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PROJECTS

In a Bachelor of Technology , projects play a crucial role in practical learning and skill development. These projects vary across disciplines such as Computer Science, Electrical Engineering, ,Electronics and communication Engineering,Mechanical Engineering, Civil Engineering, and more. They serve several purposes:

1. **Hands-on Application:** Projects allow students to apply theoretical knowledge to real-world scenarios. This practical application helps in understanding concepts better.
2. **Problem-Solving Skills:** Students encounter challenges during project work, fostering problem-solving abilities and encouraging innovative thinking.
3. **Teamwork and Collaboration:** Many projects involve teamwork, promoting collaboration, communication, and project management skills essential in professional settings.
4. **Industry Relevance:** B.Tech projects often focus on industry-specific problems or innovations, preparing students for the demands of the professional world.
5. **Research and Development:** Some projects involve research, encouraging students to explore new ideas, technologies, or methodologies within their field.
6. **Presentation and Communication Skills:** Students often present their projects, honing their abilities to articulate ideas and findings effectively.

Project topics can range from software development, robotics, renewable energy systems, infrastructure design, to data analysis, among others. The diversity of projects allows students to specialize in areas of interest and gain practical experience aligned with their career goals.

Overall, these projects serve as a bridge between academic learning and practical implementation, preparing students to become competent engineers or professionals in their chosen field upon graduation.

KTU B.Tech Curriculum

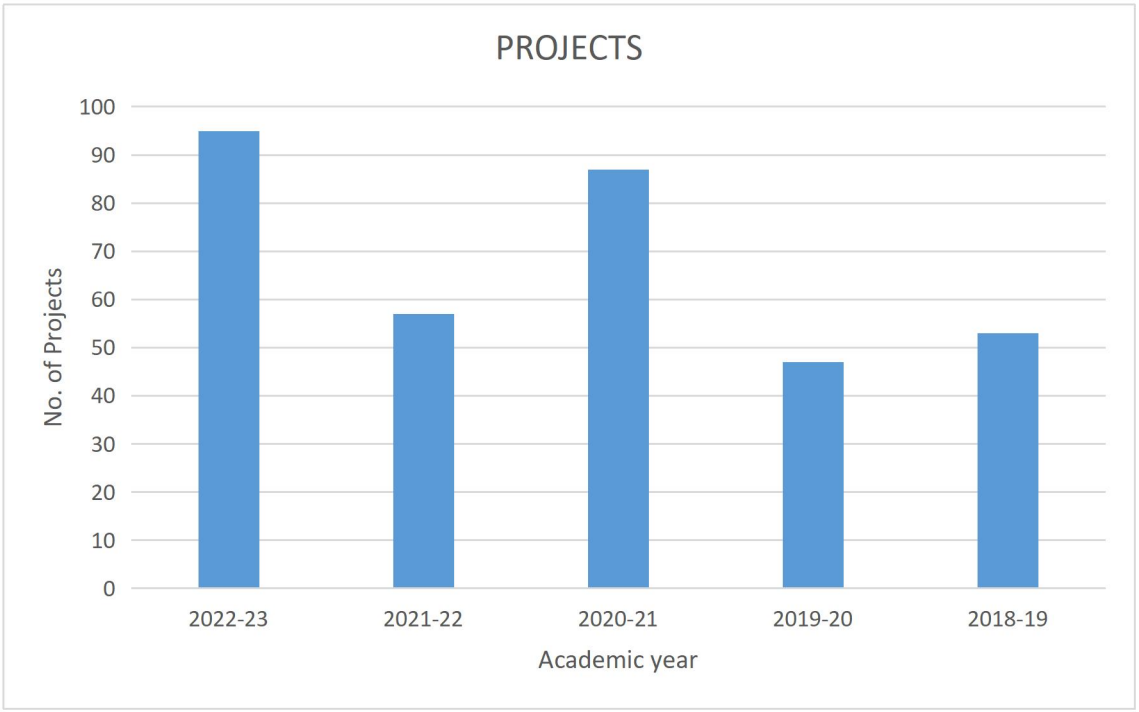
Clause R3.7 - Sl. No 7 describes the role of project work in B.Tech regulation

R3.7

Every course of B. Tech. Program shall be placed in one of the nine categories as listed in table below.

S. No.	Category	Code	Breakup of Credits
1	Humanities and Social Sciences including Management courses	HSMC	8
2	Basic Science courses	BSC	26
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc	ESC	22
4	Professional core courses	PCC	76
5	Professional Elective courses relevant to chosen specialization/branch	PEC	15
6	Open subjects – Electives from other technical and /or emerging subjects ` as specified in the curriculum concerned.	OEC	03
7	Project work, seminar and internship in industry or elsewhere	PROJ	10
8	Mandatory Courses [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Traditional Knowledge]	MC	Non credit
9	Mandatory Student Activities (Pass/Fail)	SA	2
		Total Credits	162

BAR CHART



Course code	Course Name	Credits	Year of Introduction
**492	PROJECT	6	2016

Prerequisite : Nil

Course Objectives

- To apply engineering knowledge in practical problem solving
- To foster innovation in design of products, processes or systems
- To develop creative thinking in finding viable solutions to engineering problems

Course Plan

In depth study of the topic assigned in the light of the preliminary report prepared in the seventh semester
Review and finalization of the approach to the problem relating to the assigned topic
Preparing a detailed action plan for conducting the investigation, including team work
Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed
Final development of product/process, testing, results, conclusions and future directions
Preparing a paper for Conference presentation/Publication in Journals, if possible
Preparing a report in the standard format for being evaluated by the dept. assessment board
Final project presentation and viva voce by the assessment board including external expert

Expected outcome

The students will be able to

iii. Think innovatively on the development of components, products, processes or technologies in the engineering field
iv. Apply knowledge gained in solving real life engineering problems

Evaluation

Maximum Marks : 100

(i) Two progress assessments	20% by the faculty supervisor(s)
(ii) Final project report	30% by the assessment board
(iii) Project presentation and viva voce	50% by the assessment board

Note: All the three evaluations are mandatory for course completion and for awarding the final grade.

Department of Electronics and Communication Engineering

VJEC,Chemperi

Guidelines for doing Project

We all know that the project has an important role in our future life because it has a main part in all interviews. So here we are giving some guidelines to ensure the quality of your project work

1. ***Choosing the project***
   - You should choose the subject of your project carefully.
   - If you feel strongly motivated with the subject you will be thinking of new ideas, designs and calculations at any possible opportunity and this will undoubtedly help you achieve your best
   - Please avoid repetitions. If you are doing some repeated work, then make sure that the idea and technology that you are using is a new one.
   - Get it approved by your project guide

2. ***Work in the project***

   - Please keep in mind that you have only 14 project days (4th march to 15th march) and regular project hours in this semester. So do a small part of your project in all project hours.
   - Divide the whole work in your team and make sure that each person is responsible for the completion of your project work
   - Students are expected to research background material for the project by reviewing books, journals and magazines in the library as well as using online sources available on the network
   - Students should take a prior permission from the project coordinator before going either in internet lab or in electronics lab in project hours
   - Students should maintain regular contact with their guides throughout the duration of the project.

3. ***The Log book***

   - Each batch should keep a logbook.
   - The purpose is to take notes of their own ideas, notes from literature searches, notes of meetings and discussions with the guide, developments, designs and calculations and in general, to document all the work done in the project
   - All entries to the logbook should be dated
   - Submit the logbook at every Monday to the project coordinator only after getting the approval from their guides
   - This will be useful in writing the final project report

RUBRIC FOR ASSESSMENT OF PRESENTATION

INDICATORS	VERY GOOD (5)	ACCEPTABLE (3)	UNACCEPTABLE (1)
Content completeness	Presentation includes allthe relevant key information needed	Presentation includesInformation but less relevant	Presentation lacks information
Organization of presentation	Information is in logical, interesting sequence with illustrations which audience can follow.	Information is in logical sequence which audience can follow but lacks in illustration	Cannot understand presentation because there is no sequence of information.
Clarity in delivery	Presentation audible to all and communication is effective	Presentation mostly audible and communication is not effective	Presentation is not audible
Information gathering	Digs up all kinds of information (core and peripheral related to task, comes up with exhaustive information including all the background	Collects adequate information about the task but not much about related ones	Collects minimal information and about just the particular tool/ technology
Responsiveness to Audience	Response to queries (core and peripheral level) of audience with clarity and confidence	Response to queries (core but not peripheral level) of audience with less clarity and confidence	Response to the queries is poor

ASSESSMENT SUMMARY SHEET
EC 492 PROJECT

Sl. No.	Name of the Student	Performance Indicators					
		Organization of presentation	Content completeness	Information gathering	Clarity in delivery	Responsive-ness to Audience	Total (25)

Name and Signature of Staff

Signature Not Verified

Principal.VJEC

DETECTION OF COVID-19 AND PNEUMONIA USING DEEP LEARNING

A Mini Project Report

submitted to

the APJ Abdul Kalam Technological University

in partial fulfillment of the requirements for the degree of

Bachelor of Technology

by

DENI THOMAS(VML20AD010)

DEVA NAIR(VML20AD011)

VAISHAKH P(VML20AD030)

VISHNU PRIYA N(VML20AD031)

under the supervision of

Ms.ANIT THOMAS

Assistant Professor

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

VIMAL JYOTHI ENGINEERING COLLEGE CHEMPERI

CHEMPERI P.O. - 670632, KANNUR, KERALA, INDIA

April 2023

VIMAL JYOTHI
INSTITUTIONS,CHEMPERI - KANNUR
CHEMPERI - KANNUR 0460 2212240

Accredited

NATIONAL BOARD OF ACCREDITATION
B.Tech - CSE & EEE

DEPT. OF COMPUTER SCIENCE AND ENGINEERING

CERTIFICATE

This is to certify that the report entitled **"DEEP LEARNING MODEL FOR CLASSIFYING COVID 19 AND PNEUMONIA LUNG DISEASES"** submitted by **DENI THOMAS** (VML20AD010), **DEVA NAIR** (VML20AD011), **VAISHKAKH P** (VML20AD030) & **VISHNU PRIYA N** (VML20AD031) to the APJ Abdul Kalam Technological University in partial fulfillment of the B.Tech. degree in Computer Science and Engineering is a bonafide record of the project work carried out by them under our guidance and supervision. This report in any form has not been submitted to any other University or Institute for any purpose.

27/7/23

Ms. ANIT THOMAS M
(Project Coordinator and Guide)
Dept.of CSE
Vimal Jyothi Engineering College
Chemperi

Place : VJEC Chemperi
Date : 27-06-2023

Head of the department

VIMAL JYOTHI ENGINEERING COLLEGE
Dated.....
CHEMPERI-670 632

(Office Seal)

DECLARATION

We hereby declare that the project report **Detection of covid-19 and pneumonia using deep learning** , submitted for partial fulfillment of the requirements for the award of degree of Bachelor of Technology of the APJ Abdul Kalam Technological University, Kerala is a bona fide work done by us under supervision of **Ms. ANIT THOMAS M**

This submission represents our ideas in our own words and where ideas or words of others have been included, we have adequately and accurately cited and referenced the original sources.

We also declare that I have adhered to ethics of academic honesty and integrity and have not misrepresented or fabricated any data or idea or fact or source in my submission. We understand that any violation of the above will be a cause for disciplinary action by the institute and/or the University and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been obtained. This report has not been previously formed the basis for the award of any degree, diploma or similar title of any other University.

DENI THOMAS
DEVA NAIR
VAISHAKH P
VISHNU PRIYA N

CHEMPERI
27-04-2023

ACKNOWLEDGEMENT

The Successful presentation of the mini project on the topic ”Detection of covid-19 and pneumonia using deep learning ” would have been incomplete without the mention of people who made it possible and whose constant guidance crowned our effort into success.

We convey thanks to our project guide Ms. ANIT THOMAS M of Computer Science and Engineering Department for providing encouragement,constant support and guidance which was of a great help to complete this project successfully.

Last but not the least,we wish to thank our parents for financing our studies in this college as well as for constantly encouraging us to learn engineering.Their personal sacrifice in providing this opportunity to learn engineering is greatly acknowledged.

DENI THOMAS

DEVA NAIR

VAISHAKH P

VISHNU PRIYA N

Abstract

Around 450 million people are affected by pneumonia every year, which results in 2.5 million deaths. Coronavirus disease 2019 (Covid-19) has also affected 181 million people, which led to 3.92 million casualties. The chances of death in both of these diseases can be significantly reduced if they are diagnosed early. However, the current methods of diagnosing pneumonia (complaints+chest X-ray) and Covid-19 (real-time polymerase chain reaction) require the presence of expert radiologists and time, respectively. With the help of deep learning models, pneumonia and Covid-19 can be detected instantly from chest X-rays or computerized tomography (CT) scans. The process of diagnosing pneumonia/Covid-19 can become faster and more widespread.

In this paper, we aimed to elicit, explain, and evaluate qualitatively and quantitatively all advancements in deep learning methods aimed at detecting community-acquired pneumonia, viral pneumonia, and Covid-19 from images of chest X-rays and CT scans. Being a systematic review, the focus of this paper lies in explaining various deep learning model architectures, which have either been modified or created from scratch for the task at hand. For each model, this paper answers the question of why the model is designed the way it is, the challenges that a particular model overcomes, and the tradeoffs that come with modifying a model to the required specifications. A grouped quantitative analysis of all models described in the paper is also provided to quantify the effectiveness of different models with a similar goal. Some tradeoffs cannot be quantified and, hence, they are mentioned explicitly in the qualitative analysis, which is done throughout the paper.

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Chapter 1

Introduction

1.1 Introduction

1.1.1 General Background

In this report we are aimed to present the first review of the project ”Deep learning model for classifying covid 19 and pneumonia lung diseases” Lung-related diseases mainly refer to conditions that are caused by lung infections. Lung diseases can be fatal and often lead to respiratory failure. Pneumonia is one kind of lung disease that is mainly caused because of an infection by bacteria, viruses, or fungi. Every year around 150 million children are affected because of pneumonia. Covid19 is another deadliest epidemic that has claimed millions of lives. It is preliminarily caused by the novel SARS-CoV2 virus, which affects the lungs' alveoli. However, if not detected at the early stage of infection, both pneumonia and Covid-19 can stand as lethal weapons to human lives

1.1.2 Problem Statement

One of the significant problems of radiographical findings is that the distinction of pneumonia from other pulmonary diseases cannot be made with certainty on radiological grounds alone. Moreover, this is not the only problem with the current

procedure of pneumonia diagnosis. A considerable number of medical images are produced in hospitals and medical centers daily. Consequently, radiologists are inundated with a large number of images that they have to analyze manually. In these cases, tried and tested deep learning algorithms might be helpful in assisting doctors by marking the part of the lungs where pneumonia/coronavirus disease 2019 (Covid-19) is present.

1.1.3 Scope of the system

- Many automated technologies related to medical imaging have shown promising results over the past few years, but deep learning has quickly gained prominence among them. Researchers have extensively exploited deep learning methods for detecting diseases in various body parts such as the eye, brain,2, 3 and skin.4, 5 In some medical imaging cases, it was shown that the classification performance of a deep learning model was better than that of medical specialists.

- Deep learning models for pneumonia classification and detection can automatically learn complex features from radiographs that may not be visible to the naked eye.

- Even though real-time polymerase chain reaction (RT-PCR) is the accepted as standard in the diagnosis of Covid-19, its sensitivity and specificity are not optimal.11 Other than that, many countries or regions cannot conduct sufficient RT-PCR testing for thousands of subjects in a small span of time because of the lack of people who can perform these tests. In these cases, deep learning algorithms might help if the country has enough imaging machines but fewer people who can perform the test. RT-PCR testing may also be delayed in cases of newly evolved coronavirus, because detection of a newly evolved virus requires the extraction of the new DNA sequence.

1.1.4 Objective

In this paper, we aimed to elicit, explain, and evaluate qualitatively and quantitatively all advancements in deep learning methods aimed at detecting bacterial or viral pneumonia from radiographical images. Since chest X-rays and computerized tomography (CT) scans are the most common radiographical tools doctors use today, we have covered deep learning methods that use chest X-rays, CT scans, or both as input images. As the quantitative results of these models depend on the data sets used, we group these models according to data sets, to perform a fair and uniform quantitative analysis. Although standard data sets are available for bacterial/viral pneumonia detection tasks, the same is not applicable for Covid-19 data sets due to the disease's novelty (in 2021). However, the models that leverage these data sets have been grouped by the amount and quality of images used for training and testing. This being said, it is not uncommon to find deep learning models that fail to perform well in the real world after being trained on data sets with specific sources. The poor performance in the real world is mainly because of the data set shift between training images and the images used in other hospitals. A significant amount of variability in individual hospital images also accounts for the poor performance of these models. To address this problem, we also evaluate and compare the features learned by various models to predict how well they would perform in the real world. The reason for comprehensively compiling all significant research in deep learning for pneumonia detection is to compare different models used in each scenario and identify the best deep learning architectures for each of those scenarios.

