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# Music Recommendation System

## Overview

Music recommendation systems are a type of AI used in e-commerce to suggest music to users. They can be very helpful for people who are overwhelmed by choice, or who are looking for inspiration. The main purposes and goals of Music Recommendation systems include:

### **Purpose:**

Music recommendation systems serve two main purposes: benefiting the **user** and the **retailer**.

### **User Benefits:**

- **Personalized Recommendations:** Users receive music suggestions tailored to their current emotional state and mood, enhancing relevance and enjoyment.
- **Convenience:** Eliminates the need for users to manually search for music, as recommendations are automatically generated based on their facial expressions and mood.
- **Discovery of New Music:** Introduces users to songs or genres they might not have discovered on their own, broadening their musical horizons.
- **Emotional Well-being:** Music has the potential to influence emotions positively; therefore, tailored recommendations may contribute to the user's emotional well-being.

### **Retailer Benefits:**

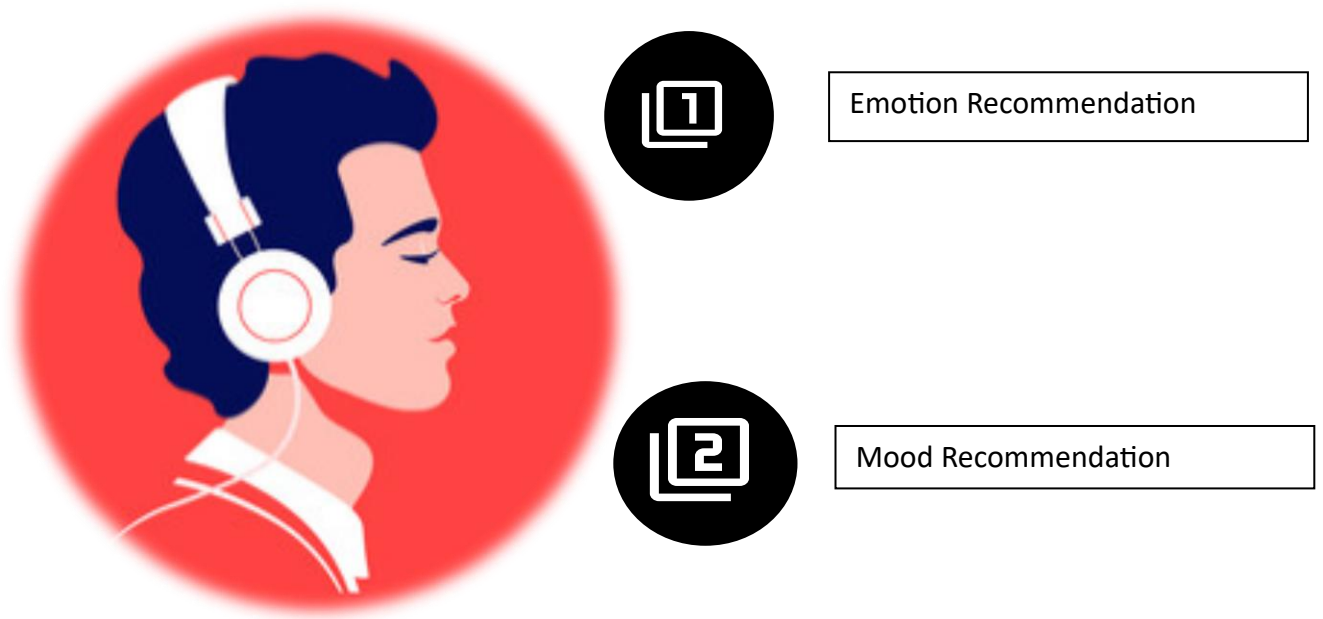
- **Enhanced Customer Experience:** Provides a more personalized shopping experience by offering music that aligns with customers' emotional states and moods, potentially increasing customer satisfaction and loyalty.
- **Increased Engagement:** Music can create a positive atmosphere in retail environments, encouraging customers to spend more time in-store and increasing their likelihood of making purchases.
- **Adaptability:** Adjusts music recommendations in real-time based on changes in customer emotions or store dynamics, ensuring continued relevance and effectiveness of the music selection.
- **Brand Image:** Contributes to a positive brand image as an innovative and customer-centric retailer that uses technology to enhance the shopping experience.

