**AI-Based Music Composition Using LSTM in MATLAB**

The project titled “AI-Based Music Composition Using LSTM in MATLAB” focuses on generating melodies automatically through deep learning, using MIDI data and sequence modeling techniques. The implementation begins by preparing a dataset of musical melodies in MIDI format. Each MIDI file is parsed using custom or third-party functions like readmidi() to extract pitch information, which is structured into sequences representing musical notes. These sequences are then preprocessed and converted into categorical data suitable for training, where each input sequence is paired with a target output shifted by one timestep to predict the next note.

For melody prediction, a deep learning architecture based on Long Short-Term Memory (LSTM) networks is chosen due to its effectiveness in modeling sequential and temporal patterns. The network consists of a sequence input layer, word embedding layer, LSTM layer with 128 hidden units, fully connected layer, and a softmax classification output. Training is performed using the trainNetwork function with the Adam optimizer, typically over 30 epochs, where the model learns to associate musical patterns and predict subsequent notes.

Once trained, the model is integrated into a melody generation pipeline. A random seed note initializes the sequence, and the trained model predicts a sequence of future notes, effectively composing a new melody. The predicted sequence is then converted back to MIDI format using writemidi() and can be played or saved for further use. This process enables the creation of unique musical compositions with minimal manual input.

In more advanced systems, similar AI-based music composition frameworks use models such as Sequence Variational Autoencoders or evolutionary optimization techniques like the Grey Wolf Optimizer to enhance realism and output quality. These systems may also incorporate rhythmic structure, harmony, and performance expression. While the current LSTM-based MATLAB implementation is simplified, it provides a foundational structure for real-time, generative music systems.

This project demonstrates how AI can transform musical creativity, automating the composition process through sequence learning and MIDI encoding. By leveraging MATLAB’s deep learning toolbox, the system can be expanded to include rhythm modeling, tempo dynamics, or more expressive control. Overall, the approach highlights the potential of combining deep learning with music theory to build AI composers that assist musicians, educators, or researchers in creative audio generation.