Chapter 2

Literature Survey

2.1 A Lightweight CNN Architecture for Chest X-ray Images Analysis to Facilitate Early Stage Detection of Lung Diseases

[1]

2.1.1 Abstract

Lung-related diseases are one of the significant causes of death among infants and children. However, the mortality rate can be reduced by the detection of lung abnormality at an early stage. Traditionally, radiologists identify irregularities by interpreting chest x-ray images which is time-consuming. Therefore, researchers have proposed many automated systems for diagnosing pneumonia and other lung-related diseases. Due to the remarkable performance of Convolutional Neural Networks(CNN) in image classification, it has gained immense popularity in chest x-ray image analysis. Most of the research has utilized famous pre-trained Imagenet models for more accurate analysis of Chest X-ray images. However, the problem with these architectures is that they have many parameters that increase the training time, which makes the detection process lengthy. This paper introduces a lightweight,

compact, and welltuned CNN architecture with far fewer parameters than the pre-trained model to analyze two of the most common lung diseases, pneumonia and Covid-19. We have evaluated our model on two benchmark datasets. Experimental results show that our lightweight CNN model has far fewer hyperparameters than other state-of-the-art models but achieves similar results. We have achieved an accuracy of 90.38% on the kermany dataset and 96.90% on the Covid-19 Radiography dataset.

2.1.2 Methodology

We used Keras, a framework built on TensorFlow, to develop our compact CNN architecture. Finally, we deployed our model and assessed its classification performance on the benchmark dataset using Kaggle, an online computing platform. We have deployed other benchmark approaches in the same environment, maintaining the same training and testing ratio to provide a fair comparison. We have used categorical cross entropy as our loss function and adam optimizer to minimize the loss function. We haven't used a constant learning rate. Instead, we have dynamically updated the learning rate based on validation accuracy. It has provided a significant benefit to the learning process of the model as opposed to keeping it constant. We have taken a batch size of 32. From Figure 5, we can see that in the case of the kermany dataset, after 20 epoch, our training accuracy and validation accuracy gets into a steady phase. In the case of the Covid-19 Radiography dataset, we can see that after only ten epochs, the validation and training accuracy gets in a stable position shown in Figure 6. Finally, we have used dropout in each convolutional block to prevent our model from overfitting.

2.1.3 Conclusion

We have developed a CNN architecture that simultaneously evaluates the output of all the convolutional blocks to enable a more accurate and exact classification of lungrelated disorders, pneumonia, and covid-19. As a result, we have achieved an overall accuracy of 96.90score of 97.00containing pneumonia and covid 19 better than other stateof-the-art approaches. Furthermore, due to being lightweight, our model

can be used in remote parts of developing countries to automatically detect pneumonia and covid-19 in its early stages when there is a shortage of radiologists. In the future, Researchers can use this architecture in other medical fields where there is a need for automated analysis of image modalities.

2.2 Classification of Lung diseases using Convolutional Neural Network algorithms

[2]

2.2.1 Abstract

Since the publication of the book Covid-19, several investigations of varying kinds have been carried out all across the globe to see how well it predicted future events. The early lung illness known as pneumonia is intimately linked to the virus known as Covid-19, which causes severe inflammation of the chest (pneumonic condition). It is difficult for doctors and other medical professionals to differentiate Covid-19 from other lung diseases including pneumonia. As a consequence of this, we need an independent diagnostic platform that is able to provide clinical results in a timely and efficient manner. Chest X-ray screening is the method that provides the most reliable diagnosis of lung disease. The purpose of this investigation was to offer a condensed CNN (RMNet) model for COVID-19 classification. When compared to prior models, the solution that has been developed requires less memory and requires fewer processing resources. When it comes to COVID-19 classification, the performance of the recommended RMNet model ensemble that makes use of ResNet18, Inceptionv3, and MobileNetV2 is superior to that of previously cutting-edge methodologies. Additionally, the ensemble model makes less of a demand on available memory and is straightforward to incorporate into the backend of a smart device. Lung cancer is produced by the unrestrained growth of aberrant cells. This proliferation may begin in either of the lungs, but it most often originates in the cells that border the

airways. Lung cancer can be prevented by maintaining a healthy immune system. These abnormal cells do not develop into lung tissue that is healthy; instead, they rapidly multiply and produce tumours. This is because of how they behave. The process by which cancer cells spread from the primary site of the disease to other parts of the body is referred to as ”metastasis.” Once the disease has spread to other areas of the body, it is much more challenging to treat it in an appropriate manner. Primary or secondary lung cancer is a classification that may be used to this disease. Primary lung cancer starts in the lungs, but secondary lung cancer starts elsewhere in the body, metastasizes, and then spreads to the lungs. Both types of lung cancer may be fatal. Because medical professionals consider them to be separate manifestations of the illness, they are not treated the same way because of this belief. The information offered by symptoms, in addition to the findings of a number of other tests, is taken into consideration by medical professionals when making a diagnosis of lung cancer. Imaging techniques such as chest X-rays, bronchoscopies, CT scans, MRI scans, and PET scans are examples of what are known as conventional imaging methods. In addition, the doctor will do a physical examination on the patient, as well as an inspection of the chest, and a test to determine whether or not there is blood in the sputum. The goal of each of these procedures is to zero in on the specific location of the tumour and determine whether other organs in the body may be at risk due to the presence of the malignant growth.

2.2.2 Methodology

Before establishing a medical diagnosis in daily life, it is in everyone’s best interest to gather the perspectives of many trained professionals in the field of medicine. The inference is able to function at a higher level of effectiveness when there is consensus among health professionals on a certain topic. Because all of the learning algorithms that are often used are based on the same concept, we incorporated several of them in the design that we showed. They have been educated on how to independently develop their projections. The models are then integrated using a brand new method called

weighted average ensembling in order to make a prediction about the class value. The forecast ought to be more accurate now that there is a different approach to fitting the parts together. ResNet18, InceptionV3, and MobileNetV2 are the three CNN models that we want to use, all of which have previously undergone training. The X-ray scans of the lungs of all three patients were obtained from Kaggle, an online database that is easily accessible.

2.2.3 Conclusion

In addition, dangerous environments may rapidly destroy models that are dependent on either deep learning or machine learning. This sort of work is essential in the contemporary smart healthcare system, and it is essential to evaluate the robustness of the recommended technique for the classification of lung illness in an adversarial scenario. A CNN ensemble classification technique has been developed in this study for the purpose of classifying pneumonia cases in lung X-ray images as being caused by either Covid-19, viral, or bacterial infections. In this particular scenario, six alternative CNN models called SqueezeNet, XceptionNet, Vgg-19, ResNet-18, MobileNetV2, and InceptionV3 were developed on the same dataset using ideal exchange learning and fine-tuning algorithms. This approach might, for example, increase performance for lung disease classification while simultaneously decreasing the computing cost of the model. This would be accomplished by reducing the number of characteristics included inside the model. It is possible that the technique being proposed may assist medical professionals by categorising lung sickness rather than pinpointing the location of damaged lung tissue in chest X-rays. When infected area detection of chest x-rays is employed, the computational difficulty of correctly identifying lung disease is decreased, and the performance of correctly detecting lung illness is enhanced. For the CNN outfit approach, the three CNN models that proved to be the most successful overall were picked. These models were ResNet-18, MobileNetv2, and InceptionV3. During the testing phase, this group technique was successful in achieving the desired level of yield.

2.3 COVID-19 RELATED LUNG DISEASE DETECTION AND CLASSIFICATION USING A DEEP LEARNING SYSTEM

[3]

2.3.1 Abstract

- COVID-19 is one of the worst illnesses in history is a pandemic. The virus is known as SARSCOVID-2 because researchers have shown that it mostly affects the respiratory system and resembles the SARS variation. In some circumstances, it might cause pneumonia and a collapse of the respiratory system. To diagnose the patients' conditions and ascertain whether lung illness was involved, doctors used X-rays or Computed Tomography (CT) scans. In this study, pulmonary conditions associated with COVID-19 are identified and described using a deep learning method. To diagnose conditions including COV-19, lung cancer, and bacterial pneumonia, the suggested method makes use of CT scan pictures. A 2D picture from a CT scan offers more trustworthy results. The 50 layers of this method are organized into a ResNet-50 convolutional neural network (CNN). Comparing the experimental results to the current methods, a higher yield accuracy is predicted.

2.3.2 Methodology

Due to the Deep Convolutional Neural Network-based algorithm used in this method, a variety of lung respiratory disorders, including COVID-19, pneumonia, and lung cancer, may be recognized and classified. The suggested approach facilitates the extraction of numerous proprties fom the database of preserved CT scan images. Preprocessing was done on these images to imrove image quality while still treatingthem as patient input. Compared to X-rays, the picture clarity data from the CT image dataset utilized in this method is better for training. Utilizing the ResNet50 architecture, this method

is utilized to obtain the features from the training dataset

2.3.3 Conclusion

Deep learning based COVID-19 lung disease detection and categorization were the main focus of the proposed approach. This method assist in the detection of lung cancer and bacterial pneumonia using CT scan pictures. the suggested technique made using CNN with 50 layers in the ResNet50 architecture. This method aids user in making judgements under pressure and offers rapid diagnosis of COVID-19 and lung disorders. when the experimental findings are compared to existing practices, the accuracy is 96%

2.4 Deep learning models for classifying cancer and COVID-19 lung diseases

[4]

2.4.1 Abstract

— The use of Computed Tomography (CT) images for detecting lung diseases is both hard and timeconsuming for humans. In the past few years, Artificial Intelligence (AI), especially, deep learning models have provided impressive results vs the classical methods in a lot of different fields. Nowadays, a lot of researchers are trying to develop different deep learning mechanisms to increase and improve the performance of different systems in lung disease screening with CT images. In this work, different deep learning-based models such as DarkNet-53 (the backbone of YOLO-v3), ResNet50, and VGG19 were applied to classify CT images of patients having Corona Virus disease (COVID-19) or lung cancer. Each model's performance is presented, analyzed, and compared. The dataset used in the study came from two different sources, the

large-scale CT dataset for lung cancer diagnoses (Lung-PET-CT-Dx) for lung cancer CT images while International COVID-19 Open Radiology Dataset (RICORD) for COVID-19 CT images. As a result, DarkNet-53 overperformed other models by achieving 100accuracy. While the accuracies for ResNet and VGG19 were 80% and 77% respectively.

2.4.2 Methodology

The study aimed to classify data into two categories, Cancer and COVID-19 using different models and compare performance.

- A. Models
- VGG-19: a CNN that is 19 layers deep. Starting with loading the weights of a pre-trained model trained on ImageNet. The network has been pre-trained to categorize photos into 1000 different item categories. Instead of using the three fully connected layers in the original VGG-19, four fully connected layers were used, each layer is followed by RELU as an activation function and dropout layer, and the last layer having 2 layers for binary classification.
- ResNet50: a CNN that is 50 layers deep, and the model used in the study was pre-trained on ImageNet. The network's picture input size is 224×224 pixels. Also,the convolutional layers were followed by the same customized fully connected layers used for VGG-19.
- DarkNet-53: which is the backbone of YOLO-v3, was made later in 2018. Its advantage is that it is significantly faster than other networks while maintaining accuracy. In this study Darknet53 was modified, instead of using the 53 layers, only 40 layers were used, because the purpose of this study is to classify images without the need to reconstruct images. After the 40 convolutional layers, a global maxpooling layer followed by two fully connected layers with a dropout layer between them were used to classify the image.

- B. Hyperparameters
- Optimizer which are algorithms or methods used to minimize an error function (loss function) or to maximize the efficiency of production, was SGD for ResNet and VGG19 and Adam for DarkNet-53. The learning rate was constant for the first 5 epoch (0.0001) then changes as a function of epoch number. The batch size of 8 for train and validation and 16 for the test were used. The binary cross-entropy which calculates the total entropy between the distributions was used as loss function.
- C. Accuracy Assessment
- Confusion matrix (CM), Precision (percent of correct predictions for each class), Recall (percent of the positive cases the model catch) and F1-score (percent of correct positive predictions)

2.4.3 Conclusion

Early detection and diagnosis of both Lung cancer and COVID-19 are very important. Therefore, in this work, multiple CNN models were used to classify cancer-affected patients using CT images. Also, the results of these models and their performance were discussed in which DarkNet-53 has the best performance in detecting both COVID-19 and cancer images, after DarkNet-53 comes ResNet50 and finally VGG-19. After achieving this highly efficient model we can add more data with different classes and do a multiclassification for any lung disease using Ct image.

2.5 Consolidated table

Paper Title	**Proposed Solution**	**Technology Used**	**Advantages**
A Lightweight CNN Architecture for Chest X-ray Images Analysis to Facilitate Early Stage Detection	Collect large dataset, preprocess, feature extraction, model selection, training, evaluation	compact CNN	High accuracy, suitable for real-time applications
Classification of Lung diseases using Convolutional Neural Network algorithms	Collect dataset, preprocess, feature extraction, model selection, training, evaluation, deployment	ResNet18, Inceptionv3, MobileNetV2, RMNet	High accuracy, suitable for real-time applications
COVID-19 RELATED LUNG DISEASE DETECTION AND CLASSIFICATION USING A DEEP LEARNING SYSTEM	Collect dataset, preprocess, feature extraction, model selection, training, evaluation, deployment	ResNet50	Accurate, fast processing
Deep learning models for classifying cancer and COVID-19 lung diseases	Collect dataset, preprocess, feature extraction, model selection, training, evaluation, deployment	DarkNet-53, ResNet50, VGG-19	High accuracy, suitable for real-time applications

Table 2.1: Consolidated table

Chapter 3

Requirement specification

3.1 Functional requirements

- Dataset: The data sets consist of chest X-ray images from patients with pneumonia and COVID-19.
- Preprocessing: Preprocessing of the images is done to improve the picture quality of the CT scan and remove any undesired items from the output.
- Feature extraction: in our proposed custom lightweight CNN, we have fed the output of each convolutional block separately into the flattened layer simultaneously via a skip connection. It has enabled the flattened layer to consider both higher- and lowerorder features equally important. As a result, both the small and large abnormalities in the lung nodule are more accurately captured in our network.
- Model architecture: The deep learning model should be designed with appropriate architecture that can effectively learn the features extracted from the x-ray and CT images. This may include convolutional neural networks (CNNs), recurrent neural networks (RNNs), or a combination of both.
- Training: The deep learning model should be trained using the labeled dataset to learn the relationship between the images and corresponding diseases.

- Evaluation: The performance of the trained model should be evaluated using appropriate evaluation metrics such as accuracy, precision, recall, and F1-score.
- Deployment: The model should be deployed in a way that it can be used to recognize diseases from real-time x-ray and CT images. This may include integration with other software or hardware systems.
- User interface: The system should have a user-friendly interface that allows users to easily input images, and identify the disease.

3.2 Software requirements

- The system should have a high level of accuracy in recognizing covid and pneumonia and predicting correctly.

3.3 User interfaces

- The system should have a user-friendly interface for ease of use.

3.4 Hardware interfaces

- There are no external hardware requirements.

3.5 Non Functional requirements

- Scalability (Transactions per second)
- Traffic on chain

Chapter 4

Proposed system and Design

This chapter mainly discuss about the proposed system and design.Also the architecture and different technical diagrams are discussed in this chapter.

4.1 Proposed system

- The system architecture consists of the following components:
- Input module: This component allows users to input an image to be analyzed by the system.
- Disease detection module: This component uses deep learning algorithms to detect and recognize covid and pneumonia lungs accurately.
- Output module: This component provides the output of recognized disease.

4.2 Feasibility Study

- A feasibility study is an analysis that considers all of a project's relevant factors including economic,technical,legal, and scheduling considerations to ascertain the likelihood of completing the project successfully.

4.2.1 Technical Feasibility

- The proposed system is technically feasible due to the availability of required hardware and software resources,including advanced image processing and machine learning algorithms.

4.2.2 Operational Feasibility

- The system can be easily integrated into existing software systems with a minimal learning curve for non-technical users.

4.2.3 Economic Feasibility

- Although the development cost for the system is high, the cost of implementation and maintenance is reasonable. The proposed system can generate revenue by licensing it to companies requiring covid and pneumonia identification and classification systems.

4.2.4 Legal Feasibility

- The system needs to comply with data privacy regulations like GDPR and CCPA, and the use of x ray and CT images needs to comply with copyright regulations of respective owners.

4.3 Design

- Data collection: The system will collect data from various sources, such as x-ray and CT images, to analyze lung patterns and extract features and identify the disease in the corresponding images.
- Pre-processing: The collected data will undergo pre-processing to eliminate noise, adjust for lighting, and improve the quality of images .

- Feature extraction: Image processing techniques like grayscaling,binarizing etc and Deep learning is used.
- Covid and pneumonia recognition: The system will use the extracted features to recognize whether the lung is affected by covid or pneumonia using an CNN model
- Output: The results of the covid and pneumonia identification processes will be presented in a user-friendly interface, including visualizations and recommendations for users.
- Continuous learning: The system will be designed to continuously learn and improve its recognition and identification accuracy by incorporating feedback and training data from users.

