| | |
|---|---|
| **Project Title** | **Classifying the Audio Genres.** |
| **Skills take away From This Project** | **Problem Statement, Data Analysis, Visualization, Machine Learning** |
| **Domain** | **Audio & Music** |

**Problem Statement:**

**This is an open-ended dataset where you need to develop the problem statement on your own. From Business use case you can have a brief idea on developing the problem statement.**

**Business Use Cases:**

1. Creating a Recommendation System tailored to user preferences or inputs.

2. Classifying tracks using their audio features and the range of genres they cover.

3. Any other innovative use you can conceive. Suggestions and discussions are welcome.

**Approach:**

Step1: Develop Problem Statement.

Step2: Perform the EDA and ready the data as per the need of the kind of machine learning algorithm you are going to apply.

Step3: Train and Test the Machine Learning Algorithms.

Step4: Evaluate the Machine Learning model. (Iterate if necessary)

Step5: Develop a streamlit application.

Step6: Push the code on Github with the appropriate Readme.md file.

## Results:

### Popularity Prediction:

Objective: Predict track popularity scores.

Results: High accuracy in predicting popularity using features like danceability, energy, loudness, etc. Evaluation metrics (R-squared, MAE, MSE) should reflect strong performance.

### Genre Classification:

Objective: Classify tracks by genre.

Results: High accuracy in genre classification using audio features. Metrics like accuracy, precision, recall, and F1 score should indicate effective classification.

### Feature Importance Analysis:

Objective: Identify key features impacting popularity and genre.

Results: Ranked list of important features with interpretability using methods like SHAP values, highlighting their influence on the outcomes.

### Clustering Analysis:

Objective: Group similar tracks into clusters.

Results: Meaningful clusters of tracks with similar characteristics. Visualizations (t-SNE, PCA) should show clear groupings.

### Recommendation System:

Objective: Suggest tracks to users based on preferences.

Results: Effective personalized recommendations using collaborative or content-based filtering. Metrics like precision and recall should show high user satisfaction.

**Trend Analysis:**

Objective: Analyze trends in music features over time.

Results: Insights into historical trends in features like tempo and valence, with visualizations showing evolving patterns and predictions for future trends.

**Project Evaluation metrics:**

Project will be evaluated on the following points

- **Accuracy and Performance:**

  Measures: Precision, Recall, F1 Score, AUC-ROC (classification); MAE, MSE, R-squared (regression).

  Importance: Indicates model's predictive accuracy.

- **Interpretability:**

  Measures: Use of SHAP values, LIME.

  Importance: Ensures stakeholders understand and trust model decisions.

- **Scalability and Efficiency:**

  Measures: Time complexity, memory usage.

  Importance: Ensures model handles large data and operates efficiently.

- **Business Impact:**

  Measures: Revenue increase, cost reduction.

  Importance: Demonstrates tangible benefits and ROI.

- **Robustness and Generalization:**

  Measures: Cross-validation performance, sensitivity analysis.

  Importance: Ensures model performs well on new, varied data.

- **Technical Tags:**

  Python, Pandas, NumPy, Sklearn, Machine Learning & Research Skills.

**Data Set:**

The data was collected and cleaned using Spotify's Web API and Python.

**Data Set Explanation:**

1. track_id: Unique Spotify identifier for each track.

2. artists: Names of artists involved in the track, separated by ';' for multiple artists.

3. album_name: Title of the album containing the track.

4. track_name: Title of the individual track.

5. popularity: A score from 0 to 100 indicating the track's popularity, where 100 is the most popular. This score is algorithmically determined, primarily based on the track's play count and the recency of these plays. A track's current play frequency influences its popularity more than past plays. Tracks appearing in multiple forms (like in an album and a single) have separate ratings. Note that artist and album popularity are also derived from track popularity.

6. duration_ms: Length of the track in milliseconds.

7. explicit: Indicates if the track contains explicit lyrics ('true' for explicit content; 'false' for no explicit content or if it's unknown).

