Configuration Manual

MSc Research Project
Data Analytics

Sumitra Sambhaji Thorat
Student ID: x20248521

School of Computing
National College of Ireland

Supervisor: Athanasios Staikopoulos

National College of Ireland
Project Submission Sheet
School of Computing

Student Name:	Sumitra Sambhaji Thorat
Student ID:	x20248521
Programme:	Data Analytics
Year:	2023
Module:	MSc Research Project
Supervisor:	Athanasios Staikopoulos
Final Submission Due Date:	01/02/2023
Project Title:	Configuration Manual
Word Count:	583
Page Count:	6

I hereby certify that the information contained in this (my submission) is information pertaining to research I conducted for this project. All information other than my own contribution will be fully referenced and listed in the relevant bibliography section at the rear of the project.

ALL internet material must be referenced in the bibliography section. Students are required to use the Referencing Standard specified in the report template. To use other author's written or electronic work is illegal (plagiarism) and may result in disciplinary action.

Signature:	
Date:	1st February 2023

PLEASE READ THE FOLLOWING INSTRUCTIONS AND CHECKLIST:

Attach a completed copy of this sheet to each project (including multiple copies).	□
Attach a Moodle submission receipt of the online project submission, to each project (including multiple copies).	□
You must ensure that you retain a HARD COPY of the project, both for your own reference and in case a project is lost or mislaid. It is not sufficient to keep a copy on computer.	□

Assignments that are submitted to the Programme Coordinator office must be placed into the assignment box located outside the office.

Office Use Only	
Signature:	
Date:	
Penalty Applied (if applicable):	

Configuration Manual

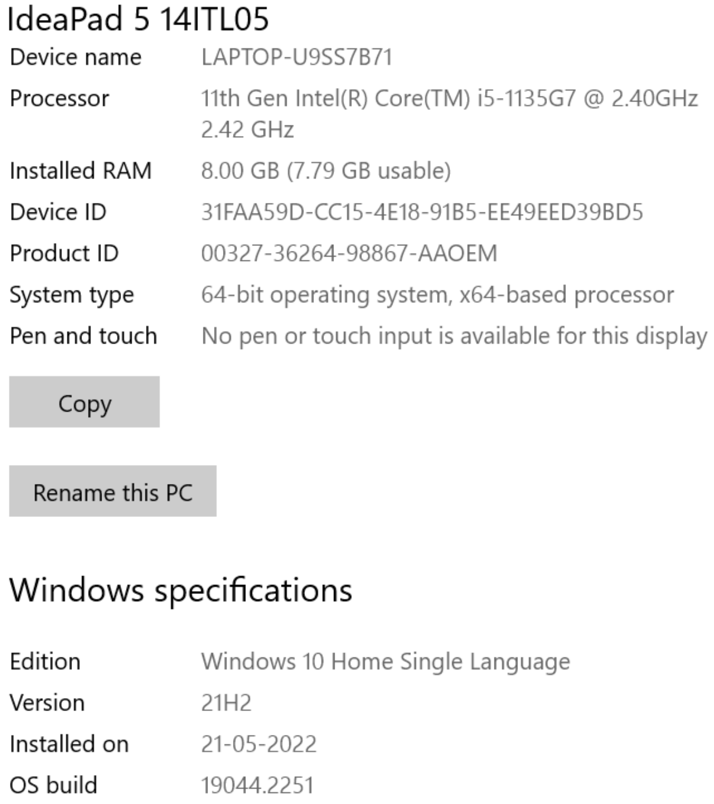
Sumitra Sambhaji Thorat
x20248521

1 Introduction

This document is prepared to assist in replicating the American and Indian Sign Language implementation.

2 Hardware and Software Configuration

The project implementation was performed on Windows 10, 64-bit operating system with 8GB RAM. Below figure shows the configuration of system.



IdeaPad 5 14ITL05

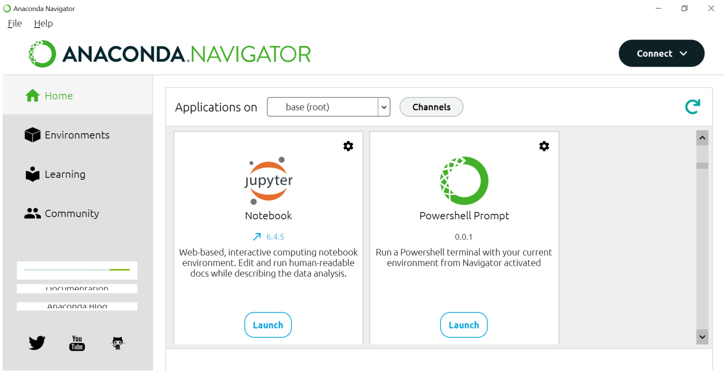
Device name	LAPTOP-U9SS7B71
Processor	11th Gen Intel(R) Core(TM) i5-1135G7 @ 2.40GHz 2.42 GHz
Installed RAM	8.00 GB (7.79 GB usable)
Device ID	31FAA59D-CC15-4E18-91B5-EE49EED39BD5
Product ID	00327-36264-98867-AAOEM
System type	64-bit operating system, x64-based processor
Pen and touch	No pen or touch input is available for this display

Windows specifications

Edition	Windows 10 Home Single Language
Version	21H2
Installed on	21-05-2022
OS build	19044.2251

Figure 1: Hardware Configuration

Jupyter Notebook from the Anaconda Navigator platform was used for writing, maintaining and executing the python code.



