Emotion Recognizing Music Player

A Dissertation submitted to
Rajiv Gandhi Proudyogiki Vishwavidyalaya
Towards partial fulfillment of the Requirements for
The Degree of Bachelor of Engineering in
Computer Science & Engineering
(Session 2018-2019)

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Recommendation

The dissertation entitled **"Emotion Recognizing Music Player"** submitted by **Anubhuti Bhargava (0822CS151013))** is a satisfactory account of the bonafide work done under our supervision is recommended towards the partial fulfillment for the award of **Bachelor of Engineering in Computer Science & Engineering** degree by **Rajiv Gandhi Proudyogiki Vishwavidyalaya, Bhopal** for the academic year 2018-2019.

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Dissertation Approval Sheet

The dissertation entitled **"Emotion Recognizing Music Player"** submitted by **Anubhuti Bhargava (0822CS151013)** is approved as partial fulfillment for the award of **Bachelor of Engineering** in **Computer Science & Engineering** degree by **Rajiv Gandhi Proudyogiki Vishwavidyalaya, Bhopal** for the academic year 2018-2019.

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Candidate Declaration

We hereby declare that the work which is being presented in this project entitled **"Emotion Recognizing Music Player"** in partial fulfillment of degree of **Bachelor of Engineering** in **Computer Science & Engineering** is an authentic record of our own work carried out under the supervision and guidance of **Ms. Karishma Mandloi**, **Assistant Professor** in **Department of Computer Science & Engineering**, **Swami Vivekanand College of Engineering, Indore.**

We are fully responsible for the matter embodied in this project in case of any discrepancy found in the project and the project has not been submitted for the award of any other degree.

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ABSTRACT

Conventional method of playing music depending upon the mood of a person requires human interaction. Migrating to the computer vision technology will enable automation of such system. To achieve this goal, an algorithm is used to classify the human expressions and play a music track as according to the present emotion detected. It reduces the effort and time required in manually searching a song from the list based on the present state of mind of a person. The expressions of a person are detected by extracting the facial features using the PCA algorithm and Euclidean Distance classifier. An inbuilt camera is used to capture the facial expressions of a person which reduces the designing cost of the system as compared to other methods. The results show that the proposed system achieves upto 84.82% of accuracy level in recognizing the expressions.

•The study of music and emotions suggests that there is a psychological relationship between a person's emotional state and the type of music they listen to.

• The purpose of this project is to make an interactive music player that automatically generates a playlist according to the current mood of the user.

• The song playlists though are, at times too large to sort out . It would be helpful if the music player was "smart enough" to sort out the music based on the current state of emotion the person is feeling.

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INTRODUCTION

1.1 Rationale

• Facial expressions are a great indicator of the state of a mind for a person. Indeed the most natural way to express emotions is through facial expressions.

• Humans tend to link the music they listen to, to the emotion they are feeling.

• We will be using facial landmarks and a machine learning algorithm, and see how well we can predict emotions in different individual.

Using Facial Landmarks is another approach to detecting emotions, more robust and powerful than the earlier used fisherface classifier, but also requiring some more code and modules.

Fig 1.1

• For detecting the emotion of an individual, We need to do a few things:
→ Get images from a webcam
→ Detect Facial Landmarks
→ Train a machine learning algorithm (we will use a linear SVM)
→ Predict emotions

• We are training our model to identify 3 emotions:
1) Happiness.
2) Neutral.
3) Sadness.

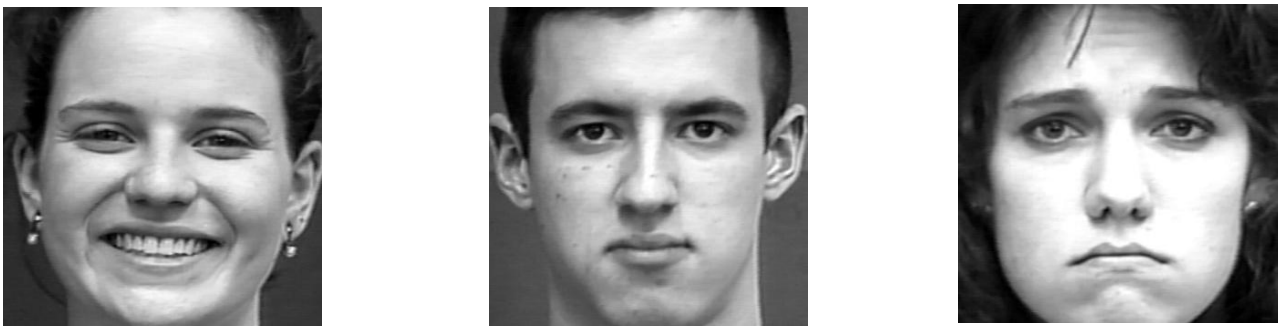


Fig 1.2

• Once the emotion is recognized, half of our task is done.

