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# Indian Coin Detection by ANN and SVM

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***Abstract***— Most of the systems available recognize the coins by taking physical properties like radius, thickness etc into consideration due to which these systems can be fooled easily. To remove above discrepancy features, drawings and numerals printed on the coin could be used as the patterns for which support vector machine can be trained so that more accurate recognition results can be obtained. In Previous techniques less emphasis given on classifier function that's why classification accuracy is not improved. For solving this problem classifier techniques can be used.

Keywords ***: Coin, Machine learning, Image, Accuracy.***

## I. INTRODUCTION

Currency can be of two types: first one is coin currency and second one is paper currency. So there are different approaches for both types of currency recognition. In business transactions, to enable computers to recognize coins and other different forms of currency has become an essential process. If the computers are able to perform such recognitions, monetary transactions becomes much easier in all forms of trade. There are many coin operated equipment in the world such as an automatic machine for payment especially vending machine. Coins used in many countries have various patterns such as shape, size, surface design, weight etc. Some coins used in different countries have similar in size, weight and surface design but different value. It is difficult for an automatic system to recognize coins with a similar pattern because coin identification by machines (mechanical method based, electromagnetic method based) relies currently on the assessment of the physical parameters of a coin.

The Reserve bank of India estimates that there is at least Rs.2 trillion of fake rupees note in circulation throughout India. The bank staffs are specially trained to detect counterfeit notes but problem begins once such notes are infiltrated into the market and circulated through common people. Even receiving counterfeit notes from ATM counters have also been reported at some places. With development of modern banking services, automatic methods for currency recognition become important in many applications such as in ATM and Automatic Goods Seller Machines.

Machine Learning Machine Learning (ML) is the process of computer learning from labeled examples. The examples are called Training Data. Based on this training data, computer comes up with rules. These rules are used later to make decisions or predictions for any new data passed into the algorithm. Machine Learning enables computers to teach themselves by identifying patterns and make decision on uncertain data. M L Framework:

$$y=f(x)$$

**Types of Machine Learning methods:**

- Supervised – Training data provided for the algorithm to learn
- Reinforcement Learning.
- Unsupervised – No training data provided.

**Supervised Learning**

Supervised learning is that machine learning algorithm that uses training dataset, which is a known dataset used to make predictions. In Supervised (inductive) learning the training data includes desired outputs. This particular training dataset contains input data as well as response values. From it, the supervised learning algorithm tends to build a model which is capable to make predictions of the response values for a new dataset. Another dataset is also used here which is known as test dataset. Test dataset is often used to validate the model. Larger the training datasets, higher is the predictive power which in turn can generalize well for new datasets.

**Reinforcement learning**

Reinforcement learning is learning which includes what to do and how to map situations to actions so as to maximize a numerical reward signal. The learner is not told which actions to take, as in most forms of machine learning, but instead must discover which actions yield the most reward by trying them. In the most interesting and challenging cases, actions may affect not only the immediate reward but also the next situation and, through that, all subsequent rewards. Reinforcement learning is defined not by characterizing learning methods, but by characterizing a learning problem.

**Unsupervised learning**

Unsupervised learning is a type of machine learning algorithm used to draw inferences from datasets consisting of input data without labelled responses. The most common unsupervised learning method is cluster analysis, which is used for exploratory data analysis to find hidden patterns or grouping in data. The clusters are modelled using a measure of similarity which is defined upon metrics such as Euclidean or probabilistic distance.

Unsupervised learning is the machine learning task of inferring a function to describe hidden structure from unlabeled data. Since the examples given to the learner are unlabeled, there is no error or reward signal to evaluate a potential solution. This distinguishes unsupervised learning from supervised learning and reinforcement learning.

**Support Vector Machine**

SVM is one of the most powerful classification techniques. Support Vector Machines are based on the idea of mapping data points to a high dimensional feature space where a separating hyper- plane can be found. SVM represents the examples as points in space, they are mapped so that the examples of the separate categories are divided by a clear gap. This mapping can be carried on by applying the kernel trick which implicitly transforms the input space into another high dimensional feature space.

