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Rule-Based Embedded HMMs Phoneme Classification to Improve Qur'anic Recitation Recognition
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Abstract
Phoneme classification performance is a critical factor for the successful implementation of a speech recognition system. A mispronunciation of Arabic short vowels or long vowels can change the meaning of a complete sentence. However, correctly distinguishing phonemes with vowels in Quranic recitation (the Holy book of Muslims) is still a challenging problem even for state-of-the-art classification methods, where the duration of the phonemes is considered one of the important features in Quranic recitation, which is called Medd, which means that the phoneme lengthening is governed by strict rules. These features of recitation call for an additional classification of phonemes in Qur'anic recitation due to that the phonemes classification based on Arabic language characteristics is insufficient to recognize Tajweed rules, including the rules of Medd. This paper introduces a Rule-Based Phoneme Duration Algorithm to improve phoneme classification in Qur'anic recitation. The phonemes of the Qur'anic dataset contain 21 Ayats collected from 30 reciters and are carefully analyzed from a baseline HMM-based speech recognition model. Using the Hidden Markov Model with tied-state triphones, a set of phoneme classification models optimized based on duration is constructed and integrated into a Quranic phoneme classification method. The proposed algorithm achieved outstanding accuracy, ranging from 99.87% to 100% according to the Medd type. The obtained results of the proposed algorithm will contribute significantly to Qur'anic recitation recognition models.

Author Keywords
Arabic vowels classification; pattern recognition; phoneme classification; phoneme duration; recitation recognition; speech recognition; Tajweed recognition

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