

ABSTRAK

Tilawah Al-Quran bergaya *mujawwad* merupakan salah satu bentuk seni yang dianjurkan dalam Islam dan memiliki karakteristik khas berupa penggunaan *maqam* yang kompleks. Setiap *maqam* memiliki ciri tersendiri dalam hal pola nada, tempo bacaan, dan transisi antar tinggi nada atau cengkok yang khas, sehingga diperlukan pelatihan intensif untuk dapat membedakannya dengan baik. Selama ini, proses pembelajaran *maqam* dilakukan secara konvensional melalui *talaqqi* secara langsung bersama guru, yang tidak mudah diakses oleh para pembelajar. Bagi pemula, membedakan antar *maqam* sering kali menjadi tantangan tersendiri, bahkan pada tingkat lanjut pun masih ditemukan kesulitan dalam mengenali nama *maqam* yang sedang dilantunkan. Kondisi ini menunjukkan pentingnya dukungan teknologi sebagai alat bantu klasifikasi *maqam* secara otomatis untuk mendukung proses evaluasi mandiri.

Penelitian ini menggunakan metode ekstraksi fitur *Mel-Frequency Cepstral Coefficient* (MFCC) yang dikombinasikan dengan fitur turunan seperti *delta* dan *delta-delta*, serta fitur statistik untuk menangkap karakteristik akustik dari tilawah *mujawwad*. *Dataset* dikumpulkan secara mandiri dari berbagai *channel YouTube* tilawah, kemudian melalui proses konversi, *trimming*, segmentasi, dan *augmentasi* hingga diperoleh 553 file audio berdurasi sekitar 25 hingga 30 detik. Model klasifikasi dibangun menggunakan algoritma *Naïve Bayes Classifier*, yang dikenal sederhana namun efektif untuk skala data kecil dengan representasi fitur yang baik. Evaluasi dilakukan melalui beberapa skenario, termasuk pengujian kombinasi fitur, variasi jumlah kelas *maqam*, dan pengujian kemampuan generalisasi model terhadap data baru.

Hasil penelitian menunjukkan bahwa kombinasi fitur MFCC, *delta*, *delta-delta*, serta statistik (*mean*, *median*, *standard deviation*, *skewness*, dan *kurtosis*) menghasilkan performa terbaik dalam klasifikasi tujuh *maqam* dengan nilai *macro average precision* (MAP) sebesar 85,63%. Di antara fitur statistik tersebut, *skewness* menjadi fitur yang paling berkontribusi dalam meningkatkan performa model. Bahkan, penggunaan subset fitur tertentu dapat menghasilkan MAP tertinggi sebesar 90,27%, yang menegaskan pentingnya pemilihan fitur yang tepat. Ketika jumlah kelas disederhanakan menjadi empat *maqam*, performa model meningkat hingga 91,73%. Evaluasi terhadap 35 data baru juga menunjukkan bahwa model berhasil mengenali enam *maqam* secara konsisten dengan total 30 data berhasil diklasifikasikan dengan benar, sementara seluruh data *maqam Jiharkah* gagal diklasifikasikan, yang menunjukkan keterbatasan kemampuan generalisasi model akibat ketidakseimbangan distribusi data latih.

Kata Kunci: Klasifikasi *Maqam*, Tilawah *Mujawwad*, MFCC, *Naïve Bayes Classifier*, Klasifikasi Audio

ABSTRACT

Mujawwad-style Quranic recitation is considered one of the artistic forms promoted in Islam and is distinguished by its intricate use of maqamat. Each maqam has unique features, such as melodic patterns, reading tempo, and transitions between pitch levels known as cengkok that require intensive training to recognize accurately. Traditionally, maqam learning is carried out through talaqqi, a direct method of oral transmission from teacher to student, which is often not easily accessible to many learners. For beginners, distinguishing between maqamat can be especially challenging, and even at an advanced level, identifying the specific maqam being recited can remain a difficult task. This situation highlights the importance of technological support as a tool for automatic maqam classification, thereby facilitating the self-evaluation process.

This study employs the Mel-Frequency Cepstral Coefficient (MFCC) feature extraction method, combined with derivative features such as delta and delta-delta, and statistical features, to capture the acoustic characteristics of mujawwad recitations. The dataset was collected independently from various YouTube channels. Through a process of conversion, trimming, segmentation, and augmentation, 553 audio files were obtained, each with a duration of approximately 25 to 30 seconds. The classification model is built using the Naïve Bayes Classifier algorithm, which is known to be a simple yet effective algorithm for small data scales with good feature representation. The evaluation was conducted through several scenarios, including testing feature combinations, variations in the number of maqam classes, and assessing the model's generalization ability against new data.

The research findings indicate that a combination of MFCC features, delta, delta-delta, and statistical measures (mean, median, standard deviation, skewness, and kurtosis) yields the best performance in classifying seven maqamat, with a macro average precision (MAP) score of 85.63%. Among the statistical features, skewness contributed the most to improving the model's performance. Using a certain subset of features resulted in the highest MAP of 90.27%, underscoring the importance of proper feature selection. When the number of classes was simplified to four maqamat, the model's performance increased to 91.73%. Evaluation on 35 new data samples also showed that the model successfully identified six maqamat consistently, with a total of 30 samples correctly classified. However, all samples of the Jiharkah maqam failed to be classified, indicating limitations in the model's generalization ability due to an imbalance in the training data distribution.

Keywords: *Maqam Classification, Mujawwad Recitation, MFCC, Naïve Bayes Classifier, Audio Classification*