4.3.1 Architecture Diagram

An architectural diagram is a diagram of a system that is used to abstract the overall outline of the software system and the relationships, constraints, and boundaries between components. It is an important tool as it provides an overall view of the physical deployment of the software system and its evolution roadmap.

4.3.2 Data Flow Diagram

A Data Flow Diagram (DFD) is a visual representation of the information flows within a system. It provides information on how how data enters and leaves the system,the changes in the system and where the data is stored. Data flow diagrams visually represent systems and processes. It may be partitioned into levels that represent increasing information flow and functional details. Levels in DFD are numbered 0,1, 2 or beyond.

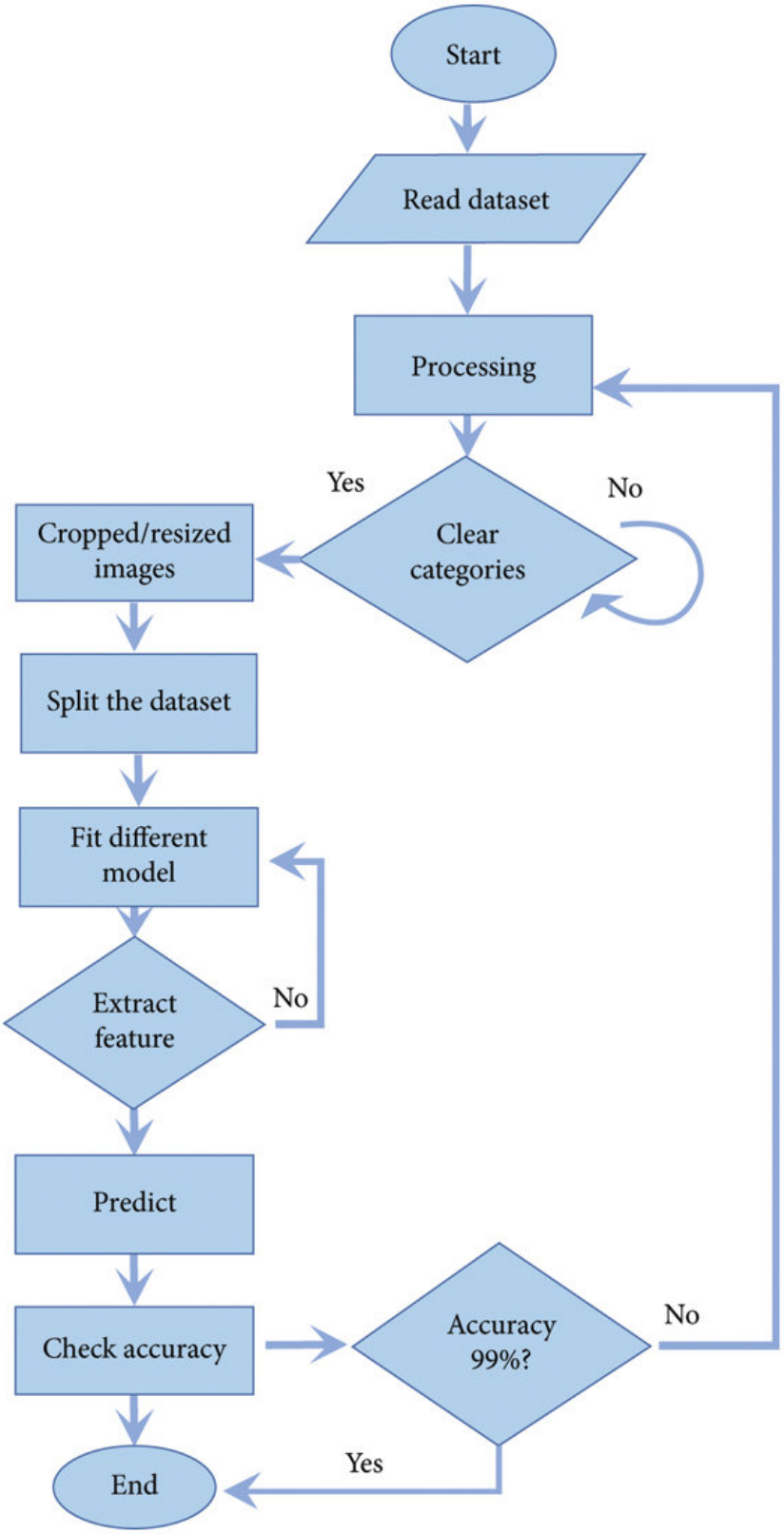

Figure 4.1: Architecture diagram

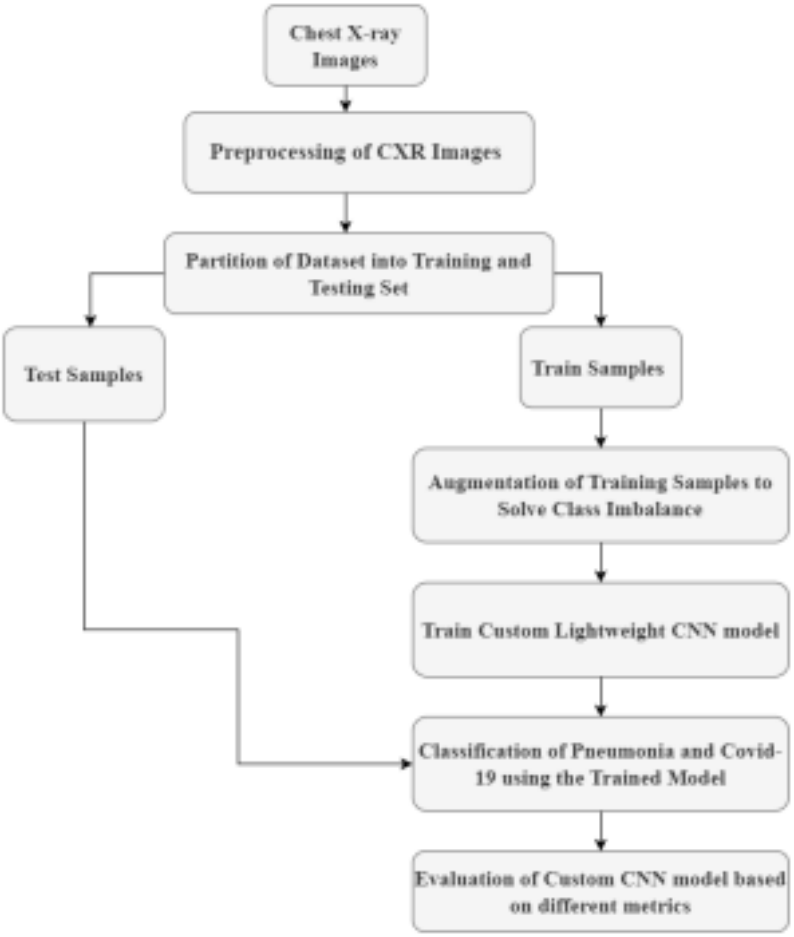

Figure 4.2: Data flow diagram

4.3.3 ER Diagram

An entity-relationship (ER) diagram is a graphical representation of the entities and relationships involved in a system or project. It helps to model the data requirements and business rules of the system, which can then be used to design the database schema.

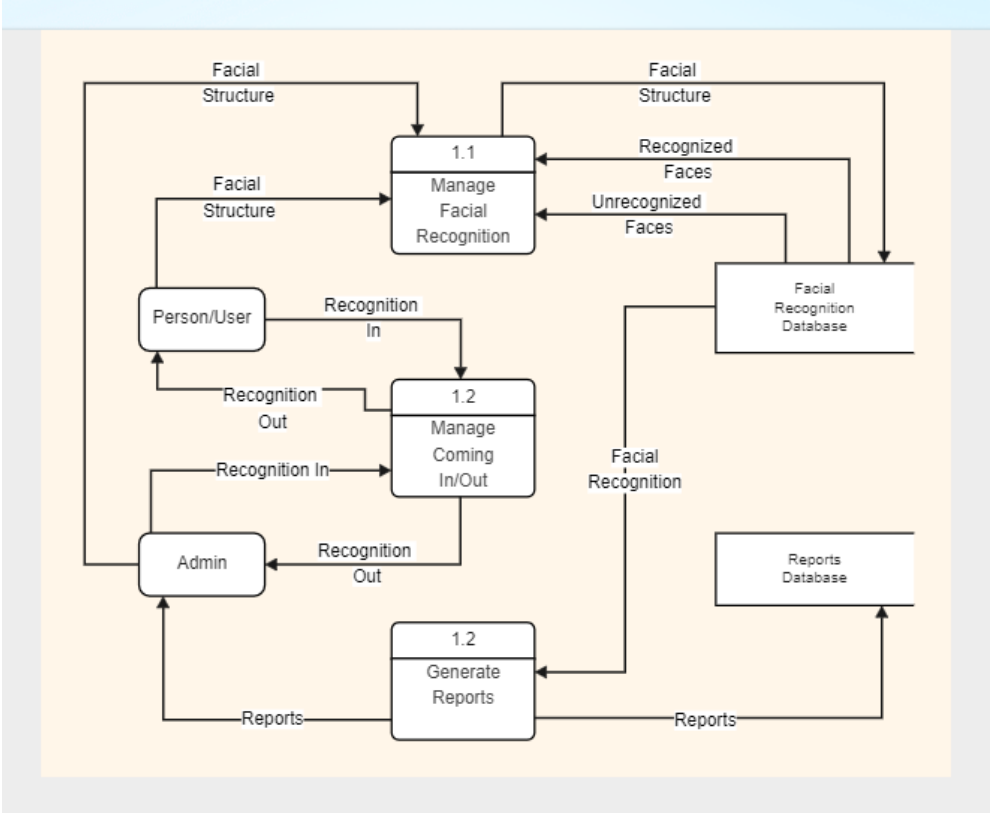

Figure 4.3: ER diagram

4.4 Gantt Chart

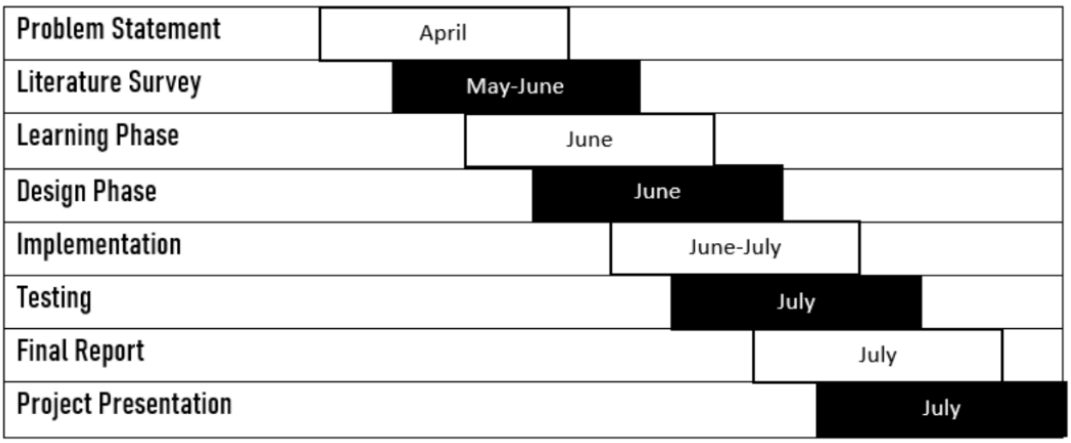

Figure 4.4: Gantt Chart

Chapter 5

Conclusion

We have developed a CNN architecture that simultaneously evaluates the output of all the convolutional blocks to enable a more accurate and exact classification of lungrelated disorders, pneumonia, and covid-19. As a result, we have achieved an overall accuracy of 96.90% and an f1-score of 97.00% while discerning between chest x-ray images containing pneumonia and covid 19 better than other stateof-the-art approaches. Furthermore, due to being lightweight, our model can be used in remote parts of developing countries to automatically detect pneumonia and covid-19 in its early stages when there is a shortage of radiologists. In the future, Researchers can use this architecture in other medical fields where there is a need for automated analysis of image modalities.

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EMOTION RECOGNITION FROM FACIAL EXPRESSION

A Mini Project Report

submitted to

the APJ Abdul Kalam Technological University

in partial fulfillment of the requirements for the degree of

Bachelor of Technology

by

AARSHA ANIL(VML20AD001)

ALANA ANCE JOHN(VML20AD002)

JASHLIN S SIMON(VML20AD013)

MARWA ABDUL RAZAK(VML20AD015)

under the supervision of

Mr. AKHIL K K

Assistant Professor

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

VIMAL JYOTHI ENGINEERING COLLEGE CHEMPERI

CHEMPERI P.O. - 670632, KANNUR, KERALA, INDIA

June 2023

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INSTITUTIONS,CHEMPERI - KANNUR
CHEMPERI - KANNUR 0460 2212240

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CERTIFICATE

This is to certify that the report entitled **EMOTION RECOGNITION FROM FACIAL EXPRESSION** submitted by **AARSHA ANIL** (VML20AD001), **ALANA ANCE JOHN** (VML20AD002), **JASHLIN S SIMON** (VML20AD013) & **MARWA ABDUL RAZAK** (VML20AD015) to the APJ Abdul Kalam Technological University in partial fulfillment of the B.Tech. degree in Computer Science and Engineering is a bonafide record of the project work carried out by him under our guidance and supervision. This report in any form has not been submitted to any other University or Institute for any purpose.

Mr. AKHIL K K
(Project Guide)
Assistant Professor
Dept.of CSE
Vimal Jyothi Engineering College
Chemperi

Ms. ANIT THOMAS M
(Project Coordinator)
Assistant Professor
Dept.of CSE
Vimal Jyothi Engineering College
Chemperi

Head of the department

Place : VJEC Chemperi
Date : 27-06-2023

VIMAL JYOTHI ENGINEERING COLLEGE
(Office Seal)
Dated.....
CHEMPERI-670 632

Signature Not Verified
Principal.VJEC

DECLARATION

We hereby declare that the project report **EMOTION RECOGNITION FROM FACIAL EXPRESSION** , submitted for partial fulfillment of the requirements for the award of degree of Bachelor of Technology of the APJ Abdul Kalam Technological University, Kerala is a bona fide work done by us under supervision of **Mr. AKHIL K K**.

This submission represents our ideas in our own words and where ideas or words of others have been included, we have adequately and accurately cited and referenced the original sources.

We also declare that I have adhered to ethics of academic honesty and integrity and have not misrepresented or fabricated any data or idea or fact or source in my submission. We understand that any violation of the above will be a cause for disciplinary action by the institute and/or the University and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been obtained. This report has not been previously formed the basis for the award of any degree, diploma or similar title of any other University.

AARSHA ANIL
ALANA ANCE JOHN
JASHLIN S SIMON
MARWA ABDUL RAZAK

CHEMPERI
27-06-2023

Signature Not Verified
Principal.VJEC

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The successful presentation of the mini project on the topic "EMOTION RECOGNITION FROM FACIAL EXPRESSION " would have been incomplete without the mention of people who made it possible and whose constant guidance crowned our effort into success.

We convey thanks to our project guide Mr. AKHIL K K of Computer Science and Engineering Department for providing encouragement,constant support and guidance which was of a great help to complete this project successfully.

Last but not the least,we wish to thank our parents for financing our studies in this college as well as for constantly encouraging us to learn engineering.Their personal sacrifice in providing this opportunity to learn engineering is greatly acknowledged.

AARSHA ANIL

ALANA ANCE JOHN

JASHLIN S SIMON

MARWA ABDUL RAZAK

Abstract

Facial Expression conveys non-verbal cues, which plays an important roles in interpersonal relations. The Facial Expression Recognition system is the process of identifying the emotional state of a person. In this system captured image is compared with the trained dataset available in database and then emotional state of the image will be displayed.

Avatars are an inevitable data emerging across the last years, from marketing,digital communication in particular,to recovery of information related to sentiment analysis and viewpoint mining.Avatar helps individuals to express feelings and their identities more "authentically" by increasing the semantic quality of visual messages.

Avatars and emoticons are both examples of non-verbal communication tools. These indicators have rapidly become an important component of a wide variety of activities, including online talking, product reviews, brand emotions, and many others. It also resulted in an increase in the amount of data science research devoted to narratives driven by avatars.

In this deep learning project, we will classify human facial expressions in order to map and filter avatars that correspond. This project's goal is to make the talking world appear more vibrant.

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Chapter 1

Introduction

1.1 Introduction

1.1.1 General Background

In this report we are aimed to present the review of the project "EMOTION RECOGNITION FROM FACIAL EXPRESSION".Avatars/emojis have end up a brand new language which could rather successfully specific an concept or emotion. This visible language is now a fashionable for online verbal exchange, to be had now no longer most effective in Twitter, however additionally in any other massive online platform including Facebook and Instagram. In today's generation human commonly have tendency to talk with every different the use of avatars.

