Part 2:
I examined five classifiers: Random Forest, Decision Tree, AdaBoost, Support Vector Machine (SVM) classifier, and Feed-Forward Neural Network (FFNN) on both the original and latent space representations. Each classifier has its own hyperparameters, so I initially focused on a single important hyperparameter for each classifier, such as the number of trees for Random Forest (Figure 1) and max_depth for Decision Tree (Figure 2). By optimizing a single hyperparameter, I achieved accuracies of 0.8 and 0.69 on the testing dataset. Subsequently, I employed the Grid Search method to determine the best combination of hyperparameters for each classifier. By tuning several hyperparameters simultaneously to maximize accuracy, I obtained better results with Grid Search compared to single hyperparameter optimization. A comparison of the accuracies achieved through single hyperparameter tuning and Grid Search is shown in Table 1, which also includes the best hyperparameters for each classifier on both the original and latent space representations. Interestingly, I found that the FFNN performed better on the original data, although the discrepancy between the training and testing datasets in the latent space was smaller (Figure 3). As shown in Figure 4, all five classifiers demonstrated better performance on the original data than in the latent space. This superior performance could be attributed to the limited number of features in the latent space (48), which may affect the classification accuracy of all classifiers. Among the classifiers, SVM exhibited the best performance based on accuracy. The accuracies of Random Forest, SVM, and FFNN were all above 0.8 on raw data, indicating strong performance for these classifiers.

