Predictive Analysis of Tic-Tac-Toe Game Outcomes using Supervised Learning Algorithms

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Abstract— *Tic-Tac-Toe is a well-known two-player game in which the objective is to place three markers in a row, either horizontally, vertically, or diagonally. In this study, we explore the application of machine learning algorithms to accurately classify the outcomes of Tic-Tac-Toe games played between two players. Specifically, we investigate the performance of Naive Bayes and K-Nearest Neighbors (KNN) machine learning models for the classification task. The dataset used for this study is sourced from the UCI machine learning repository, comprising past Tic-Tac-Toe game records. We build predictive models using Naive Bayes and KNN algorithms and evaluate their performance using metrics like accuracy, precision, and recall. The high accuracy, precision, and recall achieved by the Naive Bayes model indicate its potential for practical use in predicting the outcomes of Tic-Tac-Toe games. Such predictive models could be integrated into web-based Tic-Tac-Toe games to provide AI opponents with the ability to make informed moves, thereby enhancing the gaming experience for players.*

I. INTRODUCTION

The Spasm Tac-Toe prepackaged game is initially intended to play utilizing paper and pencil and is likewise called a round of crosses and noughts. The two players need to choose their markers, either Xs or operating system, and put down their markers in a 3X3 network. The triumphant rule for this game is that a player who has effectively put his/her marker evenly in succession, in an upward direction in a segment, or corner to corner will dominate the match [1]. In any case, there are 255,168 potential approaches to playing spasm tac-toe board or paper game [11]. The AI strategy has demonstrated its capacities to perform anticipating displaying effectively. The paper analyzes whether the order strategies can effectively anticipate the Spasm Tac-Toe game results. The managed learning strategy is an order method used to fabricate a prescient model from preparing information with the result variable. The information tests of the preparation datasetcomprise of a few qualities as information factors and a result mark [3][4][5]. The Spasm Tac-Toe prepackaged game is viewed as a parallel order issue. There are nine positional information highlights and a result variable in view of the markers positions.

II. PHILOSOPHY

A wide range of sorts of order procedures have been proposed in writing that incorporates Choice Trees, Credulous Bayesian strategies, Brain Organizations, Calculated Relapse, SVM and KNN and so on, In this paper, we assess the exhibition of the KNN calculations on Spasm tac- toe dataset was utilized for the grouping contrasted and the Naïve Bayes calculation.

2.1 Naive Bayes

Naive Bayes is a probabilistic request strategy that uses bayes speculation. It is "unsuspecting" as in a quality worth on a given class is believed to be liberated from the potential gains of various properties. The gullible bayes classifier takes a lot of features from a dataset and concludes the probability of every part occurring in each class inside the data [1][3]. For each line of data, the potential gains of the characteristics are used to discover the back probability for each class inside the dataset, the section of data is then apportioned to the class with the most important back probability. This technique is suggested as gullible considering the way that it acknowledges that all components of the dataset are independent of one another, which is an assumption that is intelligent misleading and hence straightforward. Disregarding this assumption not being legitimate in all cases, unsuspecting bayes has been shown to be a productive classifier in tremendous datasets.

Let X = (X1, X2, . . . , Xn) be an irregular variable and A1, A2, . . . , A be the properties of X related with the n parts X1, X2, . . . Xn separately (find in Figure 2). Let T = {x = (X1 = x1, X2 =x2, . . . , Xn = xn)} be the arrangement of preparing tests drawn from the number of inhabitants in X. Allow us to accept that there are c classes, C = {y1, y2, . . . , yc} and every single examples having a specific class marks Y = yj ∈ C. The undertaking of the classifier is to foresee the class name Y for a given example x. To anticipate the class mark of x, the credulous Bayes works out P(Y = yj|x) for each class yj , j = 1, 2, . . . , c and the example x is arranged in that class whose likelihood shows the most elevated esteem.

2.2 K-Nearest-Neighbors (KNN)

The KNN is a non-parametric social event strategy, which is fundamental in any case extraordinary all around [1]. The fundamental idea for k-NN depends in the wake of deciding the distances between the endeavored, and the status information tests to perceive its closest neighbors. The endeavored model is then committed to the class of its closest neighbor [4].

The KNN is a reasonable at any rate persuading strategy for blueprint. The KNN assessment is a technique for get-together items dependent upon nearest arranging models in the part space. KNN is a sort of occasion based learning, or unapproachable recognizing where the cutoff is just approximated locally and all calculation is yielded until get-together [6]

For an information record D to be mentioned, its K closest neighbors is recovered, and these developments a neighborhood of D. Greater part projecting a democratic structure among the information records in the space is overall used to pick the solicitation for D regardless of considered distance-based weighting. In any case, to apply KNN we really want to pick a sensible propelling power for K, and the achievement of assortment is a lot of wards on this worth. The basic disadvantages concerning KNN are (1) its low proficiency - being a sluggish learning strategy denies it in different applications, for example, dynamic web tunneling for a huge vault, and (2) its reliance on the choice of an "mind blowing worth" for K.

