



Spoken Language Processing - Fall 2025

Course Project

Submission Deadline: Monday 26/1/2026 on ITC

Team working policy:

As you know, this course requires a comprehensive term project that will constitute 15% of your course grade. Since most of these projects require an intensive workload, you have to work on this project in groups of **three** (maximum three!) students.

Project_Idea:

Overview

Speech-based human–computer interaction is an important area in spoken language processing. Arabic speech recognition remains challenging due to dialectal variation and limited datasets. This project focuses on recognizing isolated Arabic spoken commands using classical speech processing techniques.

Project objectives:

The objectives of this project are:

- To process Arabic speech signals
- To extract acoustic features using MFCC
- To classify spoken commands using machine learning
- To evaluate recognition performance

Dataset

A small Arabic spoken command dataset will be created. The dataset consists of six commands: افتح، اغلق، ابدأ، توقف، يمين، يسار. Audio recordings are collected from multiple speakers in a quiet environment. All recordings are stored in WAV format with a sampling rate of 16 kHz.

Methodology

Each audio signal is preprocessed by removing silence and normalizing amplitude. MFCC features are extracted from each recording. Statistical descriptors (mean and standard deviation) are used to form feature vectors. Classification is performed using machine learning algorithms such as VQ or (KNN), Gaussian Mixture Model (GMM), Random Forest, and Support Vector Machine (SVM).

Evaluation

The system performance is evaluated using classification accuracy and confusion matrices. A comparison between different classifiers is conducted to identify the most effective model.

Expected Outcomes

The system is expected to achieve an accuracy between 85% and 95% for isolated command recognition. The project demonstrates the effectiveness of classical speech processing techniques for Arabic spoken command recognition.

Tools

Python, Librosa, NumPy, Scikit-learn, Matplotlib

Tip for High Marks

In your project, emphasize:

- **Arabic speech challenges**
- **Why MFCC is suitable**
- **Why SVM performs best**
- **Error analysis**

Deliverables: each group has to submit the followings: one student does the submission and write names/IDs of his/her partners.

1. **Dataset**: a link to your collected dataset on a shared drive
2. **Source code**:

Method 1: Submit a Notebook Link

If you are using Google colab, Open your notebook

Click File → Save a copy in Drive

Rename it clearly, for example:

Arabic_Spoken_Commands_Project.ipynb

Click Share (top-right), Change access to: Anyone with the link → Viewer

Submit the Colab link

Method 2: Submit .ipynb File (Offline Copy)

In Colab:

File → Download → Download .ipynb

3. Report:

- Final project report should be 2-4 pages long in the IEEE transaction letter format (including appendices, figures, references, and everything else you choose to submit). The following is a suggested structure for the final report:
 1. Title, Author(s)
 2. Abstract: It should not be more than 300 words
 3. Introduction: this section introduces your problem, and the overall plan for approaching your problem
 4. Background/Related Work: This section discusses relevant literature for your project
 5. Methodology (system description): This section details the framework of your project. Be specific, which means you might want to include equations, figures, plots, etc
 6. Experiments and Results: This section begins with what kind of experiments you're doing, what kind of dataset(s) you're using, and what is the way you measure or evaluate your results. It then shows in details the results of your experiments. By details, we mean both quantitative evaluations (show numbers, figures, tables, etc) as well as qualitative results (show images, example results, etc).
 7. Conclusion: What have you learned? Suggest future ideas.
 8. References: This is absolutely necessary.
- IEEE conference paper template is found on the course page at Moodle (itc.birzeit.edu).