Evaluating Chess Positions from Human-versus-Human Matches

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Abstract. The placement of chess pieces during any point of the chess game is referred to as the game's current position, which can be analyzed to determine which player has a better chance of winning. Using a large database of complete chess games, a Random Forest of Decision Trees was trained to evaluate a specific position of a chess game, outputting its estimation for win percentages. Using only the current position, the 200-tree Forest reached an accuracy of 0.56.

Keywords. Multiclassification, Decision Tree, Random Forest, Chess Evaluation, Game Outcome Prediction

1 INTRODUCTION

Chess game positions are intrinsically described by where each of pieces are and the turn number which indicates how far into the game the position is and who's turn it is. From these pieces of information alone human chess players evaluate which player, black or white, is more favored to win and to what degree. The objective of this project was to train a machine learning model that takes in a position's intrinsic data and predicts the outcome of a theoretical game where that position was reached. Evaluation of chess position is the core function of chess computer engines that strive to determine the "best move" of a position.

The most common chess position evaluation metric that is used by humans and many chess computer engines is a concept called material, in which each type of piece is assigned a value the corresponds to how important and how useful that type of is [1]. We do not use material as a feature to train the Random Forests for two reasons; the value of each piece is subject to debate and can differ greatly, and the material is a consequence of what pieces are on the board, so it can be considered redundant.

The next section of this report will detail how the raw data was sourced and processed into useable data objects and Random Forests trained on that data.

2 METHODS

2.1 Pre-Processing

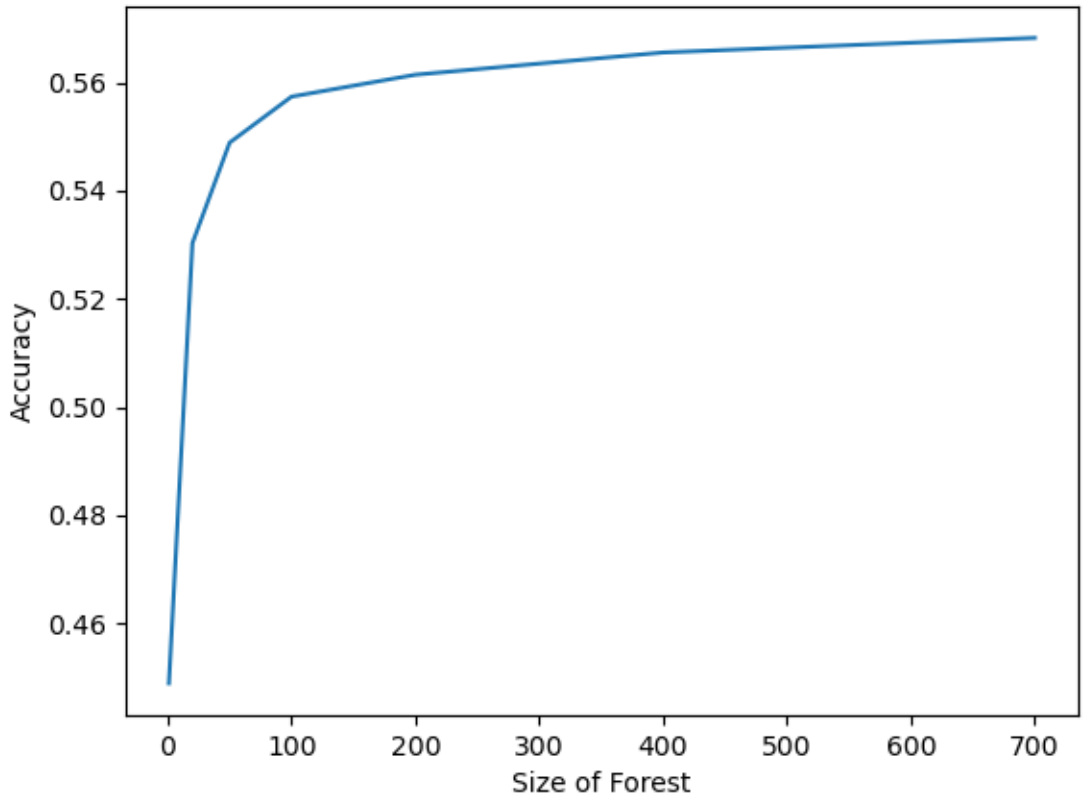
Raw data in the form of a single Portable Game Notation (.pgn) file was obtained from an anonymous user on a chess.com forum [2]. This file contained the human readable move sequences of approximately nine million chess games.

