

MACHINE LEARNING ANALYSIS OF EMOTION DETECTS ANXIETY AND DEPRESSION IN ADULT

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ABSTRACT: Whenever we are thinking about any programmable devices then the embedded technology comes into for front. The embedded technology is now a day's very much popular and most of the products were developed with microcontroller or microprocessor based embedded technology. In this project, we develop face recognition to assists adult person for independent living in their own homes. It reduces the health expenditures and burden of health care professionals in care facility units. Facial expressions are one of the key features of a human being and it can be used to speculate the emotional state at a particular moment. In this project, it employs the Convolutional Neural Network and Deep Neural Network to develop a facial emotion recognition model that categorizes a facial expression into some different emotions categorized as Afraid, Angry, Disgusted, Happy, Neutral, Sad and Surprised. This project is mainly developed for adult person the people who are not able to take care of by themselves so that we can take care of them based on their facial emotion what actually they need and also we have some sensor called accelerometer to detect the fall detection of person based on the accelerometer movements.

INTRODUCTION

Many embedded systems have substantially different designs according to their functions and utilities. In this project design, structured modular design methods adopted and the system is mainly composed of a single micro controller. Facial emotions play an important role in communication among humans and help us to understand the intentions of others and how they feel. Humans have a strong tendency to express emotions. They play an essential role in our daily lives. Human spend great amount of time in understanding the emotions of others, decoding what these signals mean and then determine how to respond and deal with them. Facial Emotion Recognition is getting into our lifestyle and impacting us more rapidly than we have predicted a few years back. Apple released a new feature on iPhone X called Animoji where the user can get a computer simulated emoji to mimic facial expressions. It is now hard for us to ignore the potential capabilities of such features. Facial Emotion Recognition has a wide range of applications. This paper proposes a new architecture in the convolutional neural network framework and compares it with different architecture on parameters like the training accuracy of the network,

testing accuracy of the model, training loss, testing or validation loss etc. Advantages → It saves time. → Efficient and reliable process to monitor changes in environment conditions and ensure security of the old person. Disadvantages → Carrying power supply

The main objectives are:

Here laptop camera will capture the image of the person and it will also recognize the facial emotion so that we can take care of them. Based on their mood and activates it's going to change like happy or sad. Based on the facial emotions of the person, the fan will be ON/OFF. then alert message is send to their parents.

INTRODUCTION TO DOMAIN: Machine learning (ML) is the scientific study of algorithms and statistical models that computer systems use to perform a task without using clear instructions, relying on patterns and inference instead. It is seen as a subset of artificial intelligence. Machine learning algorithms build a mathematical model based on sample data, known as "training data", in order to make predictions without being clearly programmed to perform the task. Machine learning algorithms are used in a wide variety of applications, such as email filtering and computer vision, where it is difficult or infeasible to develop a conventional algorithm for performing the task. The study of mathematical optimization delivers methods, theory and application domains to the field of machine learning. Data mining is a field of study within machine learning, and focuses on data analysis. Application across business problems, machine learning is also referred to as predictive analytics.

WHY MACHINE LEARNING IS IMPORTANT?

Machine learning is important because it gives enterprises a view of trends in customer behavior and business operational patterns, as well supports the development of new products. Many of today's leading companies, such as Facebook, Google and

Uber, make machine learning a central part of their operations. Machine learning has become a significant competitive differentiator for many companies.

TYPES OF MACHINE LEARNING

Machine learning implementations are classified into three major categories, depending on the nature of the learning "signal" or "response" available to a learning system which is as follows

1. Supervised learning
2. Unsupervised learning
3. Reinforcement learning
4. Semi-supervised learning

1.SUPERVISED LEARNING

As its name suggests, Supervised machine learning is based on supervision. It means in the supervised learning technique, we train the machines using the "labelled" dataset, and based on the training, the machine predicts the output. Here, the labelled data specifies that some of the inputs are already mapped to the output. More precisely, we can say; first, we train the machine with the input and corresponding output, and then we ask the machine to predict the output using the test dataset.

The main goal of the supervised learning technique is to map the input variable(x) with the output variable(y). Some real-world applications of supervised learning are Risk Assessment, Fraud Detection, Spam filtering, etc.

