National College of Ireland

Configuration Manual

MSc Research Project
Artificial Intelligence

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Configuration Manual

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1 Introduction

This paper's goal is to describe the coding procedure for the project. The hardware and software setups required to replicate the research in the future are described. This section describes the steps required to execute the script, as well as the programming and implementation procedures required for effective executable code.

2 Setup and Configuration

2.1 Hardware Configurations

The models used for this research project are processed on Windows 11 computer with a 2.40GHz 13th generation Intel Core i7 processor and 16GB RAM.

2.2 Software Configurations

1. Python 3.12.7 programming language is used for the development of color models.
2. The code is run using Spyder created with Anaconda Navigator (anaconda3).The installation guide can be found on their official website[1].

3 Data Selection

Datasets have been selected and downloaded from three different data sources mentioned below:

1. FER-2013: - https://www.kaggle.com/datasets/msambare/fer2013
2. RAVDESS Emotional Speech Audio: - https://www.kaggle.com/datasets/uwrfkaggler/ravdess-emotional-speech-audio
3. CREMA-D: - https://www.kaggle.com/datasets/ejlok1/cremad
4. Toronto Emotional Speech Set (TESS): - https://www.kaggle.com/datasets/ejlok1/toronto-emotional-speech-set-tess
5. Survey Audio-Visual Expressed Emotion (SAVEE): - https://www.kaggle.com/datasets/ejlok1/surrey-audiovisual-expressed-emotion-savee
6. Self-Recorded Videos

[1]https://docs.anaconda.com/navigator/install

4 Setting up the Project Structure

Here first I created a project directory named "Emotion Detection Complete Project". Inside the project folder there are 4 folders namely: - "Emotion Detection Through Audio Files", "Emotion Detection Through Images", "Emotion Detection Through Live Camera Feed" and "Emotion Detection Through Recorded Video". Along with these folders there exists one Requirements.txt. This file contains all the necessary libraries that are needed in order to run the project properly.

4.1 Install Required Libraries:

Use the code for installing all the libraries: -

```
In [4]: pip install -r Requirements.txt
```

Figure 1: - Installing the required libraries

4.2 Emotion Detection Through Images

It is recommended that the **"Emotion_Detection_Through_Images"** Jupyter source file must be run on Google Colab to receive the results in least time. This is being said because you won't need any dataset in hand for running this file. The code written on the file will download the dataset automatically from Kaggle. In this case, FER2013 is being used as the dataset here. After this just run every cell of the file on **Google Colab with T4 GPU** as on. You will start getting the results there after.

```
!kaggle datasets download -d msambare/fer2013

Dataset URL: https://www.kaggle.com/datasets/msambare/fer2013
License(s): DbCL-1.0
Downloading fer2013.zip to /content
 83% 50.0M/60.3M [00:00<00:00, 178MB/s]
100% 60.3M/60.3M [00:00<00:00, 168MB/s]
```

Figure 2: - Installing the required dataset

4.3 Emotion Detection Through Live Camera Feed

When you click at this folder, you will see a .py file with name **"Emotion_Detection_Through_Live_Camera".** Along with that there may exist another important file in the same folder as **"haarcascade_frontalface_default.xml".** This file will be used when you will run the "Emotion Detection Through Live Camera" file.

Enter the correct file path for **haarcascade_frontalface_default.xml** file while using the main file. This file must be operated on **Spyder** Application. It is available at Anaconda Navigator.

```
from keras.models import load_model
from time import sleep
from keras.preprocessing.image import img_to_array
from keras.preprocessing import image
import cv2
import numpy as np

face_classifier=cv2.CascadeClassifier("Enter the file path for haarcascade_frontalface_default.xml file")
emotion_model = load_model('emotion_detection_model_100epochs.h5')
class_labels=['Angry','Disgust', 'Fear', 'Happy','Neutral','Sad','Surprise']
```

Figure 3: - Enter the correct file path for haarcascade_frontalface_default.xml before running the code

4.4 Emotion Detection Through Recorded Video

When you click at this folder, you will see a .py file with name **"Emotion_Detection_Through_Recorded_Video".** Along with that there may exist same important file in the same folder as **"haarcascade_frontalface_default.xml".** This file will be used when you will run the "Emotion Detection Through Live Camera" file. Along with all this, there may exist one sample video named: - "Sample Video For Testing".