Web-based, interactive computing notebook environment. Edit and run human-readable docs while describing the data analysis.

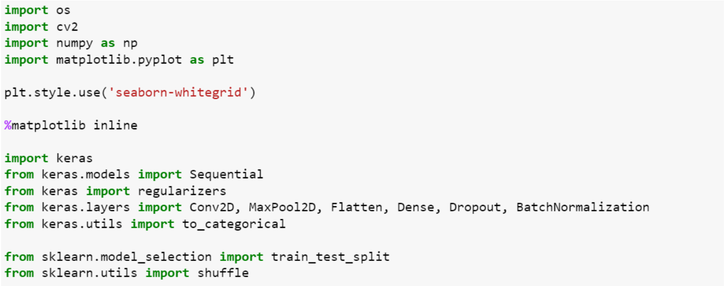
Run a Powershell terminal with your current environment from Navigator activated

Figure 2: Software Configuration

3 Required Libraries

Following are the libraries that needs to be installed and imported in python. The packages are installed using 'pip' command.

- Tenserflow
- open-cv
- Numpy
- matplotlib
- Keras
- gtts



```
import os
import cv2
import numpy as np
import matplotlib.pyplot as plt

plt.style.use('seaborn-whitegrid')

%matplotlib inline

import keras
from keras.models import Sequential
from keras import regularizers
from keras.layers import Conv2D, MaxPool2D, Flatten, Dense, Dropout, BatchNormalization
from keras.utils import to_categorical

from sklearn.model_selection import train_test_split
from sklearn.utils import shuffle
```

Figure 3: Libraries imported

4 Dataset Links and Description

Two dataset were used for this project both datasets were obtained from Kaggle. Below are the dataset links and their descriptions.

1. American Sign Langugage: https://www.kaggle.com/datasets/grassknoted/asl-alphabet

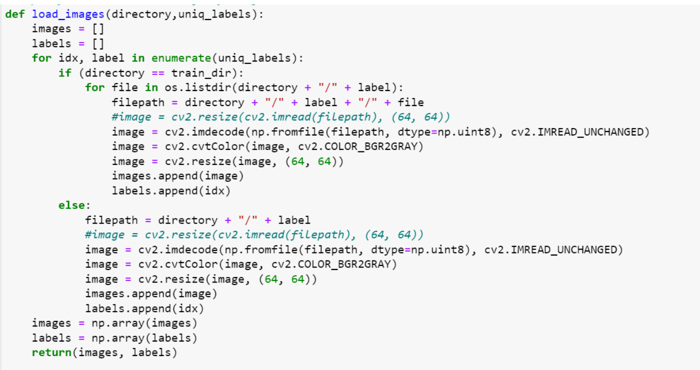
   This dataset has 29 folders of A-Z characters, each having 3000 images and 200x200 pixels. It also contains 3 extra signs which are 'delete', 'nothing' and 'space'.

2. Indian Sign Language: https://www.kaggle.com/datasets/vaishnaviasonawane/indian-sign-language-dataset

   This dataset has combination of alphabets and numbers. In total it has 35 folders each have 1200 images. this contains 1-9 numbers and A-Z characters and the images are 128x128 pixels.

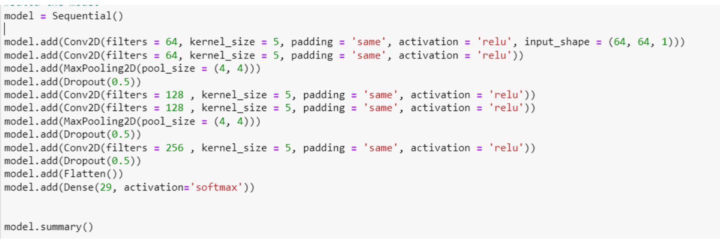
5 Cleaning, Pre-processing and Model Generation