2.UNSUPERVISED LEARNING

This type of machine learning involves algorithms that train on unlabeled data. The algorithm scans through data sets looking for any meaningful connection. The data that algorithms train on as well as the -predictions or recommendations they output are predetermined.

Unsupervised learning is different from the Supervised learning technique; as its name suggests, there is no need for supervision. It means, in unsupervised machine learning, the machine is trained using the unlabeled dataset, and the machine predicts the output without any supervision.

3.REINFORCEMENT LEARNING

This approach to machine learning involves a mix of the two preceding types. Data scientists may feed an algorithm mostly labeled training data, but the model is free to explore the data on its own and develop its own understanding of the data set.

Reinforcement learning works on a feedback-based process, in which an AI agent (A software component) automatically explore its surrounding by hitting & trail, taking action, learning from experiences, and improving its performance. Agent gets rewarded for each good action and get punished for each bad action; hence the goal of reinforcement learning agent is to maximize the rewards.

4.SEMI-SUPERVISED LEARNING

Semi-Supervised learning is a type of Machine Learning algorithm that lies between Supervised and Unsupervised machine learning. It represents the intermediate ground between Supervised (With Labelled training data) and Unsupervised learning (with no labelled training data) algorithms and uses the combination of labelled and unlabeled datasets during the training period.

Although Semi-supervised learning is the middle ground between supervised and unsupervised learning and operates on the data that consists of a few labels, it mostly consists of unlabeled data. As labels are costly, but for corporate purposes, they may have few labels. It is completely different from supervised and unsupervised learning as they are based on the presence & absence of labels.

APPLICATIONS OF MACHINE LEARNING

- Speech Recognition
- Traffic Prediction
- Product Recommendations
- Self-Driving cars
- Virtual Personal Assistant
- Online Fraud Detection
- Image Recognition

ADVANTAGES AND DISADVANTAGES

Advantages:

- It is automatic
- It is used in various fields
- It can handle varieties of data
- Machine language makes fast and efficient use of the computer
- It requires no translator to translate the code
- It is directly understood by the comp

Disadvantages:

- Chances of error or fault are more
- Data requirement is more
- Time-consuming and more resources required
- All operation codes have to be remembered
- All memory addresses have to be remembered

LITERATURE SURVEY

2.1 Title: New Avenues in Opinion Mining and Sentiment Analysis

Author:E.Cambria,B. Schuller,
Y. Xia, and C.Havas

Abstract: Others' opinions can be crucial when its time to make a decision or choose among multiple options. When those choices involve valuable resources (for example, spending time and money to buy products or services) people often rely on their

peers" past experiences. Until recently, the main sources of information were friends and specialized magazine or websites. Now, the "social web" provides new tools to efficiently create and share ideas with everyone connected to the World Wide Web. Forums, blogs, social networks, and content-sharing services help people share useful information. This information is unstructured, however, and because it's produced for human consumption, it's not something that's "machine process able." Capturing public opinion about social events, political movements, company strategies, marketing campaigns, and product preferences is garnering increasing interest from the scientific community (for the exciting open challenges), and from the business world (for the remarkable marketing fallouts and for possible financial market prediction). The resulting emerging fields are opinion mining and sentiment analysis.

Disadvantages:

In existing opinion-mining systems need to be improve to broader and deeper common and commonsense knowledge bases. More complete knowledge must be combined with reasoning methods that are more deeply inspired by human thought and psychology. This will lead to a better understanding of natural language opinions and will more efficiently bridge the gap between (unstructured) multimodal information and (structured) machine-process able data.

2.2 Title: New avenues in knowledge bases for natural language processing

Author: E. ambria, B. Schuller, Y. Xia, and and B. White

Abstract: Between the birth of the Internet and 2003, year of birth of social networks such as Myspace, Delicious, LinkedIn, and Facebook, there were just a few dozen Exabyte"s of information on the Web. Today, that same amount of information is created

weekly. The advent of the Social Web has provided people with new content sharing services that allow them to create and share their own contents, ideas, and opinions, in a time- and cost-efficient way, with virtually millions of other people connected to the World Wide Web. This huge amount of information, however, is mainly unstructured (because it is specifically produced for human consumption) and hence not directly machine-process able. The automatic analysis of text involves a deep understanding of natural language by machines, a reality from which we are still very far off. Hitherto, online information retrieval, aggregation, and processing have mainly been based on algorithms relying on the textual representation of web pages.

