Synopsis: Melody Plagiarism Detection Using A Algorithm*

GROUP: 2C44

TEAM

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Introduction

Melody plagiarism is a significant concern in the music industry, requiring efficient algorithms to compare melodies and detect similarities. This project aims to build a **Melody Comparator** using the A (A-star) algorithm*, a heuristic search technique that finds the optimal alignment between two melodies. Unlike traditional machine learning or Dynamic Time Warping (DTW) methods, A* is well-suited for this project as per the course syllabus constraints.

Objective

The primary goal is to extract melodies from songs, represent them as sequences of musical notes, and compare them using the A* algorithm to detect plagiarism. The project will analyze pitch and rhythm similarities between two melodies and return a similarity score.

Methodology

1. **Melody Extraction**
   - Convert an audio file (e.g., WAV, MP3) into a sequence of notes.
   - Use **Librosa** to extract pitch and rhythm from the song.
   - Convert extracted frequencies to **MIDI notes** for easy processing.
2. **Melody Representation**
   - Each melody is stored as a sequence of MIDI notes.
   - Notes are compared based on pitch and duration.
3. A* Algorithm for Melody Comparison
   - **Nodes:** Represent each note in the melody.
   - **Edges:** Define transitions between notes.
   - **Cost Function (g(n)):** Measures the difference in pitch and timing.
   - **Heuristic Function (h(n)):** Estimates remaining differences between melodies.
   - The algorithm searches for the most optimal alignment between two melodies.
4. **Implementation**
   - Load melodies and extract MIDI notes.
   - Implement the A* search algorithm to find the best similarity path.
   - Return a similarity score based on alignment cost.

Expected Outcomes

- A functional **melody plagiarism detection system** using A*.
- Ability to compare two melodies and provide a **similarity score**.
- Detection of potential plagiarism based on melody similarity.

Tools & Technologies

- **Python** (Librosa, NumPy, Heapq)
- A Algorithm* for optimal melody alignment
- **MIDI Note Representation** for melody comparison

Conclusion

This project provides a structured and efficient approach to detecting melody plagiarism using **heuristic search** rather than complex ML models. By leveraging **A*** for sequence alignment, the system can effectively compare melodies, making it a practical and course-compliant solution for music similarity detection.