

Intro:

This project aims to build a machine learning model that can predict the mood or emotion a song is portraying. The model is trained on data fetched from Spotify playlists, each associated with a specific emotion: happy, sad, hype, and calm.

Changes Since Project Proposal:

During the course of our project, we made several changes to our initial plan outlined in the project proposal.

1. **Data Source:** In our project proposal, we mentioned that we would use open-source datasets available online from GitHub repositories and Kaggle. However, we ended up using only the Spotify API for data collection.
2. **Machine Learning Model:** In the proposal, we mentioned that we might use Support Vector Machines (SVM), Convolutional Neural Networks (CNN), or Random Forest for our machine learning model. However, after experimenting with different models, we decided to use a Multi-Layer Perceptron (MLP) classifier. The MLP model provided a good balance between model complexity and performance.

Project Workflow:

• Data Collection and Preprocessing

Data was collected from Spotify playlists using the Spotify API. Each song's features such as tempo, loudness, energy, danceability, key, instrumentalness, and valence were collected. These features provide a comprehensive representation of each song's musical characteristics. The 'key' feature was one-hot encoded, and the 'emotion' feature was label encoded. The features were then normalized using the StandardScaler from sklearn, ensuring that all features contribute equally to the model's predictions.

• Model Building and Training

A Multi-Layer Perceptron (MLP) classifier was used as the machine learning model. The MLP had a single hidden layer of size 100. The model was trained on the training data, with a maximum of 2000 iterations for the solver to converge. The learning rate was set to be adaptive, the activation function was logistic (sigmoid), and the alpha (regularization parameter) was 0.001.

• Model Evaluation

The model's performance was evaluated on both the training and testing data. The training score achieved was **0.895734**, indicating that the model was able to accurately predict the emotion of a

song in approximately **89.57%** of cases in the training set. The testing score was **0.823899**, meaning the model accurately predicted the emotion of a song in approximately **82.39%** of cases in the testing set. These scores suggest that the model is performing well and is able to generalize to unseen data. The slight difference between the training and testing scores is expected and indicates that the model is not overfitting the training data. Additionally, the model was used to make predictions on new test data, and these predictions were saved back to the CSV file.

Conclusion and Future Work:

In conclusion, our project was successful in building a machine learning model that can predict the emotion or mood of a song. We trained our model on data from Spotify playlists that were each associated with a specific emotion: happy, sad, hype, and calm. The model performed well on both the training and testing data, with scores of 0.895734 and 0.823899 respectively.

This work is important because it can lead to applications in music recommendation systems, music therapy, and personalized playlists. By accurately predicting the emotion of a song, we can create more personalized and emotionally resonant music experiences.

Looking ahead, we could consider expanding the range of emotions, using more diverse datasets, or trying out different machine learning models to further improve the performance of our model.