A GESTURE-BASED TOOL FOR STERILE BROWSING OF RADIOLOGY IMAGES

A project report submitted in partial fulfillment of the requirements of the award of the degree of

Bachelor of Technology

in

Computer Science And Engineering

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CERTIFICATE

This is to certify that the project report titled "A Gesture-based Tool for Sterile Browsing of Radiology Images",being submitted by

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in partial fulfillment of the requirements for the award of the degree of Bachelor of Technology in Computer Science and Engineering, to the Anna University, Chennai is a record of bonafied work carried out by them my guidance and supervision.

CONTENTS

ABSTRACT

Touch less hand gesture recognition systems are becoming important in automotive userinterfaces as they. Improve safety and comfort. Various computer vision algorithms have employed color and depth cameras for hand gesture recognition, but robust classification of gestures from different subjects performed under widely varying lighting conditions is still challenging. We propose an algorithm for drivers' hand gesture recognition from challenging depth and intensity data using 3D convolutional neural networks. Our solution combines information from multiple spatial scales for the final prediction. It also employs spatio-temporal data augmentation formore effective training and to reduce potential over fitting.

1. INTRODUCTION

Project Overview

Humans can recognize body and sign language easily. This is possible due to the combination of vision and synaptic interactions that were formed along brain development. In order to replicate this skill in computers, some problems need to be solved: how to separate objects of interest in images and which image capture technology and classification technique are more appropriate, among others.

In this project Gesture based Desktop automation, First the model is trained pre trained on the images ofdifferent hand gestures, such as a showing numbers with fingers as 1,2,3,4. This model uses the integrated webcam to capture the video frame. The image of the gesture captured in the video frameis compared with the Pre-trained model and the gesture is identified. If the gesture predicts is 0 - then images is converted into rectangle, 1 - image is Resized into (200,200), 2 - image is rotated by -45°, 3 - image is blurred, 4 - image is Resized into (400,400), 5 - image is converted into grayscale etc.

Purpose:

It is used to browse through the images obtained using radiology using hand gestures rather than usingmouse, keyboard, etc thereby maintaining sterility.

2. LITERATURE SURVEY

Existing problem:

Hand Gesture Recognition Using Camera ” is based on concept of Image processing. In recentyear there is lot of research on gesture recognition using kinect sensor on using HD camera but camera and kinect sensors are more costly Hand gestures come naturally to us. It is even found that blind people use hand gestures where speaking with other blind people. Gesturing helps you access memories. Using hand gestures while you speak not only helps others remember what you say it also helps you speak more quickly and effectively!

References:

The fundamental commitments and extent of investigation can be characterized as follows:

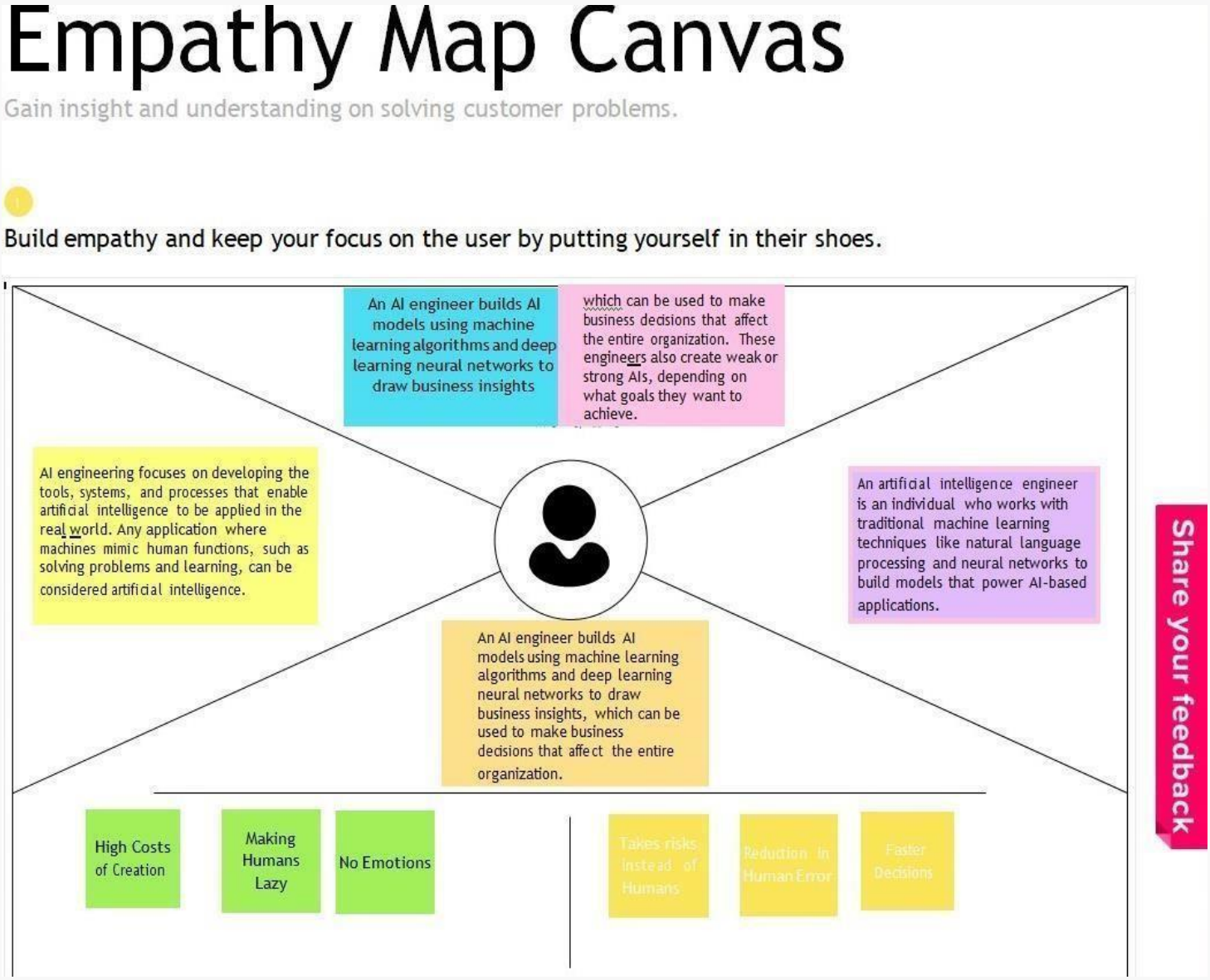
We have examined different accessible radar innovations to understand their similitudes and contrasts. Every one of the viewpoints connected with HGR acknowledgment, including information obtaining, information portrayal, information preprocessing and grouping, are made sense of exhaustively.