You can test the code on this video. You can open the video as well to double confirm whether the model is predicting the right emotion or not. This file must be operated on **Spyder** Application. It is available at Anaconda Navigator. Do remember that you may need to update the video file path on the code as it is on your computer. This may ensure that the code runs properly.

```
import sys
from deepface import DeepFace
import cv2
from collections import Counter  # To track the most frequent emotion

# Path to the video file
video_path = "Enter your video file path"
```

Figure 3: - Enter the correct file path before running the code

4.5 Emotion Detection Through Audio File

When you click at this folder, you will see a .py file with name **"Audio_Detection_Emotion_File _From_Scratch".** Along with that there may many other files that you may get as the output when you will run this entire file. This includes files like: - best_model1_weights.keras, CNN_model and CNN_model_weights.weights which you will get after training the model and extracting the best weights out of them.

Apart from this in the dataset folder you will find 4 dataset subfolders namely: - ALL, CREMA-D, RAVDESS Emotional Speech Audio and TESS Toronto emotional speech set data. Now for smooth training purposes, we have combined the data paths of all 4 datasets in response to RAVDESS Emotional Speech Audio so that there may be no issue in feature count during feature extraction since after data paths are combined all audio files can be extracted with same amount of features as RAVDESS Emotional Speech Audio files.

