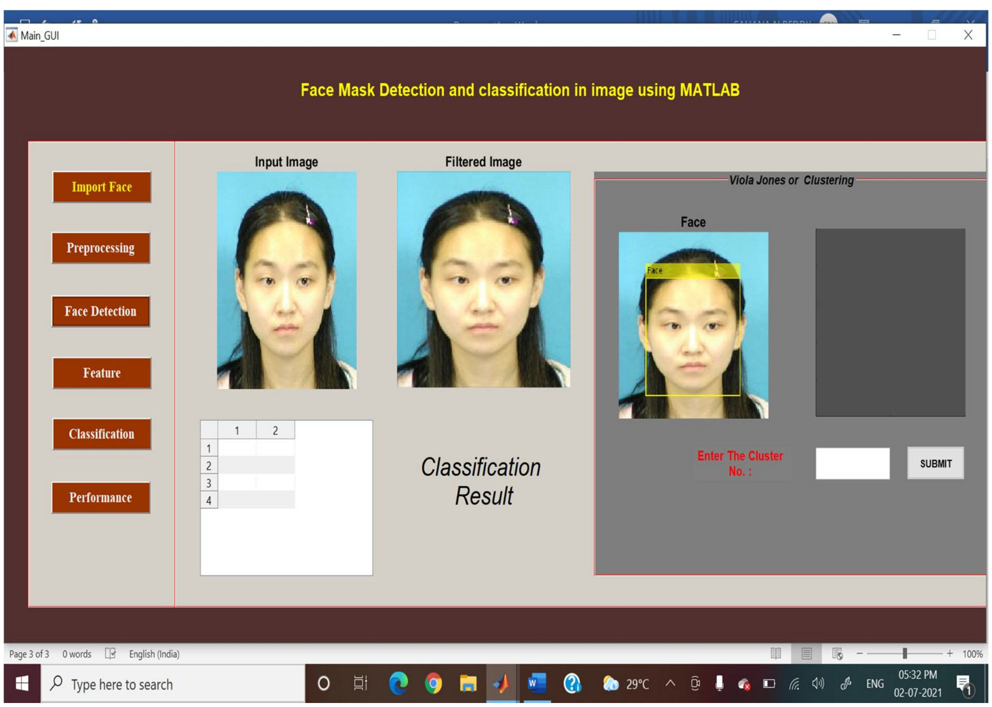

Fig 6.6 : Face detecting

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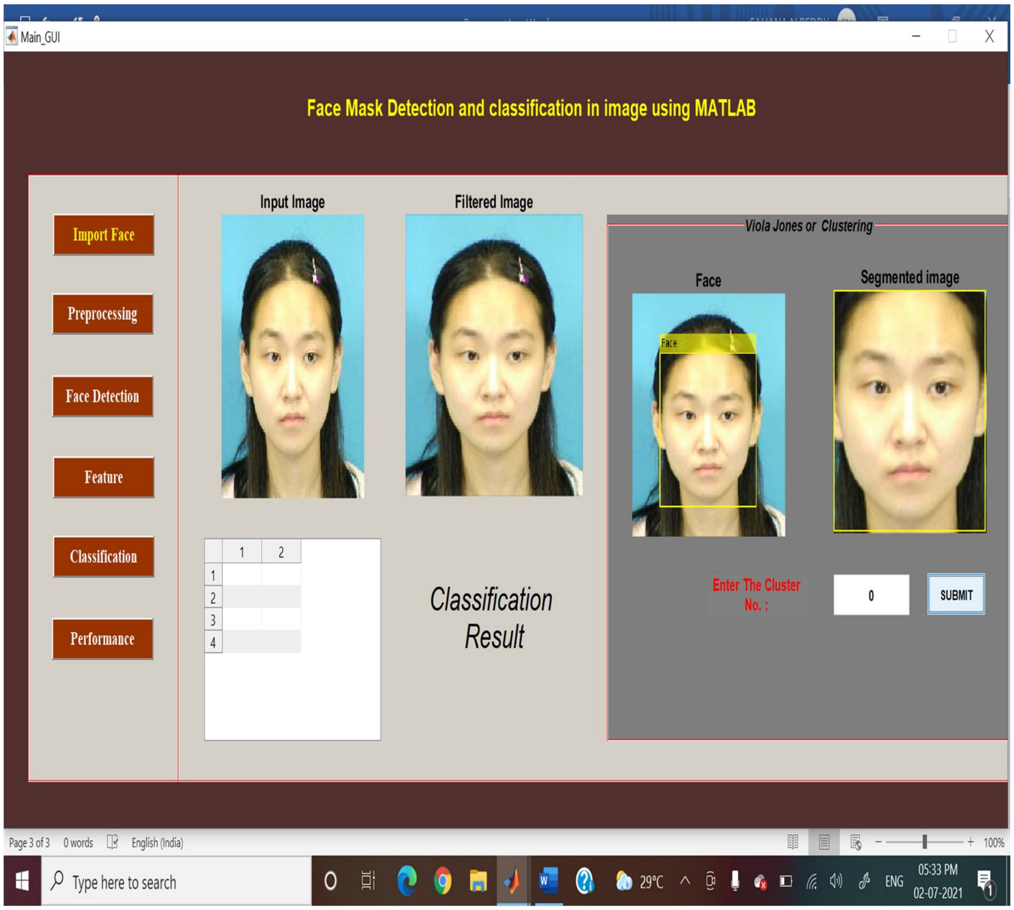