Figure 1

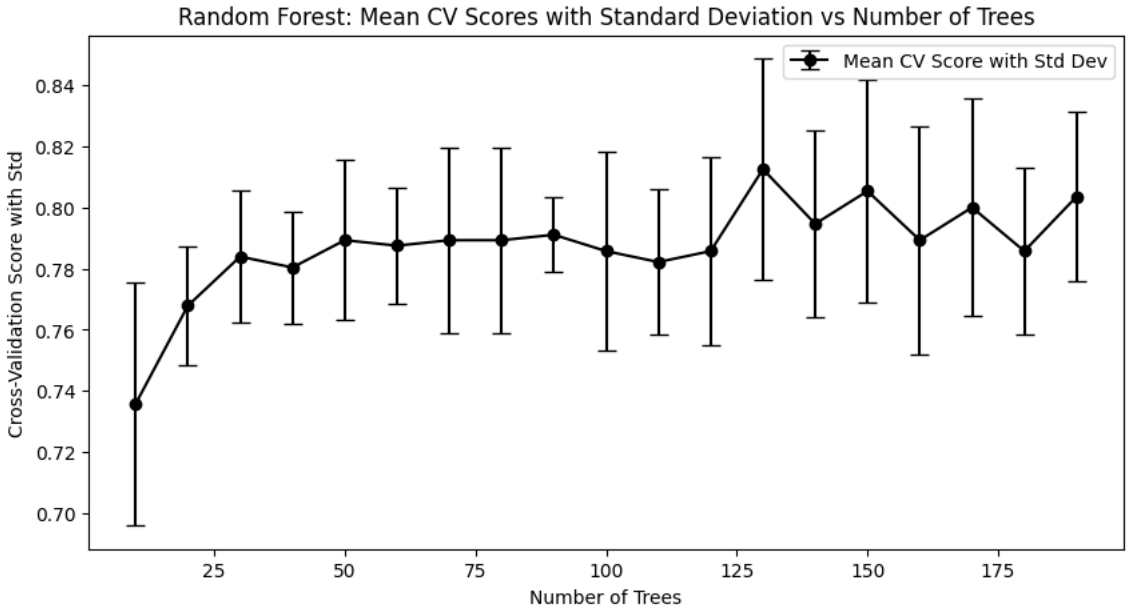

Figure 2

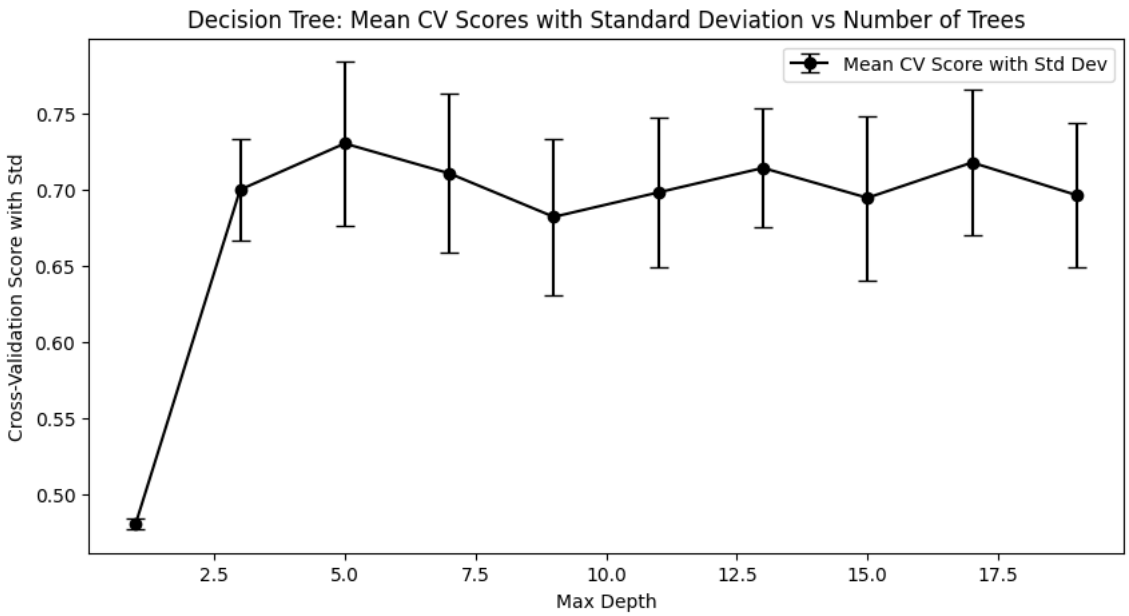

Figure 3

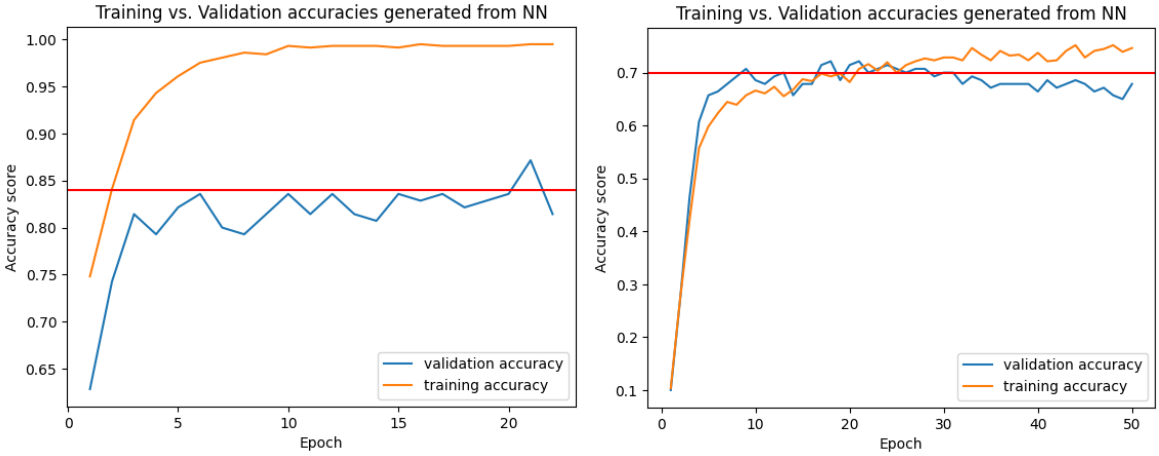

Table 1

Model	Dataset	Accuracy of single Hyperparameter	Accuracy of hyperparameters	Best Hyperparameters
Random Forest	Raw	0.8	0.8214285714285714	'max_depth': 20, 'min_samples_leaf': 1,'min samples split':2, 'n_estimators': 150
Decision Tree	Raw	0.6928571428571428	0.7357142857142858	'max_depth': 6, 'min_samples_leaf': 8,'min_samples_split': 2
AdaBoost	Raw	0.7	0.7857142857142857	'algorithm': 'SAMME', 'learning_rate': 0.1,'n_estimators': 100
SVM	Raw	--	0.8428571428571429	'C': 10, 'gamma': 0.001, 'kernel': 'rbf'
FFNN	Raw	--	0.8714	--
Random Forest	Latent Space	0.6785714285714286	0.6928571428571428	'max depth': None, 'min_samples_leaf': 1,'min samples split': 2, 'n_estimators': 100

Decision Tree	Latent Space	0.6071428571428571	0.5785714285714286	'max_depth': 6, 'min_samples_leaf': 8,'min_samples_split': 2
AdaBoost	Latent Space	0.6142857142857143	0.6714285714285714	'algorithm': 'SAMME', 'learning_rate': 0.1, 'n_estimators': 50
SVM	Latent Space	--	0.6785714285714286	'C': 1, 'gamma': 0.1, 'kernel': 'rbf'
FFNN	Latent Space	--	0.7214	--

Figure 4