	A	B
1	Emotions	Path
2	neutral	C:\Users\MAYANK\Desktop\National College of Ireland stuff\Semester 3\Eye Face Detection\Audio_Speech_Emotion_Recognition\RAVDESS Emotional speech audio\Actor_01/03-01-01-01-01-01-01.wav
3	neutral	C:\Users\MAYANK\Desktop\National College of Ireland stuff\Semester 3\Eye Face Detection\Audio_Speech_Emotion_Recognition\RAVDESS Emotional speech audio\Actor_01/03-01-01-01-01-02-01.wav
4	neutral	C:\Users\MAYANK\Desktop\National College of Ireland stuff\Semester 3\Eye Face Detection\Audio_Speech_Emotion_Recognition\RAVDESS Emotional speech audio\Actor_01/03-01-01-01-02-01-01.wav
5	neutral	C:\Users\MAYANK\Desktop\National College of Ireland stuff\Semester 3\Eye Face Detection\Audio_Speech_Emotion_Recognition\RAVDESS Emotional speech audio\Actor_01/03-01-01-01-02-02-01.wav
6	neutral	C:\Users\MAYANK\Desktop\National College of Ireland stuff\Semester 3\Eye Face Detection\Audio_Speech_Emotion_Recognition\RAVDESS Emotional speech audio\Actor_01/03-01-02-01-01-01-01.wav
7	neutral	C:\Users\MAYANK\Desktop\National College of Ireland stuff\Semester 3\Eye Face Detection\Audio_Speech_Emotion_Recognition\RAVDESS Emotional speech audio\Actor_01/03-01-02-01-01-02-01.wav
8	neutral	C:\Users\MAYANK\Desktop\National College of Ireland stuff\Semester 3\Eye Face Detection\Audio_Speech_Emotion_Recognition\RAVDESS Emotional speech audio\Actor_01/03-01-02-01-02-01-01.wav
9	neutral	C:\Users\MAYANK\Desktop\National College of Ireland stuff\Semester 3\Eye Face Detection\Audio_Speech_Emotion_Recognition\RAVDESS Emotional speech audio\Actor_01/03-01-02-01-02-02-01.wav
10	neutral	C:\Users\MAYANK\Desktop\National College of Ireland stuff\Semester 3\Eye Face Detection\Audio_Speech_Emotion_Recognition\RAVDESS Emotional speech audio\Actor_01/03-01-02-02-01-01-01.wav
11	neutral	C:\Users\MAYANK\Desktop\National College of Ireland stuff\Semester 3\Eye Face Detection\Audio_Speech_Emotion_Recognition\RAVDESS Emotional speech audio\Actor_01/03-01-02-02-01-02-01.wav
12	neutral	C:\Users\MAYANK\Desktop\National College of Ireland stuff\Semester 3\Eye Face Detection\Audio_Speech_Emotion_Recognition\RAVDESS Emotional speech audio\Actor_01/03-01-02-02-02-01-01.wav
13	neutral	C:\Users\MAYANK\Desktop\National College of Ireland stuff\Semester 3\Eye Face Detection\Audio_Speech_Emotion_Recognition\RAVDESS Emotional speech audio\Actor_01/03-01-02-02-02-02-01.wav
14	happy	C:\Users\MAYANK\Desktop\National College of Ireland stuff\Semester 3\Eye Face Detection\Audio_Speech_Emotion_Recognition\RAVDESS Emotional speech audio\Actor_01/03-01-03-01-01-01-01.wav
15	happy	C:\Users\MAYANK\Desktop\National College of Ireland stuff\Semester 3\Eye Face Detection\Audio_Speech_Emotion_Recognition\RAVDESS Emotional speech audio\Actor_01/03-01-03-01-01-02-01.wav
16	happy	C:\Users\MAYANK\Desktop\National College of Ireland stuff\Semester 3\Eye Face Detection\Audio_Speech_Emotion_Recognition\RAVDESS Emotional speech audio\Actor_01/03-01-03-01-02-01-01.wav
17	happy	C:\Users\MAYANK\Desktop\National College of Ireland stuff\Semester 3\Eye Face Detection\Audio_Speech_Emotion_Recognition\RAVDESS Emotional speech audio\Actor_01/03-01-03-01-02-02-01.wav
18	happy	C:\Users\MAYANK\Desktop\National College of Ireland stuff\Semester 3\Eye Face Detection\Audio_Speech_Emotion_Recognition\RAVDESS Emotional speech audio\Actor_01/03-01-03-02-01-01-01.wav
19	happy	C:\Users\MAYANK\Desktop\National College of Ireland stuff\Semester 3\Eye Face Detection\Audio_Speech_Emotion_Recognition\RAVDESS Emotional speech audio\Actor_01/03-01-03-02-01-02-01.wav
20	happy	C:\Users\MAYANK\Desktop\National College of Ireland stuff\Semester 3\Eye Face Detection\Audio_Speech_Emotion_Recognition\RAVDESS Emotional speech audio\Actor_01/03-01-03-02-02-01-01.wav

Figure 4: - data_path file having the combined paths of all 4 dataset files

While you will run the code you may get an output file named: - emotions.csv which will be having all the emotions extracted out of all the audio files available in the dataset. The output emotions.csv file will be generated in the main working directory.

