MMA Fight Outcome Prediction

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Problem Statement

- Create a binary classification model to predict the outcome of an MMA fight (win or loss for a given fighter) based on a set of features extracted from a database

- Use cases in live bookmaking and fight promotion data collection

- Distinct lack of predictive modelling and statistical analysis in the sport

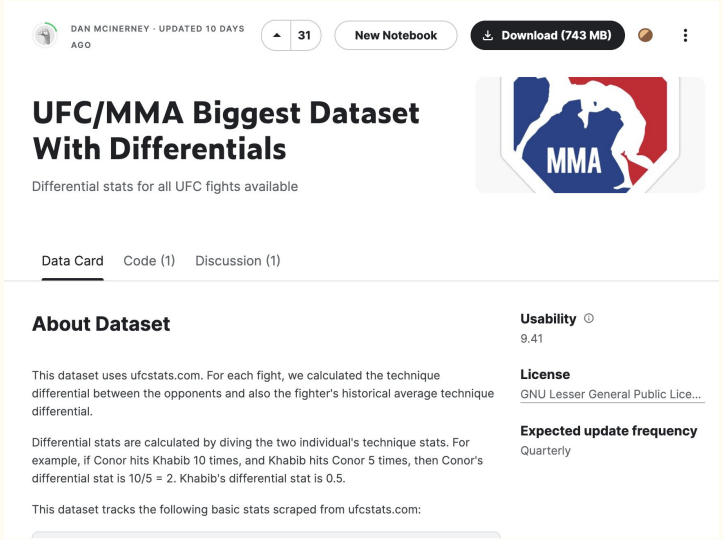
Overview

Database:

- Retrieved from Kaggle, webscraped from ufcstats.com
- 13000+ rows, 500+ feature columns in csv file

Technical Stack:

- Python based in Jupyter Notebook
- Libraries include:
  - tensorflow
  - scipy
  - sklearn
  - numpy
  - matplotlib

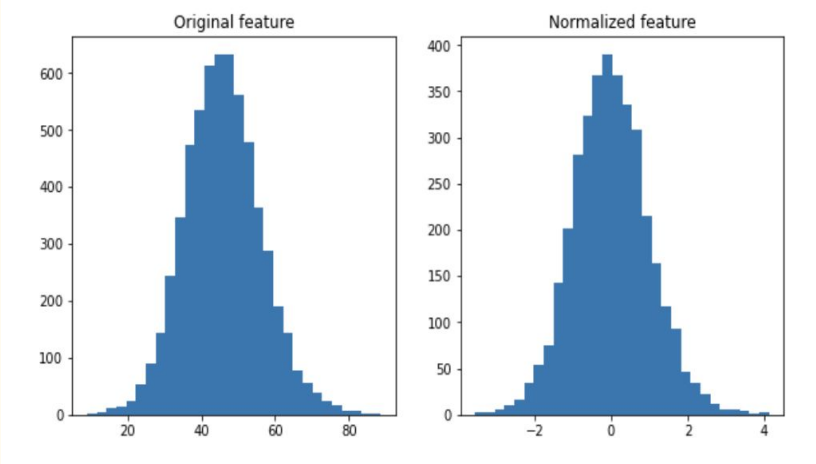


Data Pre-processing

Steps taken to clean the data:

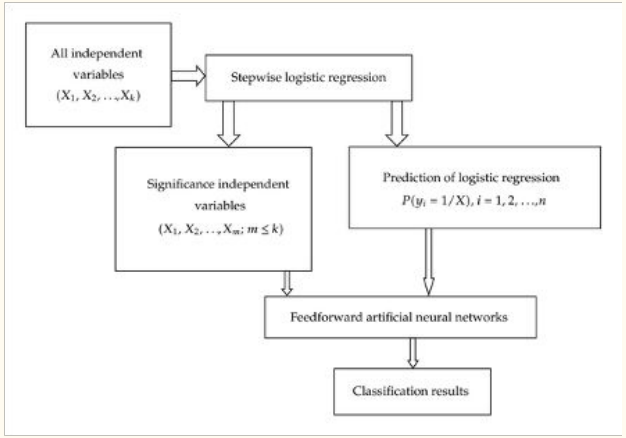
1. Remove entries with missing data
2. Split data into training, validation, test sets
3. Transform data into normal distributions centred at 0 (normalise)

Number of rows was reduced from ~13000 to ~3600



Model 1: Logistic Regression & Neural Network

- Create Logistic Regression using Least Squares Approx
  - LU Factorisation
- Regularisation (both L1 and L2)
- Feed the significant independent variables and predictions into a feed-forward neural network

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Training set evaluation:
Accuracy: 0.871
Precision: 0.867
Recall: 0.875
F1 score: 0.871

Validation set evaluation:
Accuracy: 0.816
Precision: 0.828
Recall: 0.794
F1 score: 0.811