## II. LITERATURE REVIEW

**Kaiping Wei et al. (2007)** authors presented a novel approach for classification of ancient coins based on image textual information. For extracting textual information Tree-Structured Wavelet Transform (TWT) and Ant Colony Optimization (ACO) algorithm is used. The multi resolution character of the texture is extracted by TWT, and information can be accessed in various scale rather than low frequency. In addition, segmentation algorithm based on ACO is implemented before TWT to obtain textural information with the absence of noise. The results show that this hybrid approach provides very accurate recognition results for ancient coins.

**Abdolah Chalechale (2007)** presented a novel approach for coin image recognition using image abstraction and spiral decomposition. The approach SDAI (Spiral Decomposition of Image) enables measuring the similarity between full color multi- component coin images and need no cost intensive image segmentation. Here an abstract image is derived from original image based on strong edges of the coin. Then spiral distribution of pixels in the abstract image is employed as the key concept for feature extraction. Extracted features are scale, translation and rotation invariant. The images used for query set and test database are scanned, photographed or collected from web. The proposed approach is compared with three other approaches i.e. QVE, PFD (Polar Fourier Descriptor) and EHD (Edge Histogram Distribution).The results show that the proposed approach is much better than other three approaches because it shows significant improvement in recall ratio using proposed features.

**H Hassanpour et al. (2009)** presented a robust paper currency recognition method based on Hidden Markov Model (HMM). By employing HMM, the texture characteristics of paper currencies are modeled as a random process. The proposed algorithm can be used for distinguishing paper currency from different countries. A similarity measure has been used for the classification in the proposed algorithm. To evaluate the performance of the proposed algorithm, experiments have been conducted on more than 100 denominations from different countries. The results indicate 98% accuracy for recognition of paper currency.

**Linlin Shen et al. (2009)** presented an image based approach using Gabor wavelet for coin classification. Gabor wavelets are used to extract features for local texture representation. Matching between two coin images are done via Euclidean distance measurement and the nearest neighbour classifier. To test the performance of proposed method, it is compared with two edge based methods, i.e. Edge Distance Histogram Distribution (EDHD) and Edge Angle Histogram Distribution (EAHD). On the basis of comparative study, it is concluded that EAHD achieved 24.73% accuracy, EDHD achieved over 53.09% accuracy and EAHD in combination with EDHD achieved 30.68% accuracy. Since the representative Gabor feature is applied, the discrimination power of proposed system is significantly improved and as high as 74.27% accuracy has been achieved.

**Huahua Chen (2010)** presented an approach for Chinese coin recognition based on unwrapped image and rotation invariant template matching. In this approach first of all coin segmentation is done using Hough Transformation then segmented image is unwrapped. Unwrapping is done by transforming reference and specimen coin image from Cartesian coordinates to polar coordinates. After unwrapping, the template matching is done and on the basis of this recognition is done. Experiments were performed on 144 variably rotated coins images. Out of which 116 were correctly recognized. So, overall 80.6% correct recognition was achieved.

## III. Result and Discussions

**Table: Representation of Parameters (Neural Network)**

| No. of Neurons | Precision | Recall | Accuracy |
|---|---|---|---|
| **10** | **73.35** | **73.35** | **75%** |
| **15** | **78.46** | **50** | **87%** |
| **20** | **83.35** | **75** | **75%** |
| **25** | **53.35** | **53.35** | **50%** |
| **30** | **85.7** | **66.65** | **75%** |