We made sense of the radar-recorded hand-signal information portrayal methods for 1D, 2D and 3D classifiers. In view of this information portrayal, subtleties of the accessible HGR calculations are talkedabout.

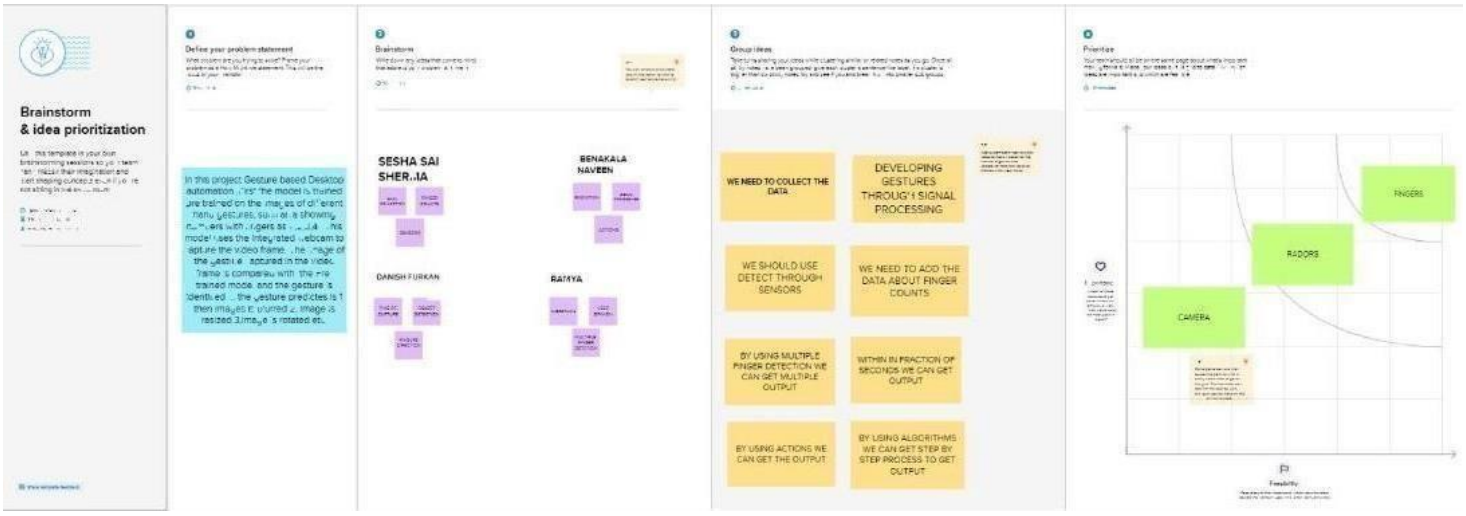
At long last, subtleties connected with application-arranged HGR research works are likewise introduced.A few patterns and study examinations are like wise include

3. IDEATION & PROPOSED SOLUTION

3.1Empathy Map Canvas:



3.1 Ideation & Brainstorming



Proposed Solution Template:

Project team shall fill the following information in proposed solution templates.

S. No	Parameter	Description
1.	Problem Statement (problem to be solved)	"Hand Gesture Recognition Using Camera " is based on concept of Image processing. In recent year there is lot of research on gesture recognition using kinect sensor on using HD camera but camera and kinect sensors are more costly.
2.	Idea / Solution description	Hand gestures come naturally to us. It is even found that blind people use hand gestures when speaking with other blind people. Gesturing helps you access memories. Using hand gestures while you speak not only helps others remember what you say, it also helps you speak more quickly and effectively!
3.	Novelty / Uniqueness	In this proposed system, "Kinect camera" plays the major role to gather the depth information from the skeleton.
4.	Social Impact / Customer Satisfaction	These results suggest that gesture aids the listener as well as the speaker and that gesture has a direct effect on listener

3.4 Problem Solution Fit

Define CS, fit into CC

1. CUSTOMER SEGMENT(S) CS

- This tools was designed for doctor for support medical imaging manipulation.
- Doctors(22+ ages)

6. CUSTOMER CONSTRAINTS CC

- Data Privacy
- Technology awareness
- Customer should have uninterrupted connection.

5. AVAILABLE SOLUTIONS AS

- In early stage the doctors has to manually do navigation and manipulation of images in an electronic medical record(EMR).
- By using the gesture-based navigation and manipulation of images is very much useful for the doctors.

Explore AS, differentiate

Focus on J&P, tap into BE, understand RC

2. JOBS-TO-BE-DONE / PROBLEMS J&P

- Reduce time
- Produce more accurate solution for the report(EMR).
- Easy navigation and manipulation of images.

9. PROBLEM ROOT CAUSE RC

- Doctor can't able to see each and every patient records.
- User friendly and doctor friendly services,
- These technologies are expensive right mom

7. BEHAVIOUR BE

- If any problem or technical issue in software faced by our customer, they will send us feedback on the same and our technical team will solve their problem in efficient way and get back to them by sending mail.

