
PROJECT: ECG SIGNAL ANALYSIS AND INTERPRETATION

OBJECTIVE:

The objective of this project is for you to apply your knowledge of signals and systems to develop a MATLAB-based ECG signal processing system and analyze the characteristics of the ECG signal.

PROJECT DESCRIPTION:

For this project, you will be using the MIT-BIH Arrhythmia Database, a widely used dataset for ECG signal processing research and education. The dataset can be downloaded from the PhysioNet website: <https://physionet.org/content/mitdb/1.0.0/>

The MIT-BIH Arrhythmia Database contains 48 half-hour excerpts of two-channel ambulatory ECG recordings, obtained from 47 different subjects. The recordings were digitized at 360 samples per second per channel with 11-bit resolution over a 10 mV range. The dataset includes annotations for various ECG features and arrhythmias, which you can use for your signal analysis and interpretation.

Your task is to complete the following steps:

1. SIGNAL PREPROCESSING:

- Review the preprocessing techniques that have already been applied to the ECG signals, such as:
- Baseline wander removal
- Power line interference removal
- Muscle artifact removal

2. FEATURE EXTRACTION:

- Implement algorithms to identify and extract relevant features from the preprocessed ECG signals, such as:
 - R-peak detection
 - Heart rate variability analysis
 - ECG wave interval measurements (P-wave, QRS complex, T-wave)

3. SIGNAL ANALYSIS AND INTERPRETATION:

- Analyze the extracted features to gain insights into the ECG signals, such as:
- Identifying normal and abnormal ECG patterns
- Describing the significance of the extracted features and their clinical relevance

4. VISUALIZATION AND REPORTING:

- Create visualizations (e.g., plots, waveforms) to effectively present your findings.
- Write a comprehensive report documenting the project, including the problem statement, methodology, results, and conclusions.

GRADING CRITERIA:

Your project will be evaluated based on the following criteria:

- Effectiveness of the feature extraction algorithms (30%)
- Accuracy and depth of the signal analysis and interpretation (40%)
- Quality of the visualizations and written report (30%)

This project will allow you to demonstrate your understanding of the following topics covered in the course:

- Representation and properties of biomedical signals (Chapter 1)
- Linear time-invariant systems and their application to ECG signals (Chapters 2-3)
- Fourier analysis and its use in ECG signal processing (Chapters 4-5)
- Sampling and reconstruction of ECG signals (Chapter 6,7)
- Digital filter design and its application to ECG noise removal (Chapters 7, 9)
- Modulation and its role in ECG signal transmission (Chapter 10)

PROJECT DELIVERY DEADLINE:

Sunday 16/4/1403

This deadline **will not be extended** in any way.

Submitting the project is **not mandatory** and is only to restore the final grade. **If the project is not done by the student himself, no grade will be given to him.**