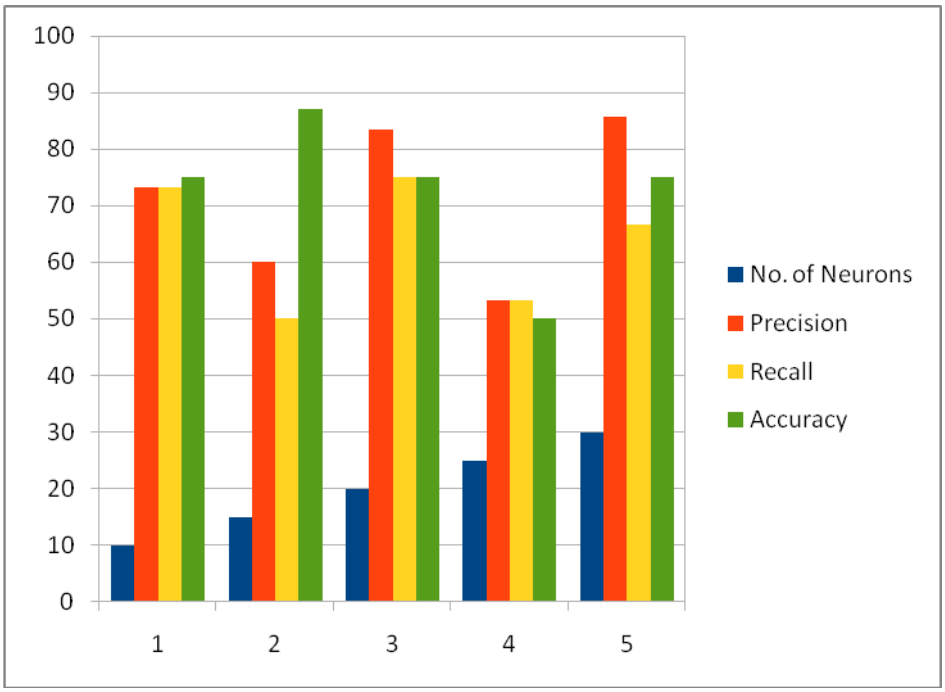


**Figure:** Graphical Representation of parameters (Neural Network)

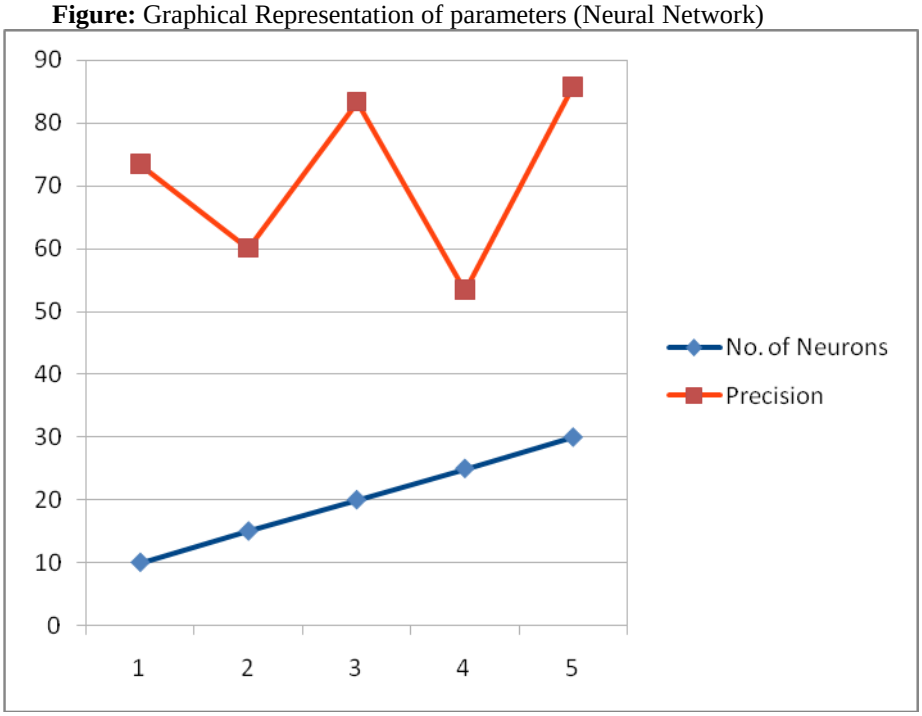


**Figure: Precision Graph for neural network**

**Table: Representation of Parameters (Support Vector Machine)**

| SVM | Precision | Recall | Accuracy |
|---|---|---|---|
| **Linear** | 63.12 | 62.94 | 68.75% |
| **Quadratic** | 64.02 | 63.84 | 71.43% |
| **Polynomial** | 64.93 | 65.28 | 75% |
| **RBF** | 69.00 | 69.44 | 72.22% |
| **Multilayer** | 34.84 | 33.97 | 36.36% |

