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The Use Of Machine Learning To Spot Counter Feit Currency

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ABSTRACT—It's no wonder that criminals would want to take advantage of the financial system by flooding it with counterfeit notes that seem very comparable to the genuine thing, given that bank cash is our country's greatest asset. When demonetization takes place, counterfeit banknotes flood the economy. A genuine banknote and a counterfeit one have numerous characteristics, making it difficult, if not impossible, to tell them apart without special equipment or training. It is a challenging task to distinguish real banknotes from fake ones. Therefore, a completely automated system is essential, and it must be available through tellers at banks and ATMs. Because counterfeit banknotes may now be made with such high quality, it is crucial that a reliable algorithm be created to evaluate whether or not a specific banknote is genuine. This study applies six different supervised machine learning techniques on a dataset from the repository of machine learning at UCI that is designed to identify counterfeit bank notes. We used three distinct train test ratios (80:20, 70 to 30, and 60:40) and analyzed the results using a variety of quantitative metrics for multiple artificial intelligence methods, including Vector Machines, randomly generated forests, Logistic Regressions, Decision Trees, Naive Bayes, and K-Nearest Neighbors. Certain SML algorithms may provide a flawless 100% success rate for a particular group of train test ratios.

INTRODUCTION

Banknotes are an essential resource for our country, used in the many daily financial transactions that take place here. Counterfeit notes with denominations almost indistinguishable with the genuine thing are printed to sow confusion among the financial market. They're forced to do a number of things that are against the law. It's important to keep a watch on forgery because although it's not a huge issue right now, the subject has been increasing the increase since the second half of the nineteenth century. Con artists will have an easier time producing counterfeit money that look almost similar to genuine ones as 20th-century technology advances. The outcome will be a historic low in investor trust in the financial system. To prevent this and maintain the smooth operation of businesses, the circulation or counterfeit bank currency must be limited. A human being has considerable difficulty distinguishing genuine from counterfeit currency. The government has standardized the look of banknotes, making it easier to spot counterfeits. However, fraudsters are now producing phony dollars that are difficult to tell apart from the genuine thing. Therefore, modern financial institutions, such as ATMs, need a way to identify genuine banknotes from fake ones. Checking the note's legitimacy The development of a system and can identify fake banknotes from real ones is a difficult task that might be considerably aided by the use of AI and ML. Many individuals now use supervised artificial intelligence techniques to address classification problems. Medical disorders have far more promising results. Authenticating currency using SML algorithms is all that some authors have used them for. We need to develop a machine that can distinguish between genuine and counterfeit currency. We take a photograph of a note as input and apply several image processing techniques to figure out what it is. Furthermore, these images are supplied to SML algorithms to verify a note's authenticity. This brief overview makes it quite evident that little development is being made in this area. Consequences of the paper: We have taken the dataset we got via the UCI ML library and pre-processed it, displaying it in many chart types. SML methods include logistic regression (LR), naïve bayes (NB), tree of decision (DT), random tree algorithm (RT), KNN), as well as support vector machines (SVM) are then used to the banknote attributes to identify the authenticity of the bills. Using a dataset featuring three distinct train/test splits, we run SML algorithms and then evaluate the outcomes using a number of industry-standard measures for evaluating machine learning techniques. Some examples of such indicators include the mean accuracy for classification (MCA), the score for F1 (F1 Score), net present value (NPV), and net depreciation rate (NDR).

RELATED WORK

"Euro Banknote Recognizer Based on Multilayer Perceptron and Radial Basis Function Networks,"

It is suggested that the Euro banknote recognition system make use of a three-layered perceptron using the Radial Basis Function, or RBF, network. One well-known pattern recognition technique that might be useful for classifying money is the three-layered perceptron. An RBF network has the capability to minimize false positives by estimating the probability of occurrence of the sample data. We employ a three-layer perception for classification, and many RBF networks for validation. There are two advantages to the proposed system over one that uses just an RBF network. The computing cost and difficulty of designing the feature extraction region do not scale linearly with the number of classes. Due to the obvious differences between IR and visible shots of Euro banknotes, we propose utilizing both types of images as input information for the system. We have analyzed how frequently the system accepts genuine banknotes and how infrequently it rejects valid data to determine the system's effectiveness.

Article: "Implementation for Multi Kernel Support Vector Machines in Automatic Detection and Classification for Counterfeit Notes"

Because to digital image technology advancements like color scanners & laser printers, it is now possible to produce high-quality counterfeit banknotes. The circulation of counterfeit currency is a serious problem worldwide. Some people have even said they've gotten counterfeit cash from automated teller machines and vending machines. There has to be a system in place to detect counterfeit money. Here, we propose the use of multi-kernel support vector machines for this purpose. Each part of a banknote is measured for its own brightness histogram. A linearly weighted combination of many kernels is used to create a single matrix. The time and space requirements of semi-definite programming (SDP) are reduced using two approaches. In the first, the kernel weights must all be positive, whereas in the second, the sum of the weights must equal 1.

