

Nov 14, 2024

# Precision in Quranic Arabic Recitation: Leveraging ASR for Tajweed Mastery

DOI

[dx.doi.org/10.17504/protocols.io.4r3l298b3v1y/v1](https://dx.doi.org/10.17504/protocols.io.4r3l298b3v1y/v1)

Khalid Ahmad Khattak<sup>1</sup>

<sup>1</sup>Keele University



Khalid Ahmad Khattak

Keele University

## Create & collaborate more with a free account

Edit and publish protocols, collaborate in communities, share insights through comments, and track progress with run records.

Create free account

OPEN  ACCESS



**DOI:** <https://dx.doi.org/10.17504/protocols.io.4r3l298b3v1y/v1>

**Protocol Citation:** Khalid Ahmad Khattak 2024. Precision in Quranic Arabic Recitation: Leveraging ASR for Tajweed Mastery. protocols.io <https://dx.doi.org/10.17504/protocols.io.4r3l298b3v1y/v1>

**Manuscript citation:**

N/A

**License:** This is an open access protocol distributed under the terms of the **[Creative Commons Attribution License](#)**, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited

**Protocol status:** Working

**We use this protocol and it's working**

**Created:** November 14, 2024

**Last Modified:** November 14, 2024

**Protocol Integer ID:** 112091

**Keywords:** Quran Recitation, Quranic Arabic Recitation, QAR, Automatic Speech Recognition, ASR, Pronunciation Verification of Arabic Recitations, goodness of Pronunciation, GOP, mastery of quranic arabic recitation, quranic arabic recitation, independent asr for quranic arabic, arabic recitation, improving recitation accuracy, feedback on pronunciation quality, recitation accuracy, quranic arabic, pronunciation quality, goodness of pronunciation, automatic speech recognition, use of automatic speech recognition, asr for tajweed mastery, pronunciation, leveraging asr, quranic, using asr, hidden markov model, computational techniques such as hidden markov model, asr, tajweed mastery, differences between speaker, tajweed rule, speaker, independent asr, accuracy

## Disclaimer

N/A

## Abstract

This protocol describes the use of Automatic Speech Recognition (ASR) to support the mastery of Quranic Arabic recitation according to Tajweed rules. By using ASR and computational techniques such as Hidden Markov Models (HMMs) and "Goodness of Pronunciation" (GOP), this protocol facilitates feedback on pronunciation quality at both segmental and holistic levels. It explores differences between speaker-dependent and speaker-independent ASR for Quranic Arabic, aiming to provide users with an advanced framework for improving recitation accuracy.

## Guidelines

N/A

## Materials

**1. Hidden Markov Model Toolkit (HTK)** - for ASR setup and model training

**2. Acoustic Data Samples:**

2.1. Primary data: Researcher's voice reciting Chapter 1 of the Quran, sampled at multiple frequencies.

2.2 Secondary data: 24 recitations from open sources, formatted and adjusted for ASR input.

**3. ASR Configuration Files** - specifying parameters like sampling frequency, filterbank channels, and MFCC parameters.

## Troubleshooting

## Safety warnings

 N/A

## Ethics statement

N/A

## Before start

N/A

## Methodology

### 1 ASR Training:

#### ***Word-Level Speaker-Dependent Model:***

Train on a specific speaker with HMM configurations (8 and 12 states) and GMM components.

#### **Word-Level Speaker-Independent Model:**

Train using a variety of speakers, including frequency adjustments to accommodate variances in pronunciation.

#### **Pronunciation Verification:**

Evaluation of recitation for both segmental errors (using GOP) and holistic scoring, including speech duration, segmentation, and fluency.

#### **Experimental Setup:**

Use of HTK for feature extraction, model training, and configuration adjustments.

Testing performed on configurations to optimize accuracy.

## Results

2 **Speaker-Dependent ASR:** Expected results with specified MFCC parameters (\_E, \_O, \_D, \_A, \_Z).

**Speaker-Independent ASR:** Expected results with specified MFCC parameters (\_E, \_O, \_D, \_A, \_Z).

## Conclusion

3 The protocol may provide an in-depth framework for implementing ASR in Quranic recitation, offering a valuable assistive tool for Tajweed adherence, particularly beneficial for a diverse audience worldwide.

## Protocol references

Quran

<https://scholar.google.com/citations?user=QzUefM0AAAAJ&hl=en>