The code in ASL_CNN.ipynb and ISL_CNN.ipynb contains the code to clean, perform image augmentation, transform and generate CNN model.



```python
def load_images(directory,uniq_labels):
    images = []
    labels = []
    for idx, label in enumerate(uniq_labels):
        if (directory == train_dir):
            for file in os.listdir(directory + "/" + label):
                filepath = directory + "/" + label + "/" + file
                #image = cv2.resize(cv2.imread(filepath), (64, 64))
                image = cv2.imdecode(np.fromfile(filepath, dtype=np.uint8), cv2.IMREAD_UNCHANGED)
                image = cv2.cvtColor(image, cv2.COLOR_BGR2GRAY)
                image = cv2.resize(image, (64, 64))
                images.append(image)
                labels.append(idx)
        else:
            filepath = directory + "/" + label
            #image = cv2.resize(cv2.imread(filepath), (64, 64))
            image = cv2.imdecode(np.fromfile(filepath, dtype=np.uint8), cv2.IMREAD_UNCHANGED)
            image = cv2.cvtColor(image, cv2.COLOR_BGR2GRAY)
            image = cv2.resize(image, (64, 64))
            images.append(image)
            labels.append(idx)
    images = np.array(images)
    labels = np.array(labels)
    return(images, labels)
```

Figure 4: Data processing



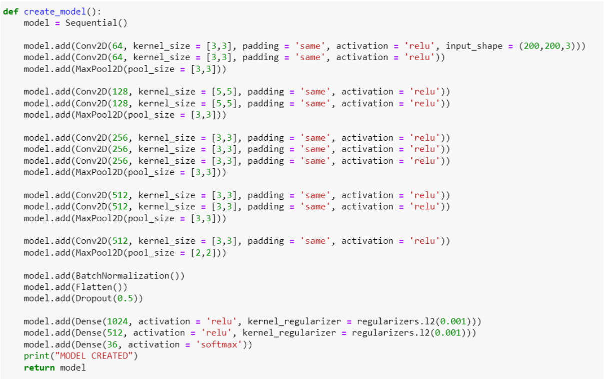
```python
model = Sequential()

model.add(Conv2D(filters = 64, kernel_size = 5, padding = 'same', activation = 'relu', input_shape = (64, 64, 1)))
model.add(Conv2D(filters = 64, kernel_size = 5, padding = 'same', activation = 'relu'))
model.add(MaxPooling2D(pool_size = (4, 4)))
model.add(Dropout(0.5))
model.add(Conv2D(filters = 128 , kernel_size = 5, padding = 'same', activation = 'relu'))
model.add(Conv2D(filters = 128 , kernel_size = 5, padding = 'same', activation = 'relu'))
model.add(MaxPooling2D(pool_size = (4, 4)))
model.add(Dropout(0.5))
model.add(Conv2D(filters = 256 , kernel_size = 5, padding = 'same', activation = 'relu'))
model.add(Dropout(0.5))
model.add(Flatten())
model.add(Dense(29, activation='softmax'))


model.summary()
```

Figure 5: CNN model for ASL

The models are saved and are named as 'isl_bestsofar.h5' and 'ASLGray.model' in the folder that is shared. The accuracy achieved for ASL 97% is and ISL is 99%

6 Sign Language Recognition and Translation

- server.py is the file that contains the implementation code.
- A web app is opened where it asks you to choose the language from a drop-down menu.
- After the selection of language, it requires you to upload image for prediction.
- When you press the upload it predicts the character and speaks it out loud.



```python
def create_model():
    model = Sequential()

    model.add(Conv2D(64, kernel_size = [3,3], padding = 'same', activation = 'relu', input_shape = (200,200,3)))
    model.add(Conv2D(64, kernel_size = [3,3], padding = 'same', activation = 'relu'))
    model.add(MaxPool2D(pool_size = [3,3]))

    model.add(Conv2D(128, kernel_size = [5,5], padding = 'same', activation = 'relu'))
    model.add(Conv2D(128, kernel_size = [5,5], padding = 'same', activation = 'relu'))
    model.add(MaxPool2D(pool_size = [3,3]))

    model.add(Conv2D(256, kernel_size = [3,3], padding = 'same', activation = 'relu'))
    model.add(Conv2D(256, kernel_size = [3,3], padding = 'same', activation = 'relu'))
    model.add(Conv2D(256, kernel_size = [3,3], padding = 'same', activation = 'relu'))
    model.add(MaxPool2D(pool_size = [3,3]))

    model.add(Conv2D(512, kernel_size = [3,3], padding = 'same', activation = 'relu'))
    model.add(Conv2D(512, kernel_size = [3,3], padding = 'same', activation = 'relu'))
    model.add(MaxPool2D(pool_size = [3,3]))

    model.add(Conv2D(512, kernel_size = [3,3], padding = 'same', activation = 'relu'))
    model.add(MaxPool2D(pool_size = [2,2]))

    model.add(BatchNormalization())
    model.add(Flatten())
    model.add(Dropout(0.5))

    model.add(Dense(1024, activation = 'relu', kernel_regularizer = regularizers.l2(0.001)))
    model.add(Dense(512, activation = 'relu', kernel_regularizer = regularizers.l2(0.001)))
    model.add(Dense(36, activation = 'softmax'))
    print("MODEL CREATED")
    return model
```

Figure 6: CNN model for ISL

6.1 Steps to execute Web App for Sign Language Recognition and Translation

To run a web app on a windows machine

- create venv (virtual environment in new folder)
  python -m venv $\backslash path\backslash to\backslash newvirtualenvironment$

- Navigate to venv $->$ Scripts $->$ open command prompt and type activate. This will activate the virtual environment.

