NEURAL NETWORK APPLICATIONS COURSE (CSE616) FINAL PROJECT – PROPOSAL

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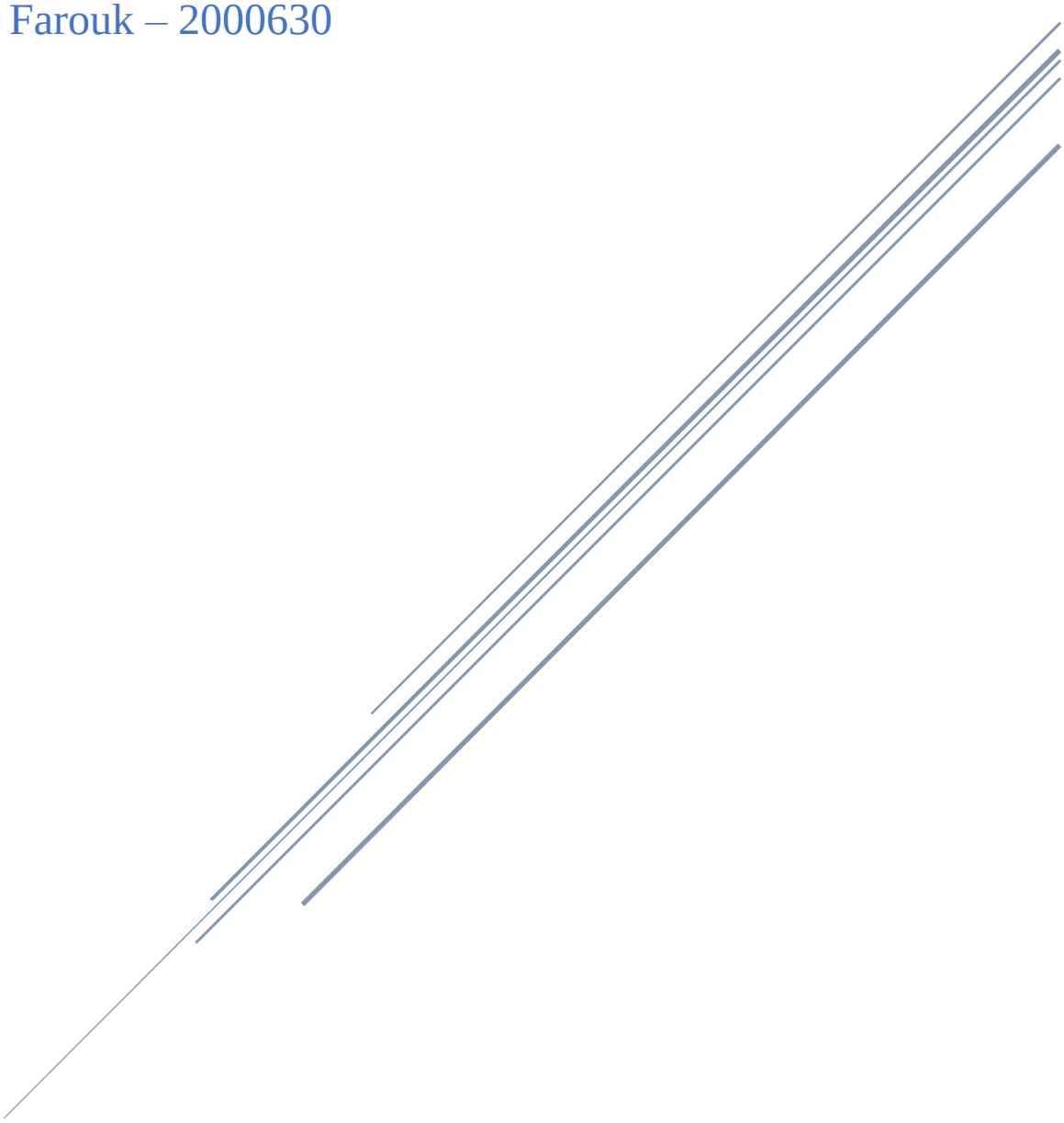

Implementing "A Study on Arrhythmia via ECG Signal Classification Using the Convolutional Neural Network" paper in python

Introduction

Cardiovascular diseases (CVDs) are the leading cause of death today. The current identification method of the diseases is analyzing the Electrocardiogram (ECG), which is a medical monitoring technology recording cardiac activity. Unfortunately, looking for experts to analyze a large amount of ECG data consumes too many medical resources. Therefore, the method of identifying ECG characteristics based on machine learning has gradually become prevalent. However, there are some drawbacks to these typical methods, requiring manual feature recognition, complex models, and long training time.

Mengze Wu, Yongdi Lu, Wenli Yang and Shen Yuong Wong propose a robust and efficient 12-layer deep one-dimensional convolutional neural network on classifying the five micro-classes of heartbeat types in the MIT- BIH Arrhythmia database in their paper "A Study on Arrhythmia via ECG Signal Classification Using the Convolutional Neural Network"[1]

Problem Statement

The paper states that the solution is implemented in Matlab – which is no longer used as much as Python. Also there's no reference for the code in the paper. In our project, we are implementing the paper's solution in Python.

Methods

We are implementing the methods and steps defined in the paper, which are:

- Data Preprocessing for denoising, using Sym4 Wavelet Transform
- Data Segmentation
- Data Enhancement by randomly duplicating the under-represented classes, and discarding the over-represent ones.

- Architecture:
    - One-dimensional 12-Layer convolution with Average Pooling
    - Dropout Layer
    - Fully Connected Layer
    - Softmax Output Layer
- Using 10-Fold-Validation in training.

Expected Results

We expect to have a CNN model behaving like the paper with an accuracy near that reached by the paper's authors; which is about 97%.

Conclusion

We introduce implementation for the CNN proposed in the "A Study on Arrhythmia via ECG Signal Classification Using the Convolutional Neural Network" paper in Python.

References

[1] https://www.frontiersin.org/articles/10.3389/fncom.2020.564015/full