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Research Paper

ANALYZING MUSIC STREAMING TRENDS USING SPOTIFY DATA

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ABSTRACT:

This project Analyzing Music Streaming Trends Using Spotify Data aims to develop a data-driven system that analyses and predicts music popularity based on audio features collected from Spotify. The objective is to design and implement an interactive platform that processes song attributes such as danceability, energy, loudness, tempo and valence to identify trends and popularity patterns in music streaming. The system provides insights through visual analytics and popularity prediction to help understand listener preferences and evolving music trends. This platform ensures efficient data handling and accurate analysis using machine learning techniques.

Key Words: ***MongoDB, Spotify Data, Music Trends Analysis, Popularity Prediction, Machine Learning***

INTRODUCTION

The rapid growth of digital music platforms has generated massive volumes of streaming data, making it essential to analyze listener behavior and music trends effectively. By leveraging this opportunity, our project, *Analyzing Music Streaming Trends Using Spotify Data*, aims to explore and understand patterns in music popularity and listener preferences using data analytics and machine learning techniques. The system is developed using Python for data processing and model building, Flask for the backend, and HTML, CSS, and JavaScript for the front end. By analyzing

audio features such as danceability, energy, loudness, tempo, and valence, the project provides insights into factors influencing song popularity. The platform offers data visualization and popularity prediction features in an interactive and user-friendly environment, enabling users to understand trends and make data-driven decisions. Through this system, artists, analysts, and music enthusiasts can gain valuable insights into evolving music trends and streaming behavior.

LITERATURE REVIEW

In recent years, several research studies have been explored related to music streaming analysis and popularity prediction using Spotify data, and certain limitations were identified. The first paper studied is *Music Popularity Prediction Using Audio Features* proposed by Kim et al., 2020. In this work, the authors focused on predicting song popularity using basic audio features, but they did not provide interactive visualizations to analyze long-term music trends. Another paper reviewed is *Analyzing Listener Behavior on Music Streaming Platforms* proposed by Johnson and Lee, 2021. This study analyzed user listening patterns but lacked a web-based platform for real-time interaction and prediction. The final paper examined is *Machine Learning Approaches for Spotify Music Data Analysis* by Verma et al., 2022, where multiple algorithms were applied for analysis, but comparative accuracy evaluation and deployment as a user-accessible system were not included. These identified limitations are effectively addressed in the proposed system by integrating data visualization, popularity prediction, algorithm comparison, and an interactive web-based dashboard.

RELATED WORK

In this project, Spotify audio feature analysis, popularity prediction, and trend visualization are integrated to analyze music streaming patterns effectively. The system utilizes data preprocessing, feature extraction, and machine learning algorithms to identify relationships between audio attributes such as danceability, energy, loudness, tempo, and valence and a song's popularity. Full-stack web technologies are employed to ensure smooth functionality and accessibility of the platform. The front end is developed using HTML, CSS, and JavaScript, providing users with an interactive, responsive, and visually appealing interface. The Flask framework serves as the back end, handling data processing, model integration, and server-side operations, while datasets are managed efficiently for analysis and prediction.

Unlike existing standalone analytical tools, this project combines data analytics, machine learning, and visualization into a unified web-based dashboard. Through a single platform, users can explore streaming trends, visualize popularity patterns, and predict song success. The use of modern full-stack technologies ensures scalability, efficiency, and reliability, delivering a practical solution for understanding music trends and supporting data-driven decision-Making.

EXISTING METHOD

In recent years, several studies have explored music streaming analysis and popularity prediction using Spotify data, but they present certain limitations. Kim et al. (2020) proposed a music popularity prediction model based on audio features; however, it lacked interactive dashboards to visualize trends over time. Johnson and Lee (2021) analyzed listener behavior on music streaming platforms, but their work did not include real-time prediction or a web-based system for user interaction. Verma et al. (2022) introduced machine learning techniques for Spotify data analysis, yet their approach did not compare multiple algorithms or store prediction results for trend visualization.The proposed *Analyzing Music Streaming Trends Using Spotify Data* project addresses these gaps by incorporating an interactive dashboard, trend visualization, popularity prediction, and algorithm comparison within a full-stack web-based platform.

PROPOSED METHOD

The proposed *Analyzing Music Streaming Trends Using Spotify Data* introduces a more advanced and technologically integrated approach to overcome the limitations of existing music analytics systems. With an interactive dashboard, the system enables users to visualize music trends and analyze popularity patterns over time, addressing the lack of effective data visualization in earlier methods. A machine learning–based popularity prediction module is integrated into the platform to compensate for the absence of real-time analytical and predictive capabilities in previous studies. The system uses Python-based data processing and machine learning models, with Flask serving as the backend framework to ensure efficient data handling and smooth integration of analytics components. Additionally, the inclusion of multiple algorithm comparisons, trend visualization charts, and feature-based analysis enhances the analytical depth beyond existing systems.