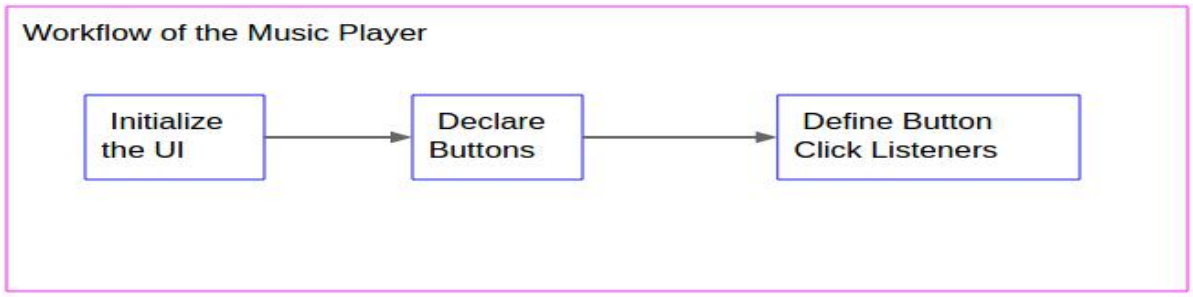
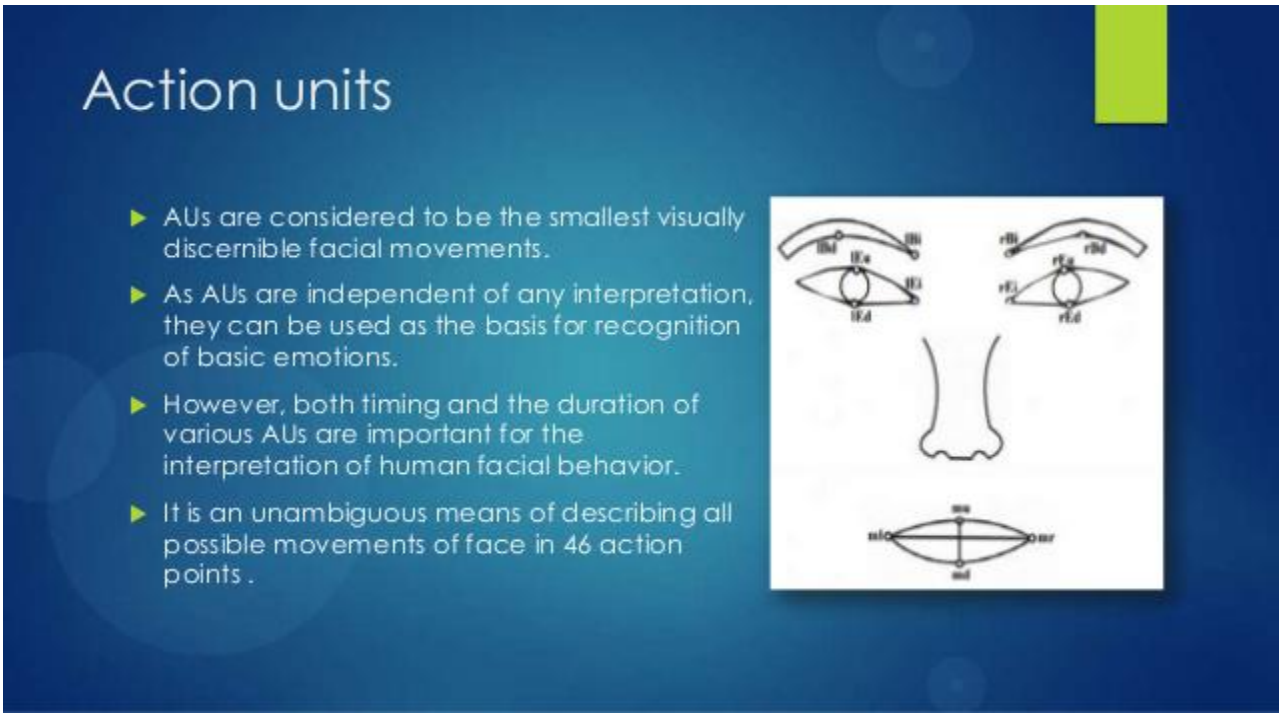


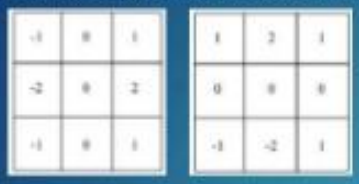
Fig 1.3

• The next step is to make a user interactive music player. Our music player will automatically generate list of songs belonging to that particular genre.

• The user will have the options to stop the song, play next song, play previous song, etc.



- Vertical edger, Horizontal edger



- The peak with the lower intensity value in horizontal projection of intensity is selected as the Y coordinate

- A pair of regions that satisfy certain geometric conditions ($G < 60$) are selected as eyes from those regions.

1.1 Head Pose Identification

1.2 PROBLEM DEFINITION:

• Generally people have a large number of songs in their databases.

• People randomly select a song from their playlists and the given song might not be appropriate for the current mood of the user and might disappoint them.

• In current music player systems, user has to choose the songs from the entire playlist that matches the current mood of the user. This process is very time consuming.

1.3 PROPOSED SOLUTION:

We have created a music player on the basis of Artificial intelligence by training our machine with mchine learning applying usng python. Basically a software is proposed as a solution of all the problems whic will recognised the facial expression of a person that is mood of a person and select and play asong from playlist that is perfect suitable for the mood. Some proposed solution points are as follows :

• The proposed system is based on extraction of facial expressions that will automatically generate the playlist thereby reducing the time and efforts of the user to choose the appropriate song that corresponds to his/her current mood.