## Applications:

Music recommendation systems have a variety of applications beyond just suggesting similar songs. Here are some interesting ways they're being used:

- **Streaming Platforms:** Enhance user engagement on streaming services like Spotify, Apple Music, or Amazon Music by suggesting playlists and tracks based on the listener's current emotional state.
- **Retail Environments:** Create a more enjoyable shopping experience in retail stores by adjusting the background music to match the mood of customers, potentially influencing their purchasing decisions positively.
- **Fitness Apps:** Provide workout playlists that align with the user's energy levels and emotional state, helping to motivate and enhance the exercise experience.
- **Personalized Radio Stations:** Customize radio stations on platforms like Pandora or personalized radio apps based on the listener's mood detected from facial expressions.
- **Virtual Assistants:** Integrate with virtual assistants like Siri, Google Assistant, or Alexa to offer music recommendations tailored to the user's emotional context or activities.
- **Healthcare Settings:** Use in hospitals or clinics to create calming or uplifting music playlists that suit the emotional needs of patients or staff, potentially improving the overall atmosphere.
- **Events and Venues:** Tailor music selections at events, concerts, or venues to suit the prevailing mood of attendees, enhancing the overall experience and atmosphere.
- **Education and Learning:** Incorporate into educational platforms or e-learning environments to provide background music that aids concentration or relaxation based on the learner's emotional state.
- **Social Media Platforms:** Enhance user-generated content on platforms like TikTok or Instagram by suggesting music tracks for videos based on the emotional expressions detected in the content.
- **Gaming:** Customize in-game music or soundtracks in video games based on the emotional responses of players, creating a more immersive gaming experience.
  - These are just a few examples, and as technology advances, we can expect even more innovative applications for Music recommendation systems in the future.