Focus on J&P, tap into BE, understand RC

Functional Requirements:

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through gmail
FR-2	User Confirmation	Confirmation via Email
FR-3	Data collection	Collection of required input data
FR-4	Data analysis	Process the given inputs using CNN and Nutrion API
FR-5	Data processing	Evaluate the data and store it in database and integrate in cloud containers
FR-6	Provide output to user	Display the result to the user

4.2 Non-Functional requirements

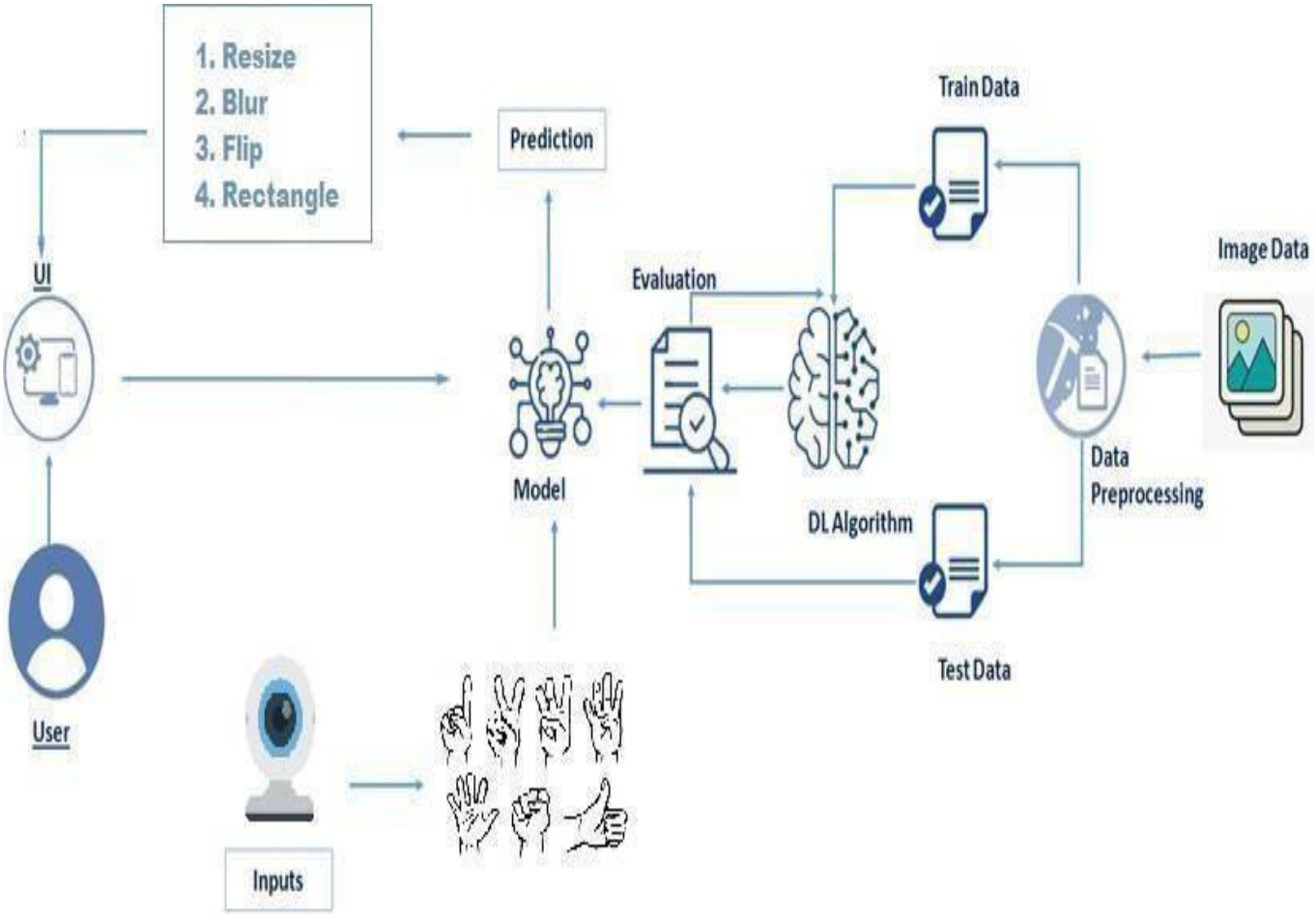
Non-functional Requirements:

Following are the non-functional requirements of the proposed solution.