Such algorithms are very good at retrieving texts, splitting them into parts, checking the spelling and counting the number of words. When it comes to interpreting sentences and extracting meaningful information, however, their capabilities are known to be very limited, as most of the existing approaches are still based on the syntactic representation of text, a method that relies mainly on word co-occurrence frequencies. Such algorithms are limited by the fact that they can process only the information that they can „see“. As human text processors, we do not have such limitations as every word we see activates a cascade of semantically related concepts, relevant episodes, and sensory experiences, all of which enable the completion of complex natural language processing (NLP) tasks – such as word-sense disambiguation, textual entailment, and semantic role labeling – in a quick and effortless way.

Disadvantages: This doesn't take context and content information for analyzing sentiments. Accuracy is too low.

2.3 Title: Affective Computing and Sentiment

Analysis

Author: E. Cambria

Abstract: Emotions play an important role in successful and effective human-human communication. In fact, in many situations, emotional intelligence is more important than IQ for successful interaction. There is also significant evidence that rational learning in humans is dependent on emotions.² Affective computing and sentiment analysis, hence, are key for the advancement of AI³ and all the research fields that stem from it. Moreover, they find applications in various scenarios and companies, large and small that include the analysis of emotions and sentiments as part of their mission. Sentiment-mining techniques can be Exploited for the creationnd automated upkeep of review and opinion aggregation websites, in which opinionated text and videos are continuously gathered from the Web and not restricted to justproduct reviews, but also to wider topics such as political issues and brand perception.

Disadvantages:

So far, sentiment-mining approaches from text or speech have been based mainly on the bag- of-words model because, at first glance, the most basic unit of linguistic structure appears to be the word.

SYSTEM SPECIFICATION:

1.PYTHON:

Python is an interpreted, object-oriented, high-level programming language with dynamic semantics. Its high-level built in data structures, combined with dynamic typing and dynamic binding, make it very attractive for Rapid Application Development, as well as for use as a scripting or glue language to connect existing components together. Python's simple, easy to learn syntax emphasizes readability

and therefore reduces the cost of program maintenance.

2.OPEN CV:

OpenCV (Open Source Computer Vision Library) is an open source computer vision and machine learning software library. OpenCV was built to provide a common infrastructure for computer vision applications and to accelerate the use of machine perception in the commercial products. Being a BSD-licensed product, OpenCV makes it easy for businesses to utilize and modify the code.

3.EMBEDDED C:

Embedded C is a set of language extensions for the C programming language by the C Standards Committee to address commonality issues that exist between C extensions for different embedded systems.

4. RENESAS MICROCONTROLLER:

The figure 3 shows R5F100LEA microcontroller from Renesas RL78 series which is a 16-bit microcontroller is used to implement this project. Microcontroller acts as the heart of the project, which controls the whole system. It contains of Flash ROM 64KB, RAM 4KB and Data Flash 4KB, and it has High speed on-chip oscillator, Self-reprogrammable under software control, 58 GPIO's, 3 UART's, Simplified I2C, 10 bit resolution ADC, 28 Interrupt Sources, ISP programming support etc.



Fig 1: Renesas Microcontroller

5. LCD

The figure shows 16*2 LCD Display. LCD stands for Liquid Crystal Display. By using the LCD, all the outputs are displayed. LCD doesn't know about

the content (data or commands) supplied to its data bus. It is the user who has to specify whether the content at its data pins are data or commands.



Fig 2: LCD Display

6. RELAYS:

A relay is an electrically operated switch. Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts. The coil current can be on or off so relays have two switch positions and most have double throw (changeover) switch contacts as shown in the diagram.



Fig 3: Relay

7. GSM:

GSM stands for Global System for Mobile communication. It establishes the mobile communication from one place to another place.



Fig 4: GSM module

8. KERAS:

Keras is an API designed for human beings, not machines. Keras follows best practices for reducing cognitive load: it offers consistent & simple APIs, it minimizes the number of user actions required for common use cases, and it provides clear & actionable error messages. It also has extensive documentation and developer guides.