## **Integration of various recommendations**



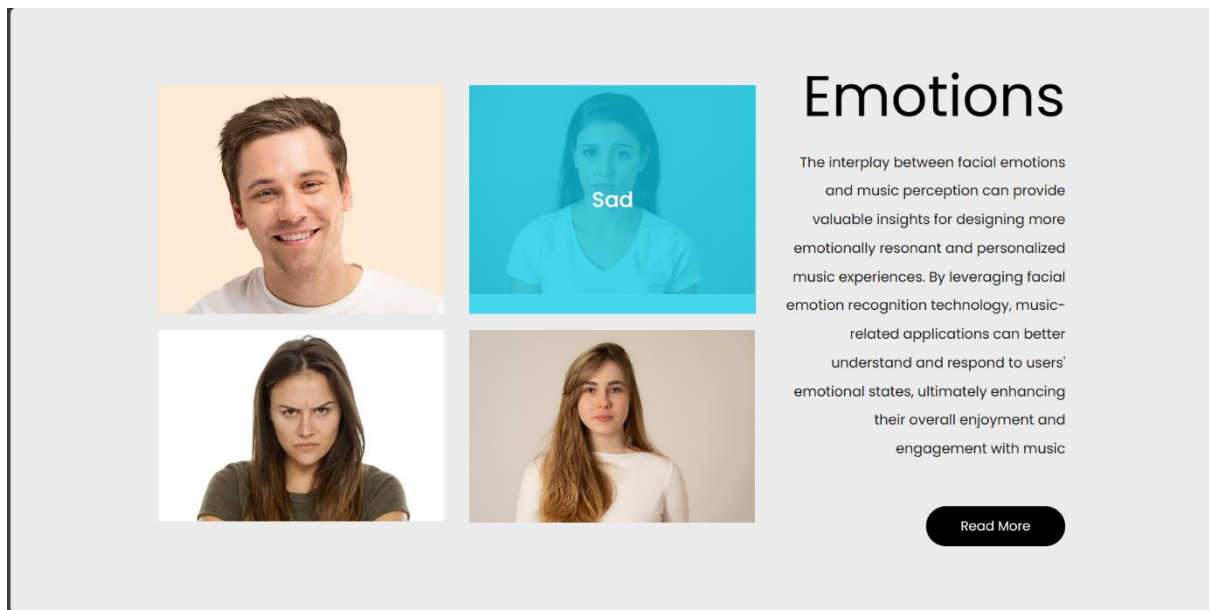
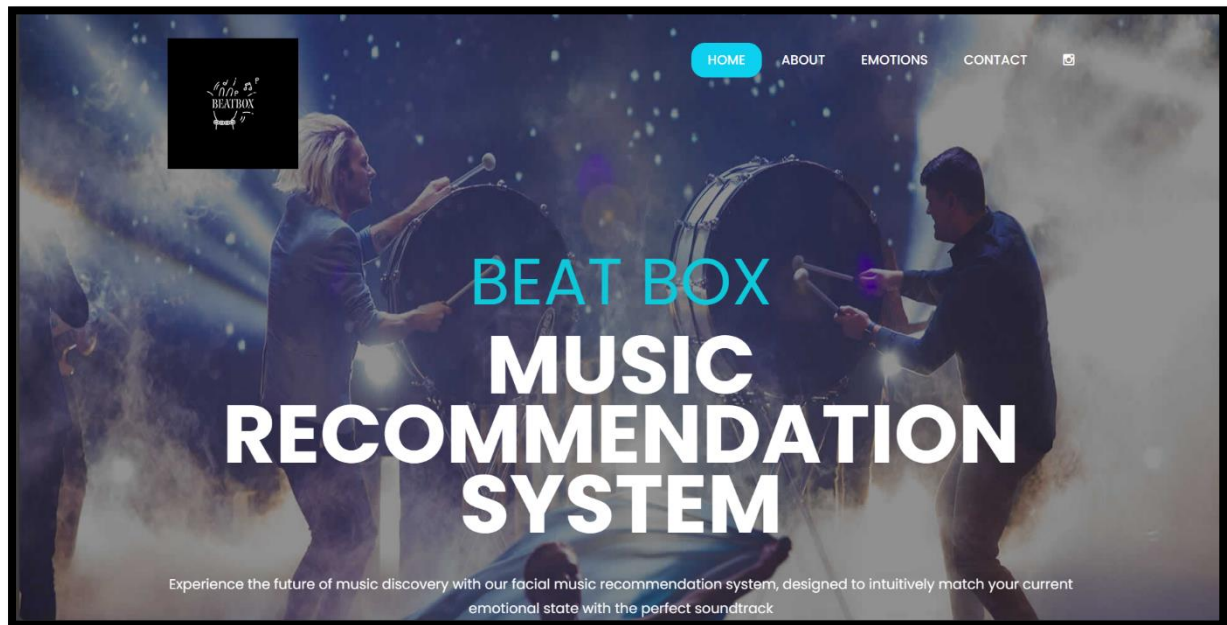
### **Emotion based recommendation :**

Facial emotion detection is a technology-driven process that involves the identification and interpretation of human emotions based on facial expressions. Using computer vision and machine learning techniques, it analyzes facial features such as eyebrow movement, eye dilation, mouth shape, and overall muscle movements to infer emotional states like happiness, sadness, anger, surprise, fear, disgust, and neutrality.

### **Mood based recommendation :**

This Mood-based recommendation systems leverage technology to suggest content, particularly music or media, based on the user's current emotional state. By analyzing various cues such as facial expressions, user inputs, or contextual data, these systems aim to enhance user experience by offering personalized recommendations aligned with their mood..