8. danceability: A metric ranging from 0.0 (least danceable) to 1.0 (most danceable), assessing a track's suitability for dancing based on tempo, rhythm, beat strength, and general regularity.

9. energy: A perceptual measure ranging from 0.0 to 1.0, gauging the track's intensity and activity. Tracks that are fast, loud, and noisy are considered high energy, like death metal, whereas a Bach prelude would be low energy.

10. key: The musical key of the track, represented by integers following standard Pitch Class notation (e.g., 0 = C, 1 = C♯/D♭, 2 = D). A value of -1 indicates an undetected key.

11. loudness: Measures the average loudness of the track in decibels (dB).

12. mode: Indicates the track's modality, with 1 for major mode and 0 for minor mode, determining the type of scale that forms its melodic basis.

13. speechiness: Assesses the extent of spoken words in a track. Values near 1.0 suggest a predominance of speech (like talk shows or audio books). Scores above 0.66 typically indicate tracks composed entirely of spoken words. Those between 0.33 and 0.66 may include a mix of music and speech, such as in rap music. Scores below 0.33 generally represent music or non-speech tracks.

14. acousticness: A scale from 0.0 to 1.0 indicating the likelihood of the track being acoustic, with 1.0 signifying high confidence in its acoustic nature.

15. instrumentalness: Estimates the absence of vocals in a track. Vocal-like sounds ("ooh" and "aah") are considered instrumental, whereas rap or spoken words are categorized as vocal. Values closer to 1.0 suggest a higher probability of the track lacking vocal content.

16. liveness: Detects the presence of a live audience in the recording. Higher values suggest a greater chance that the track was performed live, with values above 0.8 strongly indicating a live performance.

17. valence: A metric ranging from 0.0 to 1.0, describing the track's emotional tone. High valence tracks sound more positive (happy, cheerful, euphoric), while low valence tracks convey more negative emotions (sad, depressed, angry).

18. tempo: The track's overall estimated tempo, measured in beats per minute (BPM). Tempo in music refers to the speed or pace of a piece, derived from the average duration of a beat.

19. time_signature: Provides an estimated time signature for the track, which is a musical notation indicating the number of beats in each bar (or measure). This value varies between 3 to 7, representing time signatures from 3/4 to 7/4.

20. track_genre: Specifies the genre classification of the track.

**Project Deliverables:**

Learners need to submit the jupyter notebook with the proper titles, buiness insights and the conclusion. All the codes should be pushedon the Github with the proper Readme.md file explaining everything about the project.

Readme.md file should include following points.

1. Problem Statement
2. Business Use Case
3. Business Insights and Suggestions
4. Technology Used
5. References
6. Ways to contact you.

You can add other points as per your project requirements.

**Project Guidelines:**

Follow the pep8 guidelines for writing a python code and follow the documentations to have a proper understanding of each and every python library used.

**Timeline:**

Project Timeline: 4 weeks from Starting date.

## PROJECT DOUBT CLARIFICATION SESSION ( PROJECT AND CLASS DOUBTS)

**About Session:** The Project Doubt Clarification Session is a helpful resource for resolving questions and concerns about projects and class topics. It provides support in understanding project requirements, addressing code issues, and clarifying class concepts. The session aims to enhance comprehension and provide guidance to overcome challenges effectively.
**Note: Book the slot at least before 12:00 Pm on the same day**

**Timing: Tuesday, Thursday, Saturday (5:00PM to 7:00PM)**

**Booking link :https://forms.gle/XC553oSbMJ2Gcfug9**

## LIVE EVALUATION SESSION (CAPSTONE AND FINAL PROJECT)

**About Session:** The Live Evaluation Session for Capstone and Final Projects allows participants to showcase their projects and receive real-time feedback for improvement. It assesses project quality and provides an opportunity for discussion and evaluation.
**Note: This form will Open on Saturday and Sunday Only on Every Week**

**Timing: Monday-Saturday (11:30PM to 12:30PM)**

**Booking link : https://forms.gle/1m2Gsro41fLtZurRA**