III. EXPERIMENTAL RESULTS

The investigations have been coordinated by using the proposed concentrate on Weka 3.8.1 utilized for examination, characterization, and expectation. The Spasm tac-toe dataset used in this study was gained from the UCI ML archive data set [12]. In the Spasm tac-toe dataset there are 958 examples and 10 credits, there are two class names, the negative class contains 332 cases, positive class contains 626 occasions separately. The standard dataset is divided two sets one for preparing (70%) and one more set for testing (30%).

The Spasm tac-toe dataset is prepared and assessed utilizing a Naïve Bayes and KNN models utilizing grouped execution assessments like Exactness, Accuracy and Review, the Exploratory outcomes are appeared in the table-1 and same appeared in the Figure-1.

Table-1
Performance of classifiers

Algorithm	Accuracy	Precision	Recall
Naïve Bayes	97.54	97	97
KNN	95.86	96	96

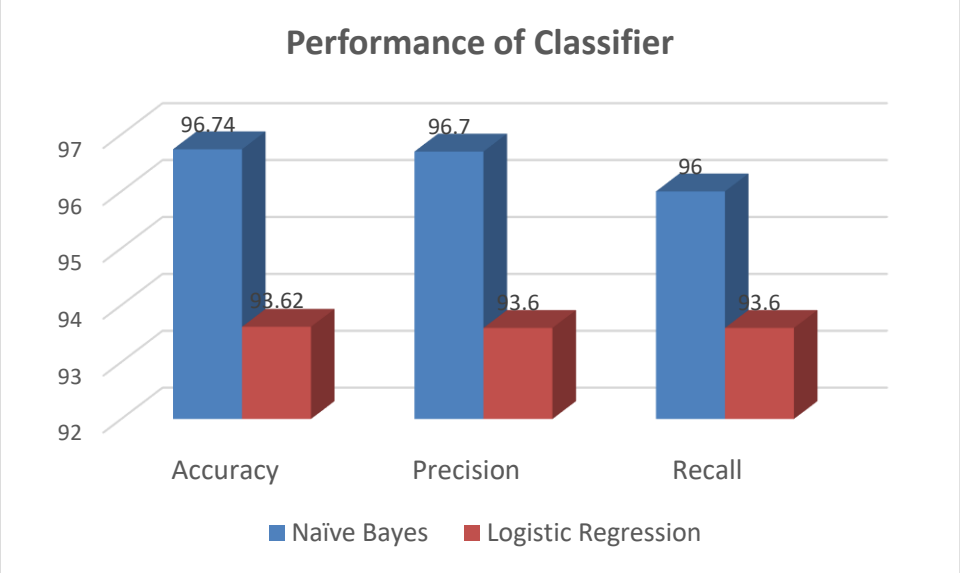

Figure-1: Performance of Classifiers

3.1 Results

The experimental results demonstrate the effectiveness of both Naive Bayes and KNN models in predicting the outcomes of Tic-Tac-Toe games. The KNN model achieved an accuracy of 95.86%, precision of 96%, and recall of 96%. However, the Naive Bayes model outperformed the KNN model, achieving an impressive accuracy of 97.54%, precision of 97%, and recall of 97%.

3.2 Discussion

The classification of Tic-Tac-Toe game outcomes using supervised learning algorithms proves to be successful. Both the Naive Bayes and KNN models exhibited high accuracy, indicating their ability to correctly predict the game results. The Naive Bayes algorithm, in particular, showed superior performance compared to the KNN algorithm, achieving higher accuracy, precision, and recall scores.

The Naive Bayes method leverages the independence assumption between features, making it effective for classification tasks with discrete data like Tic-Tac-Toe game outcomes. It was able to capture the patterns and dependencies in the data and make accurate predictions accordingly. On the other hand, the KNN algorithm relies on the similarity of instances to make predictions. While it performed well in this study, it might be sensitive to the choice of the distance metric and the number of neighbors used.

IV. CONCLUSION

In conclusion, the application of supervised learning algorithms, particularly Naive Bayes, proves to be effective in classifying the outcomes of Tic-Tac-Toe games. The high predictive accuracy achieved by the models opens up possibilities for further exploration and integration of AI in gaming applications, contributing to the development of smarter and more engaging gaming experiences.

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