1.1.2 Problem Statement

Despite the widespread use of avatars to express emotions in digital communication, there are limitations to their effectiveness,particularly when it comes to conveying nuanced or complex emotions. Traditional emotion recognition systems have also struggled to accurately identify emotions from facial expressions, often leading to low accuracy and limited emotion recognition capabilities.This lack of accurate emotion recognition hinders the effective use of avatars and impacts the ability to express

emotions in digital communication.

1.1.3 Scope of the system

- Enhancing digital communication
- Overcoming limitations of existing systems
- Wide range of emotion recognition
- Mapping emotions to avatars
- Potential applications:Our system has the potential to be integrated into various applications, such as messaging platforms, social media analysis, market research, mental health, and customer service, among others, to improve communication and user experience

1.1.4 Objective

The objective of our project is to develop a Neural Network trained on a large dataset of facial expressions to accurately identify emotions and map them to corresponding avatars. Our goal is to overcome the limitations of existing systems for emotion recognition in digital communication, such as low accuracy and limited emotion recognition capabilities. By leveraging advanced computer vision techniques, we aim to create a reliable and efficient system that enhances digital communication by providing accurate and comprehensive emotion recognition, allowing users to express their emotions more effectively through avatars.

Chapter 2

Literature Survey

2.1 Implementation of AI/ML for Human Emotion Detection using Facial Recognition

2.1.1 Abstract

Artificial Intelligence (AI) and Machine Learning (ML) have miscellaneous main extents of work and research and affection acknowledgment is individual of bureaucracy. So, concerning decide a human's first verbalization, bureaucracy or floor, endure resolve and extract the various differences of human faces like Color, Shape, Expressions, Appearance, Orientation and Brightness etc. A colossal number of algorithms and methods have existed computed and performed commotion this item, on differing changeless or non-motionless, equal organization, apparent postures, corresponding verbalizations and impartial front face. The aims of Facial despair acknowledgment are the flipping through and eliciting the data and correspondingly bestowing correct results in authentic-period. The projected work is implied on AI – ML, we will use FER-2013 dataset to train the model and we will use our own citation pictures to increase the veracity, in addition to different atheneums and ability-sets. Their mark search out realize veracity above 90percent.This projected project detects the miscellaneous empathy of human to a degree: Happy, Sad, Anger, Neutral and

Surprise.

2.1.2 Methodology

They have developed a model that recognizes five different emotions: Happy, Sad, Neutral, Surprise, and Angry. To enhance the precision of their model, they used their own pictures as well as pictures from the FER (2013) dataset, which consists of grayscale pictures with 48x48 pixels. In addition, they incorporated some free images from Github. In total, they utilized 24,000 pictures from the Fer-2013 dataset, 17,000 free Github pictures, and 50 pictures of five different individuals.

To prepare their webcam, they employed various tools such as opencv libraries, tensorflow, numpy, and Haarcascade frontal face classifier [1]. These tools enabled them to detect and recognize facial expressions in real-time and perform object recognition in pictures and videos. They configured the webcam to only recognize faces and exclude the background. As a result, the webcam identifies the face as a gray image and converts it into an RGB picture.

After recognizing a face, the model examines each image stored in the webcam data using the pretrained model (model.h5) and then identifies the person's mood. The steps involved in processing the data and identifying the moods are outlined below:

- Step 1: The user provides input in the form of an image captured by their web camera.
- Step 2: Their training model analyzes the image.
- Step 3: The data is extracted and matched with the prepared datasets, including Fer-2013 and others.
- Step 4: The emotion displayed by the user's facial expression is identified and then displayed on the screen.

2.1.3 Conclusion

This administrative task presents a project called "Human Feeling Identification using Facial Recognition," which utilizes a web application to detect a user's emotions based on their mood. The system captures the user's image using a webcam, and then converts it into a black and white image to improve accuracy and performance. Over the past two decades, facial recognition technology has made significant advancements. Today, machines can automatically verify identity and information for secure transactions, surveillance and security tasks, and access control to important areas of buildings. Facial recognition systems are important because they can imitate human coding abilities and capture nonverbal communication such as facial expressions and gestures, which play a crucial role in our interpersonal relationships. Facial emotions aid in communication, such as using subtle facial expressions to convey approval or disapproval. A simple smile can show agreement with a message, while a frown can indicate a conflict.

2.2 Facial expression recognition Using Machine Learning

2.2.1 Abstract

This paper compares two proposed methods for representing facial landmarks detection and feature extraction in order to recognize facial expressions [2]. One method uses image processing techniques like histogram equalization, thresholding, color conversion, and morphological operations, while the other method employs the Dlib library for facial landmarks detection. The study examines each feature descriptor using two classification methods: Support Vector Machine (SVM) and Multi-layer Perceptron (MLP) with three facial expression databases. These databases are the 10k US Adult Faces Database, the MUG Facial Expression Database, and a personal database. The study focuses on classifying three facial expressions: happiness,

surprise, and neutrality. The experimental results reveal that the second proposed method achieves more than 96percent accuracy, while the first proposed method shows 91.5percentage accuracy.

2.2.2 Methodology

- Two proposed methods are used here. Firstly a human face is detected inside the input image.Then the Facial regions are detected and then they locate the facial landmark.Finally, they classify every feature vector to one of the essential facial expression(Neutral, Happy and Surprise), where they utilized two machine learning algorithms to classify the facial expressions.
- Facial regions detection: This step aims to obtain a Region of Interest (RoI) corresponding to the eyes and the mouth. Therefore, they extract the feature points inside these regions, using the Jones and viola algorithm on the input image of the detected face.
- Feature Landmark Point's Extraction: To find the Landmark facial points. They have adopted image processing techniques:
- Histogram equalization.
- Gaussian filter.
- Contrast adjustment.
- Segmentation method: thresholding and morphological operations.
- Edge detector
- Pre-processing of the Eyes Region: To make the contour of the Eyes more visible. Firstly, they adjusted the intensity of the image, then the image was thresholded to select the area of interest, finally, two morphological operations are applied: dilation and filling of interstices.

- Feature Point's Extraction: After applying image-processing techniques in each of the facial regions, they used the edge detector to get the contours. After a lot of trials with different detectors, the canny edge detector gave the best results. The Canny is used for detecting the edge of each facial region, then we devised this edges for extracting facial landmarks.

- For the second proposed method, they opted to employ the Dlib library to detect facial landmarks. Firstly, they detect faces in each image by utilizing a pre-trained Histograms of Oriented Gradients (HOG) and Linear Support Vector Machines (SVM). Secondly, they detect facial regions, such as the Mouth, Right eyebrow, Left eyebrow, Right eye, Left eye, Nose, and jaw. They then extract the 68 facial points.To accomplish this, the Dlib facial landmark predictor was trained on the iBUG 300-W dataset to derive the 68 coordinates.

- Machine learning algorithms:Support Vector Machine (SVM): They formulated the facial expression recognition task as a multiclass learning process, in which each expression (neutral, happy, surprise) is attributed to a single class. For their work, they have implemented the "one-vs-the-rest" multi-class strategy, with a kernel RBF, as they had multiple classification expressions. SVM is an ideal classifier for a classification problem and is quick to learn when there are fewer features. Hence, they decided to employ it in their work.

- Multilayer Perceptron (MLP): MLP is a type of feedforward artificial neural network that is optimal for both classification and regression tasks. It is composed of three or more layers, including an input and an output layer with one or more hidden layers. They have selected this classifier due to its excellent performance and robust architecture, which employs Backpropagation for training. In their experimentation, they utilized five hidden layers to assess classifier performance and the LBFGS solver.

2.2.3 Conclusion

They have proposed two distinct methods for extracting facial landmarks, along with two different classifiers for facial expression classification. Based on experimental results, they observed that the implementation of Viola-Jones face detector performs well with frontal faces from the MUG and 10k US Adult Faces Databases. However Haar-like feature has limitations for multi-face detection and poor lighting conditions. Therefore, they utilized the Histogram of Oriented Gradient (HOG) as a suitable alternative feature, as it can detect geometric features of the face that are difficult to capture using Haar-like features and is robust to illumination changes. Hence, they employed the Dlib library, which utilizes the HOG feature, for achieving good recognition rates. In future work, they intend to enhance this method to reduce false recognition rates in cases where the face is obstructed or rotated, and to use it for extracting geometric features such as angles and distances.

2.3 Human Emotion Detection Using Open CV

2.3.1 Abstract

Facial recognition, whether from a photograph or motion picture, has become a common aspect of bioscience research [3]. Referred to as facial detection, it plays a crucial role in closed-circuit entertainment because it does not require synchronization with the object. However, facial recognition is a challenging task in tablet displays due to the variable nature of the face, which undergoes frequent changes in appearance. One of the major issues in this regard is the speed and accuracy of identification. The primary aim of this research is to identify objects of interest in real-time and keep track of them using a camera and a set of picture rules. OpenCV (a Python library) and Python language will be employed to achieve this. The technique comprises three components: a recognition module, a training module, and an identification library.

2.3.2 Methodology

Numerous studies have explored emotion detection and feature extraction using various methods. The following paragraphs provide an overview of some of the significant approaches.

Firstly, Linear Discriminate Analysis (LDA) is a technique that identifies a linear combination of features to differentiate or classify several categories or events. The resulting line layout is achieved by using a higher number of pixels to represent emotions on a computer screen. Pre-segmentation analysis by line is used to minimize characteristics and simplify the process. The new dimension is a linear mixture of pixel values that form the template.

Secondly, Principal Component Analysis (PCA) is a mathematical process that converts multiple variables associated with a small number of independent variables. Data conflicts are calculated by the first major components, and subsequent components result in further variability. PCA is widely used for analyzing data to test and create predictive models. The Eigenvalue calculation of the covariance matrix data or singular value matrix data decomposition is performed using PCA. PCA facilitates Eigenvector-based multivariate analysis to expose the internal anatomy of raw data, which explains the existing variations in data.

$$cov_{x,y} = \frac{\sum_{i=1}^{N}(x_i - \bar{x})(y_i - \bar{y})}{N - 1} \tag{2.1}$$

Finally, the Markov Hidden Model (HMM) is a mathematical model used to explain the emergence of observable situations based on hidden factors that are not directly visible. The observable situation is referred to as the 'signal' and is a sub-component of the 'state.' HMMs are particularly effective in handling temporary patterns, such as long paragraphs, written articles, touch examinations, partial extraction, and bioinformatics.

2.3.3 Conclusion

The Face Emotion Detection idea that was previously discussed has been successfully implemented, resulting in a working model that can detect a person's facial expressions in real-time . This section provides a detailed comparison of various human emotion recognition algorithms based on metrics such as accuracy, precision, detection ratio, and wrong recognition rate. Accuracy refers to the proportion of correct conclusions, including true positive and true negative outcomes.

For the purpose of this research, the human emotion detection method used was Eigenfaces, which utilizes grayscale pictures. The article describes how converting colorful pictures to black and white (grayscale) and applying Histogram Equalization is a simple methodology for automatically normalizing the brightness and contrast of emotional pictures. While this research presents a straightforward approach to human emotion detection, it is possible to enhance the accuracy of the detection by using color (generally with colored histogram fitting in HSV or any other color space instead of RGB), or implementing additional computing levels such as edge enhancement, contour recognition, motion recognition, etc.

The code in this study changes the image size to a normal size, which may alter the appearance of the picture scale. However, the same standard appearance can be maintained through image size adjustment. OpenCV employs a human emotion detection method called the Har Cascade classifier. When provided with a photo, the emotion scanner scans every image area and detects it as "Happy" or "Sad." The separation takes a fixed face scale of 50x50 pixels. Since the face in the picture may be smaller or larger, the image is divided into sections, and the face is searched over the image a few times in order to find it within the width of the scales. This may involve a significant amount of computing, but thanks to the algorithmic techniques outlined in the sidebar, segmentation is much faster, even when used on a few scales. The separator uses information stored in an XML file to determine how to split the location of each image.

2.4 Emotion recognition from facial expressions using Deep learning-CNN Model

2.4.1 Abstract

Avatars are examples of non-verbal communication tools that have become increasingly important in a variety of online activities, including chatting, product reviews, and brand sentiment analysis [4]. Consequently, research in data science related to narratives driven by avatars has increased, owing to improvements in computer vision and deep learning. Visual cues can now be used to recognize human emotions with high accuracy. This deep-learning project aims to classify human facial expressions to match and filter corresponding avatars, enhancing the vibrancy of online communication. This project is not intended to address real-world problems, but rather to facilitate the creation of avatars through software.

2.4.2 Methodology

The proposed approach uses a Haar Cascade Detection algorithm for the initial detection of human faces from the input captured by a camera. The captured input is then analyzed based on the features and database used with the support of Keras convolutional neural network model for facial recognition. A deep learning neural network called a convolutional neural network, or CNN for short, was created expressly for the task of digesting organized arrays of data, like photographs. CNN has an excellent job at recognizing design patterns that are present in the picture that is being inputted, such as lines, gradients, circles, and even eyes and faces. These may all be found in the image that is being processed. This is one area in which CNN excels. When it comes to computer vision, convolutional neural networks have shown to be particularly durable due to the aforementioned characteristic CNN may be conducted directly on a picture that is not done well, and it does not require any preparation in order to operate effectively. In the last phase, the human face is authenticated to classify the emotions of humans as happy, neutral, angry, sad, disgusted, and surprised.

The performance of the system is measured with accuracy, which is calculated by comparing the detected face and the corresponding emotions with the ground truth data.

2.4.3 Conclusion

The main focus of facial expressions is on the recognition of avatars, which are essential components of digital communication systems.Avatars allow people to convey emotions through text messages in a way that words alone cannot. Recent advances in computer vision have led to the development of high-speed image processing technologies that can recognize facial expressions and emotions. This has led to the investigation of the use of Convolutional Neural Networks (CNNs) for emotion recognition.

To optimize the successful classification of emotions in real-time, the computational criteria and sophistication of the CNN were taken into account. The results showed that human emotions can be detected in various lighting situations, angles, and scenes. Furthermore, our project was able to successfully understand human expressions and emotions through the use of novel findings and consolidations with the issue of faces superimposed.

2.5 HSEmotion: High-speed emotion recognition library

2.5.1 Abstract

There has been a recent focus on reducing algorithmic bias in affective behavior and facial expression recognition models [5]. This paper introduces a new software tool called HSEmotion, which offers fast and precise emotion recognition capabilities. The tool utilizes multiple EfficientNet-based models that are trained to classify emotions in static facial photos. Results from experiments show that these pre-trained models

can serve as efficient feature extractors for quick and accurate emotion recognition in video-based tasks, without requiring complete fine-tuning of the neural network.

2.5.2 Methodology

HSEmotion involves using a combination of deep learning algorithms and signal processing techniques to extract features from facial expressions and speech signals in real-time. For extracting facial expressions, they used a convolutional neural network (CNN) to extract features such as facial landmarks and facial action units. For speech signals, they used a combination of Mel-frequency cepstral coefficients (MFCCs) and spectral features to extract acoustic features. The SVM classifier is trained on the dataset of facial expressions and speech signals to recognize the different emotional states. To enable real-time processing, the researchers optimized the algorithm to run efficiently on a variety of hardware platforms, including CPUs and GPUs. This allows for high-speed emotion recognition in real-world scenarios.

2.5.3 Conclusion

HSEmotion is a powerful and efficient emotion recognition library that provides real-time emotion recognition capabilities. With its use of deep learning algorithms and state-of-the-art computer vision techniques, HSEmotion can accurately identify a wide range of emotions from facial expressions and other visual cues. Its modular design and easy-to-use APIs make it an ideal choice for developers and researchers looking to integrate emotion recognition into their applications and projects. Overall, HSEmotion is a valuable tool for emotion analysis and can be used in a variety of fields, including psychology, marketing, and entertainment.

2.6 CONSOLIDATED TABLE

Paper Title	Year	Proposed Solution	Technology Used	Accuracy
Implementation of AI/ML for Human Emotion Detection using Facial Recognition	2022	Developing a system to detect and compare the various expressions to deduce the exact emotional state of a person	SVM,LDA,DBN,CNN	93%
Facial expression Recognition Using Machine Learning	2021	Collect dataset, preprocess, feature extraction, model selection, training, evaluation, deployment	SVM,MLP,LBP,LDA, ANN	First proposed method has 91.5% accuracy and 96% accuracy
Human Emotion Detection Using OpenCV	2022	To sight object of interest in real time and to stay chase of constant object supported camera and picture set rule by means of Open CV,	OpenCV,PCA,LDA, Haar Cascades	85%
Emotion recognition from facial expressions using deep learning.	2022	Recognize human facial emotions in order to comprehend and analyze human face expressions, to analyze and monitor similar emojis.	CNN,OpenCV,Tensorflow, numpy	84.76%
HSEmotion: High-speed emotion recognition library	2022	Real-time face detection, feature extraction, emotion classification	AFEW,CNN,MTCNN, LSD	63.03%

Table 2.1: Consolidated table

Chapter 3

Requirement specification

3.1 Functional requirements

- Dataset: A dataset of labeled facial images with corresponding emotional labels is needed to train the deep learning model.
- Preprocessing: Preprocessing of the facial images is required to remove any noise or irrelevant features. This may include normalization, resizing, and grayscale conversion.
- Feature extraction: The deep learning model should be able to extract relevant features from the preprocessed facial images, such as facial landmarks, texture, and color.
- Model architecture: The deep learning model should be designed with appropriate architecture that can effectively learn the features extracted from the facial images. This may include convolutional neural networks (CNNs), recurrent neural networks (RNNs), or a combination of both.
- Training: The deep learning model should be trained using the labeled dataset to learn the relationship between the facial features and corresponding emotions.
- Evaluation: The performance of the trained model should be evaluated using appropriate evaluation metrics such as accuracy, precision, recall, and F1-score.