• The user will have the option to change the current playing song and switching to another one.

• The users will get rid of the traditional method of the song selection and hence this will provide users a whole new experience for listening their favourite music.

There are also some challenges in face recognisition that are mentioned as follows:

- Pose And frequent head movements
- Presence of structural components
- Occlusion
- Image orientation
- Imaging conditions
- Subtle facial deformation
- Ambiguity and uncertainity in face motion measurement .

So we have overcome all this by applying machine learning using python . And recognised facial expression with upto 60% accuracy initial it is implemented only for 3 facial expression in future will we expanded for more exression and with many more features.

1.4 REPORT ORGANIZATION

In Chapter 1 we have discussed about the introduction of our system .It gives the information about What is about it? What are the problems because of which we have selected this problem?And how to resolve these problems?

In Chapter 2 we have given the detailed about the existing and their faults. And the proposed systems are having some issues but they can solve main issue but still there are some lacks in

them and also discussed about the technology and tools that we have used n this system.

In Chapter 3 we have given the information of the model that we have used to make the system and what all the advantages and disadvantages that we have faced. All the requirements that is needed while making the project i.e. Software and Hardware requirements. We have discussed about the feasibility criteria of this system and what all the functions will be performed and by whom in the system with the help of use case diagram.

In Chapter 4 there is a design of system on with it is basically implemented what all are the activities and sequencing of the system. The database it is required with what entities and also with the relationship between them.

In Chapter 5 there is discussion of next phase of project creation that is testing, after implementation of design it is tested on different strategies and levels to make it perfect and secure it from any kind of loss.

In the last Chapter 6 we have given the conclusion and all the references with the help of which we have Created this project.

Chapter - 2
LITERATURE SURVEY

2.1 Related Works

I .Various techniques and approaches have been proposed and developed to classify human emotional state of behavior. The proposed approaches have focused only on the some of the basic emotions. For the purpose of feature recognition, facial features have been categorized into two major categories such as Appearance-based feature extraction and Geometric based feature extraction by zheng . Geometric based feature extraction technique considered only the shape or major prominent points of some important facial features such as mouth and eyes. In the system proposed by Changbo , around a total of 58 major landmark points was considered in crafting an ASM..The appearance based extraction feature like texture, have also been considered in different areas of work and development. An efficient method for coding and implementing extracted facial features together with multi-orientation and multi-resolution set of Gabor filters was proposed by Michael Lyons.

II. An accurate and efficient statistical based approach for analyzing extracted facial expression features was proposed by Renuka R. Londhe. The paper was majorly focused on the study of the changes in curvatures on the face and intensities of corresponding pixels of images. Artificial Neural Networks (ANN) was used in the classification extracted features into 6 major universal emotions like anger, disgust, fear, happy, sad, and surprise. A Scaled Conjugate Gradient back-propagation algorithm in correlation with two-layered feed forward neural network was used and was successful in obtaining a 92.2 % recognition rate. In order to reduce the human effort and time needed for manual segregation of songs from a playlist, in correlation with different classes of emotions and moods, various approaches have been proposed.

• The idea for this project is taken from the blogs and research topics from the websites like researchgate.org, stackoverflow.com, etc.