Test set evaluation:
Accuracy: 0.817
Precision: 0.821
Recall: 0.798
F1 score 0.809
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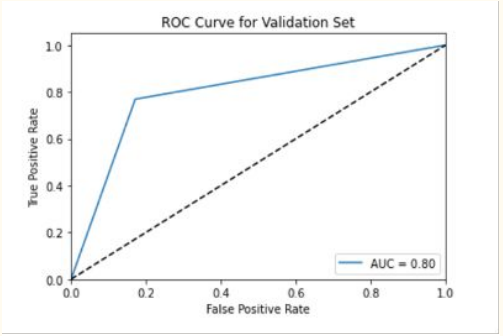

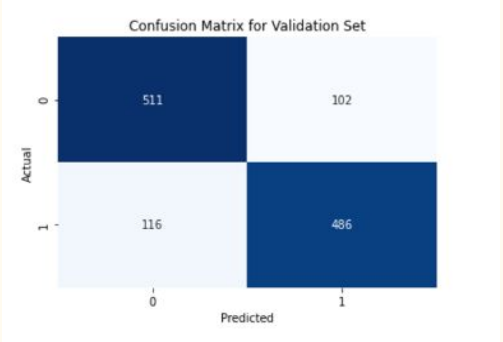

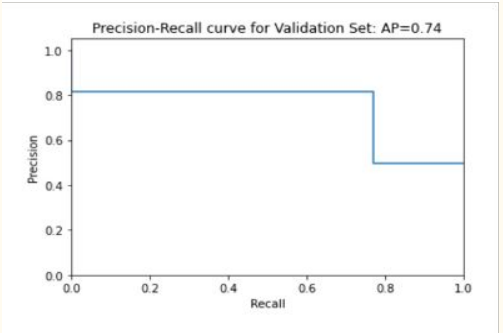

Model 2: SVM Classifier Using QR Factorisation

- Perform QR Factoristion
  - Decompose training dataset into QR matrices
  - Transform validation and test dataset using the obtained R matrix
- Refine parameters
  - RandomSearch
  - Recursive Feature Elimination (RFE)
- Train SVM based on identified best features

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Training - Accuracy: 0.7916
Training - Precision: 0.8197
Training - Recall: 0.7436
Training - F1 Score: 0.7798
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Validation - Accuracy: 0.7992
Validation - Precision: 0.8151
Validation - Recall: 0.7691
Validation - F1 Score: 0.7915
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Test - Accuracy: 0.7969
Test - Precision: 0.8134
Test - Recall: 0.7572
Test - F1 Score: 0.7843
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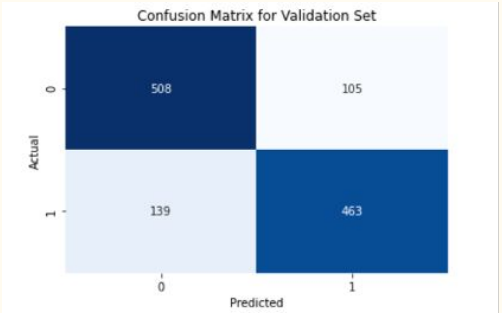

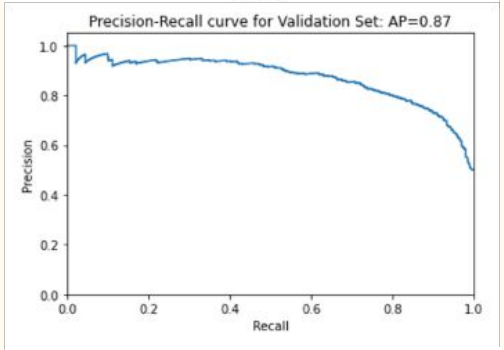

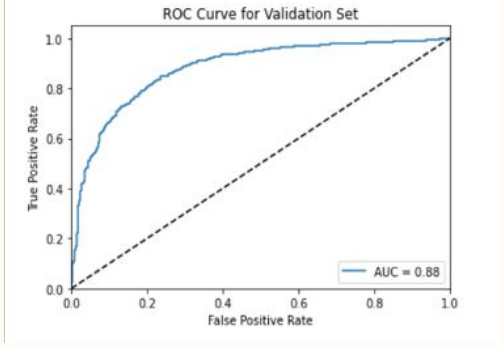

Conclusions and Evaluation

Metric/Aspect	Model 1 (Logistic Regression + Feedforward Neural Network)	Model 2 (SVM with QR Factorization and Hyperparameter Tuning)
Accuracy	Higher	Lower
Discriminative Ability (AUC)	Lower	Higher
Precision-Recall Trade-off (AP)	Lower	Higher
Scalability	Limited	Better
Adaptability to New Data/Live Data	Limited	Better
Future Development Potential	Limited	Higher
Best Use Case	High accuracy priority, stable data inputs	Complex/diverse datasets, live fight data integration