A1 0

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
2	0.173828	0.264648	0.372559	0.486328	0.625488	0.681152	0.720703	0.651855	0.562988	0.559082	0.55957	0.567383	0.541016	0.52002	0.437012	0.421387	0.37207	0.341309	0.308594	0.203613	0.149414	0.071777	0.047363
3	0.254395	0.375977	0.504883	0.49707	0.491699	0.489258	0.486816	0.495605	0.507324	0.508789	0.510742	0.503418	0.5	0.509277	0.503906	0.506836	0.470215	0.43457	0.348633	0.237305	0.158691	0.075684	0.049316
4	0.256348	0.354492	0.471191	0.414063	0.378418	0.373535	0.354492	0.408691	0.466797	0.522461	0.580566	0.585938	0.5625	0.483398	0.415527	0.346191	0.292969	0.277344	0.20166	0.143066	0.105469	0.062988	0.07373
5	0.246582	0.360352	0.48291	0.473145	0.473145	0.482422	0.490234	0.506836	0.514648	0.517578	0.522949	0.511719	0.497559	0.499023	0.484375	0.475586	0.435547	0.364258	0.253906	0.159668	0.107422	0.063965	0.08252
6	0.24707	0.389648	0.564941	0.642578	0.665527	0.68457	0.67627	0.666992	0.648926	0.595703	0.52832	0.496582	0.450195	0.521484	0.551758	0.553223	0.497559	0.396484	0.350586	0.247559	0.180664	0.10791	0.033203
7	0.250977	0.379395	0.501953	0.493164	0.50293	0.50293	0.515137	0.527344	0.522949	0.509766	0.494141	0.48877	0.479492	0.491699	0.497559	0.505371	0.48877	0.447266	0.404785	0.280273	0.18457	0.108887	0.03418
8	0.216309	0.289551	0.348633	0.321777	0.316406	0.348145	0.403809	0.442871	0.438965	0.421387	0.39209	0.35498	0.325195	0.305176	0.277344	0.282715	0.274414	0.277344	0.25293	0.180664	0.128906	0.079102	0.061523
9	0.254395	0.39209	0.518066	0.521484	0.520508	0.510742	0.512695	0.512695	0.512695	0.509277	0.498047	0.497559	0.498047	0.501953	0.509277	0.489746	0.461426	0.419434	0.335449	0.243164	0.15918	0.092773	0.073242
10	0.183105	0.376953	0.55127	0.64209	0.800781	0.777832	0.80127	0.789551	0.794922	0.850098	0.879395	0.853516	0.832031	0.777344	0.726074	0.68457	0.541992	0.385742	0.220703	0.102051	0.05957	0.063965	0.068848
11	0.253906	0.381348	0.510742	0.511719	0.516602	0.503906	0.50293	0.499023	0.505371	0.520996	0.514648	0.516113	0.506836	0.503906	0.500977	0.496582	0.477539	0.388184	0.290527	0.195313	0.108398	0.089355	0.091309
12	0.239258	0.356934	0.471191	0.444824	0.421875	0.395508	0.362305	0.356445	0.356934	0.373535	0.384277	0.396484	0.377441	0.325195	0.254883	0.174316	0.118652	0.092773	0.096191	0.09375	0.091309	0.082031	0.078125
13	0.255859	0.387695	0.509277	0.506348	0.503418	0.494141	0.496094	0.493652	0.493164	0.503906	0.507324	0.504883	0.51123	0.499512	0.4375	0.345703	0.242188	0.154297	0.113281	0.099121	0.095215	0.081055	0.078125
14	0.248535	0.411621	0.51416	0.41748	0.60498	0.636719	0.708008	0.695313	0.612793	0.41748	0.45459	0.541504	0.56543	0.724609	0.63916	0.542969	0.449219	0.299805	0.1875	0.100098	0.053223	0.061523	0.0625
15	0.251953	0.377441	0.507813	0.501465	0.513672	0.521484	0.508789	0.504883	0.502441	0.491211	0.491699	0.505371	0.499023	0.502441	0.504883	0.487793	0.461426	0.349609	0.243652	0.140137	0.061523	0.067383	0.071289
16	0.262695	0.384277	0.498047	0.458496	0.447266	0.410645	0.381348	0.361816	0.376465	0.394043	0.411133	0.416504	0.343262	0.304688	0.239746	0.17627	0.146973	0.097656	0.075195	0.065918	0.067383	0.067383	0.069824
17	0.243164	0.360352	0.492188	0.498047	0.509277	0.516602	0.512695	0.506348	0.502441	0.500488	0.495117	0.503906	0.494141	0.488281	0.479004	0.453613	0.369629	0.272461	0.177734	0.103027	0.088379	0.084961	0.088379
18	0.220215	0.37793	0.37793	0.441406	0.338867	0.388184	0.604004	0.743652	0.846191	0.864746	0.860352	0.842285	0.850098	0.766113	0.742676	0.679688	0.567871	0.513184	0.410156	0.349121	0.258301	0.182129	0.109375
19	0.257324	0.378906	0.504883	0.511719	0.50293	0.518555	0.514648	0.504883	0.501953	0.487793	0.492188	0.49707	0.49707	0.48877	0.48584	0.48877	0.492188	0.474609	0.450195	0.422852	0.317871	0.230957	0.146973
20	0.239258	0.350098	0.456543	0.411621	0.364746	0.333496	0.339844	0.374023	0.382813	0.405273	0.395996	0.373047	0.356934	0.322754	0.305664	0.322266	0.334473	0.356934	0.348633	0.268066	0.200684	0.131836	0.077148