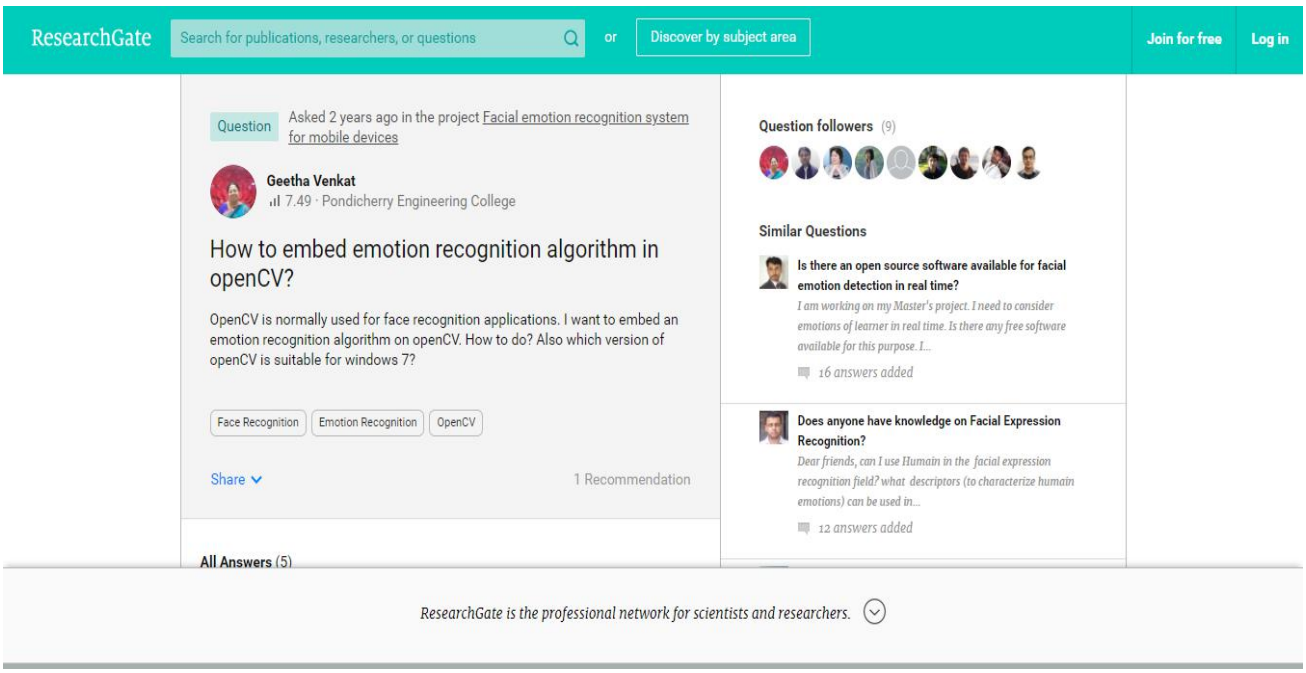


Fig 2.1

2.2 TECHNOLOGY STACK

The language I'll be using is PYTHON.

→ Following python dependencies will be required :

- **Sklearn**

Scikit-learn (formerly scikits.learn) is a free software machine learning library for the Python programming language.
It feature various classification, regression and clustering algorithms including support vector machines, random forests, gradient boosting, *k*-means and DBSCAN, and is designed to interoperate with the Python numerical and scientific libraries NumPy and SciPy.

- **Dlib**

Dlib is a modern C++ toolkit containing machine learning algorithms and tools for creating complex software in C++ to solve real world problems. It is used in both industry and academia in a wide range of domains including robotics, embedded devices, mobile phones, and large high performance computing environments. Dlib's open source licensing allows you to use it in any application, free of charge.

- **Open CV**

OpenCV (Open Source Computer Vision Library) is released under a BSD license and hence it's free for both academic and commercial use. It has C++, Python and Python interfaces and supports Windows, Linux, Mac OS, iOS and Android. OpenCV was designed for computational efficiency and with a strong focus on real-time applications. Written in optimized C/C++, the library can take advantage of multi-core processing. Enabled with OpenCL, it can take advantage of the hardware acceleration of the underlying heterogeneous compute platform.

GUI tools for music player :

- **Tkinter**

Python library used for making GUI.

- **Pygame**

Python library used for making GUI and games

- **Mutagen**

Python library used to fetch the metadata.

- **Some other python libraries**

Chapter - 3
ANALYSIS

3.1 PROCESS MODEL ADOPTED:

3.1.1 Description

A prototype is a version of a system or part of the system that's developed quickly to check the customer's requirements or feasibility of some design decisions.

So, a prototype is useful when a customer or developer is not sure of the requirements, or of algorithms, efficiency, business rules, response time, etc.

In prototyping, the client is involved throughout the development process, which increases the likelihood of client acceptance of the final implementation.

While some prototypes are developed with the expectation that they will be discarded, it is possible in some cases to evolve from prototype to working system.

A software prototype can be used:

[1] In the **requirements engineering**, a prototype can help with the elicitation and validation of system requirements.It allows the users to experiment with the system, and so, refine the requirements. They may get new ideas for requirements, and find areas of strength and weakness in the software.Furthermore, as the prototype is developed, it may reveal errors and in the requirements. The specification maybe then modified to reflect the changes.

[2] In the **system design**, a prototype can help to carry out deign experiments to check the feasibility of a proposed design.

For example, a database design may be prototype-d and tested to check it supports efficient data access for the most common user queries.

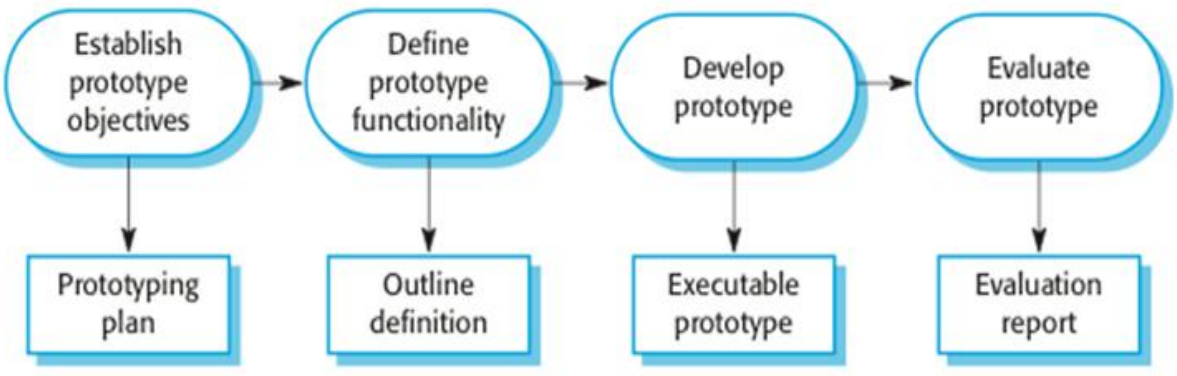


Fig 3.1

3.1.2 Advantages of Prototype model:

- Users are actively involved in the development
- Since in this methodology a working model of the system is provided, the users get a better understanding of the system being developed.
- Errors can be detected much earlier.
- Quicker user feedback is available leading to better solutions.
- Missing functionality can be identified easily
- Confusing or difficult functions can be identified Requirements validation, Quick implementation of, incomplete, but functional, application.

