Bank Note Authentication

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About

- Banknote authentication refers to the process of verifying the authenticity of paper currency to ensure it is genuine and not counterfeit.
- With the advancement of technology, counterfeiters have become increasingly sophisticated.
- Here are some common techniques used for banknote authentication:
- Security Features
- Ultraviolet (UV) Light
- Magnetic Ink Detection
- Microscopic Inspection

PROBLEM

- Our task is to predict whether a bank currency note is authentic or not based upon attributes of the note.
- This is a binary classification problem and we will use knn algorithm to solve this problem. the rest of the section consists of standard machine learning steps.
- Data were extracted from images that were taken from genuine and forged banknote-like specimens for digitization.
- What tool to use to extract the attributes from the notes?
- Which Machine Learning model need to be used to predict the legitimacy of the note?

Introduction

- Trust: Checking banknotes ensures trust in transactions by preventing fake money from circulating.
- Stability: Authentication maintains economic stability by stopping counterfeit money from damaging the economy.
- Global Issue: Counterfeit currency affects everyone, so we need reliable systems to prevent its spread.
- Security Features: Banknotes have special marks like watermarks that show they're real.
- Prevention: Authentication systems are crucial for stopping fake money and keeping transactions secure.

Software Requirements Specifications (SRS)

- Python
- Logistic Regression
- K_Nearest- Neighbour
- Support Vector Machine
- Dataset

Dataset

- BankNote dataset- https://www.kaggle.com/datasets/shanks0465/banknoteauthentication
- The dataset is based upon four attributes of the note:
- Skewness
- Variance
- Entropy
- Curtosis

DATASET OVERVIEW

	A	B	C	D	E	F	G	H
1	Variance	Skewness	Curtosis	Entropy	Class			
2	3.6216	8.6661	-2.8073	-0.44699	0			
3	4.5459	8.1674	-2.4586	-1.4621	0			
4	3.866	-2.6383	1.9242	0.10645	0			
5	3.4566	9.5228	-4.0112	-3.5944	0			
6	0.32924	-4.4552	4.5718	-0.9888	0			
7	4.3684	9.6718	-3.9606	-3.1625	0			
8	3.5912	3.0129	0.72888	0.56421	0			
9	2.0922	-6.81	8.4636	-0.60216	0			
10	3.2032	5.7588	-0.75345	-0.61251	0			
11	1.5356	9.1772	-2.2718	-0.73535	0			
12	1.2247	8.7779	-2.2135	-0.80647	0			
13	3.9899	-2.7066	2.3946	0.86291	0			
14	1.8993	7.6625	0.15394	-3.1108	0			
15	-1.5768	10.843	2.5462	-2.9362	0			
16	3.404	8.7261	-2.9915	-0.57242	0			
17	4.6765	-3.3895	3.4896	1.4771	0			
18	2.6719	3.0646	0.37158	0.58619	0			
19	0.80355	2.8473	4.3439	0.6017	0			
20	1.4479	-4.8794	8.3428	-2.1086	0			
21	5.2423	11.0272	-4.353	-4.1013	0			
22	5.7867	7.8902	-2.6196	-0.48708	0			

MACHINE LEARNING MODEL

- Logistic Regression

  Predictive statistical model for binary classification problems.

