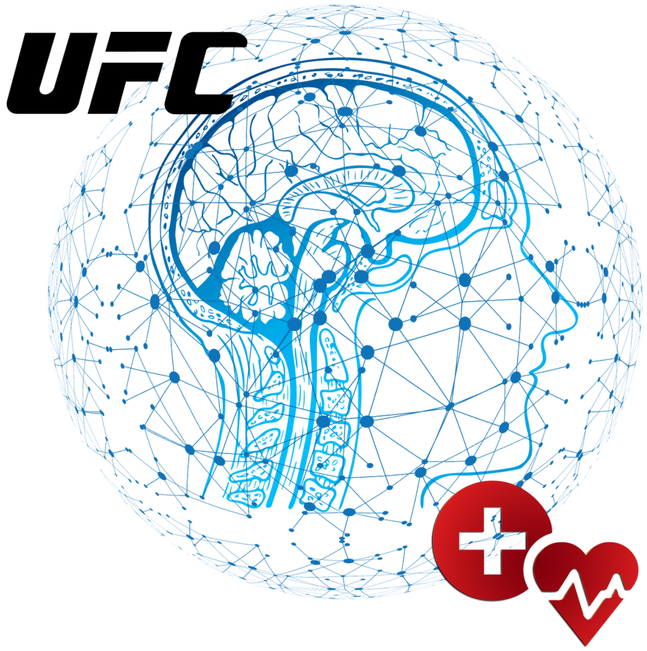


Machine Learning Model Evaluation for UFC Fight Outcomes & Healthcare Diagnostics

By: Kanwarpartap Singh Brar

UFC Data (Binary Classification)

Machine Learning Models Tested:

- Decision Tree Classifier
- Logistic Regression
- Support Vector Machines (SVM)
- Random Forest Classifier (Ensemble)

Evaluated Using:

- Accuracy Score
- Precision
- Recall
- F1-Score
- Confusion Matrix
- Hyperparameter Tuning

Healthcare Data (Multiclass Classification)

Machine Learning Models Tested:

- K-Nearest Neighbors (KNN)
- Support Vector Machines (SVM)
- Random Forest (Ensemble)
- Perceptron

Evaluated Using:

- Accuracy Score
- Precision
- Recall
- F1-Score
- Confusion Matrix
- Hyperparameter Tuning

UFC Data:

Summary:

- 3,333 examples
- 194 features
- All fight data collected from July 2016 to November 2024 (8 years)
- Aim: Predict fight winner

Data Preprocessing:

- Custom feature vector from Fighter1 - Fighter2
- Created ‘fighter_stats’ dataset using career averages
- Filled null values with 0, indicating the non-existent round
- Used the custom feature vector to pull the fighter statistic data from

Prediction:

- SVM & Random Forest expected to be best performers

Healthcare Data:

Summary:

- 44,000 examples
- 15 features
- Label is ‘Test Result’: 3 classes (normal, abnormal, inconclusive)

Data Preprocessing:

- Dropped irrelevant columns
- Created ‘Length of Stay’ as a new feature
- Used One-Hot Encoding, Label Encoding, and feature scaling with StandardScaler

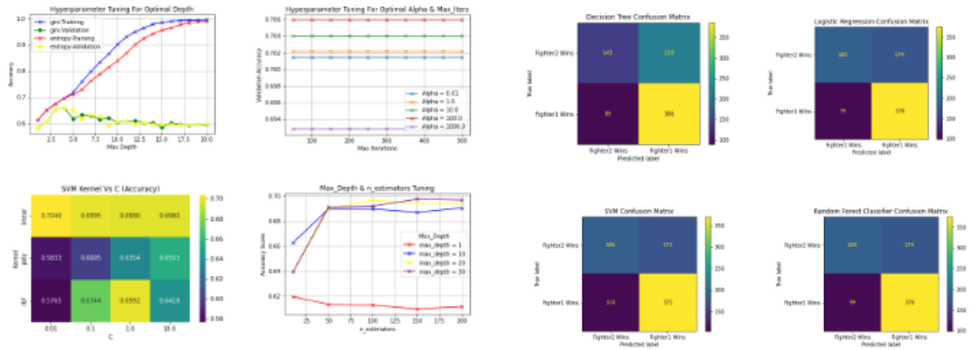
Prediction:

- SVM & Ranodm Forest expected to be best performers

UFC Data Results:

Model	Accuracy	Precision	Recall	F-1 Score
Decision Tree	0.634	0.63	0.61	0.6
Logistic Regression	0.673	0.67	0.65	0.65
SVM	0.668	0.66	0.65	0.65
RF Ensemble	0.673	0.67	0.65	0.65

Model	Optimal Hyperparam	Optimal Hyperpa
Decision Tree	Max Depth' : 4	Criterion': Gini
Logistic Regression	C': .01	Max Iter': 50
SVM	C': .01	Kernel": Linear
RF Ensemble	Max Depth' : 30	n_estimators': 150



Performance Summary:

- Logistic Regression & Random Forest were top performers (67.3% accuracy)
- SVM was in the middle (66.8%)
- Decision Tree performed worst (63.4%)

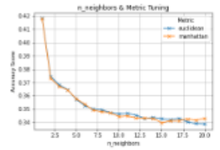
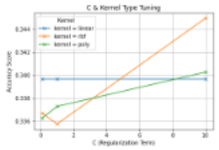
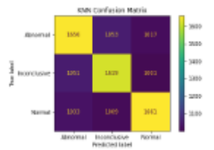
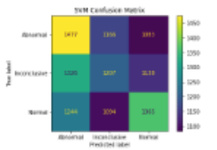
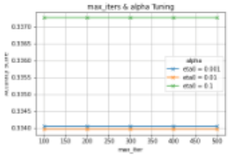
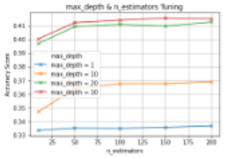
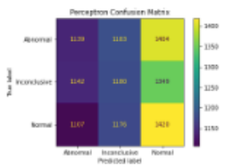
Confusion Matrix Summary:

- All the models showed a slight bias toward predicting Fighter1
- This could be because the dataset was imbalanced, with Fighter1 having the majority of the labels. This could have occurred due to Fighter1 being the ‘favorite’.

Healthcare Data Results:

Model	Accuracy	Precision	Recall	F-1 Score
KNN	0.445	0.44	0.44	0.44
SVM	0.365	0.36	0.36	0.36
Perceptron	0.337	0.34	0.34	0.34
RF Ensemble	0.438	0.44	0.44	0.44

Model	Optimal Hyperparam	Optimal Hyperpa
KNN	Metric': 'Euclidean'	n_neighbors': 1
SVM	C: '10'	Kernel': rbf
Perceptron	alpha': .1	max_iter: '100'
RF Ensemble	max_depth: '30'	n_estimators: '150


Performance Summary:

- KNN & Random Forest were top performers (44.5% & 43.8% respectively)
- SVM was in the middle (36.5%)
- Perceptron performed worst (33.7%)

Confusion Matrix Summary:

- Looking at the confusion matrices we can see there is high misclassification across all models.
- ‘Inconclusive’ class was the most misclassified

CONCLUSION

- Quality of the features and dataset has a major impact on the performance of the model, even moreso than the algorithm itself

UFC Data Future Works:

- Incorporate recent fight weighting
- Integrate real time API to have an updated dataset

Healthcare Data Future Works

- Conduct feature engineering to create more relevant and predictive features