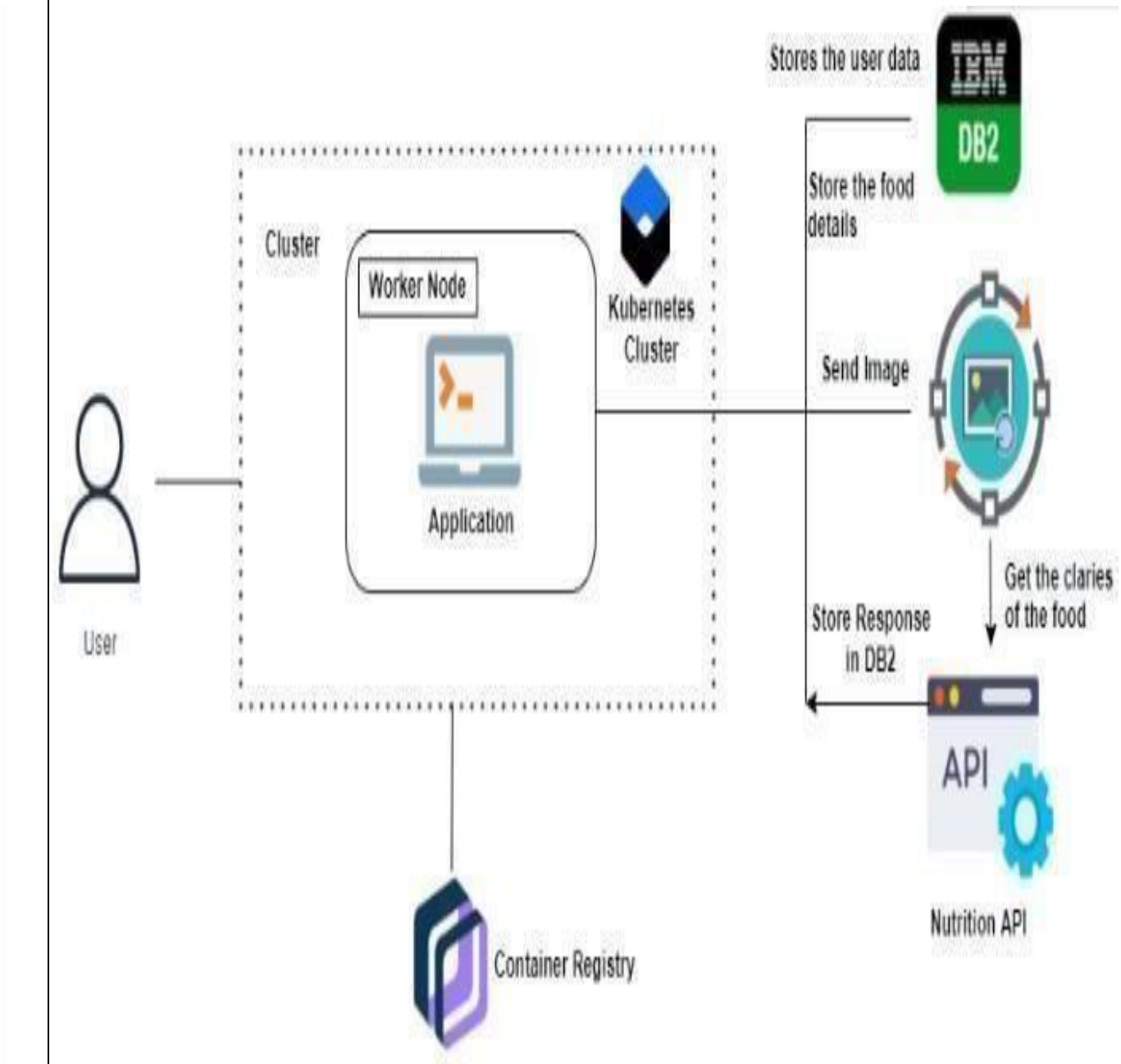
FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	User-friendly and overall satisfaction of the user while using the website
NFR-2	**Security**	The website provides proper authentication and verification
NFR-3	**Reliability**	The site always provides reliable outputs and lacks failures
NFR-4	**Performance**	Provides 100% efficiency of the output
NFR-5	**Availability**	The product is readily available for all kinds of users when needed
NFR-6	**Scalability**	Effective in obtaining good accuracies

5. PROJECT DESIGN

Solution & TechnicalArchitecture



Technical Architecture



6. PROJECT PLANNING & SCHEDULING:

Sprint Planning & Estimation:

1. Defining our classification categories
2. Collect training images
3. Train the model
4. Test our model

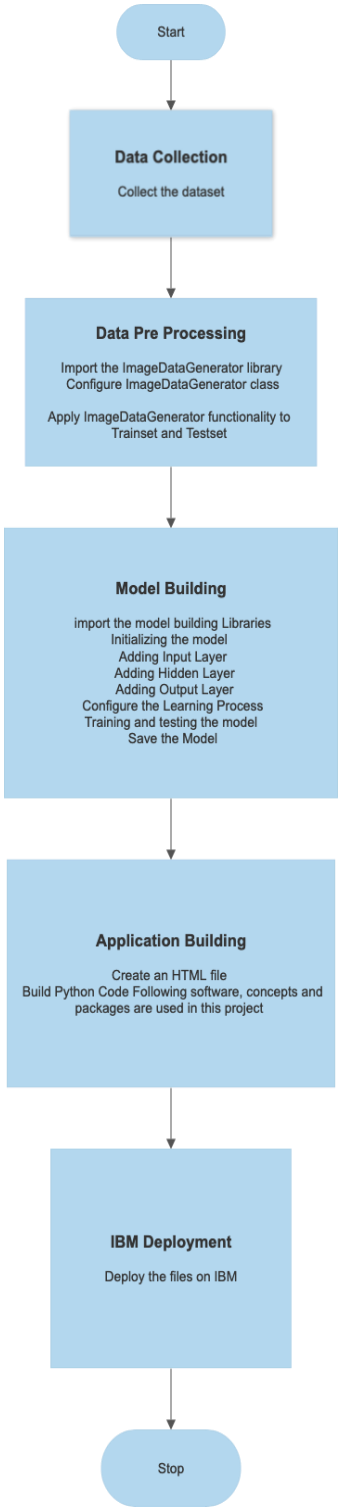
User interacts with the UI (User Interface) to upload the image as input Depending on the different gesture inputs different operations areappliedto the inputimage.
Once model analyses the gesture, the prediction with operation appliedonimage isshowcased on the UI.

To accomplish this, we have to complete all the activities and tasks

listedbelow:Data Collection.
Collect the dataset or Create the datasetDataPre processing
Import the ImageDataGenerator libraryConfigure ImageDataGenerator class

- Apply ImageDataGenerator functionality to Trainset and Testset
- Model Building
- Import the model building Libraries
- Initializing the model
- Adding Input Layer
- Adding Hidden Layer
- Adding Output Layer
- Configure the Learning Process
- Training and testing the model
- Save the Model
- Application Building
- Create an HTML file
- Build Python Code

Sprint Delivery Schedule:



