Prediction of Chess Endgame using Decision Tree and SVM Classifiers

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Abstract

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1 Introduction

1.1 Background\Problem Formulation

Discuss what a Chess Endgame is. Discuss how one would go about determining a Chess Endgame?

1.2 Outline of Report

In section(2) we describe the dataset from the UCI repository used for our training and testing environment. We also provide insight into the parameterizations of the original data and why we think those parameterizations will yield improved classification results. In section(3) we discuss the theory and limitations of the two proposed classification methods. In section(4) we will show results heuristically drawn from simulations for the two proposed methods and discuss results related to these findings. Finally, in section(5) we will make final conclusions and possible algorithmic strategies to improve the results.

2 Dataset

2.1 Chess (King-Rook vs. King) Data Set

Discuss the dataset from UCI. Format of the data.

2.1.1 Notation

Chess Board Positions: Let the following notation describe the space of a Chess board,

$$\begin{aligned} \text{File} &\in [a, b, c, d, e, f, g, h] \\ &\in [1, 2, 3, 4, 5, 6, 7, 8] \\ \text{Rank} &\in [1, 2, 3, 4, 5, 6, 7, 8] \end{aligned} \tag{1}$$

Game Pieces: Let the three game pieces be defined as $Piece_i$, where $i = [1, 2, 3]$ represents the piece index,

$$\begin{aligned} Piece &\in [W_k, W_r, B_k] \\ W_k &= \text{White King} \\ W_r &= \text{White Rook} \\ B_k &= \text{Black King} \end{aligned} \tag{2}$$

Examples: Let a example of a game be defined as $Game_j$ where $j = [1, 2, 3, \dots]$ is the game row index,

$$Game_j = [Piece_i \{file_j, rank_j\}] \tag{3}$$

The entire set of examples is labeled as $\mathbf{X}$.

Class Labels: Class labels are defined as the remaining moves till checkmate of B_k. Note, checkmate of B_k is called on the m^{th} move of B_k.

$$\begin{aligned} y_j &\in [draw, 0, 1, 2, 3, 4, \dots, m] \\ &\in [-1, 0, 1, 2, 3, 4, \dots, m] \end{aligned} \tag{4}$$

The entire set of training class labels is labeled as $\mathbf{y}$.

2.2 Parameterization

Discuss how we parameterized the data.

Several parameter functions are used to classify or achieve an objective function, these parameter functions are labeled as $\mathbf{\Phi}(\mathbf{X})$.

3 Theory of Proposed Methods

3.1 Theory: Decision Trees

Theory goes here.

3.2 Theory: Support Vector Machines (SVM)

Theory goes here.

4 Simulation\Classification Results

4.1 Results: Decision Tree

4.2 Results: Support Vector Machine (SVM)

You can insert images by using the following code. Just place them in the figs folder and make sure they are in *.eps format.[1]

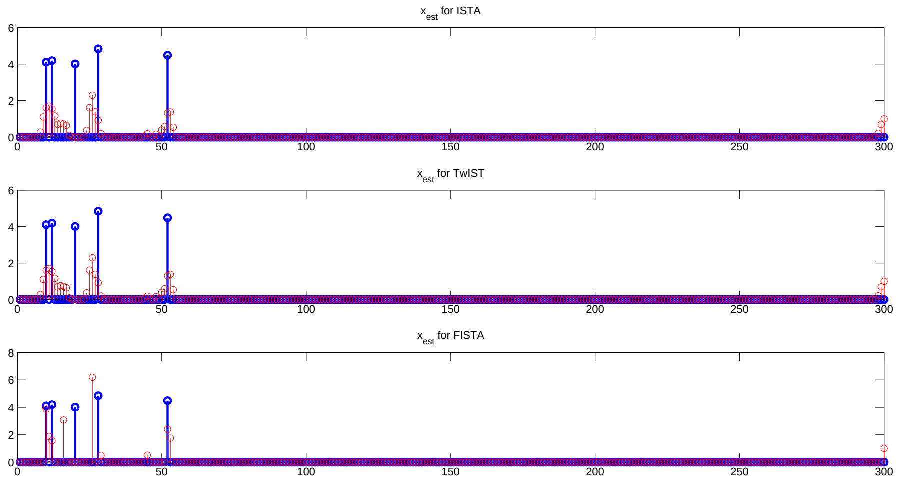

Figure 1: CaptionName: Test Image from figs folder

5 Conclusions

References

[1] Christopher M. Bishop, *Pattern Recognition and Machine Learning*, Springer, New York, NY 10013, 2006.

[2] Chih-Wei Hsu, "A practical guide to support vector classification," 2010.

[3] Asa Ben-Hur and Jason Weston, "A users guide to support vector machines," in *Data Mining Techniques for the Life Sciences*, vol. 609 of *Methods in Molecular Biology*, pp. 223–239. Humana Press, 2010.

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[6] Michael Bain, "Chess (king-rook vs. king) data set," 1994.