## Our Website interface:



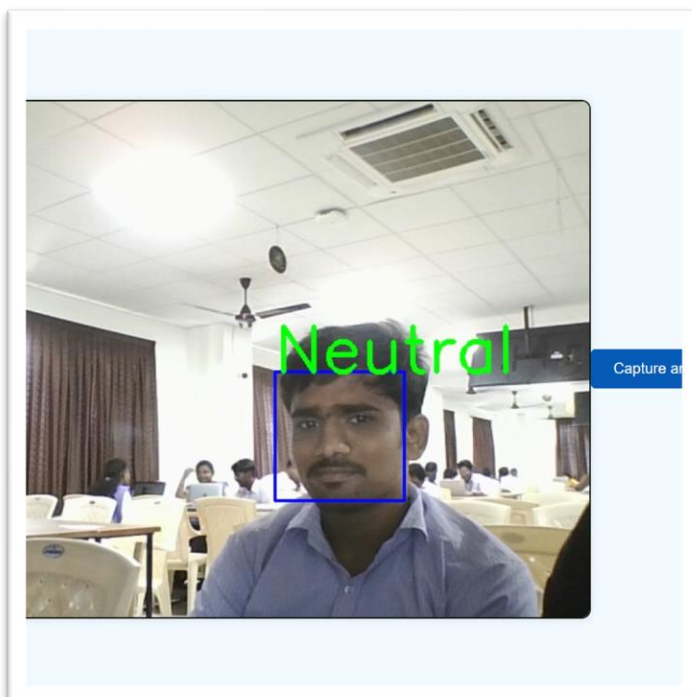
# Emotion Based Recommendation

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## Purpose and Applications:

### **Purpose of Emotion Based Recommendation:**

- **Personalization:** Tailors recommendations to the user's current emotional context, ensuring content relevance and resonance.
- **Enhanced User Experience:** Improves user satisfaction by offering content that matches their emotional preferences, thereby creating a more immersive and enjoyable experience.
- **Engagement and Retention:** Increases user engagement and retention rates by delivering content that captivates and resonates with the user's emotions.
- **Behavioral Insights:** Provides valuable insights into user behavior and preferences based on emotional responses, enabling better understanding and anticipation of user needs.



Emotion Recommendation

## Applications of Image Based Recommendation:

- **E-commerce Platforms:** This is a prime area where image-based recommendations shine. Imagine browsing for clothes online and seeing a jacket you like. You can upload a picture of that jacket and the system recommends similar styles, colors, or patterns, even if they are from different brands. This is also applicable to furniture, home décor, or any product where aesthetics are a major buying factor.
- **Social Media Inspiration:** Social media platforms can leverage image-based recommendations to suggest products based on user-uploaded photos. For instance, you could post a picture of your new shoes and the platform recommends similar styles or complementary accessories.
- **Personalized Trend Exploration:** These systems can analyze user-uploaded photos and suggest trendy items that fit their individual style. This allows users to discover new trends while staying true to their preferences.
- **Virtual Styling and Design:** Emotion-based recommendations can be integrated into virtual styling tools. By uploading a picture of yourself, the system could recommend clothes that flatter your body type or suggest how to style different pieces together. Similarly, for interior design tools, users could upload an image of their room and get recommendations for furniture or décor that matches the existing style.
- **Personalized Shopping:** Online stores can suggest products that align with the user's emotional state, such as comfort foods or cozy clothing when they detect a user is feeling down.
- **Targeted Advertising:** Ads can be tailored to the user's mood, increasing the likelihood of engagement and purchase.
- **Content Curation:** Social media platforms can adjust the content shown in a user's feed to improve their mood or match their current emotional state.
- **Engagement Suggestions:** Platforms can suggest interactions, such as reaching out to friends or participating in certain activities, to enhance the user's emotional well-being.

# **Mood Based Recommendation:**

This Mood-based recommendation systems leverage technology to suggest content, particularly music or media, based on the user's current emotional state. By analyzing various cues such as facial expressions, user inputs, or contextual data, these systems aim to enhance user experience by offering personalized recommendations aligned with their mood..