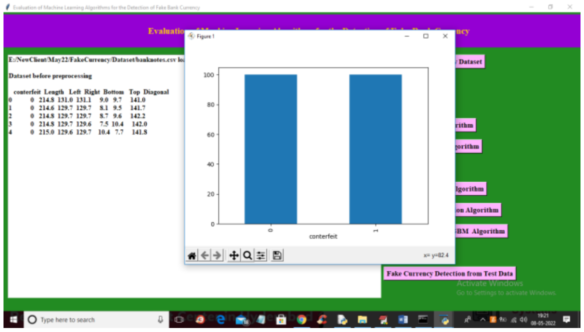
METHODOLOGY

In this research, we implemented three algorithms that make use of machine learning strategies for predictive modeling and supervised learning. Our training metrics, including a comparison to a benchmark model and an f-beta score, are shown. In addition, this facilitates the analysis of which features have the most predictive potential. Support vector, boost gradient, and k-nearest neighbor algorithms see the most action. We used accuracy & f-beta score assessment criteria to assess the effectiveness of these classifiers. We investigated the impact of training data size on prediction accuracy by subjecting our classifier model to training on datasets of varying sizes. Test data and a subset of training data prediction scores were obtained. We also determined how long it takes to do both training and prediction. Finally, grid search was used to further develop the winning model. Training results as a function of train sets SVC K-Nearest Neighbor Boost Gradient Accuracy training.

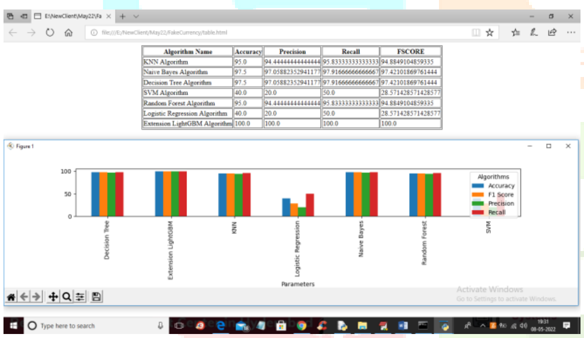
RESULT AND DISCUSSION

The writer is using a number of algorithms that use machine learning to identify the authenticity of currency in an effort to combat the damage done to economies worldwide by the proliferation of counterfeit notes and coins. Many other fields, such as healthcare estimation, cyberattack prediction, the detection of credit card fraud, and many more, have shown the efficacy of machine algorithms. Therefore, the author recommends employing machine learning to identify fake currency.

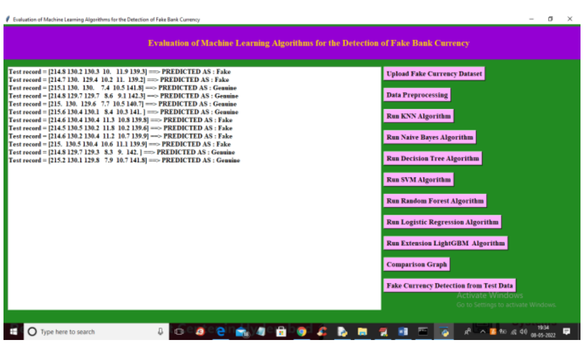
The author of the paper you propose uses many well-established machine learning techniques (KNN, decision trees, SVM, Random Forest, and logarithm regression, Naive Bayes), but none of the more recent techniques (ELM, XGBOOST, MLP, etc.), consequently we have extended the paper by adding the LightGBM algorithm and comparing its performance to that of each of the other algorithms.



The y-axis shows the total number of records, while the x-axis displays the appropriate class labels. To import the dataset, normalize it, replace missing values w zeros, and split it into a train and test set, select the "Dataset Pre-processing" button.



We provide the metrics for each method (including accuracy, precision, recall, plus FSCORE) and present a comparison graph; LIGHTGBM has excellent extended accuracy across the board.



The expected result, "Genuine or Fake," determined by the test data is shown after the square brackets.

CONCLUSION

In this work, the SML methods SVM, LR, NB, DT, RF, and KNN are applied on a banknote authentication dataset obtained from the UCI ML repository using one of three different train test ratio (80:20, 60:40, 70:30). There are a total of 1372 entries in the dataset; 4 of these serve as features, while the remaining 1 serves as a target attribute, indicating whether or not a specific record is an authentic bank note or a fake. We first looked at the data using KDE, Box plots, and par plots. Each quality was considered because of its individual and cumulative significance to the intended class. Using a train-test split of 80:20, the ROC curve & the Learning curve were used to evaluate the relative efficacy of six SML algorithms. The 80:20 ratio between training and testing yields 100% accuracy with KNN but only 84% with NB. The performance of SVM, LR, NB, DT, RF, & KNN in the context of SML has been measured using conventional quantitative analysis measures such as the MCC, F1 Score, NPV, NDR, precision, & others. KNN achieves the highest precision when contrasting train test ratios of 80:20 and 70:30. A ideal model not only has an MCC near to 1, but also an F1m of 1 in both the testing and training stages. When comparing the two train test ratios, a naive Bayes approach has the lowest level of accuracy (84% in 80:20 and eighty-six in 70:30) and MCC (86% in 80:20 and 88% in 70:30). When compared to the other five SML methods, decision trees are shown to have the greatest MCC value (+1) and the highest accuracy (100%) when using a train:test split of 60:40. Naive Bayes gets the lowest accuracy compared to other approaches. For convenience, a histogram is generated for every one of the five metrics used to assess a Support Vector Machine (LR, NB, DT, RF, & KNN).

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