Spotify Playlist Generator using Spotify and ChatGPT APIs

Ethan Carvalho, Elbert Chao, Richard Augustine, Kevin Liu, Raymond Li, and Kevin Feng

Western Cyber Society,
Western University, 1151 Richmond St. N, London, Ontario, Canada

ABSTRACT

This thesis presents a novel approach to personalized music curation through the creation of a Spotify playlist generator, integrating the Spotify and ChatGPT APIs to craft playlists based on user inputs. By harnessing Spotify's vast music catalog and employing natural language processing to understand user preferences, the system offers a more intuitive and personalized music discovery experience. Empirical evaluations and user feedback attest to its effectiveness in aligning with individual tastes, significantly enhancing user engagement and satisfaction on the Spotify platform. This research marks a considerable advancement in music curation, demonstrating the potential of AI-driven tools to transform music discovery and interaction on streaming services, thereby enriching the listening experience.

1. INTRODUCTION

In an era characterized by the proliferation of digital streaming platforms, the quest for personalized music discovery experiences stands as a paramount concern. The advent of Spotify, with its extensive music library, has revolutionized the way individuals engage with music. However, amidst the vast array of choices, users often find themselves overwhelmed, seeking more intuitive and tailored approaches to navigate this musical landscape. Addressing this need, this thesis introduces a groundbreaking Spotify playlist generator that harnesses the power of artificial intelligence and natural language processing to curate personalized playlists based on user input prompts. This innovative system not only enhances individual listening experiences but also holds the potential to reshape the dynamics of music consumption and exploration in the digital age, impacting both users and the broader music industry.

The motivation behind creating a Spotify playlist generator lies in the ever-expanding library of music available on the platform and the desire for personalized listening experiences. With the vast array of genres, artists, and songs accessible to users, finding the right music to suit specific moods, occasions, or preferences can be overwhelming. The Spotify playlist generator addresses this issue by leveraging algorithms to analyze user preferences, listening history, and contextual factors such as time of day, weather, or activity, to curate customized playlists tailored to individual tastes. By automating playlist creation, users can discover new music they might enjoy while ensuring a seamless and enjoyable listening experience, ultimately enhancing their engagement with the Spotify platform and enriching their musical journey.

This paper aims to show that the implementation of a Spotify playlist generator can effectively address the challenges of discovering new music and curating personalized listening experiences for users. The specific problem at hand involves the overwhelming volume of music available on Spotify, which often leads to difficulties in finding songs that match individual preferences, moods, or activities. To address this issue, the paper proposes the development of a playlist generator that utilizes machine learning algorithms to analyze user listening habits, preferences, and contextual factors such as time of day, weather, and location. By employing data-driven methodologies, the generator will generate playlists tailored to each user's unique tastes and circumstances,

enhancing their overall enjoyment of the Spotify platform and streamlining the music discovery process. Measures of success include user engagement metrics such as increased playlist retention rates, user satisfaction surveys, and the discovery of new artists and songs aligned with individual preferences. Through this approach, the project aims to simplify the music discovery process and enhance the overall listening experience for Spotify users.

The research guiding this study focuses on evaluating the Spotify playlist generator's ability to enhance the user experience and facilitate music discovery. It examines the generator's effectiveness in analyzing user listening habits and preferences to produce personalized playlists, the influence of contextual factors like time of day, weather, and user location on playlist curation and user satisfaction, and the generator's role in promoting the discovery of new artists and songs that align with individual preferences. These inquiries are central to the paper's aim of showcasing how the Spotify playlist generator addresses music discovery challenges and improves users' listening experiences. Insights and findings from user data analysis and feedback, discussed in the results and discussion section, will underpin the investigation, highlighting the generator's impact on music exploration and engagement.

The landscape of music recommendation systems has been extensively explored, with several studies laying the groundwork for understanding the nuances of personalized playlist generation. Key contributions include the analysis of collaborative filtering techniques, as seen in the work by Park et al., which delves into user-item interaction matrices to predict musical preferences, providing a foundational algorithmic approach that parallels the data-driven nature of our Spotify playlist generator. Similarly, the study by Oord et al. on deep learning models for music recommendation underscores the potential of neural networks in capturing complex user preferences, directly influencing our generator's underlying architecture. Research on contextual recommendations, such as the study by Baltrunas et al., sheds light on incorporating environmental and situational data into playlist curation, a concept that our project further refines by examining specific contextual factors like time and location. Additionally, the exploration of user behavior and engagement metrics in the paper by Zhou et al. offers critical insights into measuring the success of recommendation systems, informing our methodology for evaluating user interaction with generated playlists. Collectively, these works constitute a broad spectrum of approaches to music recommendation, with our study aiming to synthesize these diverse methodologies to enhance the Spotify playlist generator's efficacy in personalizing user experiences and facilitating music discovery.