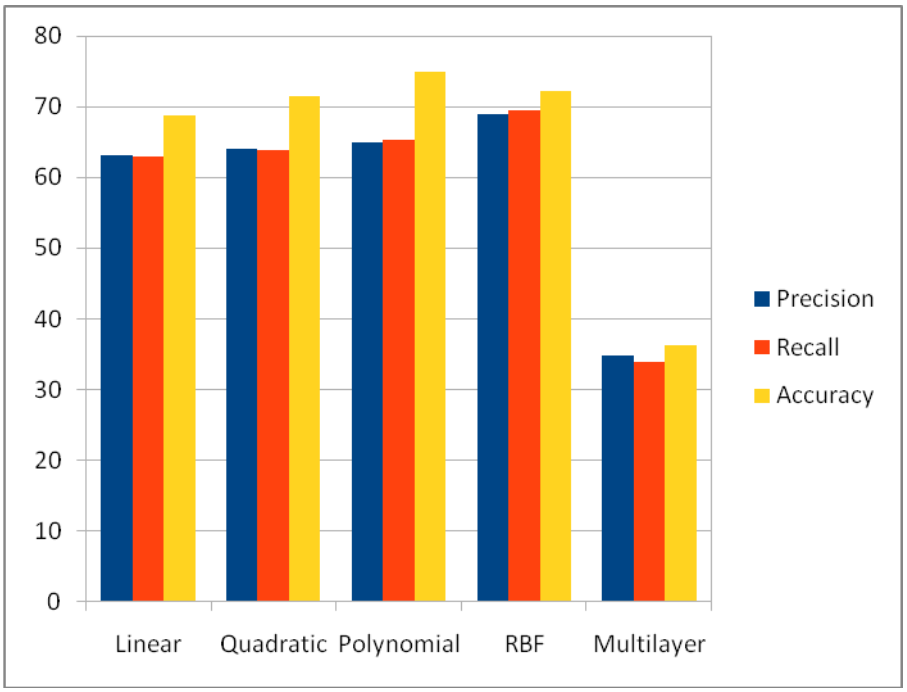


**Figure:** Graphical Representation of parameters (SVM)

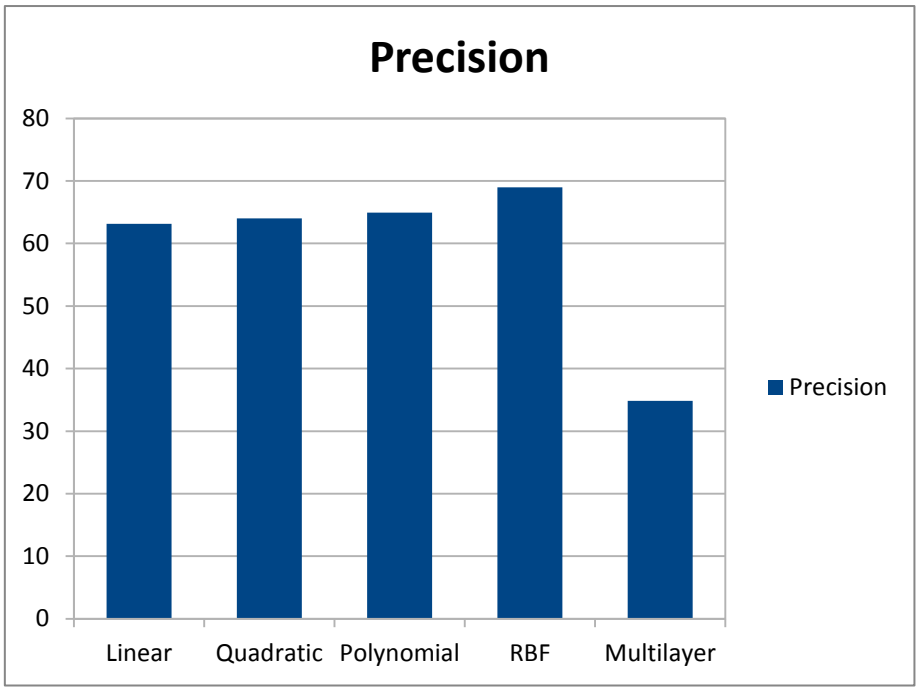


**Fig: Graphical Representation of Precision (SVM)**

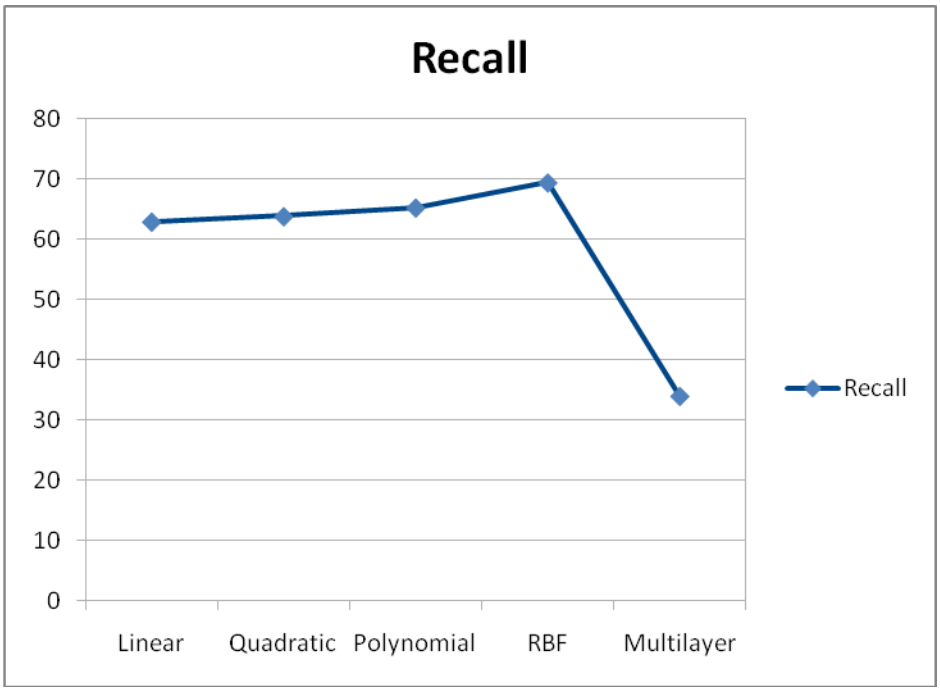


**Figure: Graphical Representation of Recall (SVM)**

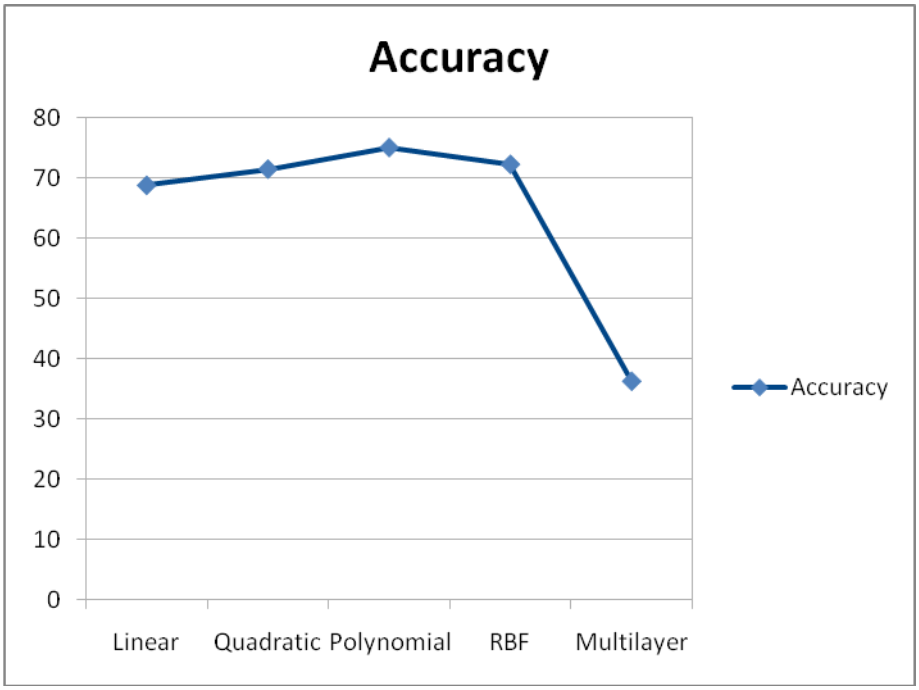


**Fig: Graphical Representation of Accuracy (SVM)**

**Table: Representation of parameters for SVM (RBF)**

| **SVM** | **Precision** | **Recall** | **Accuracy** |
|---|---|---|---|