- Deployment: The model should be deployed in a way that it can be used to recognize emotions from real-time facial images or videos. This may include integration with other software or hardware systems.
- User interface: The system should have a user-friendly interface that allows users to easily input facial images or videos, and view the recognized emotions.

3.2 Software requirements

- The system should have a high level of accuracy in recognizing facial expressions and suggesting appropriate avatars.
- The system should be able to operate on both images and videos.

3.3 User interfaces

- The system should have a user-friendly interface for ease of use.

3.4 Hardware interfaces

- There are no external hardware requirements.

3.5 Non Functional requirements

- Scalability (Transactions per second)
- Traffic on chain

Chapter 4

Proposed system and Design

This chapter mainly discuss about the proposed system and design.Also the architecture and different technical diagrams are discussed in this chapter.

4.1 Proposed system

- The system architecture consists of the following components:
- Input module: This component allows users to input an image or video to be analyzed by the system.
- Emotion recognition module: This component uses deep learning algorithms to detect and recognize facial expressions accurately.
- Avatar suggestion module: This component suggests appropriate avatars based on the recognized emotions.
- Output module: This component provides the output of recognized emotions and suggested avatars.

4.2 Feasibility Study

- A feasibility study is an analysis that considers all of a project's relevant factors including economic,technical,legal, and scheduling considerations to ascertain the likelihood of completing the project successfully.

4.2.1 Technical Feasibility

- The proposed system is technically feasible due to the availability of required hardware and software resources,including advanced image processing and machine learning algorithms.

4.2.2 Operational Feasibility

- The system can be easily integrated into existing software systems with a minimal learning curve for non-technical users.

4.2.3 Economic Feasibility

- Although the development cost for the system is high, the cost of implementation and maintenance is reasonable. The proposed system can generate revenue by licensing it to companies requiring emotion recognition and avatar identification systems.

4.2.4 Legal Feasibility

- The system needs to comply with data privacy regulations like GDPR and CCPA, and the use of emojis needs to comply with copyright regulations of respective owners.

4.3 Design

- Data collection: The system will collect data from various sources, such as images and videos, to analyze human facial expressions and extract emojis used in the corresponding texts.
- Pre-processing: The collected data will undergo pre-processing to eliminate noise, adjust for lighting, and improve the quality of images and videos.
- Feature extraction: Image processing techniques like grayscaling,binarizing etc and Deep learning is used.
- Emotion recognition: The system will use the extracted features to recognize the emotions expressed by individuals using an ANN model
- Avatar identification: The system will identify the avatars that are associated with the recognized emotions expressed in the text.
- Output: The results of the emotion recognition and avatar identification processes will be presented in a user-friendly interface, including visualizations and recommendations for users.
- Continuous learning: The system will be designed to continuously learn and improve its recognition and identification accuracy by incorporating feedback and training data from users.

4.3.1 Architecture Diagram

An architectural diagram is a diagram of a system that is used to abstract the overall outline of the software system and the relationships, constraints, and boundaries between components. It is an important tool as it provides an overall view of the physical deployment of the software system and its evolution roadmap.

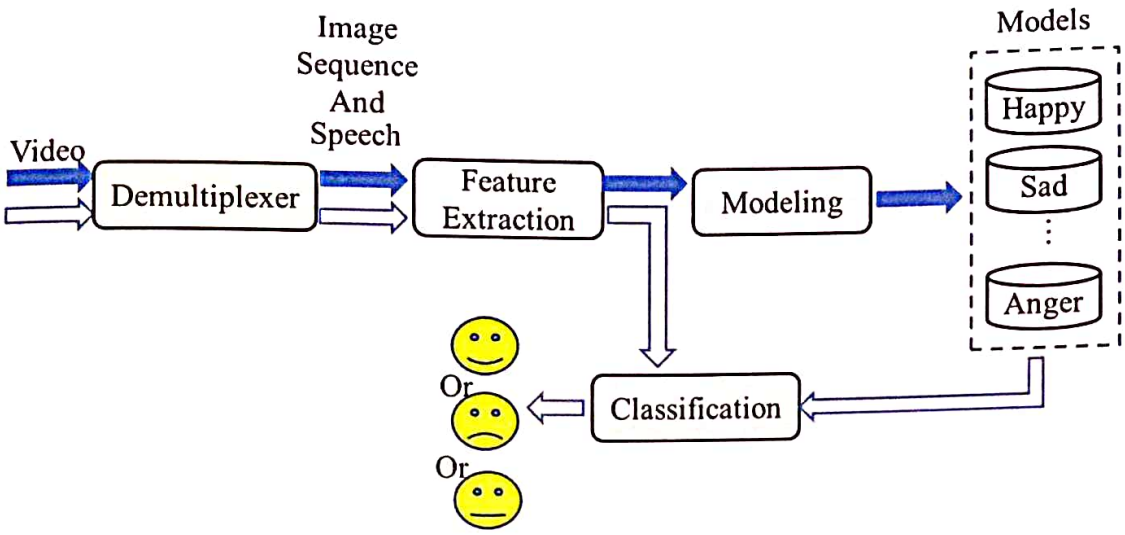


Figure 4.1: Architecture diagram

4.3.2 Use Case Diagram

A dynamic and behavioral diagram in UML is use case diagram. Use cases are basically set of actions, services which are used by system. To visualize the functionality requirement of the system this use case diagram are used. The internal and external events or party that may influence the system are also picturized. Use case diagram specify how the system acts on any action without worrying to know about the details how that functionality is achieved.

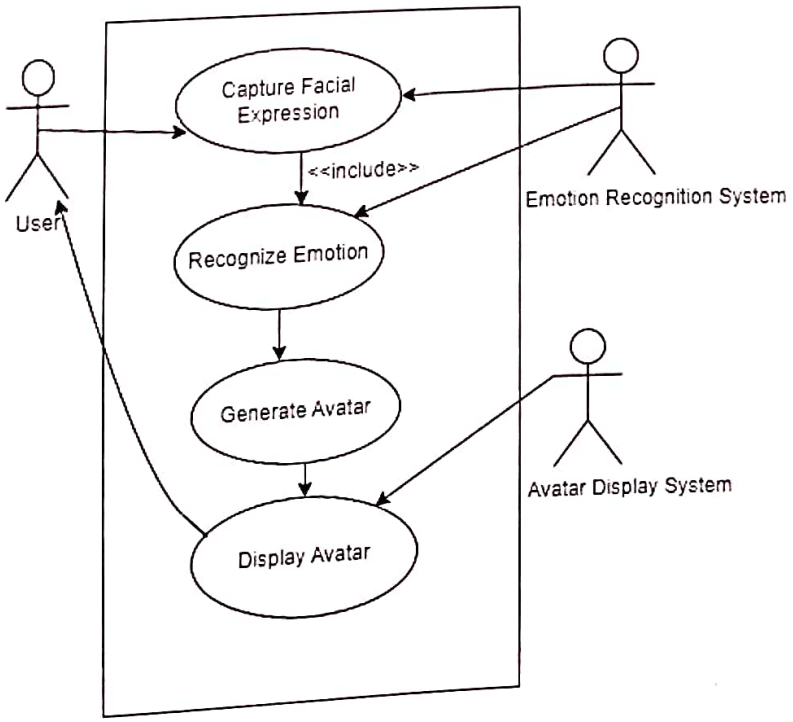


Figure 4.2: Usecase

4.3.3 Data Flow Diagram

A Data Flow Diagram (DFD) is a visual representation of the information flows within a system. It provides information on how how data enters and leaves the system,the changes in the system and where the data is stored. Data flow diagrams visually represent systems and processes. It may be partitioned into levels that represent increasing information flow and functional details. Levels in DFD are numbered 0,1, 2 or beyond.