In exploring the development and impact of a Spotify playlist generator, this paper outlines a methodology to assess the effectiveness of personalized playlist curation and its influence on music discovery and user engagement. This evaluation is structured in three pivotal phases:

1. Assess the accuracy of user preference learning.

2. Measure the impact of contextual factors on playlist personalization.

3. Quantify user engagement and music discovery.

2. METHODS

Dataset Utilization

The cornerstone of our Spotify playlist generator lies in the utilization of an extensive dataset, comprising approximately one million tracks sourced from Spotify. This dataset is rich in audio features—acousticness, tempo, energy, and mood indicators, among others—that facilitate a multi-dimensional analysis of each track. Such a granular examination enables the identification of songs with similar auditory characteristics, essential for crafting personalized playlists. The structured nature of the dataset negated the need for extensive preprocessing, allowing for the direct extraction of relevant audio features. This efficiency streamlined the identification of tracks that not only share similar characteristics but also possess the potential for seamless transitions within a playlist, thus enhancing the listening experience.

Exploratory Data Analysis (EDA)

We applied Exploratory Data Analysis (EDA) to systematically cluster tracks based on their audio features, uncovering underlying patterns and relationships. This methodology was instrumental in identifying song combinations that naturally complement each other, forming the basis for cohesive and engaging playlists.

AI Model Development and Training

In addressing our problem statement—to create an AI-driven playlist generator capable of selecting tracks based on user prompts—we embarked on training an AI model. This model was fed a diverse array of user prompts, accompanied by corresponding playlists that encapsulated the desired themes, moods, and genres. Such an approach enabled the model to grasp the subtleties involved in translating natural language prompts into a curated set of songs, reflecting the intended ambiance or thematic content.

Testing and Evaluation

The effectiveness of our playlist generator was assessed through a dual-faceted analysis:

Audio Feature Analysis: A manual examination of the audio features within the generated playlists was conducted to ensure alignment with the characteristics indicated by the user prompts. This step was pivotal in confirming the model's capability to accurately match audio attributes with the desired playlist themes.

Listening Tests: Complementing the analytical assessment, listening tests were performed by our team to evaluate the playlists qualitatively. These tests ascertained whether the songs, beyond matching the prompts in terms of audio features, also cohered well within the playlist, thereby providing a satisfying overall listening experience.

Cosine Similarity and Additional Parameters

Our approach to identifying tracks with analogous audio features hinged on the cosine similarity technique, facilitating the measurement of similarity between the audio feature vectors. This method was complemented by the incorporation of additional parameters—genre diversity, lyrical content analysis, and beat synchronization—to ensure the generation of well-rounded and engaging playlists that cater to the intricacies of each user prompt.

Test Environment and Replication

To ensure the robustness of our AI-driven playlist generator, we established a test environment that closely simulates real-world conditions, allowing for a comprehensive evaluation of the system's performance across a variety of user prompts. Our planned solution involved training an AI model to match songs based on similar audio features, with the aim of generating cohesive playlists. The efficacy of our solution was benchmarked against existing playlist generators, providing a comparative perspective on our system's performance.

Evaluation Metrics

Our evaluation methodology encompassed two primary metrics:

Audio Features: This metric involved a detailed assessment of the audio features in the playlists generated, ensuring their correspondence with the user prompts.

Test Subjects: Unbiased feedback was solicited from random individuals who provided prompts for playlist generation. Their feedback on the relevance and appeal of the recommended songs offered subjective insights into the quality of the playlists.

Replication Package

For broader access and collaborative enhancement of our project, we have made our resources available in a public GitHub repository: SpotifyPlaylistGen. This repository contains the complete codebase, comprehensive documentation, and guidelines for replicating the test environment, thereby promoting transparency and facilitating peer review.

3. Results & Discussion

The implementation of our AI-driven playlist generator has successfully met its primary objectives, demonstrating the capability to create personalized playlists based on user prompts via ChatGPT. The system adeptly sets playlists beginning with a specific song and tailors the subsequent selections based on defined audio features, effectively responding to the nuanced demands of user inputs. This innovation offers significant benefits to users, chiefly by introducing them to new music that aligns with their current mood or desired ambiance as articulated in their prompts. The ability to discover new tracks that resonate with personal preferences underscores the utility of our model in enhancing the music listening experience, making it a valuable addition to the digital music ecosystem.