## **Purpose:**

- **Personalization:**

- **Customized Experiences:** Provide a more personalized user experience by recommending content or products that match the user's current mood.
- **Enhanced Engagement:** Increase user engagement by suggesting items that resonate with the user's emotions, making them more likely to interact with the platform.

- **Emotional Well-being:**

- **Mood Improvement:** Recommend content or activities that can uplift the user's mood, such as suggesting relaxing music during stressful times or motivational videos when feeling down.
- **Stress Reduction:** Offer recommendations that help reduce stress and anxiety, such as calming apps, meditation sessions, or relaxing activities.

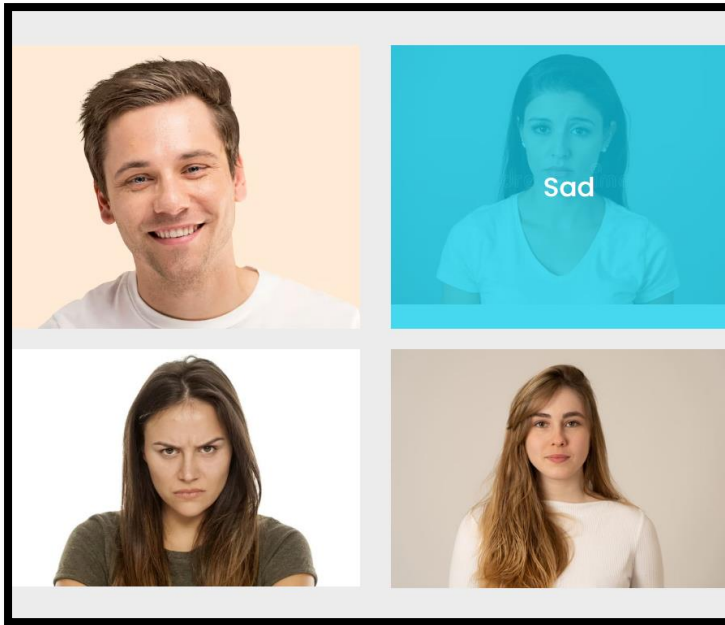
- **Increased Satisfaction:**

- **User Retention:** By continuously providing relevant and mood-congruent recommendations, users are more likely to stay loyal to the platform.
- **Positive User Experience:** Enhance overall user satisfaction by making interactions feel more intuitive and empathetic.

- **Efficient Content Discovery:**

- **Relevant Suggestions:** Help users discover new content that they might not have found otherwise but is likely to suit their current emotional state.
- **Time-Saving:** Reduce the time users spend searching for appropriate content by offering spot-on recommendations that align with their mood.





Based on mood  
Recommendation

## Applications:

- **Music Streaming Services:**

- **Spotify, Apple Music, Pandora:** These platforms can suggest playlists or songs based on the user's current mood. For instance, they can offer upbeat songs for a user who is feeling happy or calm instrumental music for someone who is stressed.

- **Video Streaming Services:**

- **Netflix, Hulu, Amazon Prime Video:** These services can recommend movies or TV shows that match the user's emotional state. For example, they can suggest comedies for a user who needs cheering up or thrillers for someone looking for excitement.

- **E-commerce:**

- **Amazon, eBay, Etsy:** Online shopping platforms can recommend products based on the user's mood. For example, they might suggest comfort foods or cozy blankets to someone feeling down or workout gear to someone feeling energetic.

- **Mental Health and Wellness Apps:**

- **Calm, Headspace, Happify:** These apps can provide mood-based recommendations for meditation sessions, breathing exercises, or mental health articles. For example, they can suggest stress-relief exercises for anxious users or gratitude practices for those feeling sad.
-

# **Implementation Of Music Recommendation System(MRS)**

## **Models and Libraries Involved**

### **Data Sources:**

- **User Data:**

Purchase history, browsing behavior, saved items, ratings, and voice descriptions (in text-based systems).

- **Item Data:**

Information about the clothes themselves, like color, style, brand, material, size, and even image data.