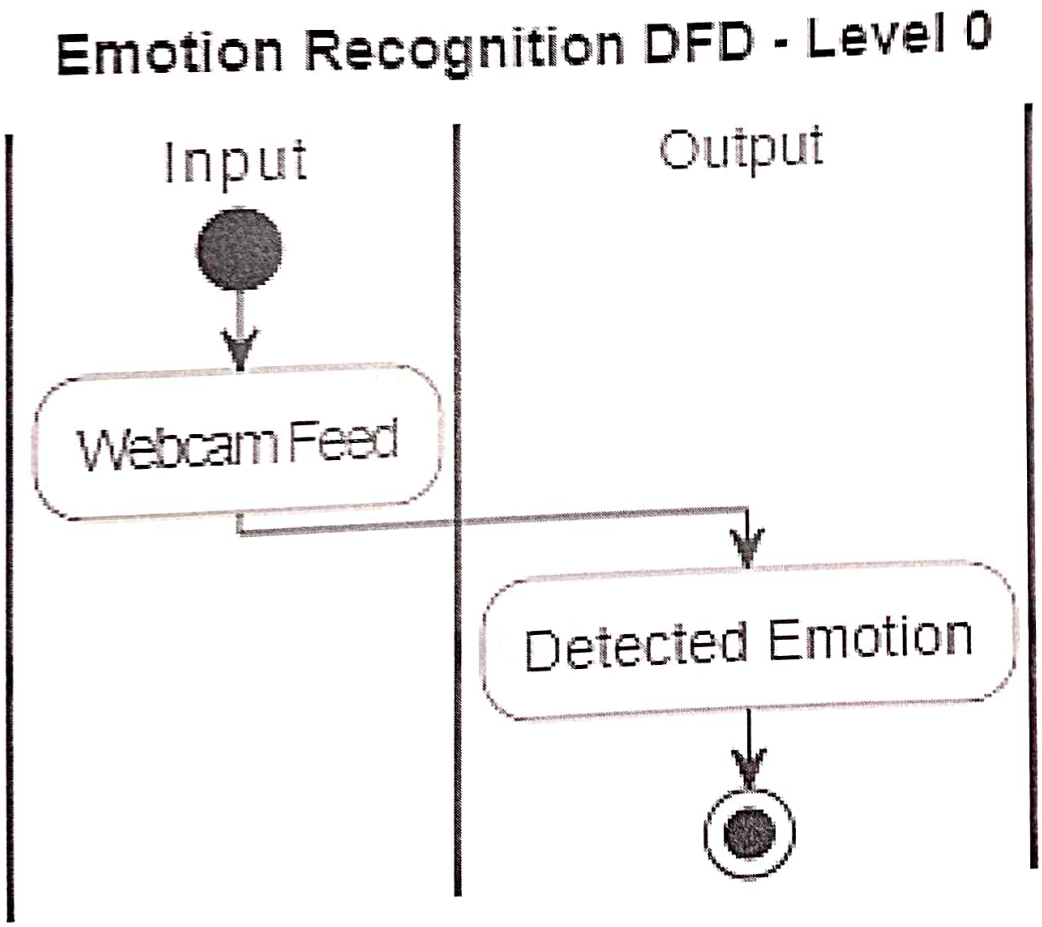


Figure 4.3: DFD-Level 0

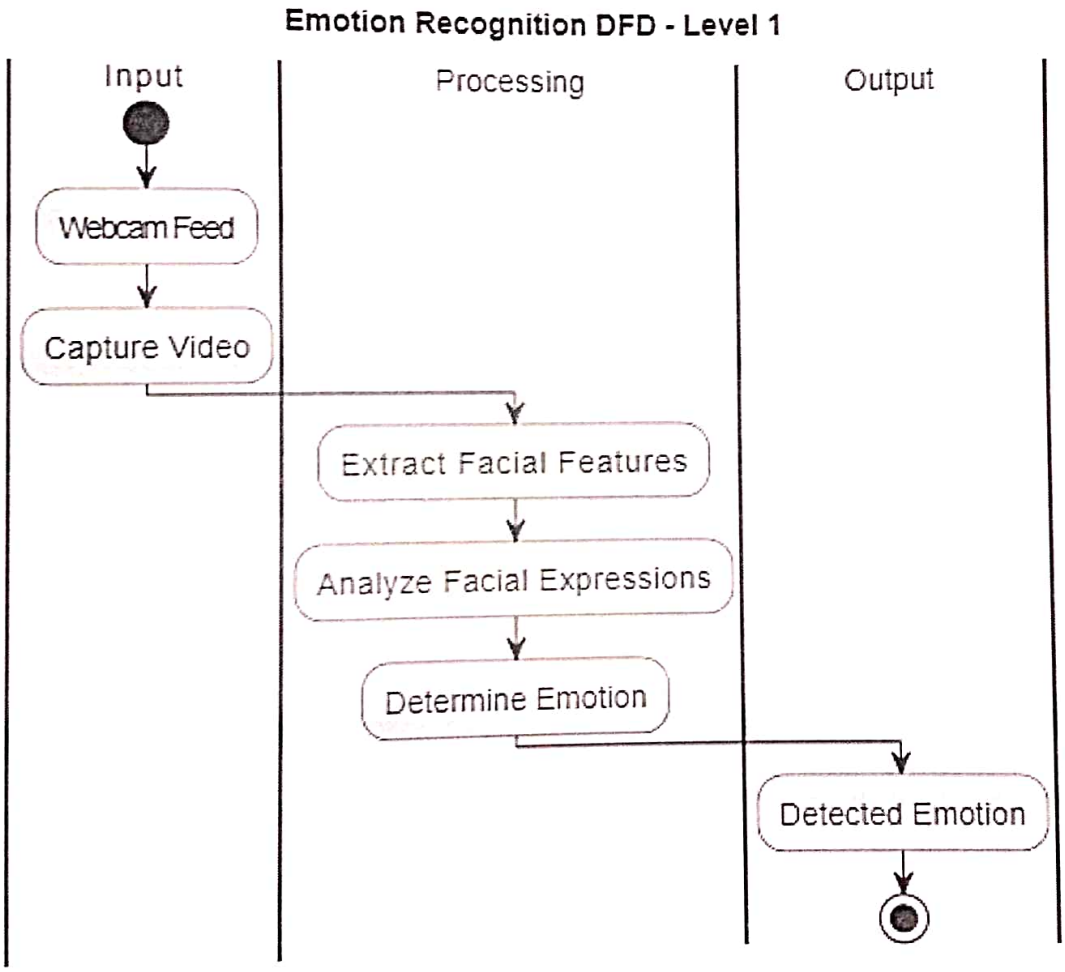


Figure 4.4: DFD-Level 1

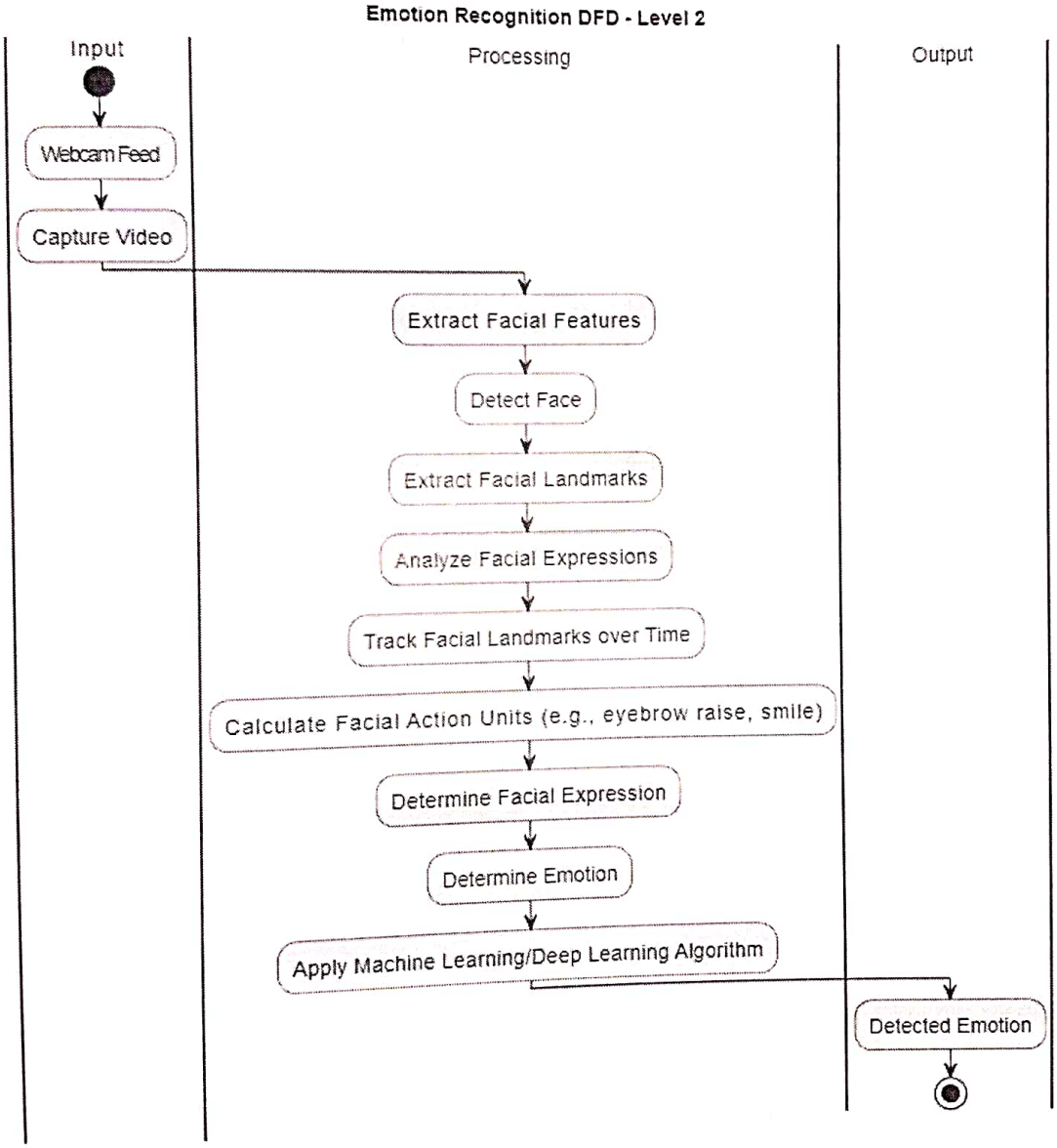


Figure 4.5: DFD-Level 2

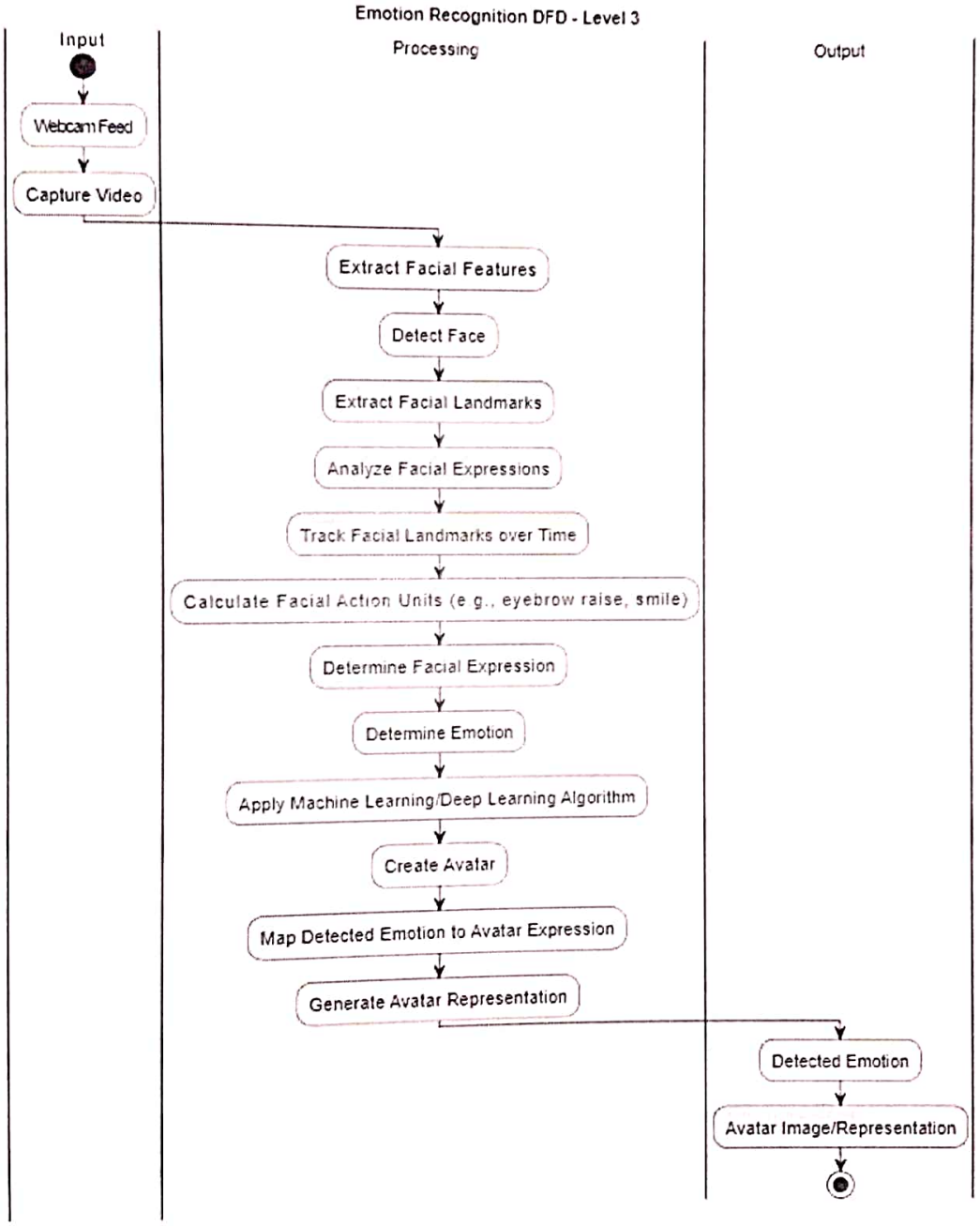


Figure 4.6: DFD-Level 3

4.3.4 ER Diagram

An entity-relationship (ER) diagram is a graphical representation of the entities and relationships involved in a system or project. It helps to model the data requirements and business rules of the system, which can then be used to design the database schema.