9. NUMPY:

NumPy is an open source library available in Python that aids in mathematical, scientific, engineering, and data science programming. It works perfectly well for multi-dimensional arrays and matrices multiplication. NumPy is a programming language that deals with multi-dimensional arrays and matrices. On top of the arrays and matrices, NumPy supports a large number of mathematical operations.

10. TENSORFLOW:

TensorFlow is a free and open-source software library for dataflow and differentiable programming across a range of tasks. It is a symbolic math library, and is also used for machine learning applications such as neural networks. It is used for both research and production at Google, TensorFlow is Google Brain's second-generation system.

METHODOLOGIES

The main steps of proposed methodology are shown below

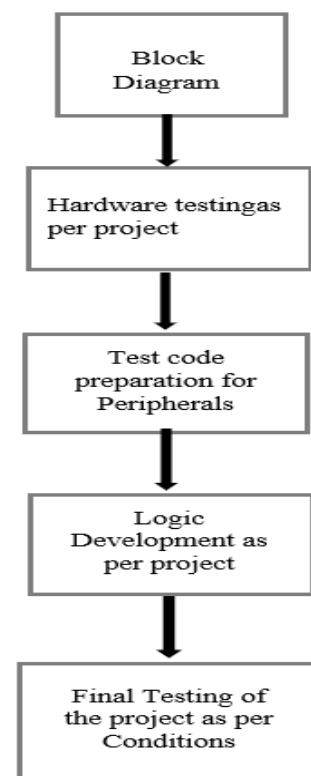


Fig 5: Methodologies

The main steps of proposed methodology are shown below

- Hardware testing as per the project.
- Test code preparation for peripheral
- Logic development as per the project.
- Test the entire component.
- Connection made as shown in block diagram.
- Coding in Embedded c.
- Dump code into hardware kit
- Interface Hardware and Software.
- Get the output and cross verification or apply for test conditions

SYSTEM ARCHITECTURE

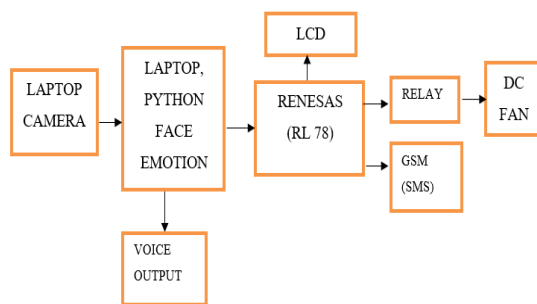


Fig 6: Block Diagram

The above figure shows the complete block diagram/Implementation of the project and logical connections of the project is analysed. Required hardware and software are collected. All Python Libraries have to be imported. At Starting Stage Only you have to check laptop camera is active or not. In pre-processing steps Cascade Input will read. Then the project input image will read. Harr cascade Classifier will do Face Detection. After that emotions will analysis and detected. On the emotion basis voice output will be generated or Fan ON.

IMPLEMENTATION DETAIL WITH MODULES

1.Data Collection:

DATASETS USED:

Several public databases were used in order to assess face expression recognition algorithms: Frontal face dataset from Haarcascade.

FER2013 dataset: FER2013 is an open-source dataset generated by Pierre-Luc Carrier and Aaron Courville for an ongoing project and later given publicly for a Kaggle competition. The FER2013 database was launched during the 2013 International Conference on Machine Learning's Challenges in Representation Learning. FER2013 is a massive and unrestricted database that was automatically compiled using the Google image search API.

After rejecting incorrectly labelled frames and modifying the cropped region, all photos have been registered and resized to 48*48 pixels. This dataset contains 35,887 grayscale, 48x48-pixel pictures of faces displaying a range of emotions -7 emotions, all labeled.



Fig 7: Images of FER2013 dataset

2.Haar Cascade Algorithm:

Haar Cascade is a machine learning object detection algorithm used to identify objects in an image or video and based on the concept of features proposed by Paul Viola and Michael Jones, "Rapid Object Detection using a Boosted Cascade of Simple Features" in 2001. Where a cascade function is trained from a lot of positive and negative images. It is then used to detect objects in other images.