Figure 5: - emotions file having the features extracted out of all the audio files

After that you may also receive some pickle files as the output namely: - encoder2.pickle and scaler2.pickle which can be used for saving the models and calling them so that next time you can use the already trained models for prediction and thus you will not require to run the entire code and train the models again.

For this there exists another .py file namely: - **"Code with pre-trained model".** This file can be run when you do not want to run the entire code and train the models once again. Here give the correct local file paths where you have saved the CNN Model, best_model1_weights.keras, scaler2.pickle and encoder2.pickle files. After mentioning the correct file paths you will be able to run this file and may predict the emotion of any audio file.

```
import numpy as np
import librosa
from tensorflow.keras.models import model_from_json
import pickle

# Load the pre-trained model
with open("Here enter the path for pre-loaded CNN model", 'r') as json_file:
    loaded_model_json = json_file.read()
loaded_model = model_from_json(loaded_model_json)
loaded_model.load_weights("Here enter the path where you have saved best_model1_weights.keras
print("Loaded model from disk")

# Load the scaler
with open("Here enter the path where you have saved scaler2.pickle", 'rb') as f:
    scaler = pickle.load(f)

# Load the encoder
with open("Here enter the path where you have saved encoder2.pickle", 'rb') as f:
    encoder = pickle.load(f)
```

Figure 6: - Mention the correct file paths while using the "Code with Pre-trained Model" file

While testing just use the files from RAVDESS Dataset folder. This is because the file path is combined with response to RAVDESS. If you may use any other folder for testing then it may through error while trying to extract the features from that audio file. This is because the expected and actual dimensions of features will be different.

5 Google Drive Links to the Dataset

Due to the memory constraints while submitting the final work, I am also attaching the google drive links of all the datasets used for image and audio emotion detection but that could not be added due to less memory available for submission. These include: -

1. **Dataset used for performing the emotion detection through images: -** https://drive.google.com/drive/folders/1te0XnSZWfT_ZAWGGkKk-NGGwlnoOQ27a?usp=sharing
2. Datasets used for Audio Emotion Detection: - https://drive.google.com/drive/folders/1xIiZu-O3CxC8E2LKF8GEQwymMFsZJyXp?usp=sharing

6 Files that may need link to open

Due to the memory constraints while submitting the final work, I am also attaching the google drive links of all the trained models keras files that are quite large. These files are namely: - **VGG16_Transfer_Learning.keras, ResNet50_Transfer_Learning.keras, Custom_CNN_augmented_model.keras and Custom_CNN_model.keras.** Since they are taking lot of space so I cannot upload them directly on moodle link. That is why I am uploading them to my google drive account and may share the link so that these files can be accessed and downloaded by anyone who has the link. Additionally, I may be adding one more file **"emotions.csv".** This file is also big, that is why I will be sharing the link for it too. This file comes as an output when the emotion detection through the audio file is run. If you want to access these files then kindly use the links I am attaching below: -

https://drive.google.com/drive/folders/1YwCQV25h0uoP6yOYMdzLrZjmP7IsfPfs?usp=sharing