7. CODING & SOLUTIONING

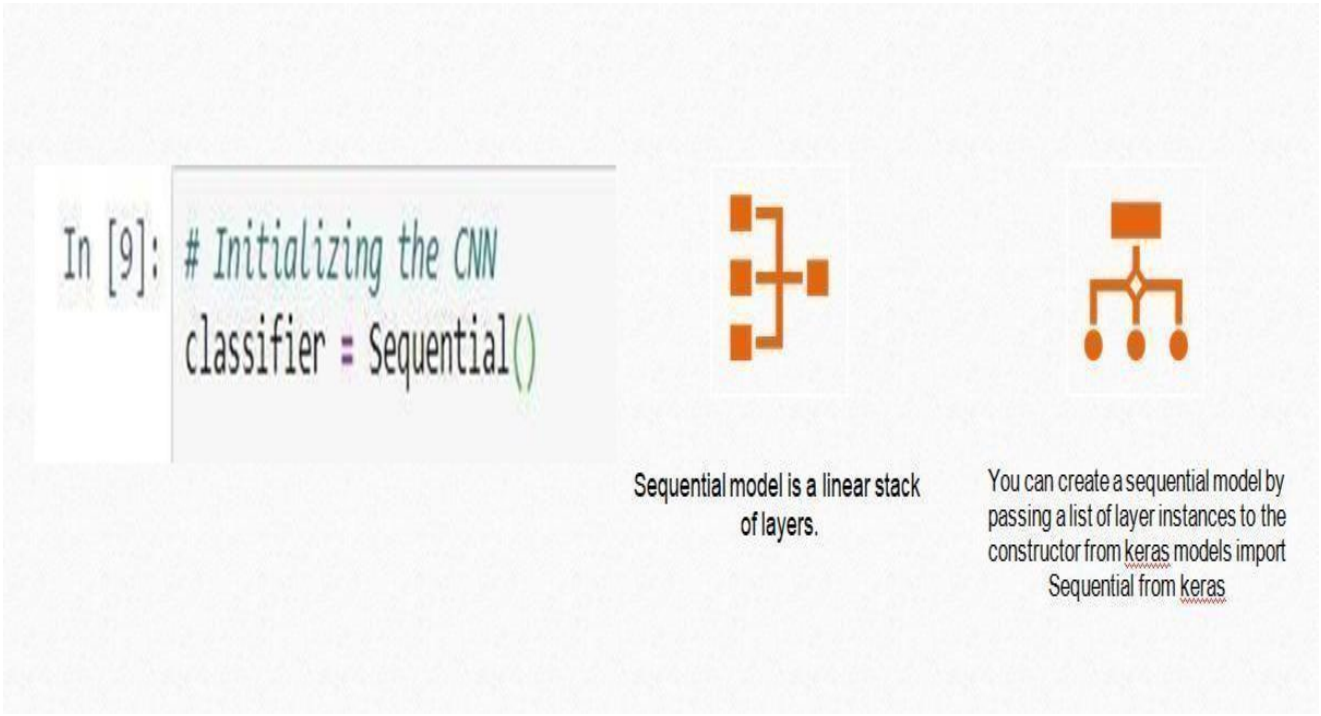
Feature-1

Importing the Model Building Libraries

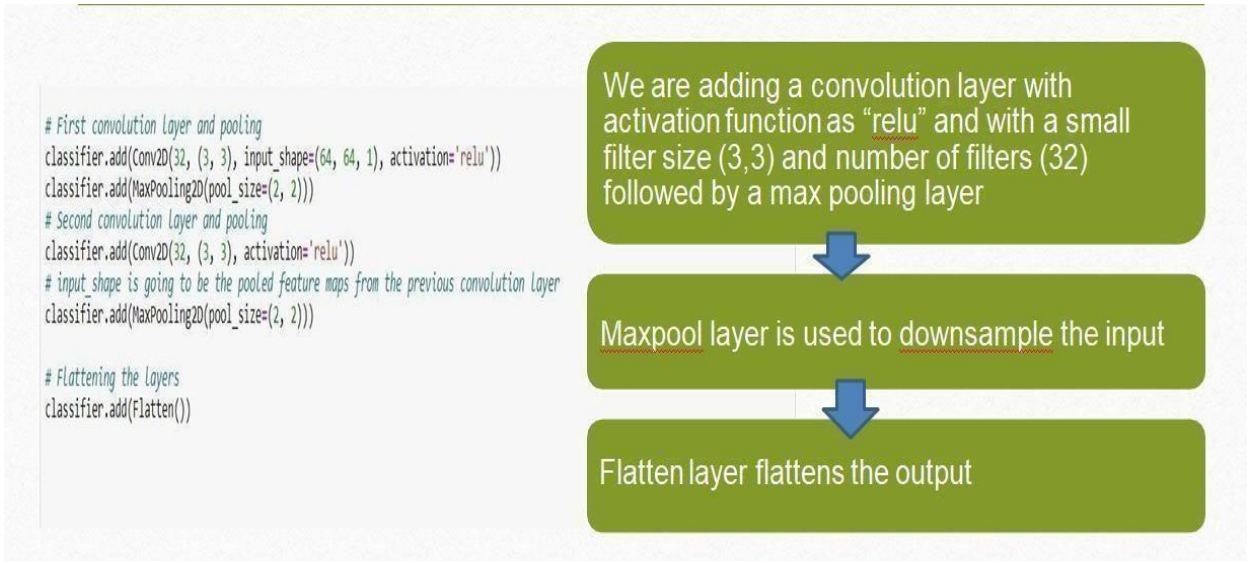
In [1]:
```
import numpy as np
import tensorflow
from tensorflow.keras.models import Sequential
from tensorflow.keras import layers

from tensorflow.keras.layers import Dense,Flatten

from tensorflow.keras.layers import Conv2D,MaxPooling2D
from keras.preprocessing.image import ImageDataGenerator
```

```
Using TensorFlow backend.
```