Here they will work with face detection. Initially, the algorithm needs a lot of positive images (images of faces) and negative images (images without faces) to train the classifier. Then they need to extract features from it.

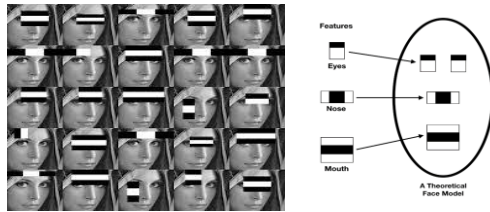


Fig 8: Image detection using Haar cascade classifier

Image conversion into Grayscale

Grayscale images have many shades of gray in between. Grayscale images are often the result of measuring the intensity of light at each pixel in a single band of the electromagnetic spectrum. Images of this sort, also known as black-and-white, are composed exclusively of shades of gray, varying from black at the weakest intensity to white at the strongest. Grayscale images also called as binary Images.

Cascading Classifiers

The cascade classifier consists of a number of stages, where each stage is a group of weak learners. These weak learners are simple classifiers called decision stumps. Each stage is trained using a method called boosting. Boosting provides the ability to train a highly accurate classifier by taking the weighted average of decisions made by the weak learners.

Algorithm:

1. First, the haar cascade method is used to detect faces in each frame of the webcam feed.
2. The region of image containing the face is resized to 48x48 and is passed as input to the CNN.

3. The network outputs a list of softmax scores for the seven classes of emotions.
4. The emotion with maximum score is displayed on the screen

3.Facial feature extraction:

Convolutional layer: In order to encode memory in our network the filters need to convolve over multiple words in the sentence and try to extract the score by looking at sequence of n-words. Our convolutional layer has 400 filters.

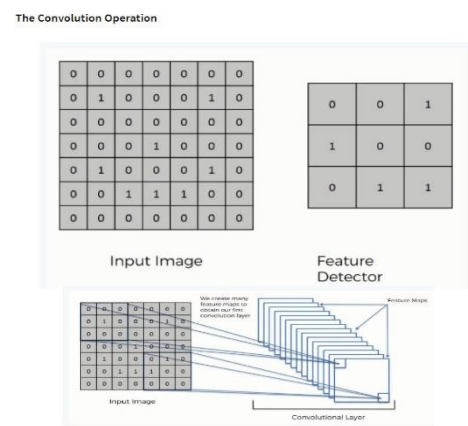


Fig 9: Convolutional Operation

ReLU layer: It is the first activation function that we use to increase the non-linearity.

Max pooling layer: Then through a max pooling layer we keep the important feature

Fully connected layer: We eventually apply a Fully Connected neuron layer

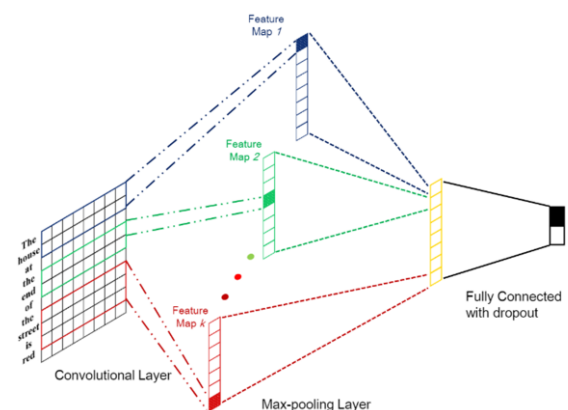


Fig 10: Working of CNN

4.Expression recognition:

Facial expression recognition software is a system that detects emotions in human faces by using biometric indicators . Because it collects and analyses information from images, it is possible to offer an unfiltered, unbiased emotional reaction or data that is unfiltered and impartial.