Disadvantages of Prototype model:

- Leads to implementing and then repairing way of building systems.
- Practically, this methodology may increase the complexity of the system as scope of the system may expand beyond original plans.
- Incomplete application may cause application not to be used as the full system was designed Incomplete or inadequate problem analysis.

3.1.3 Reason to use:

The proposed system has desired system needs to have a lot of interaction with the end users so this is the best approach to be implemented in this project.

3.2 REQUIREMENT ANALYSIS

3.2.1 Software Requirements:

The language I'll be using is PYTHON.
→ Following python dependencies will be required :
- Sklearn
- Dlib
- Open CV
- Tkinter
- Pygame
- Mutagen
- Some other python libraries

• Python 3.6

• Anaconda distribution.

• OS: Windows 7 or higher/Ubuntu.

3.2.2 Hardware Requirements:

• CPU : Intel i3 or higher

• GPU : Any GPU that is compatible with OpenGL 3.2(NVIDIA GEFORCE recommended)

• RAM : 4 GB minimum(8 GB recommended)

• Web camera

3.3 Feasibility Study

3.3.1 Technical Feasibility:

This app will be technically feasible to the systems which fulfill its technical requirements. However it can be made more feasible for other devices in future.

3.3.2 Economical Feasibility:

The music player will be available for users in either very small budget or will be made free for users. The free version will have only the basic features whereas the paid version will include features like automatic music emotion recognition by using music data mining or music information retrival.

3.3.3 Operational Feasibility:

The stable version of the app will be an easy to operate .exe file which can be opened in any machine fulfilling its requirements.

3.3 Use case model:

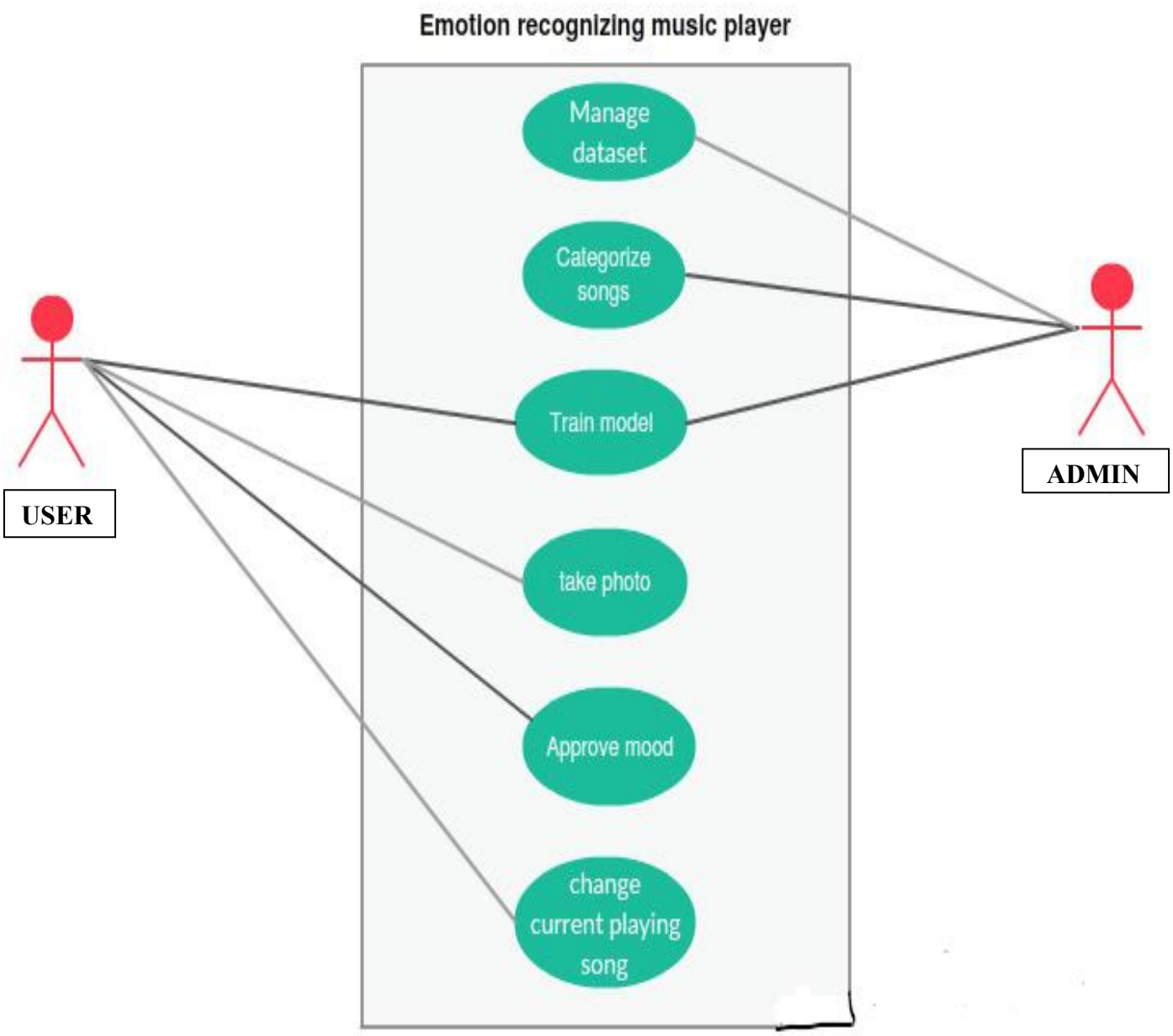


Fig 3.2

3.4 Use Case Description

The admin will access following functionalities :

Dataset management:
It is a crucial task and hence to be carried out by the admin. The dataset contains various pictures in various test folders which are used for training the machine learning model and predict output. Enhancement of dataset with different user's face pictures will gradually increase the accuracy of the Proposed model.