Fig 6.7 : Segmentation

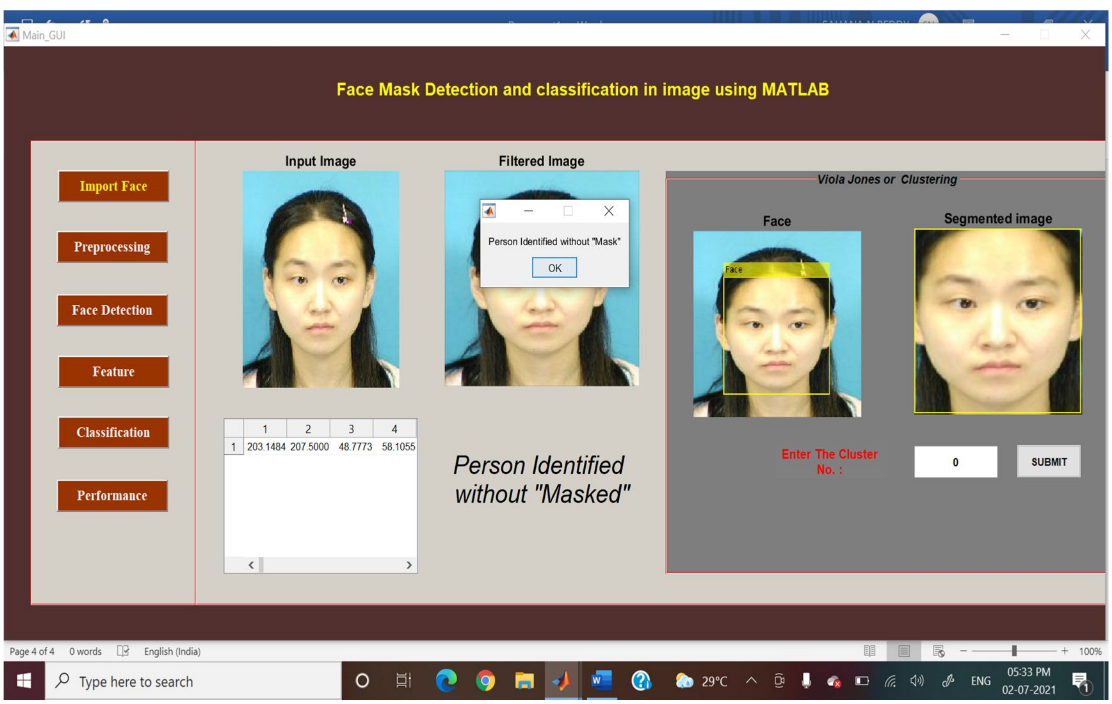


Fig 6.8 : Result

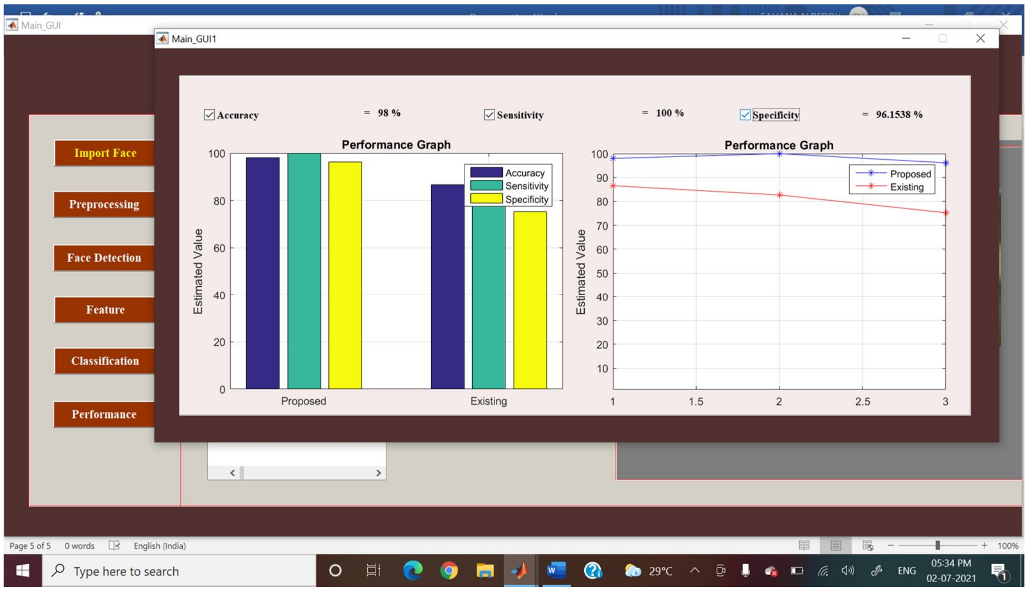


Fig 6.9 : Graph

VII. CONCLUSION AND FUTURE ENHANCEMENT

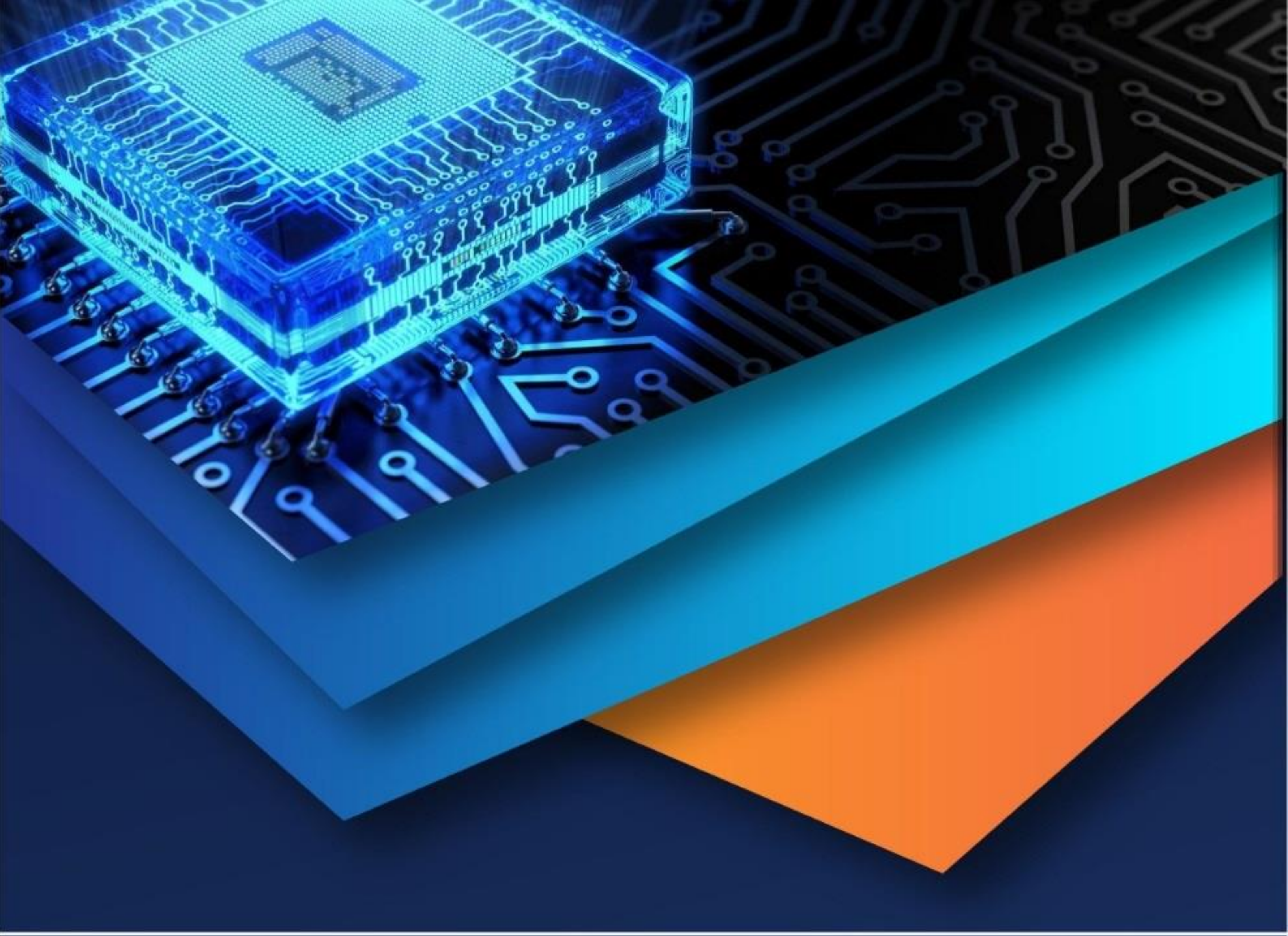
A. Conclusion

This project was done to help increase productivity in the medical field and to help increase the vigilance in other Institutions where a lot of people would enter and exit on a daily basis. This project is aimed at finding mask defaulter entering the institution, the hospital and a community the defaulters are identified and requested to wear a mask within the entered space. Therefore this will help curb the spread of the infection and keeping the community safe for everyone.

B. Future Enhancement

This application has much potential for future enhancement. As the new technologies are easily available as open source, many new features can be added to it. Few of the enhancements can be worked on are as follows:.

1) Improve the GUI to make it modern or futuristic.
2) Utilize cloud functionality to store the user data on cloud.
3) Making the application more secure by adding more privacy measures.



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IMPACT FACTOR: 7.129

TOGETHER WE REACH THE GOAL

IMPACT FACTOR: 7.429

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