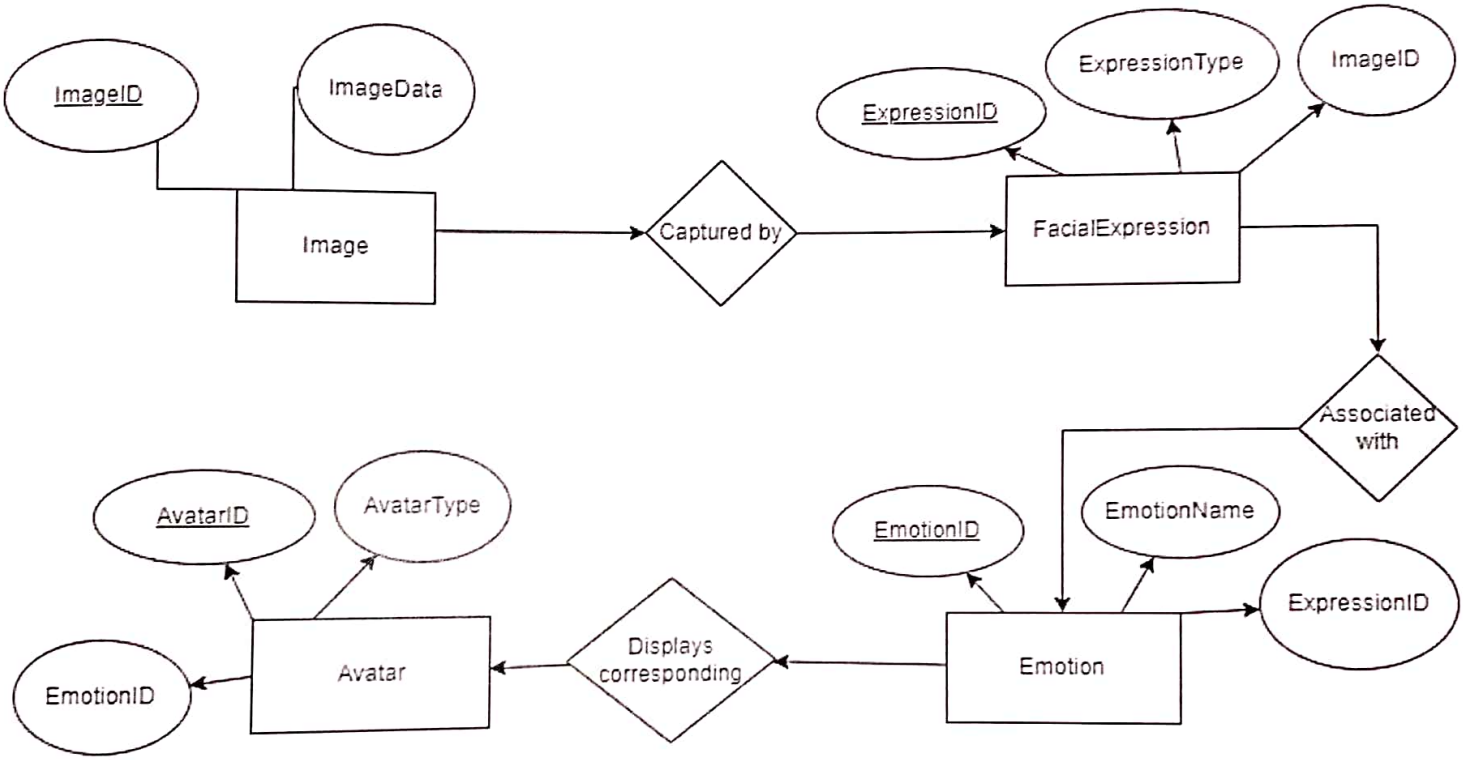


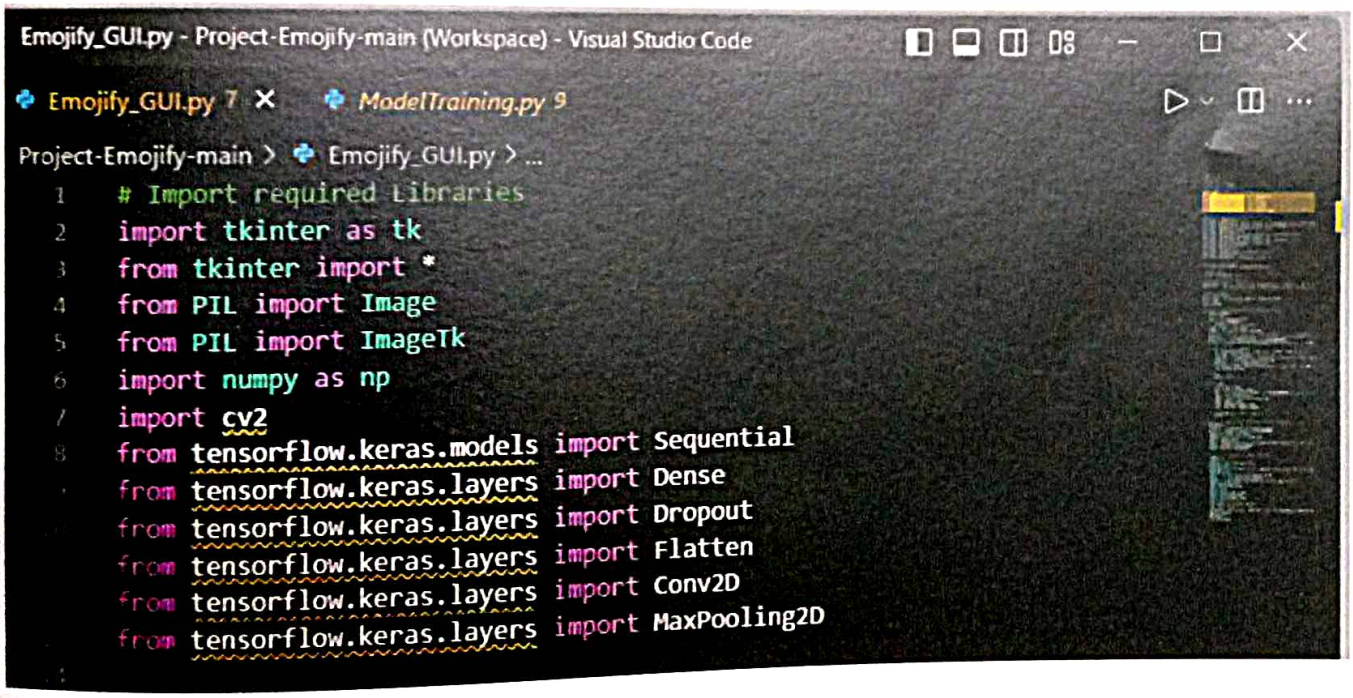
Figure 4.7: ER diagram

Chapter 5

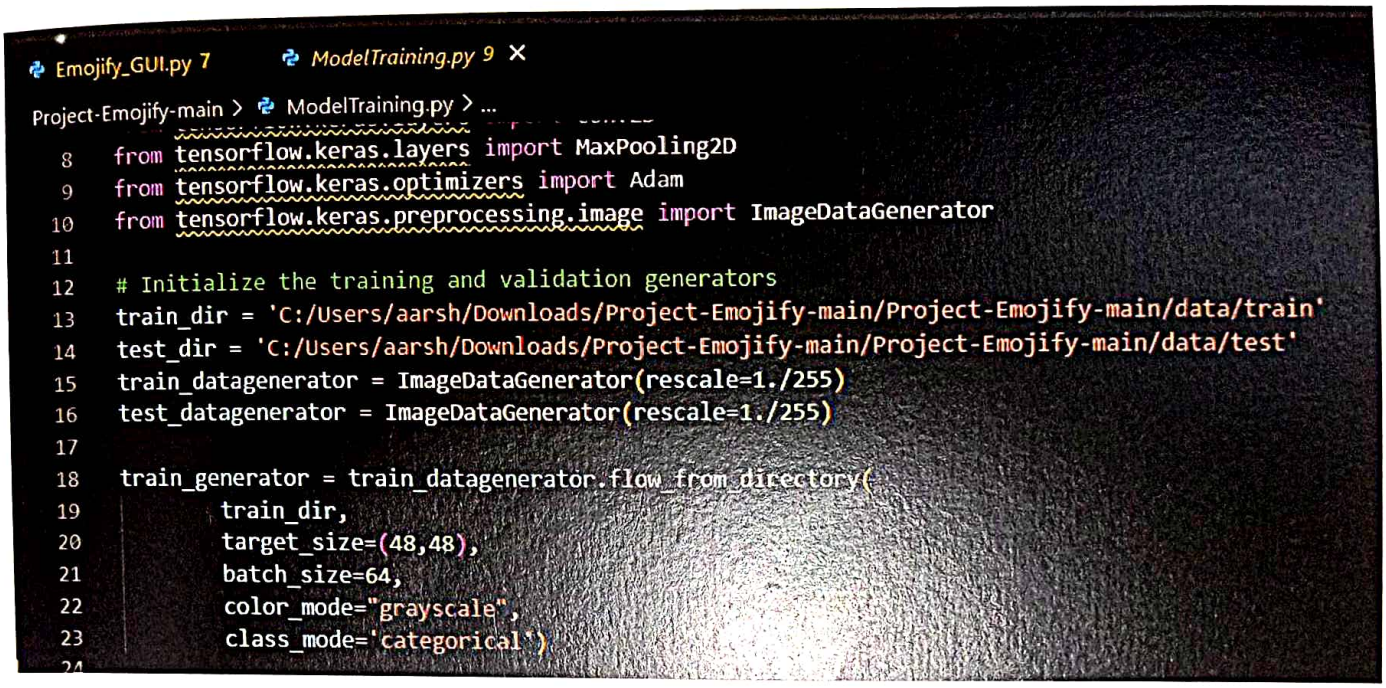
IMPLEMENTATION

5.1 Implementation

5.1.1 Importing necessary libraries



5.1.2 Importing train and test directories



Emojify_GUI.py 7 ModelTraining.py 9

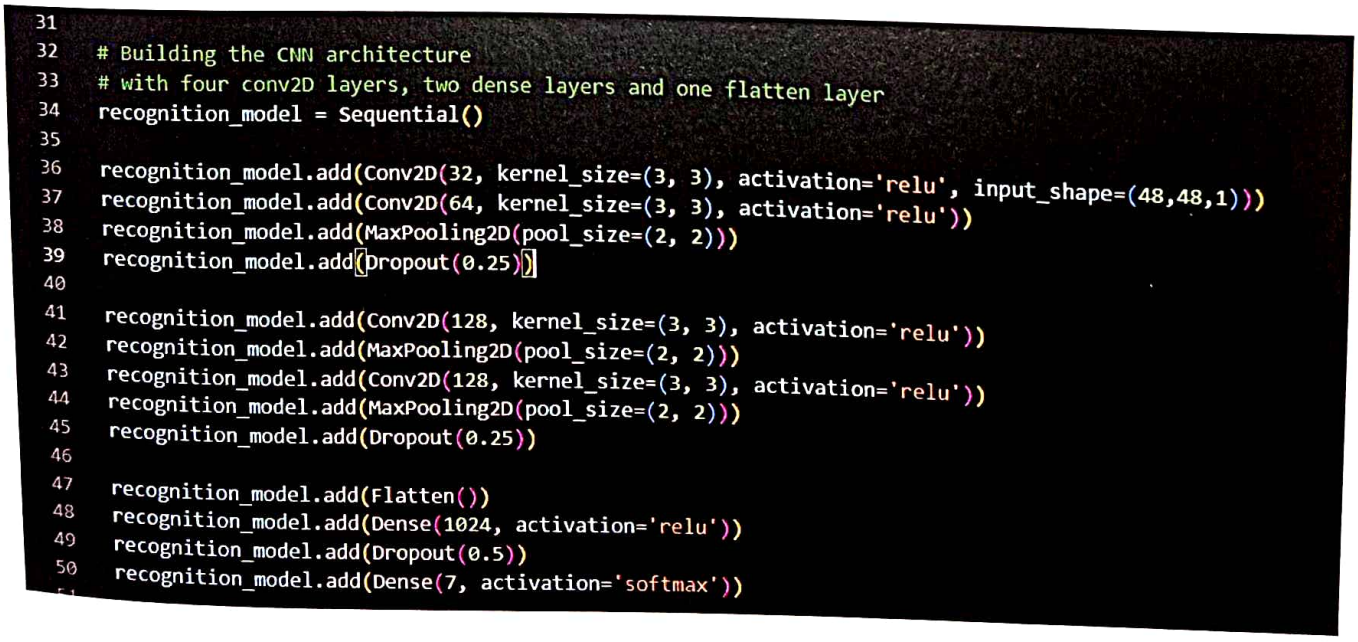
Project-Emojify-main > ModelTraining.py > ...

```
from tensorflow.keras.layers import MaxPooling2D
from tensorflow.keras.optimizers import Adam
from tensorflow.keras.preprocessing.image import ImageDataGenerator

# Initialize the training and validation generators
train_dir = 'C:/Users/aarsh/Downloads/Project-Emojify-main/Project-Emojify-main/data/train'
test_dir = 'C:/Users/aarsh/Downloads/Project-Emojify-main/Project-Emojify-main/data/test'
train_datagenerator = ImageDataGenerator(rescale=1./255)
test_datagenerator = ImageDataGenerator(rescale=1./255)

train_generator = train_datagenerator.flow_from_directory(
        train_dir,
        target_size=(48,48),
        batch_size=64,
        color_mode="grayscale",
        class_mode='categorical')
```

5.1.3 Building the CNN architecture with four conv2D layers, two dense layers and one flatten layer



```
# Building the CNN architecture
# with four conv2D layers, two dense layers and one flatten layer
recognition_model = Sequential()

recognition_model.add(Conv2D(32, kernel_size=(3, 3), activation='relu', input_shape=(48,48,1)))
recognition_model.add(Conv2D(64, kernel_size=(3, 3), activation='relu'))
recognition_model.add(MaxPooling2D(pool_size=(2, 2)))
recognition_model.add(Dropout(0.25))

recognition_model.add(Conv2D(128, kernel_size=(3, 3), activation='relu'))
recognition_model.add(MaxPooling2D(pool_size=(2, 2)))
recognition_model.add(Conv2D(128, kernel_size=(3, 3), activation='relu'))
recognition_model.add(MaxPooling2D(pool_size=(2, 2)))
recognition_model.add(Dropout(0.25))

recognition_model.add(Flatten())
recognition_model.add(Dense(1024, activation='relu'))
recognition_model.add(Dropout(0.5))
recognition_model.add(Dense(7, activation='softmax'))
```

5.1.4 Train the model

```
# Compile Model
import tensorflow as tf
recognition_model.compile(loss='categorical_crossentropy',optimizer=tf.keras.optimizers.legacy.Adam(learning_rate=0.0001, decay=1e-6),metrics=['accuracy'])

# Train the model
recognition_model_info = recognition_model.fit(
        train_generator,
        steps_per_epoch=28709 // 64,
        epochs=60,
        validation_data=test_generator,
        validation_steps=7178 // 64)

# saving the trained Model Weights
recognition_model.save_weights('recognition_model.h5')
```

5.1.5 Load the saved weights and global variables

```
# Load the saved weights
face_model.load_weights('recognition_model.h5')

# Disable OpenCL
cv2.ocl.setUseOpenCL(False)

# Create Datasets Dictionaries
facial_dict = {0: "   Angry   ", 1: "Disgusted", 2: "  Fearful  ", 3: "   Happy   ", 4: "  Neutral  ", 5: "    Sad    ", 6: "Surprised"}
emojis_dict = {0: "emojis/angry.png", 1: "emojis/disgusted.png", 2: "emojis/fearful.png", 3: "emojis/happy.png",
               4: "emojis/neutral.png", 5: "emojis/sad.png", 6: "emojis/surprised.png"}

# Global variables
last_frame1 = np.zeros((480, 640, 3), dtype=np.uint8)
cap1 = None
show_text = [0]
bound_box = cv2.CascadeClassifier('haarcascades_cuda/haarcascade_frontalface_default.xml')
```

5.1.6 Function to get face captured and recognize emotion

```
def Capture_Image():
    global cap1, last_frame1
    if cap1 is None:
        cap1 = cv2.VideoCapture(0)
        if not cap1.isOpened():
            print("Can't open the camera1")

    flag1, frame1 = cap1.read()
    frame1 = cv2.resize(frame1, (600, 500))

    gray_frame = cv2.cvtColor(frame1, cv2.COLOR_BGR2GRAY)
    n_faces = bound_box.detectMultiScale(gray_frame, scaleFactor=1.3, minNeighbors=5)

    for (x, y, w, h) in n_faces:
        cv2.rectangle(frame1, (x, y - 50), (x + w, y + h + 10), (255, 0, 0), 2)
        roi_frame = gray_frame[y:y + h, x:x + w]
        crop_img = np.expand_dims(np.expand_dims(cv2.resize(roi_frame, (48, 48)), -1), 0)
        prediction = face_model.predict(crop_img)
        maxindex = int(np.argmax(prediction))
        cv2.putText(frame1, facial_dict[maxindex], (x + 20, y - 60), cv2.FONT_HERSHEY_SIMPLEX, 1, (255, 255, 255),
                    2, cv2.LINE_AA)
        show_text[0] = maxindex

    if flag1 is None:
        print("Error!")

    elif flag1:
        last_frame1 = frame1.copy()
        pic = cv2.cvtColor(last_frame1, cv2.COLOR_BGR2RGB)  # to store the image
        img = Image.fromarray(pic)
        imgtk = ImageTk.PhotoImage(image=img)
        lmain.imgtk = imgtk
        lmain.configure(image=imgtk)
        lmain.after(10, Capture_Image)
```

5.1.7 GUI Window to show captured image with emoji

```
# GUI Window to show captured image with emoji
if __name__ == '__main__':
    root = tk.Tk()
    heading = Label(root, bg='black')
    heading.pack()
    heading2 = Label(root, text="Avatar", pady=20, font=('arial', 45, 'bold'), bg='black', fg='#CDCDCD')
    heading2.pack()
    lmain = tk.Label(master=root, padx=50, bd=10)
    lmain2 = tk.Label(master=root, bd=10)
    lmain3 = tk.Label(master=root, bd=10, fg="#CDCDCD", bg='black')
    lmain.pack(side=LEFT)
    lmain.place(x=50, y=250)
    lmain3.pack()
    lmain3.place(x=960, y=250)
    lmain2.pack(side=RIGHT)
    lmain2.place(x=900, y=350)
    root.title("Avatar")
    root.geometry("1400x900+100+10")
    root['bg'] = 'black'
    exitbutton = Button(root, text='Quit', fg="red", command=root.destroy, font=('arial', 25, 'bold')).pack(side=BOTTOM)
    Capture_Image()
    Get_Emoji()
    root.mainloop()
```