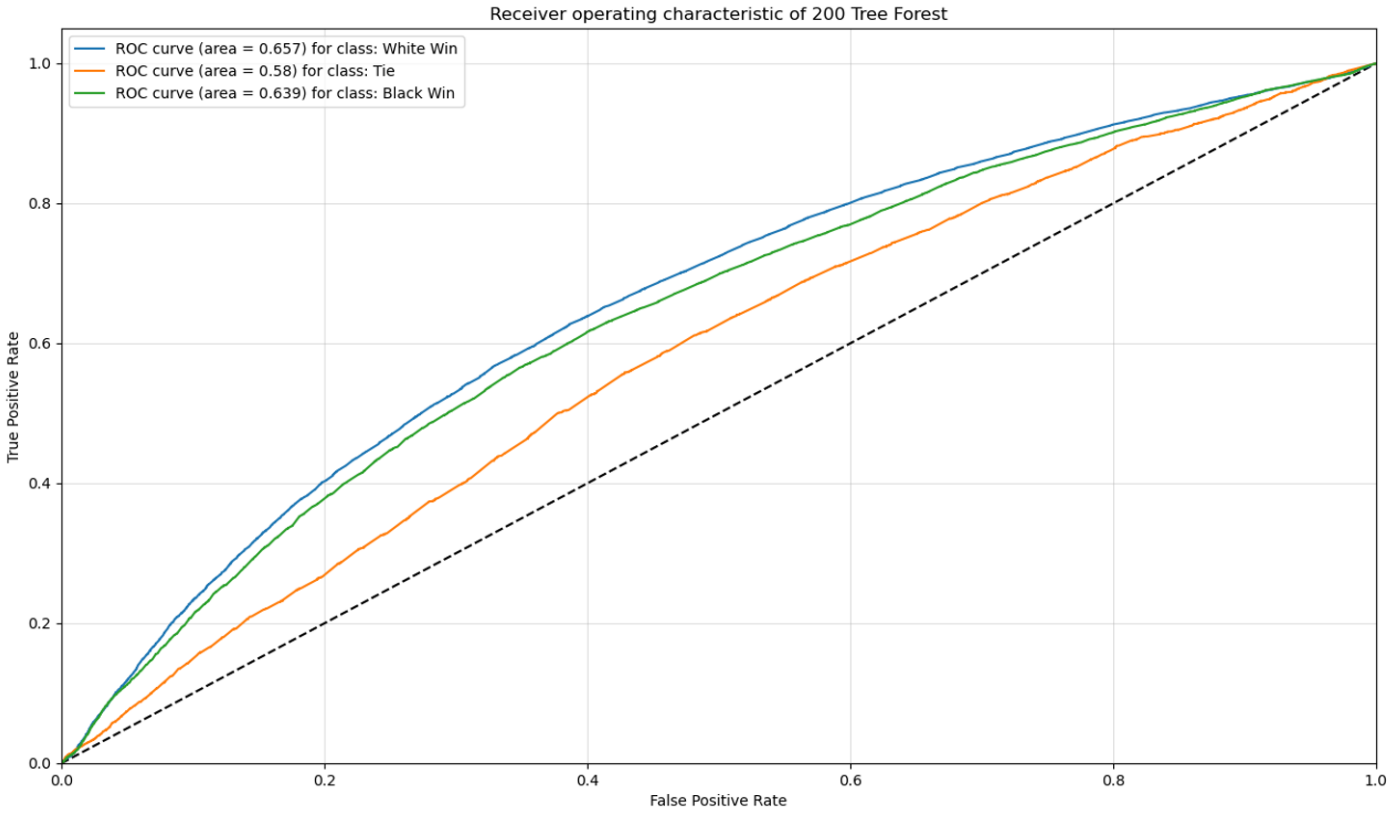
The sequence of chess moves that describes a game is also referred to as Portable Game Notation (PGN); the first task of pre-processing the raw PGNs was filtering out sequences that were incomplete or contained illegal characters. The second and more major task of pre-processing was converting a PGN to list of positions that could be used to train the Random Forest. To accomplish this a representation of the position would be generated and each possible immediate successor position would also be generated. Then, the successor position which matched the specific move of the PGN that was being processed would be converted into a numerical data object.

2.2 Training

The data objects were Split into training and validation sets for the Random Forest Classifier which utilizes bagging of many equally sized Decision Trees to calculate a classification probability for each class.

3 RESULTS


0.56
0.54
0.52
0.50
0.48
0.46
Accuracy
0
100
200
300
400
500
600
700
Size of Forest



4 CONCLUSION

This report has shown that a large enough Random Forest of multiclassification decision trees can be used to evaluate chess game positions using confidence in the classification. Given a large enough forest size, above 100, the model was able to predict the outcomes better than a random classifier.

Future work for this project would include examining how the accuracy and ROC-AUC of other types of machine learning models such as Linear Regressors or Neural Networks compare to Random Forests for this data set.

The variability of human play not being accounted for in the weighting of data is a limitation of this research. Further research is needed on how the model(s) perform given human-versus-human game data that has been weighted by participant skill as a player's individual skill plays a significant role in weather a favorable position is capitalized upon.

5 REFERENCES

1. David Hooper and Kenneth Whyld. 1996. *The oxford companion to chess*, Oxford University Press.

2. GM_Alphazer0. Chess PGN database over 9 million games - chess forums. Retrieved December 13, 2021, from https://www.chess.com/forum/view/general/chess-pgn-database-over-9-million-games