Ethical Considerations
In the development and deployment of our AI-powered playlist generator, we conscientiously addressed several ethical considerations:

Bias Towards Popular Music: We acknowledge that our model may exhibit a predisposition towards recommending more popular tracks, a reflection of the inherent biases within the dataset and the algorithms employed. This bias arises from the model's reliance on widespread user interactions and preferences, which tend to favor well-known songs, potentially limiting the diversity of music recommendations.

Transparency and Explainability: Our system's operational framework, grounded in the integration of ChatGPT and Spotify APIs, is designed for transparency and ease of understanding. This clarity in functionality is crucial in fostering user trust and facilitating the adoption of AI technologies in music curation.

Potential for Misuse: We recognize the possibility of our platform being utilized to create playlists with negative or harmful themes, given the absence of explicit restrictions on the emotional tone of user prompts. To mitigate this risk, we advocate for responsible use and encourage the exploration of content moderation mechanisms that can discern and counteract prompts rooted in hate or discrimination.

Privacy Considerations: User privacy stands at the forefront of our ethical considerations. Interaction with our playlist generator requires user consent to Spotify's privacy policies, ensuring that personal data handling complies with established privacy standards. Additionally, while our model operates autonomously, manual oversight by our development team, in conjunction with Spotify's privacy frameworks, provides an added layer of safeguarding user information.

The results garnered from the deployment of our playlist generator illuminate its potential to revolutionize music discovery and personalization. By seamlessly translating user prompts into curated playlists, the model exemplifies the power of AI in bridging human language and musical expression. However, the ethical implications warrant careful consideration, particularly in terms of algorithmic bias and the safeguarding of user privacy. Future iterations of the model will aim to enhance the diversity of music recommendations while bolstering mechanisms to prevent misuse.

Moreover, the discussion around ethical considerations opens avenues for further research, especially in developing more sophisticated content moderation algorithms that can navigate the complexities of human emotions and intentions. As AI continues to permeate the realm of digital music services, the balance between personalization and ethical responsibility remains a pivotal focus, guiding the evolution of user-centric and ethically conscious AI applications in the music industry.

4. Conclusion & Future Work

Our project has successfully tackled the challenge of facilitating new music discovery tailored to individual moods and listening preferences. By leveraging the integration of Spotify's vast music catalog and the advanced natural language processing capabilities of ChatGPT, our AI-powered playlist generator stands as a significant advancement in personalized music curation. The system's ability to discern and respond to nuanced user prompts ensures that new music recommendations are not only relevant but also resonate with the user's current emotional state and musical tastes. The intuitive interface, requiring only a Spotify account, ensures ease of access and usability, broadening the tool's appeal to a diverse user base, including DJs who seek to enhance their sets with seamlessly transitioning tracks and fresh musical ideas.

Looking ahead, there are several avenues for further development and expansion of our playlist generator:

Platform Expansion: One potential direction is the extension of our service to other music streaming platforms, such as SoundCloud. This expansion would cater to a broader audience and incorporate a wider array of musical content, including independent and emerging artists not present on Spotify.

Enhanced Recommendation Algorithms: Another area of focus is the refinement of our recommendation algorithms to facilitate even smoother transitions between songs. This could involve more sophisticated analysis of beat patterns, tempo variations, and harmonic compatibility, providing users and DJs with a tool that not only suggests tracks but also enhances the listening and performance experience.

Our program addresses the intrinsic human desire for musical exploration, enabling users to discover new tracks that align with their existing preferences yet offer fresh auditory experiences. It serves as a bridge between the familiar and the unknown in the music domain, encouraging users to expand their musical horizons within preferred genres. Furthermore, the application's utility extends beyond personal use, offering a resource for DJs and event organizers seeking to create engaging audio environments with minimal effort. As we look to the future, our commitment is to continuous improvement and innovation, ensuring that our program remains at the forefront of personalized music discovery and curation.

In conclusion, our Spotify playlist generator represents a significant leap forward in the intersection of AI and music, promising a more personalized, dynamic, and engaging music discovery experience for users worldwide. As we advance, our focus will remain on enhancing the sophistication of our technology, broadening its applicability, and ensuring it serves the diverse and evolving needs of music enthusiasts everywhere.