Chapter 6

RESULTS AND DISCUSSION

6.1 Result

6.1.1 Training our model dataset,we got an accuracy of 89.34%

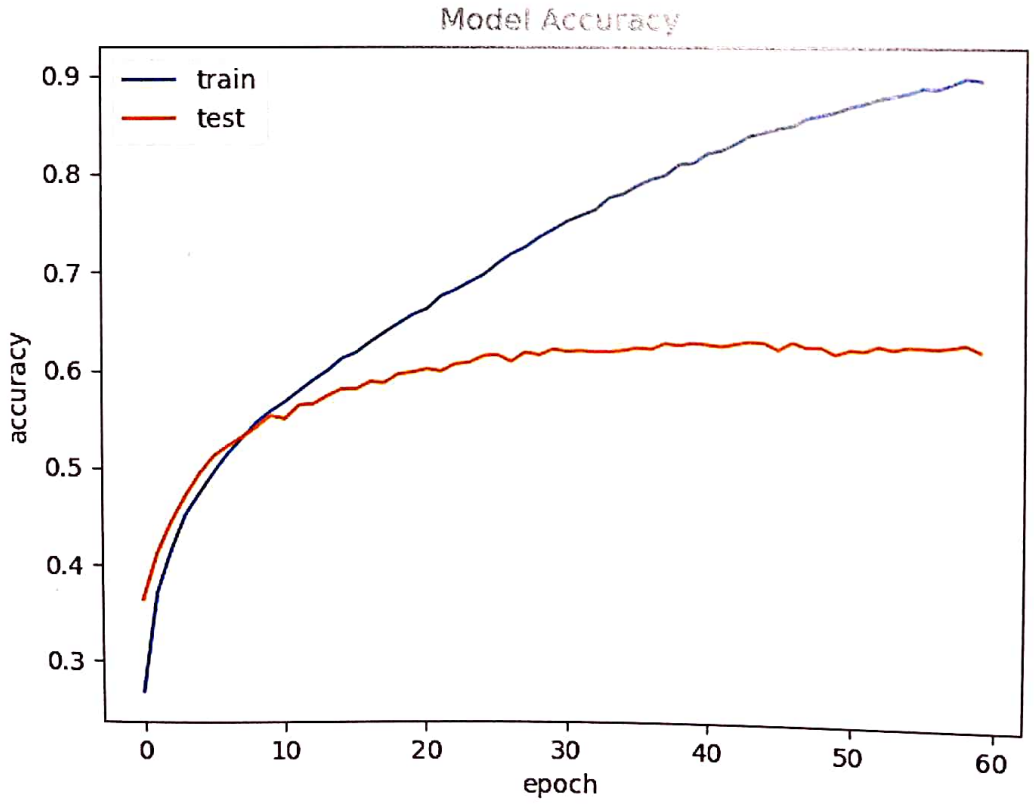


Figure 6.1: Accuracy

6.1.2 Accuracy after trained for 60 epochs

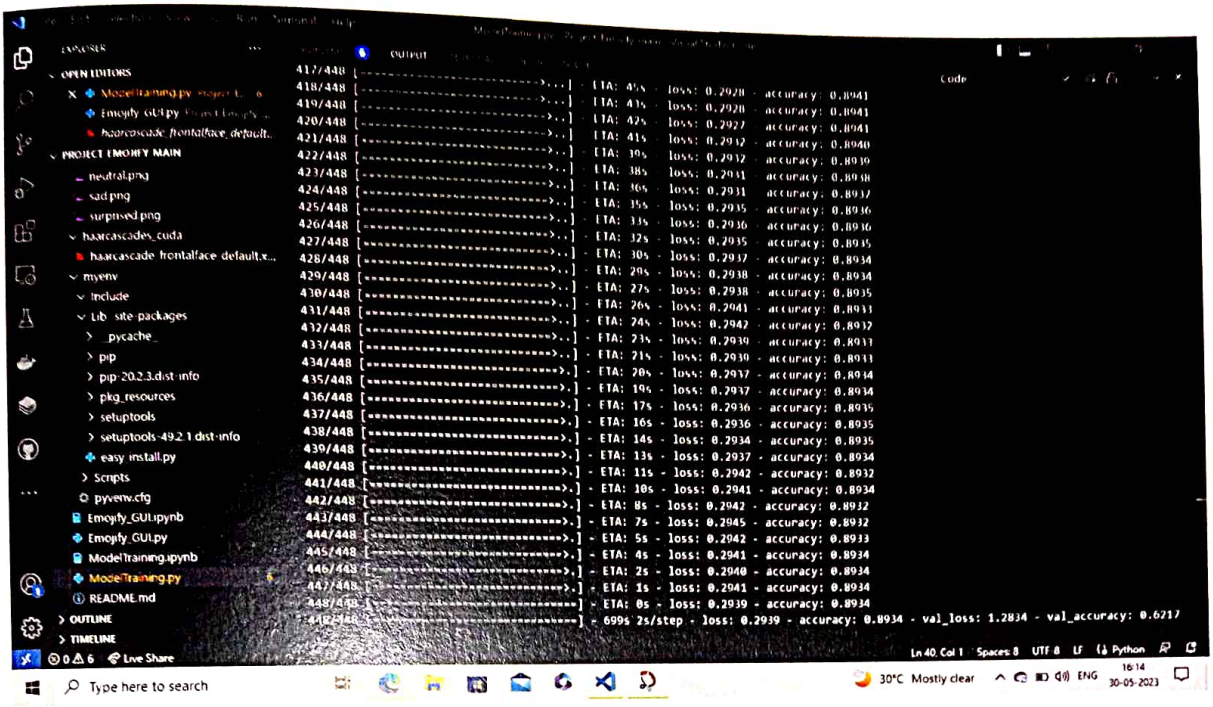


Figure 6.2: Trained for 60 epochs

6.1.3 Loss graph plot

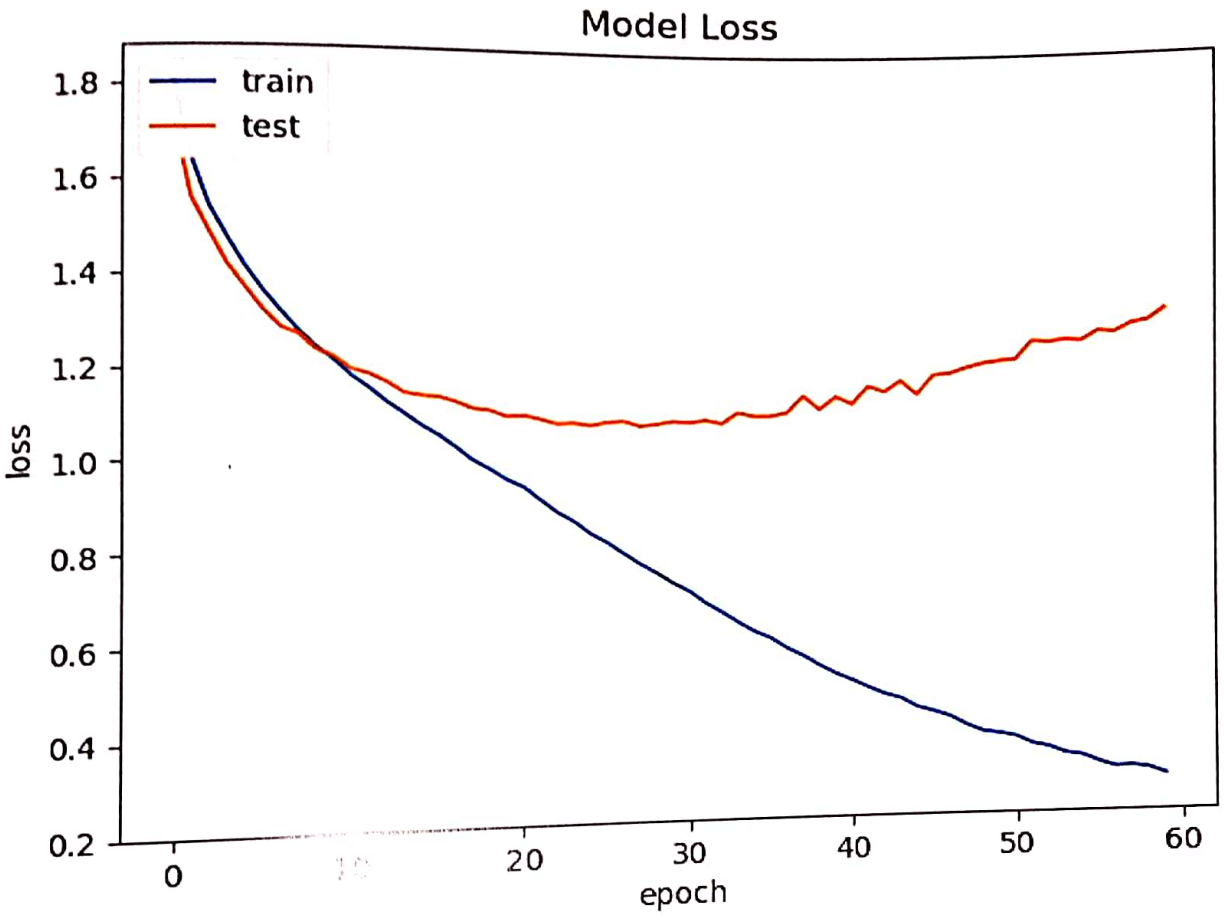


Figure 6.3: Loss graph

6.1.4 Output

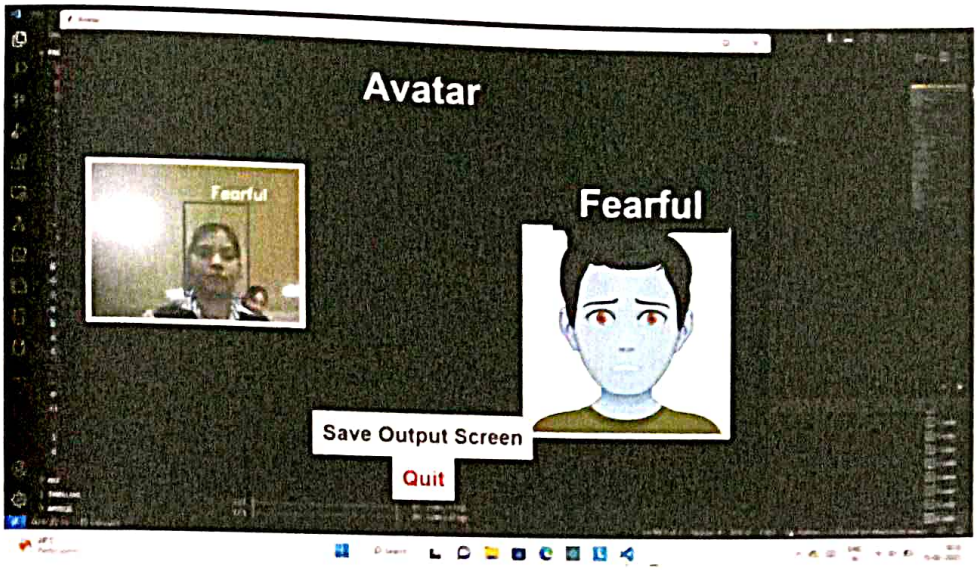


Figure 6.4: Output screen

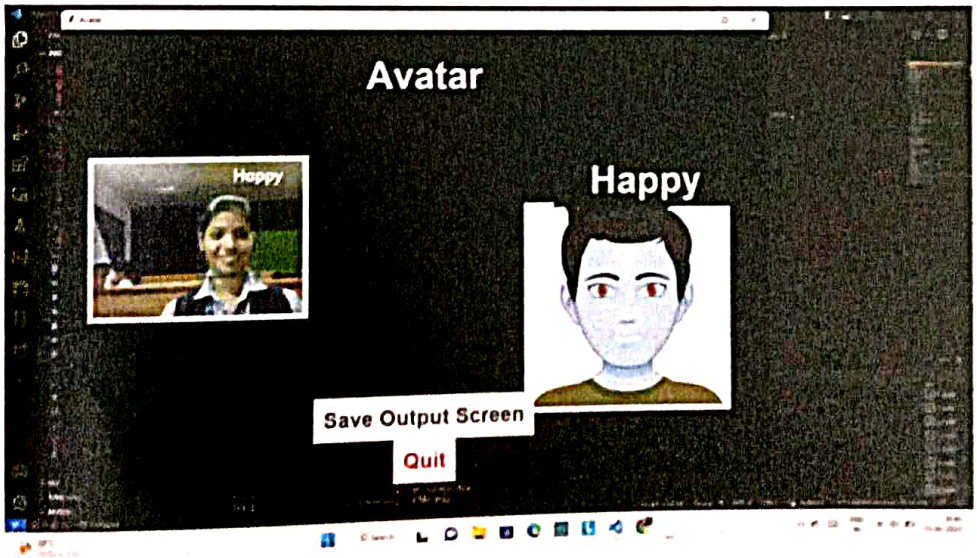


Figure 6.5: Output screen 2

Chapter 7

Conclusion

Emotion recognition from facial expressions is a rapidly evolving field with significant potential for real-world applications in fields like psychology, marketing, and security. Recent advancements in computer vision and machine learning techniques have enabled the development of accurate and reliable emotion recognition models that can analyze facial expressions in real-time. However, there are still some challenges to be addressed, such as ensuring the accuracy and fairness of the models across different demographics and avoiding the potential ethical issues associated with the use of facial recognition technology. Despite these challenges, the potential benefits of emotion recognition from facial expressions are immense, and it is likely that this technology will continue to be a topic of interest in the years to come.

References

[1] A. K. Goel, A. Jain, C. Saini, Ashutosh, R. Das, and A. Deep, "Implementation of ai/ml for human emotion detection using facial recognition," in *2022 IEEE 4th International Conference on Cybernetics, Cognition and Machine Learning Applications (ICCCMLA)*, 2022, pp. 511–515.

[2] H. Chouhayebi, J. Riffi, M. A. Mahraz, A. Yahyaouy, and H. Tairi, "Facial expression recognition using machine learning," in *2021 Fifth International Conference On Intelligent Computing in Data Sciences (ICDS)*, 2021, pp. 1–6.

[3] M. Srivastav, P. Mathur, T. Poongodi, S. Sagar, and S. A. Yadav, "Human emotion detection using open cv," in *2022 2nd International Conference on Innovative Practices in Technology and Management (ICIPTM)*, vol. 2, 2022, pp. 748–751.

[4] H. Qasim, M. Safa, H. Tiwari, and D. Arun, "Emotion recognition from facial expressions using deep learning-cnn model," in *2022 International Conference on Power, Energy, Control and Transmission Systems (ICPECTS)*, 2022, pp. 1–15.

[5] A. V. Savchenko, "Hsemotion: High-speed emotion recognition library," *Software Impacts*, vol. 14, p. 100433, 2022. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S2665963822001178

REPORT ON PROJECT EXHIBITION
DIGITAL ELECTRONICS

- Venue :- Digital Electronics Lab
- Date :- 2nd August 2022
- Time :- 1:00 pm –4:00 pm
- Total number of Participants :-Total: 30

  IEEE members: 14
  Non-IEEE members: 16

IEEE PELS SBC VJEC conducted a Project exhibition for S4 EEE students. Students are divided into 4 batches and demonstrated different projects related to application of digital electronics.

Project List:

SL NO	Reg. No. of students	PROJECT NAME
1	VML20EE013 VML20EE014 VML20EE015 VML20EE016	WATER LEVEL INDICATOR ALARM WITH BUZZER
2	VML20EE001 VML20EE002 VML20EE003 VML20EE004	VU METER USING LM3915 IC
3	VML20EE025 VML20EE030 VML20EE027 VML20EE028	LED BLINKING INDICATOR USING BC 547 TRANSISTOR
4	VML20EE011 VML20EE012 VML20EE010	BLINKING LED
5	VML20EE017 VML20EE018 VML20EE019	RC CAR

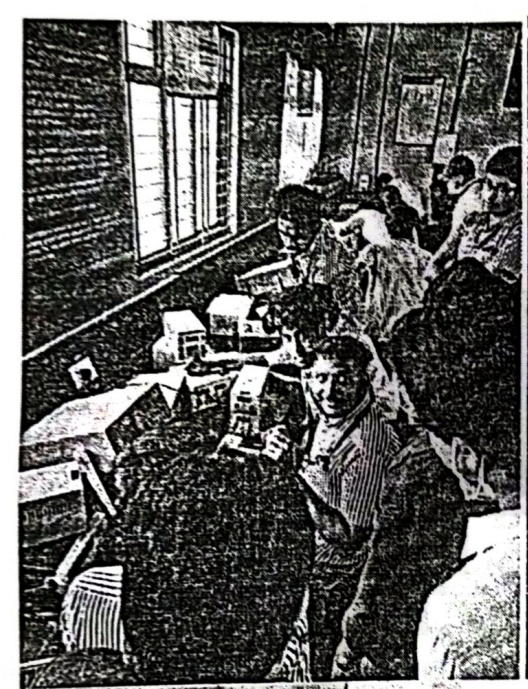
Signature Not Verified

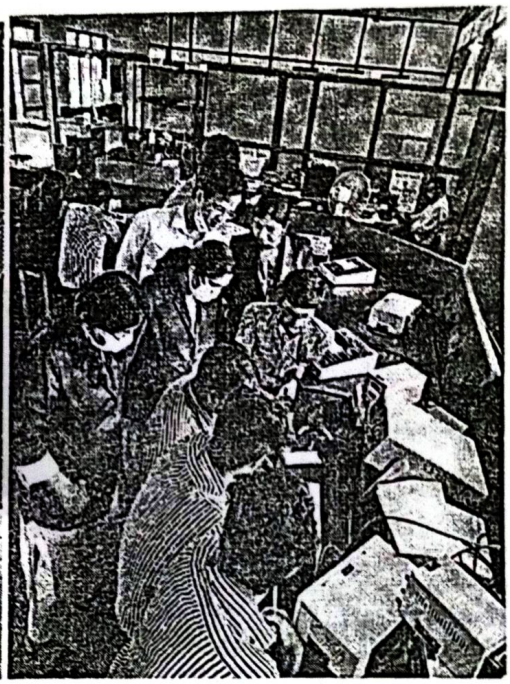
Principal.VJEC

6	VML20EE021 VML20EE022 VML20EE023 VML20EE024	LED DISE DISPLAY

A core team of faculty members evaluated the exhibition and made good interaction with the team members. The project resulted in understanding many engineering concepts of digital electronics. The application of few ideas of these core subjects were made clear during the project. Also, the training helped to understand the industrial application of various electrical and electronics components such as control loops, timer.

Photo Gallery:





8/8/22

Signature Not Verified

Principal.VJEC

HOD EEE

2021 - 2022

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

CERTIFICATE

This is to certify that the report entitled "**VU METER USING LM3915 IC** " is a bonafide record of the EEL 204 Digital Electronics project done by **Abhishek K, Abhishek Vinod M, Agil Mathews Antony, Aishwarya C** under our guidance towards the partial fulfilment of the requirements for the award of the Degree of Bachelor of technology in Electrical & Electronics Engineering of Dr. A.P.J Abdul Kalam Technological University through Vimal Jyothi Engineering College, Chemperi.

COURSE COORDINATORS

Ms. Teena George
Assistant professor
Department of EEE
VJEC Chemperi

Ms. Jyothi Joseph
Assistant professor
Department of EEE
VJEC Chemperi

HEAD OF THE DEPARTMENT

Ms. Laly James
Associate professor & HOD
Department of EEE
VJEC Chemperi

Signature Not Verified
Principal.VJEC

2021 - 2022

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

CERTIFICATE

This is to certify that the report entitled " **WATER LEVEL INDICATOR ALARM WITH BUZZER** " is a bonafide record of the EEL 202 Micro project done by **Anfas, Antony thomas, Arjunlal , Aswin Raj** under our guidance towards the partial fulfilment of the requirements for the award of the Degree of Bachelor of technology in Electrical & Electronics Engineering of Dr. A.P.J Abdul Kalam Technological University through Vimal Jyothi Engineering College, Chemperi.

COURSE COORDINATORS

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VJEC Chemperi

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Ms. Laly James
Associate professor & HOD
Department of EEE
VJEC Chemperi

VIMAL JYOTHI ENGINEERING COLLEGE

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

PROJECT EXHIBITION - IMPACT REPORT

Topic: PROJECT EXHIBITION
Course: EEL 204 - Digital Electronics Lab
Date: 2nd August 2022
Semester and academic year: S4, 2021-22
Duration (no of days): 1
Batch: S4, (2020-24 EEE Batch)

Project List:

SL NO	Reg. No. of students	PROJECT NAME
1	VML20EE013 VML20EE014 VML20EE015 VML20EE016	WATER LEVEL INDICATOR ALARM WITH BUZZER
2	VML20EE001 VML20EE002 VML20EE003 VML20EE004	VU METER USING LM3915 IC
3	VML20EE025 VML20EE030 VML20EE027 VML20EE028	LED BLINKING INDICATOR USING BC 547 TRANSISTOR
4	VML20EE011 VML20EE012 VML20EE010	BLINKING LED
5	VML20EE017 VML20EE018 VML20EE019 VML20EE020	RC CAR
6	VML20EE021 VML20EE022 VML20EE023 VML20EE024	LED DISE DISPLAY

a. **Knowledge acquired** (knowledge you gained through your project experience and relate this knowledge to what you learned in specific courses at the college)

The project resulted in understanding many engineering concepts of Analog Electronics, Basic Electronics

control system components and digital electronics. The application of few ideas of these core subjects were made clear during the project. Also, the training helped to understand the industrial application of various electrical and electronics components such as control loops, timer.

b. Skills learned: (skills and any career-specific abilities that you gained during your project like technical skills, problem analysis, etc. Discuss any of the skills that you learned as part of courses at the college)

The students were able to acquire few skills for the career such as the problem analysis skill, Critical Thinking and team work. Students are able to understand and evaluate the practical aspects of digital electronics course. Also they were able to implement the concepts and experiments, learned and conducted in the lab session. The project preparations helped to identify various electronics components and their applications. The latest engineering tools for solving the electrical as well as electronics issues were discussed and suitable components for the topics are selected. The groups got an exposure to design and analytical skills during the session.

c. Impact analysis: Compare the **knowledge and skills sets** that you gained (mentioned as per para a& b above) before and after your internship/visit

Use scale from 1 to 4

Poor = 1 satisfactory = 2, very good = 3 and excellent = 4

Sl. No	Knowledge/Skills	Before	After
1	Practical application of Engineering concepts	1	4
2	Exposure to Design and Analytical skills	1	2
3	Introduced modern engineering tools	1	3
4	Research based knowledge	1	2
5	Contributed to your lifelong learning	1	3
6	Apply knowledge of electrical fundamentals, analog & digital electronics to the field of electrical & electronics systems in industry.	2	4
7	Develop technical knowledge, skill, and competence to identify comprehend and solve problems in research and academic related to industrial drives & control	1	3

d). Connected POs & PSOs Attainment

(Select **relevant POs /PSOs** and rate the same for the Industrial Training /internships/Industrial visits undergone)

Use scale from 1 to 3

1 –Poor, 2-Medim, 3- High

POs	Rating			POs	Rating			PSOs	Rating		
	3	2	1		3	2	1		3	2	1
PO 1	3			PO 7				PSO 1	3		
PO 2		2		PO 8				PSO 2	3		
PO 3	3			PO 9	3						
PO4			1	PO 10		2					
PO 5	3			PO 11		2					
PO 6			1	PO 12	3						

| Program Outcomes (POs)

Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

Problem Analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

- **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

| Program Specific Outcomes (PSOs)

- Apply the knowledge of electrical fundamentals, circuit design, control engineering, analog & digital electronics to the field of electrical & electronics systems in industry.
- Develop technical knowledge, skill, and competence to identify comprehend and solve problems in research and academic related to power system [illegible], industrial drives & control.

| Program Educational Objectives (PEOs)

- Graduates will achieve broad and in-depth knowledge of Electrical & Electronics Engineering relating to industrial practices and research to analyze the practical problems and think creatively to generate innovative solutions using appropriate technologies.
- Graduates will make valid judgment, synthesize information from a range of sources and communicate them in sound ways appropriate to the discipline.
- Graduates will sustain intellectual curiosity and pursue lifelong learning not only in areas that are relevant to Electrical & Electronics Engineering, but also that are important to society
- Graduates will adapt to different roles and demonstrate leaderships in global working environment by respecting diversity, professionalism and ethical practices.

Vision

To evolve as a centre of excellence, to train students in contemporary technologies, to meet the needs of global industry and to develop them into skillful engineers instilled with human values and professional ethics.

Mission

To produce competent and disciplined Electrical & Electronics Engineers through delivery of quality education to meet the ongoing global challenges in alignment with technical education system and society

Signature Not Verified

Faculty Signature

Principal VJEC

INNOVATIVE PROJECTS MADE BY THE STUDENTS DURING THE TECHFEST 2023			
Sl No	NAME	PROJECT NAME	TEAM MATE
1	ASHLYN WILSO	SOLAR TRACKER	GOKUL
2	EBIN JOHN	RC CAR	EBIN
3	AMAL RAJ	ARDUINO OBSTACLES	ANFAS P, AMAR , ABHISHEK K
4	SEBIN MS	MOBILE PHONE DETECTOR C	DENO BABY, M
5	MUHAMMED ZI	SMART DUSTBIN	NAKUL GANES
6	SIJU BIJOY	ULTRASONIC SECURITY ALARM	VINEET BINOY,
7	RELVIN ROSHA	MAGNETIC REPULSION TRAC	
8	JITHIN NAIR	DISTANCE INDICATOR	THEERTHA
9	RELVIN ROSHA	WIRELESS POWER TRANSMI	
10	SEBIN MS	HOME AUTOMATION	ABHISHEK K, SEBIN M.S.

Signature Not Verified

Principal.VJEC