- **External Data:**

Fashion trends, social media data (what's popular on influencers' pages), and even weather information can be used to tailor recommendations.

### **Machine Learning Models:**

- **Collaborative Filtering:**

This technique analyzes user-user interactions to recommend items that users with similar tastes have purchased or liked. (Libraries: Scikit-learn (Python), Apache Mahout (Java))

- **Content-Based Filtering:**

This approach focuses on item attributes like color, style, and brand to recommend similar items to those the user has interacted with. (Libraries: TensorFlow (Python), PyTorch (Python))

- **Matrix Factorization:**

This technique breaks down user-item interaction data into a lower-dimensional space, capturing latent factors that influence user preferences. (Libraries: scikit-learn (Python), Surprise (Python))

### **Deep Learning Models:**

- **Natural Language Processing (NLP) Models:** For voice-based systems, NLP models are used to understand the user's spoken descriptions, extract keywords and

sentiment, and translate them into actionable data for recommendations. (Libraries: spaCy (Python), NLTK (Python))

- **Convolutional Neural Networks (CNNs):**

Inception V3 is a pre-trained CNN architecture specifically designed for image recognition. It can be a powerful tool in fashion recommendation systems. By feeding product images into the Inception V3 model, the system can extract high-level features like patterns, textures, and styles. These features can then be used to recommend similar clothing items to the user based on their uploaded image or browsing history. (Libraries: TensorFlow (Python), PyTorch (Python))

### **Additional Points about Inception V3:**

- **Transfer Learning:**

Inception V3 is often used in a technique called transfer learning. The pre-trained model weights are leveraged as a starting point, and then fine-tuned with a specific fashion image dataset to improve its accuracy in recognizing clothing styles and features.

- **Benefits:** Inception V3 offers several advantages:
  - **High Accuracy:** It's been shown to achieve good performance on image recognition tasks.
  - **Efficiency:** By using a pre-trained model, developers can save time and resources compared to training a CNN from scratch.
  - **Scalability:** The model can handle large datasets of clothing images effectively.

## **OpenCV**

**OpenCV (Open Source Computer Vision Library)** is an open-source computer vision and machine learning software library. It includes several hundred computer vision algorithms.

- **Purpose in the Code:**
  - **cv2.dnn.readNet:** Loads a pre-trained deep neural network model.
  - **cv2.dnn\_DetectionModel:** Creates a detection model from the loaded network.
  - **cv2.VideoCapture:** Captures video from a camera or video file.
  - **cv2.imshow:** Displays an image or video frame.
  - **cv2.flip:** Flips an image or video frame.
  - **cv2.putText:** Puts text on an image or video frame.
  - **cv2.rectangle:** Draws rectangles on an image or video frame.
  - **cv2.imencode:** Encodes an image into a specific format (e.g., JPEG).