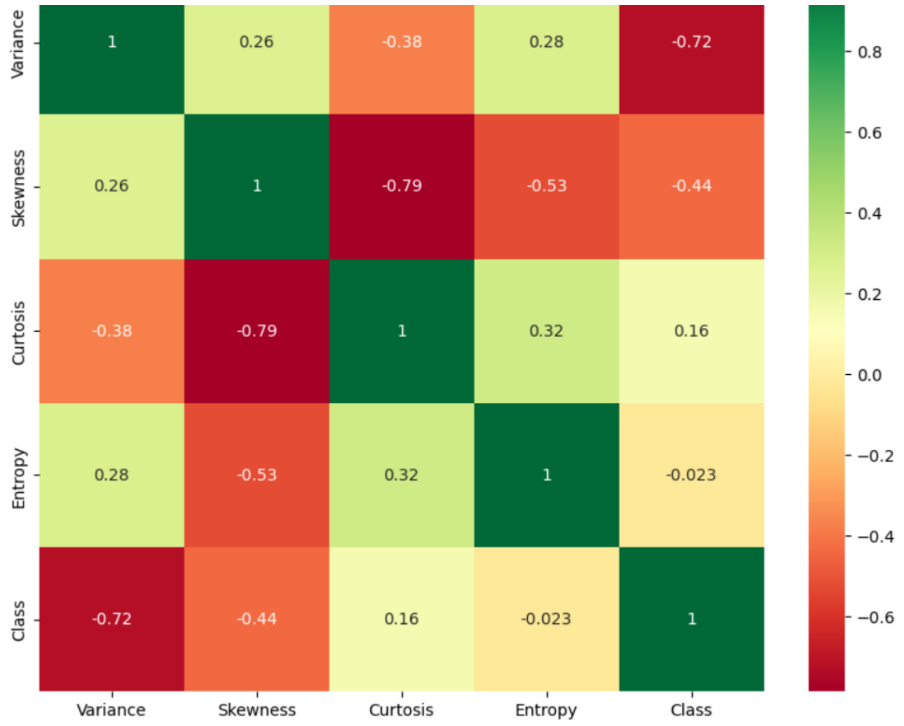
- K Nearest Neighbour

  Non-parametric method for pattern recognition, classification, and regression.

- Support Vector Machine

  Effective for classification and regression tasks in machine learning.

HEATMAP ANALYSIS



ALGORITHIM COMPARISON

Logistic Regression

```
log = LogisticRegression()
log_model = log.fit(X_train, y_train)
log_model.score(X_test, y_test)
```

```
0.9801324503311258
```

KNN

```
[ ]  knn = KNeighborsClassifier()
     knn_model = knn.fit(X_train, y_train)
     knn_model.score(X_test, y_test)
```

```
1.0
```

Support Vector Machine

```
[[151   2]
 [  2 120]]
              precision    recall  f1-score   support

           0       0.99      0.99      0.99       153
           1       0.98      0.98      0.98       122

    accuracy                           0.99       275
   macro avg       0.99      0.99      0.99       275
weighted avg       0.99      0.99      0.99       275

0.9854545454545455
```

TESTING

```
test_data = pd.DataFrame(X_test, columns=['variance', 'skewness', 'curtosis', 'entropy'])
test_data.head()
```

	variance	skewness	curtosis	entropy
0	0.424469	0.765542	-0.383330	-0.587638
1	-0.223275	1.076167	-1.062076	-0.644263
2	-0.107552	0.884557	-0.813739	-0.944083
3	-0.741536	1.710000	0.370490	-1.784561
4	0.725912	1.277560	-1.088273	-0.127902

```
df[df['Class']== 1]
```

	Variance	Skewness	Curtosis	Entropy	Class
762	-1.39710	3.31910	-1.392700	-1.99480	1
763	0.39012	-0.14279	-0.031994	0.35084	1
764	-1.66770	-7.15350	7.892900	0.96765	1

PREDICTING THE LEGITIMACY

```
[ ]  knn_model.predict([[3.62160, 8.6661, -2.8073, -0.44699]])

     array([0])

[ ]  knn_model.predict([[-2.54190  ,-0.65804,  2.684200, 1.19520]])

     array([1])
```

CONCLUSION

- Bank authentication, powered by machine learning and data analysis.
- It plays a vital role in upholding financial integrity by preventing counterfeit currency from circulating.
- With continuous advancements in technology and vigilant implementation of authentication measures.
- We can maintain trust in the monetary system and secure economic stability for all.

FUTURE ENHANCEMENTS

- Advanced Technologies Integration
- Improved Data Analysis
- Real-time Verification
- Multi-modal Authentication
- User-Friendly Interfaces

REFERENCES

- https://www.kaggle.com/datasets/shanks0465/banknoteauthentication
- https://www.researchgate.net/publication/323223299_Analysis_of_Banknote_Authentication_System_using_Machine_Learning_Techniques
- https://ieeexplore.ieee.org/document/7164721
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Team Work

Poojitha's Work

- Algorithms exploring
- Implications of algorithms
- Testing
- Suitable model Prediction

Jyothi's Work

- Data Set Exploration
- Literature survey
- Cleaning Data set
- Algorithms Comparison

Thank YOU