Fig 11: Detection of Emotions

RESULT

9.1 SNAPSHOTS

Hardware output:

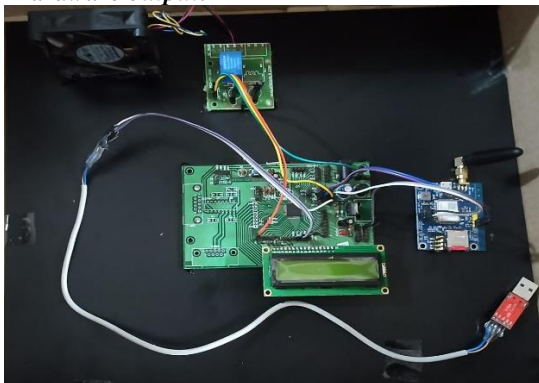


Fig 12: Hardware Components

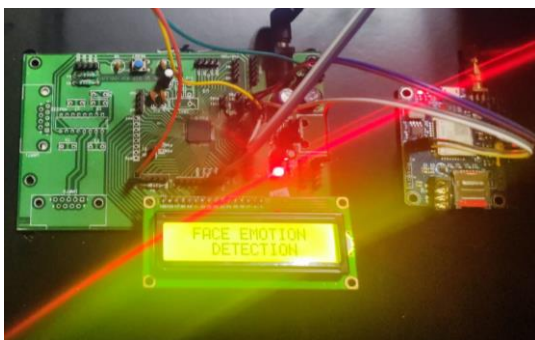


Fig 13: Working of Hardware

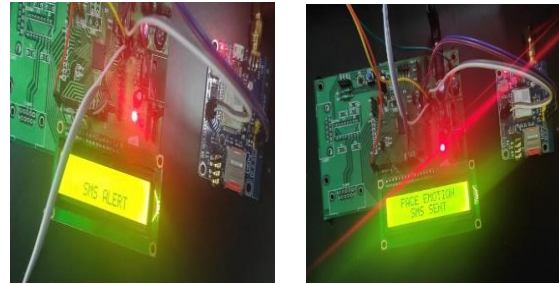


Fig 14: Initiation of SMS

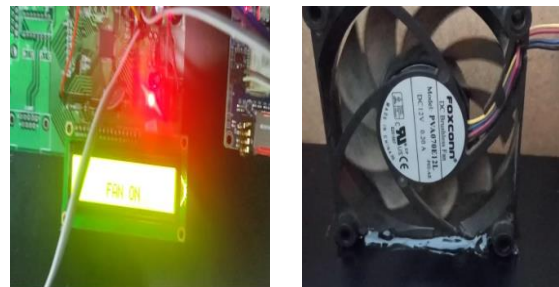


Fig 15: Initiation of Fan

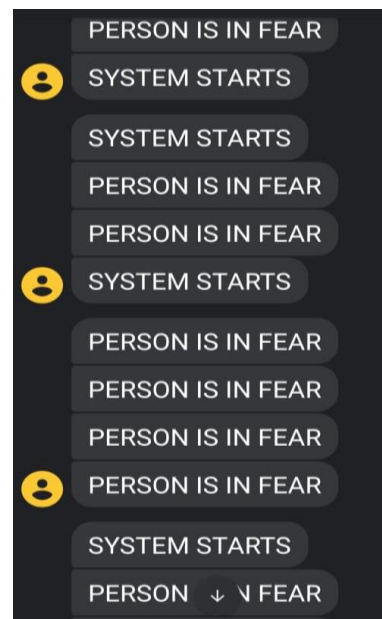


Fig 16: Message sent to user

Software output:



Fig 17: Facial emotion detection

CONCLUSION

In this case, when the model predicts incorrectly, the correct label is often the second most likely emotion. The facial expression recognition system presented in this research work contributes a resilient face recognition model based on the mapping of behavioral characteristics with the physiological biometric characteristics. The physiological characteristics of the human face with relevance to various expressions such as happiness, sadness, fear, anger, surprise and disgust are associated with geometrical structures which are stored as base matching template for the recognition system. The behavioral aspect of this system relates the attitude behind different expressions as property base. The property bases are alienated as exposed and hidden category in genetic algorithmic genes. The gene training set evaluates the expressional uniqueness of individual faces and provides a resilient expressional recognition model in the field of biometric security. The design of a novel asymmetric cryptosystem based on biometrics having hierarchical group security eliminates the use of passwords and smart cards as opposed to earlier cryptosystems. It requires

a special hardware support like all other biometrics system. This research work promises a new direction of research in the field of asymmetric biometric cryptosystems which is highly desirable in order to get rid of passwords and smart cards completely. Experimental analysis and study show that the hierarchical security structures are effective in geometric shape identification for physiological traits.

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