SYSTEM ARCHITECTURE

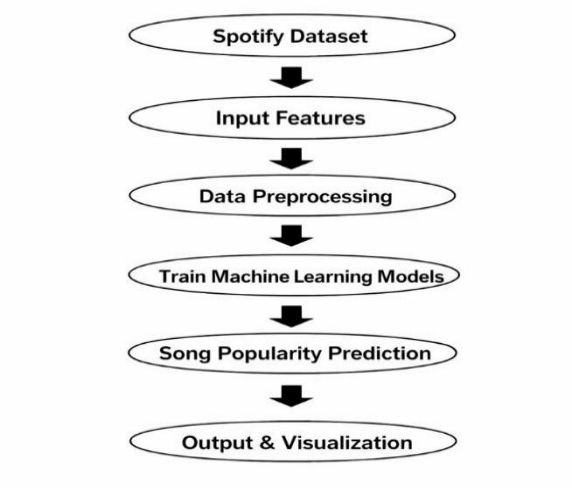


Fig 1:System Architecture

METHODOLOGY DESCRIPTION

The proposed *Analyzing Music Streaming Trends Using Spotify Data* project is developed using a systematic and modular approach to ensure accurate analysis, efficient data processing, and user accessibility. The architecture follows a step-by-step flow starting from user interaction to popularity prediction, ensuring that each stage contributes to meaningful music trend analysis.

User Interface & Authentication Module: The process begins with a secure user interface where users can log in to access the system. Authentication ensures authorized access and maintains data integrity. Flask is used for backend handling of user requests and routing, while the interface is designed using HTML, CSS, and JavaScript for a smooth user experience.

Dashboard: After successful access, users are redirected to a dashboard that serves as the central control panel of the system. It allows users to upload or select Spotify datasets, input audio feature values, and view prediction results in an interactive and user-friendly layout.

Dataset Loading: This module handles the loading of Spotify datasets containing song attributes such as danceability, energy, loudness, tempo, speechiness, acousticness, and valence. The data is prepared for further processing and analysis.

Data Preprocessing: The collected data is cleaned and transformed by handling missing values, normalization, and feature scaling to improve the accuracy of the analysis and machine learning models.

Feature Extraction: Relevant audio features are selected from the dataset to identify patterns and relationships that influence song popularity. This step reduces complexity and enhances model performance.

Machine Learning Model: Various machine learning algorithms are applied to train the model using the extracted features. The system evaluates the models to select the most accurate one for prediction.

Popularity Prediction: The trained model predicts the popularity of songs based on input audio features. The results help in understanding music trends and listener preferences, supporting data-driven insights for artists, analysts, and music enthusiasts.

RESULTS AND DISCUSSION

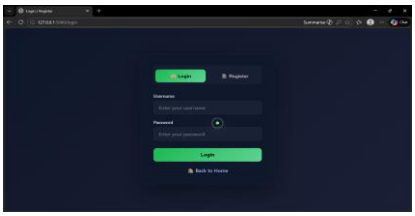


Fig2: Login Page

To log in to the Analyzing Music Streaming Trend Using Spotify Data, please enter your credentails.

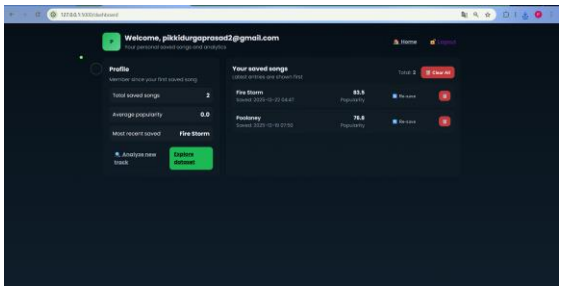


Fig3: Dashboard

Dashboard consists the users song prediction history.



Fig4: Home Page

This is the home page of the website here we can click the predict button to start the prediction of a song

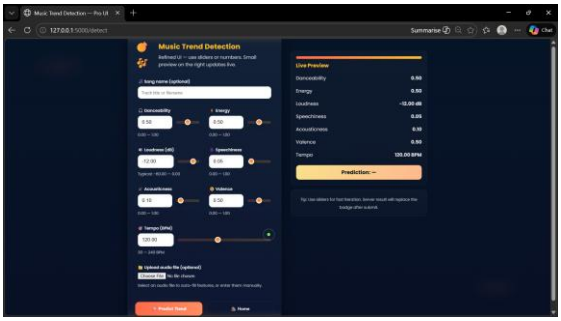


Fig5: Song Upload Page

In this page we can upload the song or we can enter the values manually of a song.



Fig6: Result Page

In this page we can se the popularuty value of song and the visulization

CONCLUSION AND FUTURE ENHANCEMENT:

Conclusion:

This project demonstrates a comprehensive and effective approach to analyzing music streaming trends using Spotify data. By combining data preprocessing, feature extraction, and machine learning techniques, the system successfully identifies patterns that influence song popularity. The integration of predictive models enables meaningful interpretation of how audio features such as tempo, energy, and danceability impact listener preferences. Additionally, the development of a user-friendly web interface enhances accessibility, allowing users to explore insights interactively. Overall, the system serves as a valuable tool for understanding music consumption behavior and supports data-driven decision-making in the music industry.

Future Enhancements

To further improve the system, several enhancements can be implemented. Integrating real-time Spotify API data would allow continuous updates and more relevant trend analysis. Incorporating advanced deep learning models such as LSTM or transformer-based architectures could significantly improve prediction accuracy by capturing temporal patterns in music trends. The addition of personalized recommendation systems would enhance user experience by suggesting songs based on individual preferences. Furthermore, developing more interactive and visually rich dashboards using advanced visualization tools can provide deeper insights into evolving trends. Expanding the dataset to include user demographics, geographic data, and social media influence could also improve analysis and broaden the system's applicability.

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