The inspiration for this project comes from a performance practice in Indian Classical music called *Jugalbandi*, which features a call-and-response interaction between players, guided by an intuitive understanding of each other's instruments. My approach began with exploring ways to classify different tabla hits.

According to research, "there are approximately fifteen acoustically distinct strokes that fall into three broad categories:

1. Resonant, ringing strokes played on the treble drum.
2. Non-resonant, noisy strokes played on either drum.
3. Low, resonant strokes played on the bass drum."

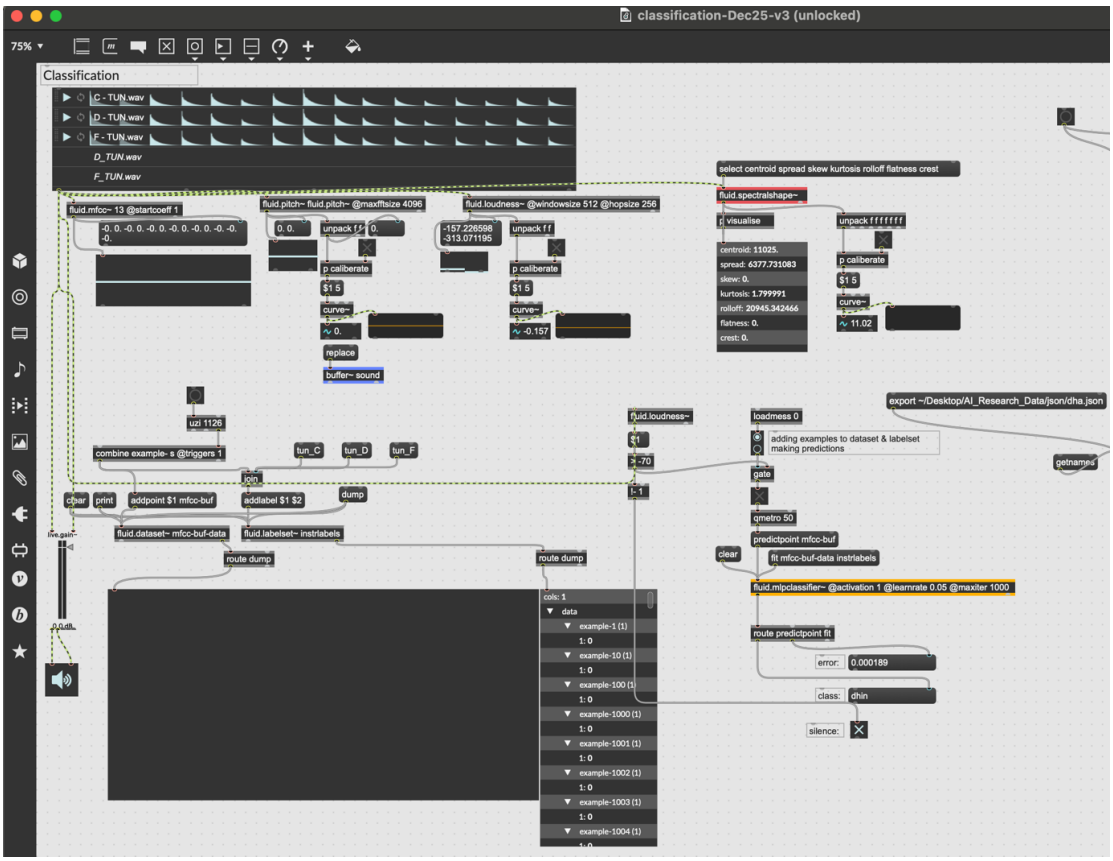
These named strokes form the fundamental vocabulary of tabla music and are played in sequence to create characteristic phrases. In my work, I refer to these as *hits* or *bols* of the tabla—for example, *Dha, Dhin, Ta, Tin, Tak, Kat,* and so on.

Classification of Tabla Hits

To classify tabla hits, I used the Flucoma package in Max/MSP (with 24 MFCCs) and Wekinator's classification model with the Naïve Bayes algorithm. This method produced the most accurate results compared to other approaches I tested.