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- **Data Source for MRS :**

<https://www.kaggle.com/datasets/aadityasinghal/facial-expression-dataset>

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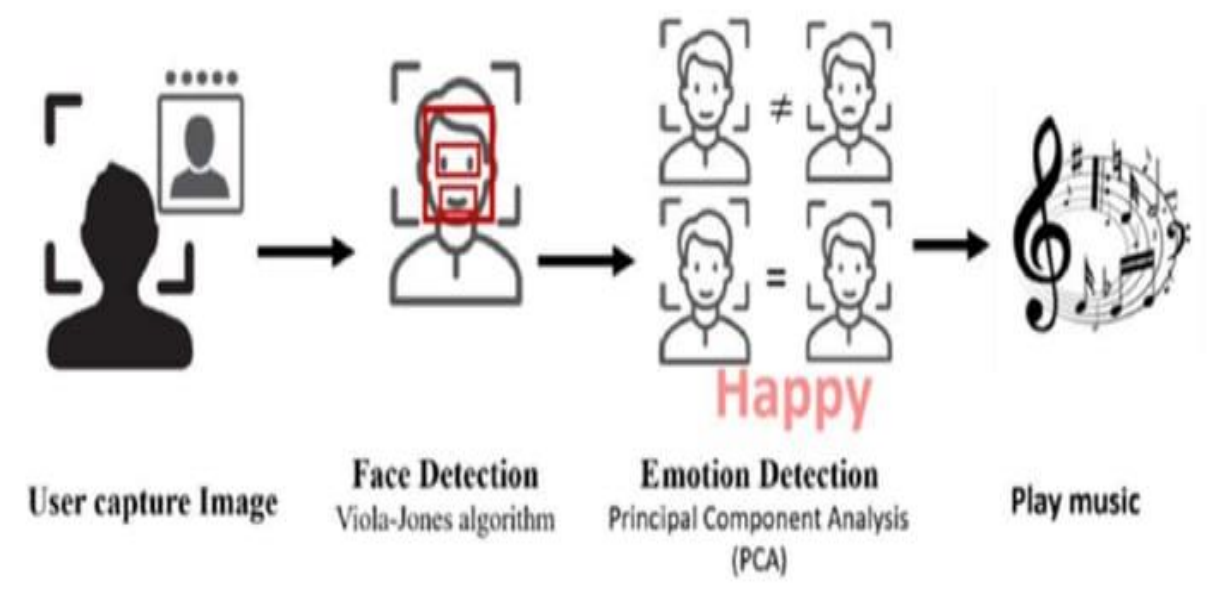
## Code for Music Recommendation System:

---

```
• import pandas as pd
• import tensorflow as tf
• import cv2
• import matplotlib.pyplot as plt
• import numpy as np
•
• mood_music = pd.read_csv("data/data_moods.csv")
• mood_music = mood_music[['name','artist','mood','id']]
•
• def recommend(mood,n):
•     name = []
•     artist = []
•     link = []
•     if mood == 'Angry':
•         filter1=mood_music['mood']=='Calm'
•         f1=mood_music.where(filter1)
•         f1=f1.dropna()
•         f2 =f1.sample(n)
•         f2.reset_index(inplace=True)
•         name = list(f2['name'])
•         artist = list(f2['artist'])
•         link = list(f2['id'])
•     elif mood == 'Happy' or mood == 'Neutral':
•         filter1=mood_music['mood']=='Happy'
•         f1=mood_music.where(filter1)
•         f1=f1.dropna()
•         f2 =f1.sample(n)
•         f2.reset_index(inplace=True)
•         name = list(f2['name'])
•         artist = list(f2['artist'])
•         link = list(f2['id'])
•     elif mood == 'Sad':
•         filter1=mood_music['mood']=='Sad'
•         f1=mood_music.where(filter1)
•         f1=f1.dropna()
•         f2 =f1.sample(n)
•         f2.reset_index(inplace=True)
•         name = list(f2['name'])
•         artist = list(f2['artist'])
•         link = list(f2['id'])
•     elif mood == 'Surprise':
•         filter1=mood_music['mood']=='Energetic'
•         f1=mood_music.where(filter1)
•         f1=f1.dropna()
•         f2 =f1.sample(n)
```

- `f2.reset_index(inplace=True)`
  - `name = list(f2['name'])`
  - `artist = list(f2['artist'])`
  - `link = list(f2['id'])`
  - `links=[]`
  - `for i in link:`
  - `links.append('https://open.spotify.com/track/'+i)`
  - `return [name,artist,links]`
- 

## Our Backend Process:



1. **Facial Image:** The user's facial image serves as the input to the system.
2. **Facial Emotion Detection:** A deep learning model, like a convolutional neural network (CNN), analyzes the facial image to detect emotions accurately.
3. **Feature Extraction:** Emotional features, such as intensity and expression, are extracted from the facial image.
4. **Music Recommendation:** The emotional features are used to correlate with suitable music selections stored in the system's database.
5. **Output:** Based on the user's detected emotions, the system generates personalized music recommendations aligned with the user's emotional state. These recommendations are then presented to the user for listening.