Categorize songs:
Admin will categorize various songs according to various categories such as happy, neutral, sad.

Train model:
Admin will have right to train the model on given dataset.

The user will use following functionalities :

Train models:
Users will have right to train the model on given dataset.

Take photo:
Users can open camera and take their photo for emotion recognition.

Approve mood:
Once the mood is predicted by the system, user has right to approve or reject the answer

Change current playing song:
User can change current playing song as per their need.

Chapter-4

DESIGN

4.1 Activity diagram

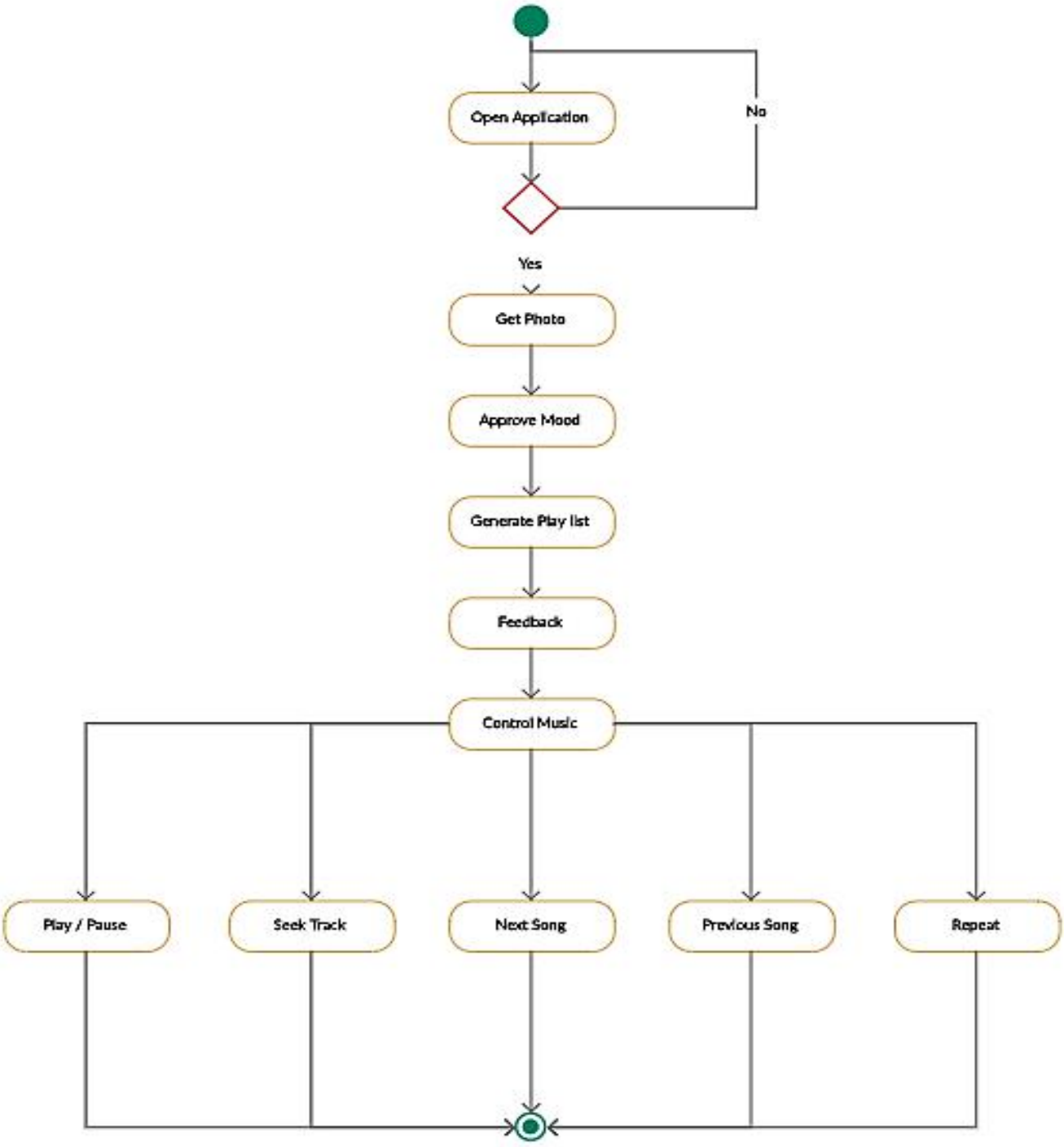


Fig 4.1

4.2 Sequence Diagram

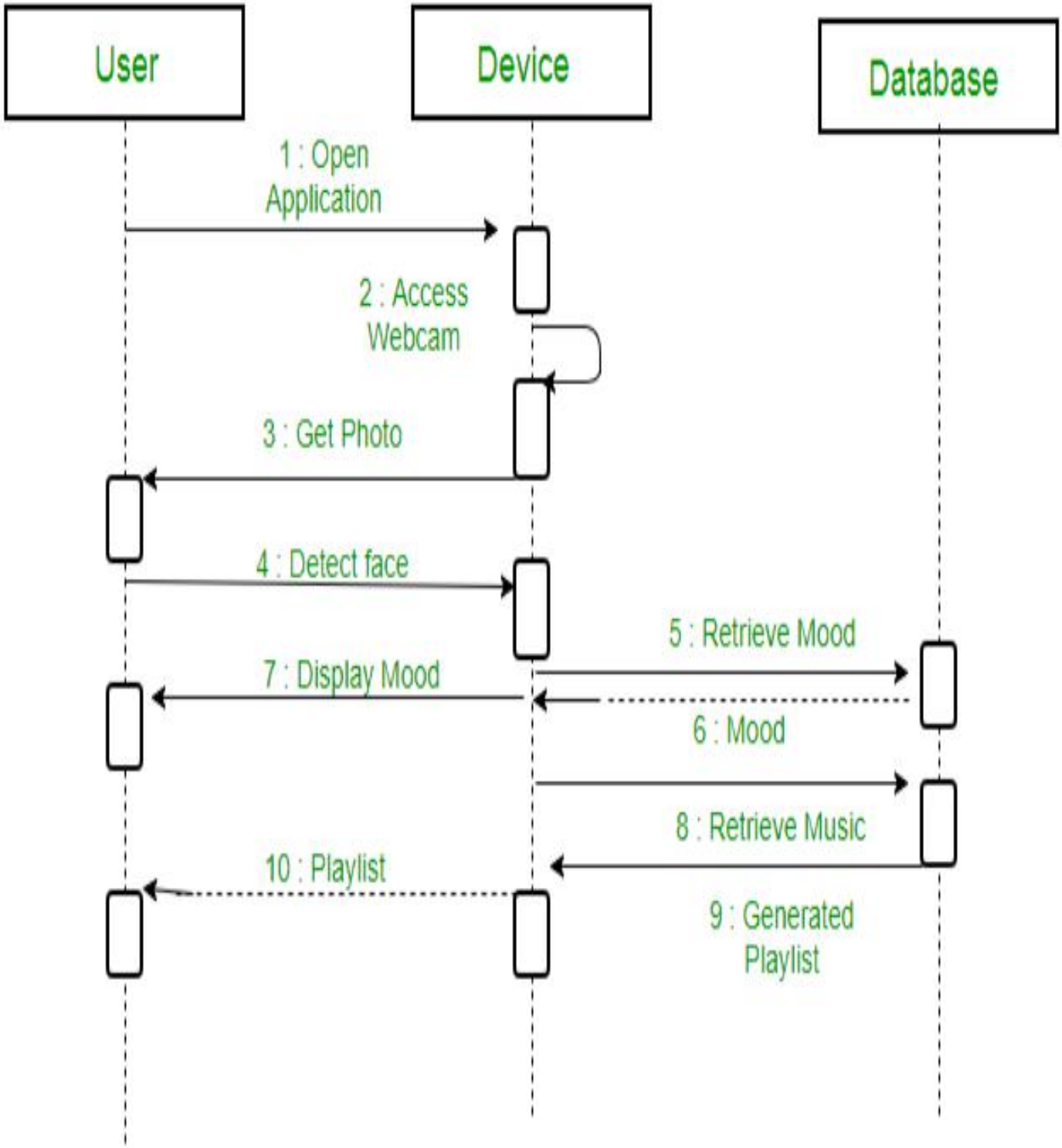


Fig 4.2

Chapter-5
IMPLEMENTATTION AND TESTING

5.1 Language Used Characteristics

We have used Python to implement this project. Python is a simple, robust and secure programming language. Here are the key features of Python:

*** Simple**:
The Python language is easy to learn. Python code is easy to read and write.

*** Familiar**:
Python is similar to C/C++ but it removes the drawbacks and complexities of C/C++ like pointers and multiple inheritances. So if you have background in C/C++, you will find Python familiar and easy to learn.

*** Object-Oriented:**
Unlike C++ which is semi object-oriented, Python is a fully object-oriented programming language. It has all OOP features such as abstraction, encapsulation, inheritance and polymorphism.

*** Robust:**
With automatic garbage collection and simple memory management model (no pointers like C/C++), plus language features like generics, try-with-resources,… Python guides programmer toward reliable programming habits for creating highly reliable applications.

*** Secure:**
The Python platform is designed with security features built into the language and runtime system such as static type-checking at compile time and runtime checking (security manager), which let you creating applications that can't be invaded from outside. You never hear about viruses attacking Python applications.

*** Platform Independence:**
Python code is compiled into intermediate format (bytecode), which can be executed on any systems for which Python virtual machine is ported. That means you can write a Python program once and run it on Windows, Mac, Linux or Solaris without re-compiling. Thus the slogan "Write once, run anywhere" of Python.

