**Project Proposal: Music Generation Using Deep Learning and Generative AI**

**Introduction:**

The music generation project leverages deep learning and generative AI techniques to create new musical compositions based on existing musical data. The core of this project involves training a neural network on chroma features extracted from a large dataset of music tracks, enabling the model to generate new sequences that maintain the musical structure and style of the input data.

**Technical Overview:**

**1. Data Preparation:**

- Dataset: Currently, the project uses a sample dataset of 150 music sequences, each with 1500 timesteps and 12 chroma features. The final implementation will scale this up to millions of songs.

- Feature Extraction: Chroma features are extracted from audio files to capture the harmonic content of the music. This process involves loading audio files, computing the chroma feature matrix, and normalizing the features.

**2. Model Architecture:**

- LSTM Network: A Long Short-Term Memory (LSTM) network is employed due to its effectiveness in handling sequential data. The model consists of two LSTM layers, each with 64 units, followed by batch normalization and dropout layers to prevent overfitting. The output layer uses a softmax activation function to predict the next chroma features in the sequence.

- Model Training: The model is trained using categorical cross-entropy loss and the Adam optimizer. The training process includes early stopping, learning rate reduction, and model checkpointing to ensure optimal performance and prevent overfitting.

**3. Generative Process:**

- The trained model generates new music sequences by predicting the next set of chroma features based on a seed sequence. This involves rolling the input sequence and feeding the model's output back into itself iteratively.

- The generated numerical data is converted back to MIDI format for playback and evaluation.

**Future Scope:**

**1. Scaling Up:**

- Big Data Integration: To handle the vast amount of data, the project will be implemented on big data platforms like Databricks, which facilitates the processing and analysis of millions of songs.

- Advanced Architectures: Future iterations may explore more sophisticated generative models such as GANs (Generative Adversarial Networks) or Transformer-based architectures to improve the quality and diversity of the generated music.

**2. Enhanced Features:**

- Dynamic and Timbre Features: Incorporating additional musical features like dynamics and timbre to enrich the generated compositions.

- Style Transfer: Implementing style transfer techniques to generate music in the style of specific genres or artists.

**3. User Interaction:**

- Customization: Developing interfaces for users to customize the generated music, including selecting styles, instruments, and other musical elements.

- Real-Time Generation: Enabling real-time music generation for applications in live performances and interactive installations.

**Conclusion:**

This project represents a significant step forward in the field of generative music using deep learning. By leveraging advanced neural networks and big data platforms, we aim to create a scalable solution capable of producing high-quality, original music. The current sample dataset serves as a proof of concept, with the potential for expansive growth and innovative applications in the future.