| RBF | 99.53 | 99.50 | 99.57% |

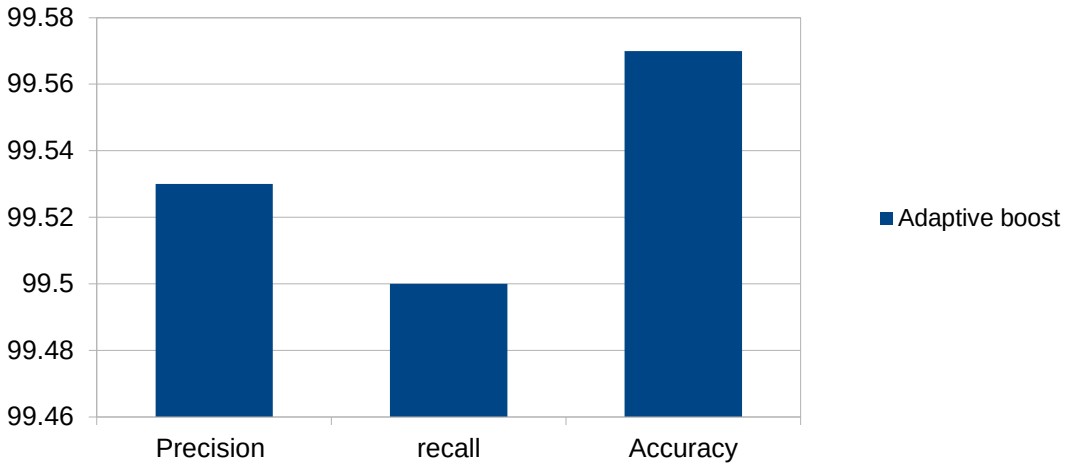


**Fig: Graphical Representation of parameters (SVM)**

## IV. CONCLUSION

Most of the systems available recognize the coins by taking physical properties like radius, thickness etc into consideration due to which these systems can be fooled easily. To remove above discrepancy features, drawings and numerals printed on the coin could be used as the patterns for which support vector machine can be trained so that more accurate recognition results can be obtained. In Previous techniques less emphasis given on classifier function that's why classification accuracy is not improved. For solving this problem classifier techniques can be used.

In this thesis the accuracy of detecting different coins is increased.
Accuracy obtained by Svm is 75%
Accuracy obtained by Neural Network is 87%
Accuracy obtained by Adaptive boost is upto 99%, so we can conclude adaptive boost performs better than other classifier for detection the coin.

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