Initializing the Model



Adding CNN Layers




```
# First convolution layer and pooling
classifier.add(Conv2D(32, (3, 3), input_shape=(64, 64, 1), activation='relu'))
classifier.add(MaxPooling2D(pool_size=(2, 2)))
# Second convolution layer and pooling
classifier.add(Conv2D(32, (3, 3), activation='relu'))
# input_shape is going to be the pooled feature maps from the previous convolution layer
classifier.add(MaxPooling2D(pool_size=(2, 2)))

# Flattening the layers
classifier.add(Flatten())
```

Adding Dense Layers

- Dense layer is deeply connected neural network layer. It is most common and frequently used layer.
- Understanding the model is very important phase to properly use it for training and prediction purposes.
- Keras provides a simple method, summary to get the full information about the models and its layers.

```
In [10]: # Adding a fully connected layer
         classifier.add(Dense(units=128, activation='relu'))
         classifier.add(Dense(units=6, activation='softmax')) # softmax for more than 2
```

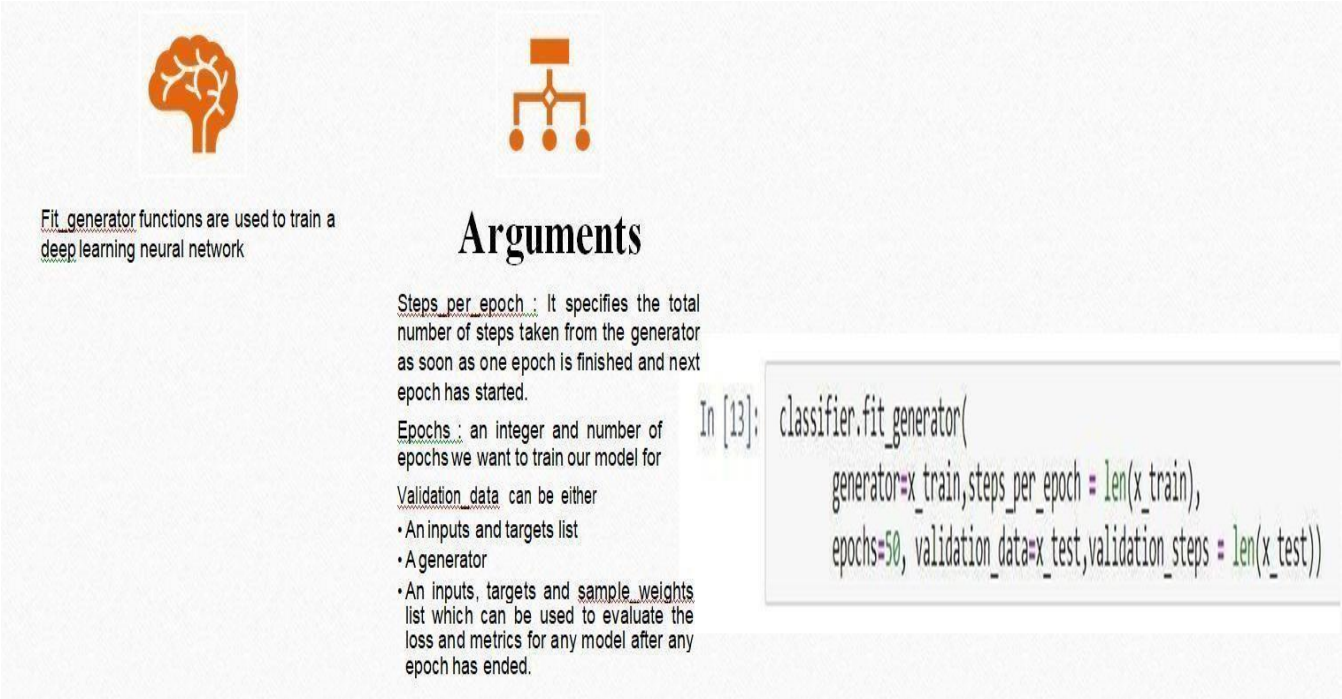
```
classifier.summary()
```

```
Model: "sequential"
_________________________________________________________________
Layer (type)                 Output Shape
=================================================================
conv2d (Conv2D)              (None, 62, 62, 32)
_________________________________________________________________
max_pooling2d (MaxPooling2D) (None, 31, 31, 32)
_________________________________________________________________
conv2d_1 (Conv2D)            (None, 29, 29, 32)
_________________________________________________________________
max_pooling2d_1 (MaxPooling2 (None, 14, 14, 32)
_________________________________________________________________
flatten (Flatten)            (None, 6272)
_________________________________________________________________
dense (Dense)                (None, 128)
_________________________________________________________________
dense_1 (Dense)              (None, 6)
=================================================================
Total params: 813,286
Trainable params: 813,286
Non-trainable params: 0
_________________________________________________________________
```