Besides the above features, programmers can benefit from a strong and vibrant Python ecosystem:

Python is powered by Oracle - one of the leaders in the industry. Python also gets enormous support from big technology companies like IBM, Google, Redhat so it has been always evolving over the years.

There are a lot of open source libraries which you can choose for building your applications.

There are many superior tools and IDEs that makes your Python development easier.

There are many frameworks that help you build highly reliable applications quickly.

The community around Python technology is very big and mature, so that you can get support easily.

5.2 Testing

Testing is a process used to identify the correctness, completeness and quality of developed computer software. With that in mind, testing can never completely establish the correctness of computer software.

5.2.1 Testing objectives

Software Testing has different goals and objectives. The major objectives of Software testing are as follows:

- Finding defects which may get created by the programmer while developing the software.
- Gaining confidence in and providing information about the level of quality.
- To prevent defects.
- To make sure that the end result meets the business and user requirements.
- To ensure that it satisfies the BRS that is Business Requirement Specification and SRS that is System Requirement Specifications.
- To gain the confidence of the customers by providing them a quality product.

5.2.2 Testing methods and strategies:

The various levels of testing being followed in our project are:

1. Unit Testing: The unit tests are performed on the units and modules while the programmer is coding them. Units and modules committed to the code repository are not allowed to have any known bugs. The programmer of a unit owns this unit and is responsible for testing it and finding any bugs contained in it. Following are the modules we tested individually to ensure that the information properly flows in and out of the unit module.

Login module:

User module: Functioning and its support to different kinds of members were tested.

2. Integration testing: In integration testing the separate modules will be tested together to find weaknesses and bugs in the system. This way any bottlenecks in the system can be identified and the corresponding module can be redesigned.

3. System testing: System testing will compare the system specifications against the actual system. Test cases are derived from the systems use cases, the functionality of the system is tested based on these tests.

4. Acceptance testing: The goal of acceptance testing is to verify that the user requirements have been achieved. The customer will perform acceptance testing in the evaluation phase of the project, but will also participate in acceptance testing at intermediate stages.

5. System Testing: System testing is an important phase. Testing represents an interesting anomaly for the software. Thus, a series of testing are performed for the proposed system before the system is ready for user acceptance testing. Unit testing is essential for the verification of the code produced during the coding phase and hence the goal is to test the Internal logic of the modulus.

6. White Box Testing: White box testing sometimes called glass-box testing case design method that uses the control structure of the particular design to derive test classes.

7. White box testing: It is sometimes behavioral testing or particular or partition testing. It attempts to find errors in the following categories.

- Incorrect or missing functions.
- Interface errors.
- Errors in data structure or external database access.
- Performance errors and initialization and termination errors.

8. Incremental integration testing: Bottom up approach for testing i.e. continuous testing of an application as new functionality is added; Application functionality and modules should be independent enough to test separately. Done by programmers or by testers.

9. Alpha testing – In house virtual user environment can be created for this type of testing. Testing is done at the end of development. Still minor design changes may be made as a result of such testing.

10. Beta testing – Testing typically done by end-users or others. Final testing before releasingapplication for commercial purpose.

A testing strategy is a general approach to the testing process rather than a method of devising particular system or component tests. Different testing strategies may be adopted depending on the type of system to be tested and the development process used. There are two different strategies available: Top-Down Testing and Bottom-Up Testing.

5.2.3 Test Cases:

Test 01: Successful detection

Original mood of user: Happiness

Mood recognized: Happiness

Output: Playlist of happy songs was played.

Test 02: Unsuccessful detection

Original mood of user: Sadness

Mood recognized : Neutral

Test 03: Successful operation

Original mood of user: Neutral

Mood detected: Neutral

Output: Playlist of neutral songs was played.

Test 04: Unsuccessful detection

Original mood of user: Happiness

Mood recognized : Neutral

Test 05: Unsuccessful detection

Original mood of user: Sadness

Mood recognized : Happiness

Test 06: Unsuccessful detection

Original mood of user: Neutral

Mood recognized : Happiness

Chapter-6
CONCLUSION

This chapter discusses the conclusions and limitations of the project. The project set out to investigate the impact of various techniques in classifying human emotion. It also set out to use the classified emotion to sort out music playlists for a person. This chapter also performs an evaluation on the approach taken. The lessons learnt during the course of this project are also discussed and finally the chapter concludes with the possible future directions of the project. During the development of the project, existing techniques for feature extraction and emotion recognition were thoroughly researched, highlighting the benefits and problems with each associated. After thorough research 3 feature extraction techniques were decided upon and further techniques to improve classification accuracy were chosen. Further research dictated the use of the Support Vector Machines as the classifier to be used.

6.1 Limitations

The biggest limitation of the project is in the general approach taken for emotion recognition using facial cues. The camera must take a full frontal image of the user to determine the emotion of the user accurately. Even though rotation invariance is taken into account for two of the feature extractors, accuracy rates of subjects facing the camera sideways was extremely low in comparison to frontal images.

6.2 Conclusion

In summary it is clear to see that the project set out and achieved its basic functionality. The feature extraction techniques could evidently be improved and much more advanced techniques exist to improve the accuracy of an emotion recognition system. Within this project there is scope for more work that could allow for the complexity of the modelling to be increased, which could evolve the result of the binding between the two main domains of current research: Music theory and Image analysis.

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