- After activating venv we need to download dependencies

- Type cd .. in command prompt (go in previous folder, requirements.txt file is placed in venv folder)

- Run the following command pip install -r requirements.txt

- Now navigate to $-> Sign_Language->$Flask-Server folder in command prompt

- Run server.py in command prompt

- Go to http://127.0.0.1:5000

- App is ready to use

7 American and Indian Sign Language Recognition

Below are the screenshots of experiment conducted and the output received.

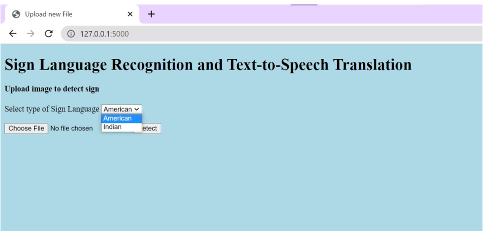
Figure 7 represents the homescreen of the web app.

Figure 8 represents ASL image selection for recognition.

Figure 9 displays the prediction of an ASL image and the character is spoken out loud.

Figure 10. shows the image for ISL recognition of character.

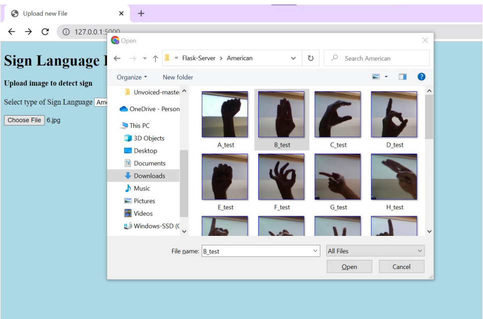
Figure 11 represents the ISL prediction of selected image. The character is spoken out loud.


Sign Language Recognition and Text-to-Speech Translation

Upload image to detect sign

Select type of Sign Language: American

Figure 7: Sign Language Recognition

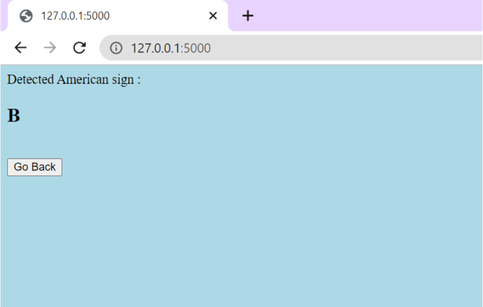

Sign Language I

Upload image to detect sign

Select type of Sign Language: Am

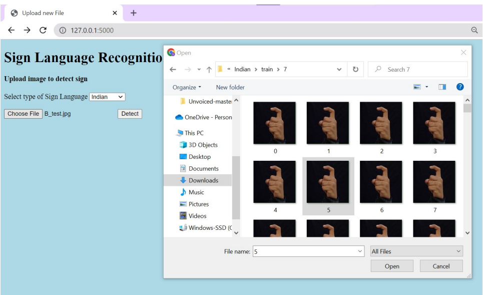
File name: B_test

Figure 8: ASL image upload


Detected American sign :

B

Figure 9: ASL prediction

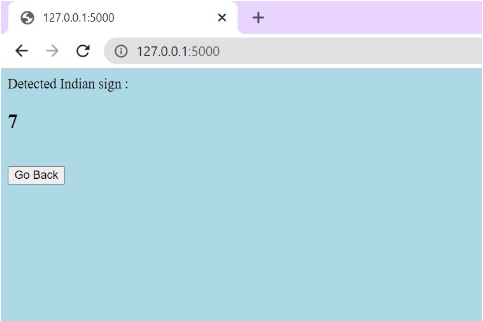

Sign Language Recognitio

Upload image to detect sign

Select type of Sign Language: Indian

File name: 5

Figure 10: ISL image upload



Detected Indian sign :

7

Figure 11: ISL prediction

8 Data Dependencies

Place this folder under ..\x20248521$_{S}ign_{L}anguage_{R}ecognition$\Sign$_{L}anguage$\Flask-Server https://studentncirl-my.sharepoint.com/:f:/x20248521$_{s}tudent_{n}cirl_{i}e?csf = 1web = 1e = HMnfuy$