Comparison of Banknote Classification Methods

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Keywords—

# Introduction

*To do:*

* *Currrent situation and problems*
* *Research objectives + type of work done*
* *Obtained results*
* *Progress made if any*
* *Potential impact of results on theory, practice*
* *Could briefly mention report strcucture*

# Related Work

*To do:*

* *Previous work in the field*
* *Possible research gap*
* *Could mention other image classification studies*
* *Any literature analysis*

# Methods

Our purpose with this experiment is to compare the accuracy of different classification models in the sklearn library when authenticating banknote images. Our methodology behind this experiment goes as follows:

1. Dataset analysis.
2. Preprocessing of the dataset.
3. Training and testing the models on the preproceessed data using K-Fold cross-validation technique.
4. Comparing the models trained on best and worst feature set.
5. Dissecting and analyzing accuracy change of every model over various polynomial degrees and finilizing the results.

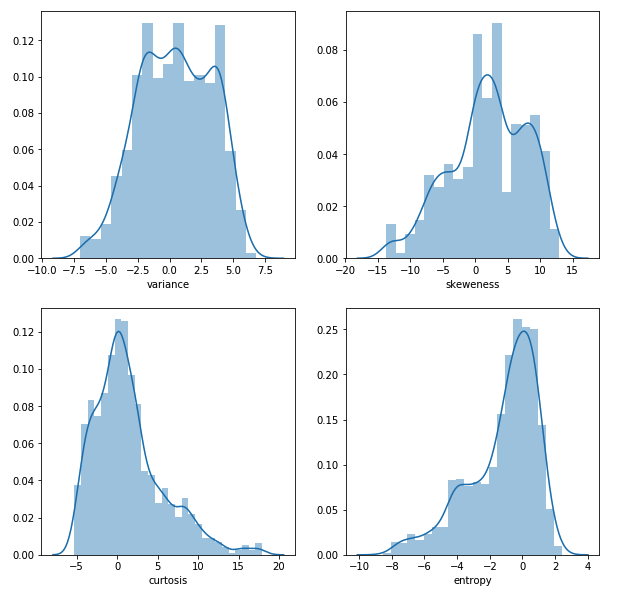
## Data

The data used for this experiment were initially extracted from the images of banknote specimens. The image dimensions were preset to be 400 by 400 pixels with an approximate resolution of 600 dpi [1]. The features from the images were retrieved using the WT (Wavelet Transform) tool. The feature dictionary is presented in Table 1.

TABLE I. Data Dictionary

|  |  |  |  |
| --- | --- | --- | --- |
| **Column** | **Feature Name** | **Definition** | **Data Type** |
| 1 | variance of image | pixel spread | continuous |
| 2 | skewness of image | image assymetry | continuous |
| 3 | curtosis of image | peakness/flatness | continuous |
| 4 | entropy of image | pixel intensity | continuous |
| 5 | class | 1-legal, 0-forged | continuous |

The data file *data\_banknote\_authentication.txt* contains the above features and has the dimensionality of 5 columns representing the features and 1372 rows representing the instances. The visual presentation of features 1-4 is summarized in Figure 1.



1. Distribution of features 1-4 from the banknote dataset.

## Data Preprocessing

## Model Training

* *Goal for the selection of models*
* *What is being measured*

For this experiment we selected 10 models from the sklearn library.

1. Gaussian Naive Bayes
2. Logistic Regression
3. Stochastic Gradient Descent Classifier
4. K-Nearest Neighbours Classifier
5. Decision Tree Classifier
6. Random Forest Classifier
7. Linear Support Vector Classifier
8. Radial Basis Function Support Vector Classifier
9. Linear Discriminant Analysis
10. Multi-Layer Perceptron Classifier

## Model Testing

# Experimental Results

* *Will probably be the longest part of the report*
* *Majority of the figures will go here*
* *Details of each result or just an overall summary regarding best/worst models*

# Conclusions

# References

1. Dua, D. and Graff, C. (2019). UCI Machine Learning Repository [http://archive.ics.uci.edu/ml]. Irvine, CA: University of California, School of Information and Computer Science.

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