Final Report

Classic ML Models (Task 2) vs. Deep Learning Models (Task 3)

All the experimental results are presented in the excel workbook

Define: Models were evaluated using normal evaluation on the train and test labels, K-fold Validations, LOSO-CV validations for both train and test labels in Task 2. For task 4, built three simple models were build: Conv1d(CNN), Multi-Layer Perceptron (MLP), and Long Short-Term Memory (LSTM).

Observations and Analysis

1. Classic ML Models:

   1. Logistic Regression and Random Forest consistently outperform other models across all tasks and evaluation strategies.
   2. Logistic Regression achieves the highest performance in K-Fold and LOSO-CV evaluations with an F1 score of 0.9834 (K-Fold Test) and 0.9204 (LOSO-CV Test).
   3. AdaBoost performs poorly in all settings, with significantly lower accuracy, precision, recall, and F1 scores.

2. Deep Learning Models:

   1. The CNN Model achieves the highest performance among DL models, with an F1 score of 0.9464 on train labels and 0.9736 during K-Fold training.
   2. The MLP Model performs close to CNN but lags slightly behind, particularly in F1 score (0.9039 on normal train and test labels).
   3. The LSTM Model underperforms relative to CNN and MLP, with lower accuracy and F1 scores, particularly on normal train and test labels (F1 = 0.8106).

3. Comparison:

   1. Classic ML Models such as Logistic Regression and Random Forest perform comparably to Deep Learning Models, especially in terms of accuracy and F1 scores.
   2. The CNN Model shows strong results in Task 4 using K-Fold CV, achieving similar performance to Logistic Regression and Random Forest.

3. Classic ML models outperformed deep learning models in K-Fold Cross Validations. Additionally, using K-Fold CV gave much higher accuracy than LASO-CV.
4. Deep learning models require more computational resources and training time, while classic ML models like Logistic Regression achieve high performance with relatively less complexity.
5. Logistic Regression and Random Forest remain strong contenders in classic ML approaches, achieving the best overall performance across tasks.
6. Among DL models, CNN delivers the highest accuracy and F1 score, making it a suitable alternative when deep learning techniques are preferred.