

Coursera

# Forged Banknote Detection

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Dear manager,

This letter is a final summary of the experimental Data Science project started a few weeks ago about the automated system for detection of forged banknotes.

## Introduction

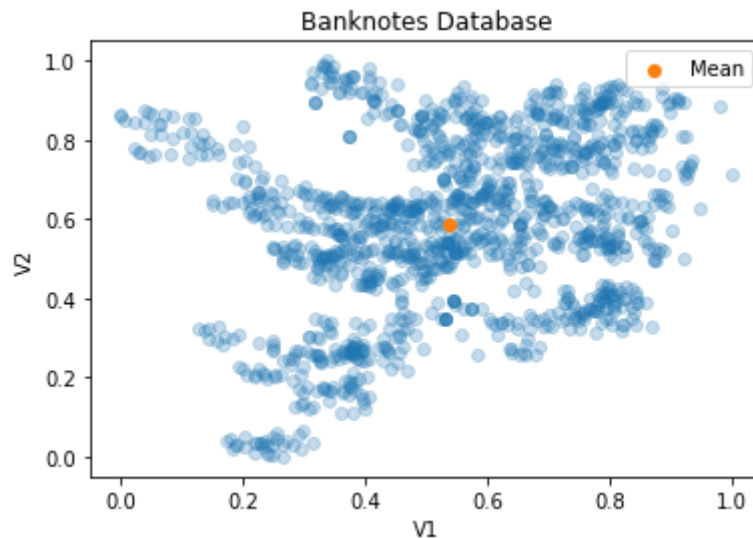
With the advance of the computer science field and the development of machine learning, the use of automated systems is becoming a trend among top companies, which aim to reduce costs and build more reliable systems. The current method used by this bank to identify forged banknotes is purely manual, where a trained member of the staff uses his eyes and experience to tell whether a banknote is original or not. This method is error prone and this employee could be more useful in another position. An automated system to detect forged banknotes will surely increase the speed and reliability of the bank.

## Our project

The purpose of our project is to develop a model that can tell whether a banknote is forged or original, with **95% accuracy**. We are glad to announce today that we have finalised the first tests with our model and we achieved promising results. Our system is now ready to be tested in our agencies in a beta phase.

To develop this classifier, we have used a database that includes features of genuine and forged banknotes. These information were obtained from photos of real

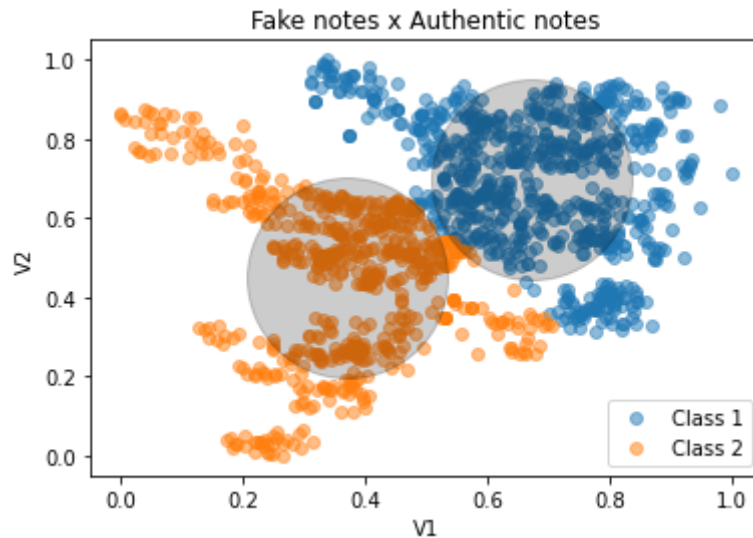
banknotes specimens through a technique called *Wavelet Transform*. The features used in this classifier are *variance* and *skewness*. Using mathematics, statistics and computer science techniques, our team of scientists was able to create a system to identify clusters with similar features that uses machine learning to identify the most determining features in a banknote and automatically classify whether a banknote is authentic or fake. In this first image we show how our initial data looks like.



The image above was generated in the initial phase of the development and show how the characteristics of real and fake notes look similar to the human eye.

To find the clusters that split our data in two, we have used a unsupervised machine learning technique called *K-Means*. This technique basically finds the centroids with the shortest distance to our data. If we have just one cluster, the centre of this cluster is basically the mean, that is what show the figure above. However, when you are looking for two or more clusters, this task becomes a bit more complicated, and that's what this technique does for you. The *K* means the number of clusters to find. In our case, it was **two**.

The image below show how our data gets split after we use the K-Means technique and apply some data processing. Our model was able to find the two clusters, representing the *authentic* and *forged* banknotes. With this model we can, now, classify any banknote and tell if it's genuine or not. We just need to use take a photo of the note, extract some features, and feed our system with this information. In a matter of seconds we have our answer. The training was performed several time, showing little or no change in the results. This confirms how stable our classifier is.



## Final Considerations

These are some initial results and our perspectives are excellent. The next phase now is the testing phase, where our system can be used in practice and compared to the current manual method. We are sure that as soon as our system confirms our perspectives, it will be adopted in definitive.

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