Process of Finding the Optimal Solution

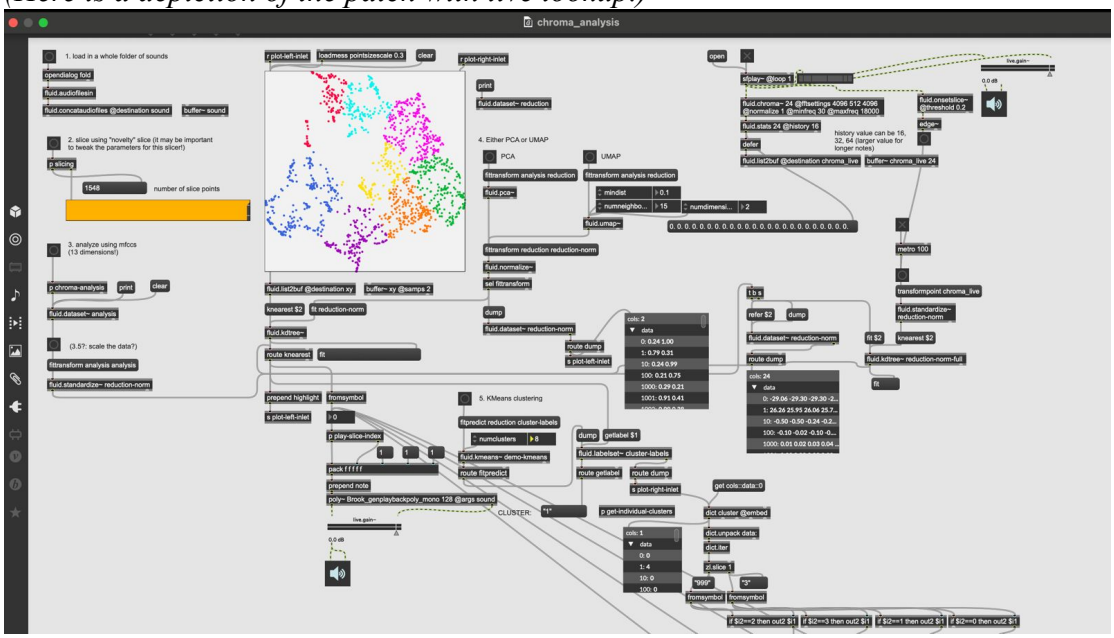
1. **First Approach:** I initially used the MLP classifier in Flucoma to categorize tabla strokes. However, the classifications were inconsistent and unreliable.



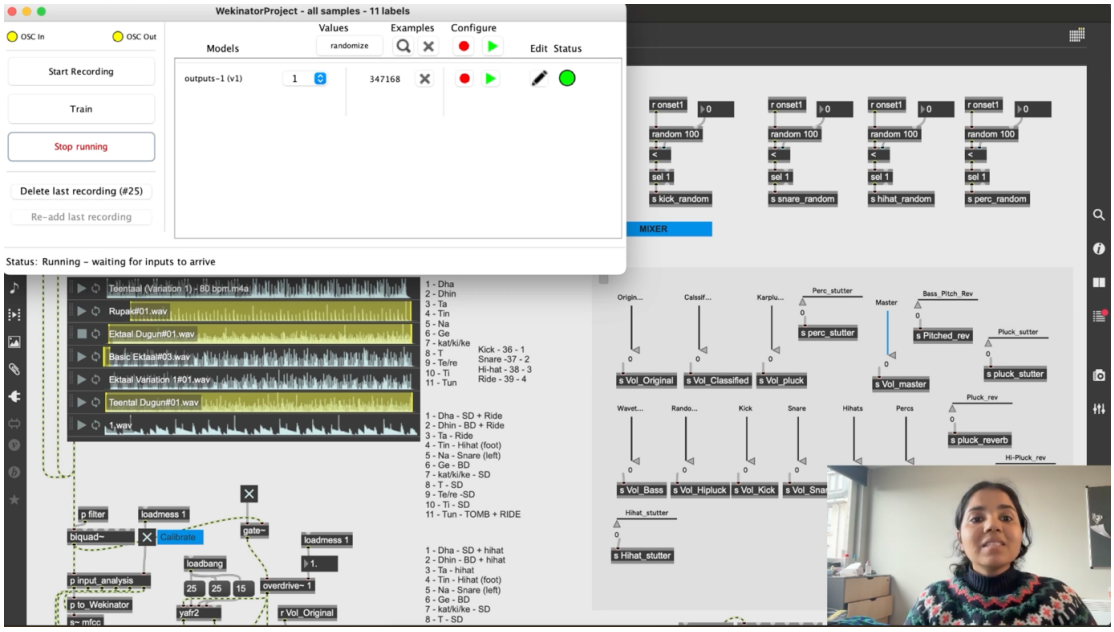
2. **Second Approach:** I attempted live lookup classification using the KD-tree method within Flucoma. I extracted various audio features, including MFCCs, Mel bands,

chroma, and spectral centroid. This max patch was inspired by patches by Ted Moore and Taylor Brooke. However, since the tabla is a pitched percussion instrument, spectral centroid and chroma were not effective in classification, leading to significant errors. Ultimately, I relied on MFCCs, which produced sonically interesting results but failed to establish a one-to-one correlation between the tabla and drums.

(Here is a depiction of the patch with live lookup.)



3. **Third Approach:** After these setbacks, I revisited my research and came across *The AI Tabla Improviser* paper by Parag Chordia. In this study, he used a Naïve Bayes model with 24 MFCCs for classification, employing the Weka package to create a custom classifier within a Max patch. Based on his findings, I applied the Naïve Bayes algorithm in Wekinator, which yielded significantly better results compared to my previous methods.



(Here is a walkthrough of the Wekinator and tabla classification process.)

Rhythmic Mapping and Challenges

The detected tabla bols serve as triggers for kick, snare, and hi-hat patterns in Max, generating rhythms extracted from the tabla sequences.

However, a major challenge remains: some tabla strokes sound timbrally similar (based on MFCCs) but have different names, leading to classification errors. I believe that refining the results requires training a machine-learning model on entire tabla patterns rather than isolated hits. By incorporating both pattern recognition and individual stroke classification—aligned with the theoretical framework of Indian Classical music—I aim to achieve more accurate results in future research.

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