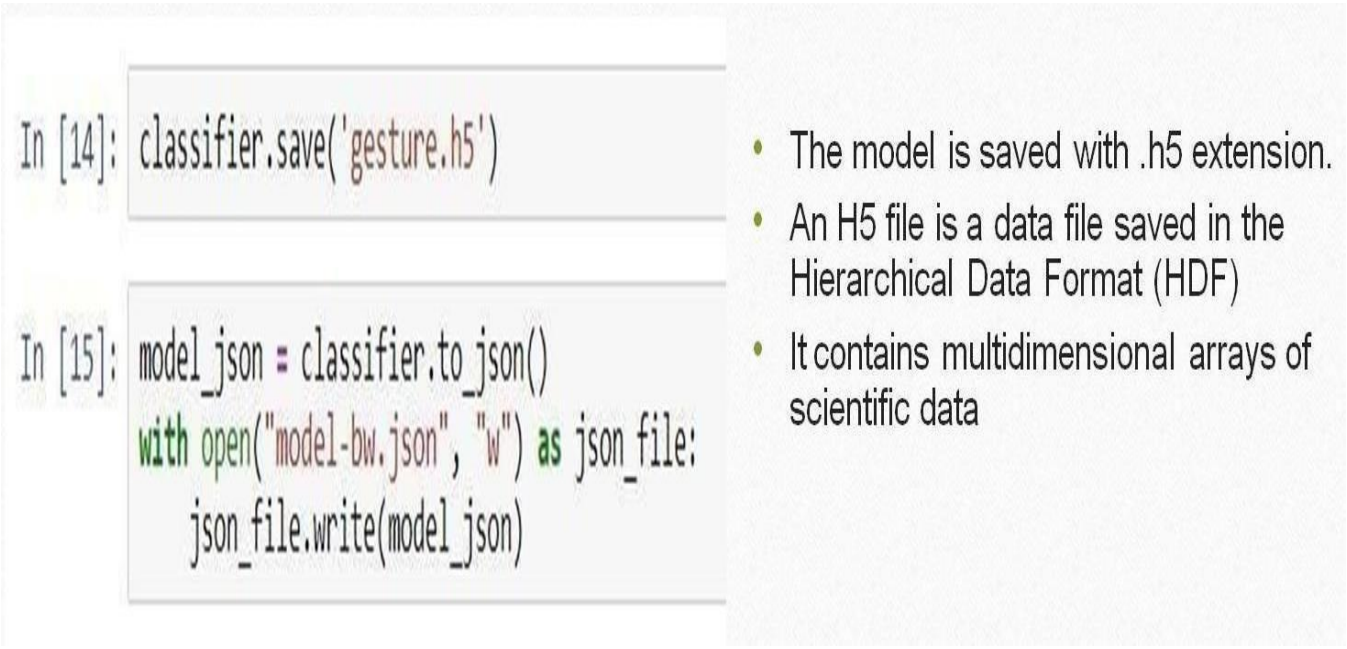
8. TESTING

Test Cases

Train the mode:



Save the model:



Test the model:

Evaluation is a process during development of the model to check whether the model is best fir for the Givenproblem and corresponding data

```
In [24]: index=['0','1','2','3','4','5']
         result=str(index[pred[0]])
         result

Out[24]: '3'
```

```
In [23]: img = image.load_img(r"C:\Manisha\3.jpg",grayscale=True,target_size= (64,64))
         x = image.img_to_array(img)
         x = np.expand_dims(x,axis = 0)
         pred = model.predict_classes(x)
         pred

Out[23]: array([3], dtype=int64)
```

```
In [16]: from tensorflow.keras.models import load_model
         from keras.preprocessing import image
         model = load_model("gesture.h5")
```

User Acceptance

Testing: Configure the

Learning Process

Configure the Learning Process

The compilation is the final step in creating the model. Once the compilation is done, we can move on to the training process.

Optimization is an important process which optimize the input weights by comparing the prediction and the loss function

```
In [12]: classifier.compile(optimizer='adam', loss='categorical_crossentropy', metrics=['accuracy'])
```

Metrics is used to evaluate the performance of our model. It is similar to loss function, but not used in training process

Source Code:

Build Python Code

Build flask file 'app.py' which is a web frameworkwritten in pythonfor server-side scripting.
App starts running when " name " constructor is called in main.

render_template is used to return html file.
"GET" method is used to take input from the user.
"POST" method is used to display the output to the user.

Importing Libraries

```
from flask import Flask,render_template,request
# Flask-It is our framework which we are going to use to run/serve our application.
#request-for accessing file which was uploaded by the user on our application.
import operator
import cv2 # opencv library
import matplotlib.pyplot as plt
import matplotlib.image as mpimg
import numpy as np

from tensorflow.keras.models import load_model#to load our trained model
import os
from werkzeug.utils import secure_filename
```

- Creating our flask application and loading our model:

```
app = Flask(__name__,template_folder="templates") # initializing a flask app
# Loading the model
model=load_model('gesture.h5')
print("Loaded model from disk")
```

- Routing to the html Page

```
@app.route('/')# route to display the home page
def home():
    return render_template('home.html')#rendering the home page


@app.route('/intro') # routes to the intro page
def intro():
    return render_template('intro.html')#rendering the intro page

@app.route('/image1',methods=['GET','POST'])# routes to the index html
def image1():
    return render_template("index6.html")
```

The above three route are used to render the home, introduction and the indexhtml pages.

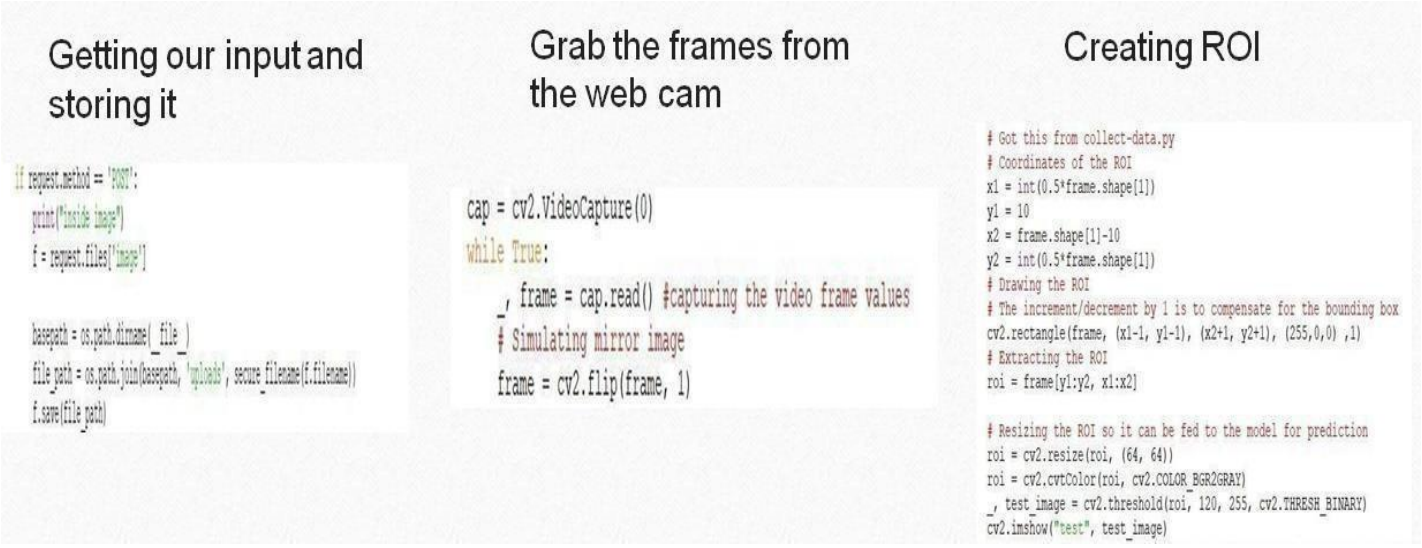
```
@app.route('/predict',methods=['GET', 'POST'])# route to show the predictions in a web UI
def launch():
```