## **Implementation Of Flask:**

### **Libraries and Models involved:**

#### **Libraries used:**

##### **Flask**

**Flask** is a micro web framework written in Python. It is lightweight and easy to use, making it a popular choice for web development, particularly for small to medium-sized applications.

- **Purpose in the Code:**
  - **Flask:** Creates the Flask application instance.
  - **render\_template:** Renders HTML templates.
  - **Response:** Generates HTTP responses.
  - **url\_for and redirect:** (Not used in the current code, but commonly used for URL handling and redirects.)

### **Code implementation of Flask:**

```
from flask import *
```

```
from MRC import *
```

```
from FED import *
```

```
app = Flask(__name__)
```

```
@app.route('/')  
def index():  
    return render_template('index.html')
```

```
@app.route('/about')
```

```
def about():
```

```
    return render_template('about.html')
```

```
@app.route('/gallery')
```

```
def gallery():
```

```
    return render_template('gallery.html')
```

```
@app.route('/contact')
```

```
def contact():
```

```
    return render_template('contact.html')
```

```
@app.route('/camera')
```

```
def camera():
```

```
    return render_template('camera.html')
```

```
@app.route('/video_feed')
```

```
def video_feed():
```

```
    return Response(cam(), mimetype='multipart/x-mixed-replace; boundary=frame')
```

```
@app.route('/recommends', methods=['POST'])
```

```
def recommends():
```

```
    mood = print_label()
```

```
    arr = recommend(mood,10)
```

```
    name = arr[0]
```

```
    artist = arr[1]
```

```
    link = arr[2]
```

```
    return  
render_template('recommendations.html',mood=mood,name=name,artist=artist,link=link)
```

```
@app.route('/neutral')
```

```
def neutral():
```

```
arr = recommend('Neutral',25)

name = arr[0]

artist = arr[1]

link = arr[2]

return render_template('neutral.html',mood='Neutral',name=name,artist=artist,link=link)
```

```
@app.route('/sad')
```

```
def sad():
```

```
    arr = recommend('Sad',25)

    name = arr[0]

    artist = arr[1]

    link = arr[2]

    return render_template('sad.html',mood='Sad',name=name,artist=artist,link=link)
```

```
@app.route('/angry')
```

```
def angry():
```

```
    arr = recommend('Angry',25)

    name = arr[0]

    artist = arr[1]

    link = arr[2]

    return render_template('angry.html',mood='Angry',name=name,artist=artist,link=link)
```

```
@app.route('/happy')
```

```
def happy():
```

```
    arr = recommend('Happy',25)
```



```
name = arr[0]

artist = arr[1]

link = arr[2]

return render_template('happy.html',mood='Happy',name=name,artist=artist,link=link)

if __name__ == '__main__':

    app.run(debug=True)
```

## **Advantages of Music recommendation system:**

1. **Personalized Experience:** Tailors music suggestions to match user's current emotional state, enhancing their listening experience.
2. **Enhanced Engagement:** Music aligned with user's emotions increases engagement and fosters a deeper connection with the content.
3. **Discovery of New Music:** Introduces users to new genres or artists based on their emotional preferences, expanding their musical horizons.
4. **Valuable Insights:** Collects data on user emotions, offering valuable insights for refining recommendations and content curation strategies.

## **Conclusion:**

- In conclusion, music recommendation systems play a pivotal role in transforming the way users discover and enjoy music. By leveraging advanced algorithms and user data, these systems offer personalized, relevant, and mood-congruent music suggestions that enhance the overall listening experience. The benefits are manifold: from increasing user engagement and satisfaction to driving business value through customer retention and revenue growth.
- Overall, music recommendation systems represent a critical innovation in the digital music industry, enhancing user interactions, enabling effective data utilization, and offering a scalable solution that adapts to the diverse and dynamic preferences of music listeners worldwide and preferences. Stay tuned for more updates as we work diligently to bring our website to life!

