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| Module Code: | EE5907 |
| Module Name: | Pattern Recognition |
| Submitted by: | Charlene |
| Matriculation No: | A0280349Y |
| Assignment Topic: | Face Recognition with PCA and LDA crafted from Scratch for Feature Extraction followed by KNN, SVM, CNN, GMM for Recognition |
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# Abstract

This homework report explores several image denoising techniques for Coronary Computed Tomography Angiography (CCTA) and Non-Contrast Computed Tomography (NCCT) images that were contaminated with 4 different types of synthetic noises, which are Gaussian, motion blur, periodic and salt-and-pepper noise. Denoising algorithms were developed in Python, version 3.10, on top of baseline algorithms that were commonly used for each individual noise. Furthermore, the performance of these algorithms was measured and compared against the original images, by using the Peak Signal-to-Noise (PSNR) and Structural Similarity Index (SSIM). *Results indicate that while simple methods such as median filtering effectively remove noise, more advance techniques perform better in preserving image structure. This study provides insights into selecting appropriate denoising techniques for medical imaging applications*

*The codes used for this assignment are appended at the end of this submission in Appendix A.*

# Introduction

This assignment was implemented on Windows 10 with Python 3.10.

Based on the assignment guidelines, MLP (Multi-Layer Perceptron) and RBF (Radial Basis Function) neural network models are used for classification.

These 2 neural network models are then evaluated based on accuracy, precision, recall, F1-score and ROC Curve and AUC score.

# Feature Extraction with PCA and LDA

## Dataset Preparation

I am not comfortable using my own selfies. Hence, I have written a code to extract 10 random images from subjects that were not included within the 25 whilst using the same seed. The generated output is then saved into a <.txt> file for part 1\_2. The console output for part1\_1 is shown in Fig.1, and the 10 randomly selected images are shown in Fig.2.

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| Fig. . A set of 25 randomly selected subjects, along with 10 random images from a subject not included in the 25. |
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| *Fig. 2. The 10 randomly selected images* |

# Classification with RBF Network with Random RBF Centers

## Construct RBF Neural Network with 1 Random RBF Center

## Construct RBF Neural Network with 6 Random RBF Center

## Compare Constructed RBF Neural Networks in 2a and 2b

Discuss the effects of the numbers of hidden neuron on the performance of the RBF network

# Comparison of MLP and RBF

With the fixed random seed, the metrics generated by both classifiers can be used to analyse their performance.

# Bibliography

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[4] B. Goyal, A. Dogra, S. Agrawal, and B. S. Sohi, “Noise issues prevailing in various types of medical images,” *Biomedical and Pharmacology Journal*, vol. 11, no. 3, pp. 1227–1237, Sep. 2018, doi: 10.13005/bpj/1484.

# Appendix A

The code repository can be accessed from github at <https://github.com/thisischarlene/ee5907_ca1>.

File Directory