And the predict route is used for prediction and it contains all the codes which are used for predicting ourresults. Firstly, inside launch function we are having the following things:

- Getting our input and storing it
- Grab the frames from the web cam.
- Creating ROI
- Predicting our results
- Showcase the results with the help of opencv
- Finally run the application

Getting our input and storing it

Once the predict route is called, we will check whether the method is POST or not if is POST then we will request theimage files and with the help of so function we will be storing the image in the uploads folder in our local system



Predicting our results

```
result = model.predict(test_image.reshape(1, 64, 64, 1))
prediction = {'ZERO': result[0][0],
              'ONE': result[0][1],
              'TWO': result[0][2],
              'THREE': result[0][3],
              'FOUR': result[0][4],
              'FIVE': result[0][5]}
# Sorting based on top prediction
prediction = sorted(prediction.items(), key=operator.itemgetter(1), reverse=True)

# Displaying the predictions
cv2.putText(frame, prediction[0][0], (10, 120), cv2.FONT_HERSHEY_PLAIN, 1, (0,255,255), 1)
cv2.imshow("Frame", frame)
```

```
        #loading an image
        image1=cv2.imread(file_path)
        if prediction[0][0]=='ONE':

            resized = cv2.resize(image1, (200, 200))
            cv2.imshow("Fixed Resizing", resized)
            key=cv2.waitKey(3000)

            if (key & 0xFF) == ord("1"):
                cv2.destroyWindow("Fixed Resizing")

        elif prediction[0][0]=='ZERO':

            cv2.rectangle(image1, (480, 170), (650, 420), (0, 0, 255), 2)
            cv2.imshow("Rectangle", image1)
            cv2.waitKey(0)
            key=cv2.waitKey(3000)
            if (key & 0xFF) == ord("0"):
                cv2.destroyWindow("Rectangle")

        elif prediction[0][0]=='TWO':
            (h, w, d) = image1.shape
            center = (w // 2, h // 2)
            M = cv2.getRotationMatrix2D(center, -45, 1.0)
            rotated = cv2.warpAffine(image1, M, (w, h))
            cv2.imshow("OpenCV Rotation", rotated)
            key=cv2.waitKey(3000)
            if (key & 0xFF) == ord("2"):
                cv2.destroyWindow("OpenCV Rotation")

        elif prediction[0][0]=='THREE':
            blurred = cv2.GaussianBlur(image1, (11, 11), 0)
            cv2.imshow("Blurred", blurred)
            key=cv2.waitKey(3000)
            if (key & 0xFF) == ord("3"):
                cv2.destroyWindow("Blurred")
        else:
            continue


        interrupt = cv2.waitKey(10)
        if interrupt & 0xFF == 27: # esc key
            break


    cap.release()
    cv2.destroyAllWindows()
return render_template("home.html")
```

9. RESULT

Final findings (Output) of the project along with screen shots. Through this project we foundthat we can maintain the sterility of an operation theater, etc by using hand based gesture tools to browse the images obtained.

10. ADVANTAGES & DISADVANTAGES

Advantages:

Major advantage of this tool is that it helps to maintain the sterility of the environment. It is also easy to use and is quicker than the existing methods to browse images.

It can also be performed even if the surgeon is a bit far away from the system, this helps tosave time.

The tool does not need the person using it to have an apparatus or any devices on them to use it. They can simply move their hands to browse through the images.

Disadvantages:

The tool can be quite expensive as it requires cameras and other expensive devices to captureimages and process it.

APPLICATIONS

This hand based gesture tool developed can be mainly used in the medical industry to browseimages without compromising the sterility.

However it can also be used in different industries while presenting certain ideas, duringmeetings, and can be used by teachers while teaching.

11. CONCLUSION

In this project we developed a tool which recognizes hand gestures and enables doctors to browse through radiology images using these gestures. This enables doctors and surgeons to maintain the sterility as they would not have to touch any mouse or keyboard to go through the images.

This tool is also easy to use and is quicker than the regular method of using mouse/keyboard.

It can be used regardless of the users location since they don't have to be in contact with anydevice. It also does not require the user to have any device on them to use it.

Further this technology can be extended to other's industries like it can be used by present byteachers for show images in the classroom.

FUTURE SCOPE

- The tools can e be made quicker by increasing the reconigation speed.
- More number of gestures can be added there by increasing this tools functionalities andus abilities for different purpose.
- Tracking of both hands can be added to increase the set of commands.
- Voice commands can also be added to further increase the functionality.

REFERENCES

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2410001/
https://pubmed.ncbi.nlm.nih.gov/18451034/
https://www.researchgate.net/publication/5401674_A_Gesture
https://www.researchgate.net/publication/5401674_A_Gesture

APPENDIX

Git hub link:

IBM-EPBL/IBM-Project-14650-1659588154: A Gesture-based Tool for Sterile Browsing of Radiology Images (github.com)

Video link:

https://youtube.com/watch?v=41NaEPKknDI&feature=share