

# An Image Based Approach to Unmasking of Fake Coins

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**Abstract** – Recent years fake coin has same resemblance of their genuine counterparts so we propose a new approach to detect a fake coins using their image prototypes. Caney's edge detection is a method that is used to detect the edge of coins. Harris corner is a corner detecting algorithm that differentiates the coin from the surrounding image. SIFT is a local key points detector and descriptor that is used to find the features points of the image. A post processing procedure is proposed to remove the mismatched key points. One class learning is conducted for fake coin detection. Genuine coins are needed to train their classifier. SVM is a classification algorithm that classifies the coin is fake or real. The impressive results have demonstrated its effectiveness.

**Index Terms** – fake coin, genuine coin, image representation, dissimilarity space, multi class learning.

## 1. INTRODUCTION

Compared with paper currency, coins benefits from their great residence to abrasion, so coins are widely used in our daily life coins are mainly used in vending machines,page and use toilet, parking,telephone booths and so on.some people enjoy collecting coins as they usually have artistic value and can give a vivid insight to the social life in history. Our government going to introduce new coins , suppose that counterfeiting ring manufacture and sells fake coins , which have caused great loss and damage to the socisty.it is imperative to be able to detect fake coins .This is also an important task in the field of numismatics . So an automatic fake coin detection system is highly desired.

## 2. RELATED WORKS

Coin diameter, thickness, weight or shape these measurements has a discriminative power to identify the coin genuine or fake.Now a days counterfeiting rings manufacture a fake coin that has same resemblance with genuine coin.An image signature various with respect to the number of patches. Patch may be a single pixel in an image or it may be a significant feature or edge in an image an image can be modified by using some transformation like image rotation, scaling. Electronic, magnetic, x-ray fluorescence and x-ray diffraction are some method to detect fake coin.Now the growing popularity of smartphones image processing approach is highly desired it being from low cost and ease of use .The image captured from a coin and the detection of fake coins are carried but by template matching.

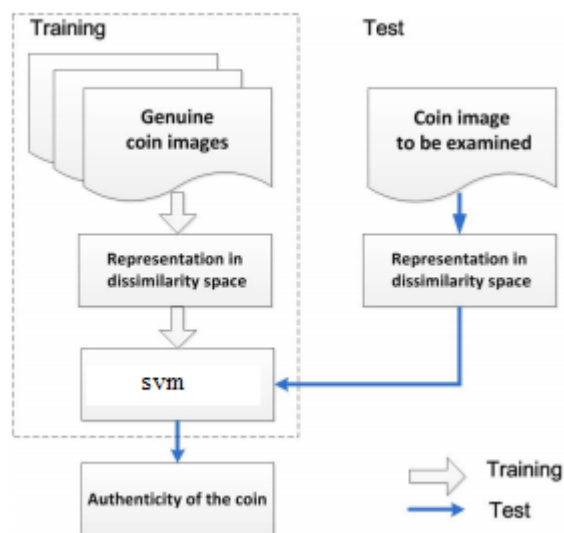


Fig 1:Block diagram of the proposed approach

Coin recognition is used to reduce the sensitivity to the variation among the coins from the same class .The first step for Fake coin detection is an image representation[1].Here vector representation facilitates the access to a rich repository of machine learning tools such as support vector machine and neural networks. Single vector usually lacks sufficient descriptive power so the dimension of the vector is determined by the number of prototypes. Scale invariant features transform(SIFT),Harris detector are the algorithm which used to detect local key points and describe an image[2]. A visual word vocabulary is built through clustering the local descriptor obtain from a training set.Arbitrary descriptor is represented by its nearest visual word in the vocabulary.SVM is the classification algorithm that separates training samples by margin hyper plane .Features points are matched with training coins dataset then after the feature comparison by using svm algorithm will be generated the result.

## 3. OUR MOTIVATION

Image processing is a popular approach that is performs some operation on image. Using this approach extract some useful information from image. Preprocessing is an improvement of the image Data that suppresses unwanted distortion or

enhances some image features. The proposed system consists three preprocessing techniques that is median filtering, detecting edge, and Hough circle[6]. The median filtering is a technic is used to remove noise from an image that improves the result of later processing. It preserve edge while removing noise training data set store the proto types of genuine and fake coins. Array is used to store that proto type Hariss features, scale invariant features transform or the attribute used to compare two coins proto type[3]. Feature point is invariant under view changes, zoom, lighting conditions etc. Local key point detector and descriptor is used to describe an image because of their superb discriminative power. To construct the dissimilarity space, each coin image to be detected will be compared with some proto type coins that are genuine and selected beforehand, based on which the image can be represented as a vector. Finally SVM classifies the coin real are fake. Promising results have conformed the potential of the proposed approach.

#### 4. REPRESENTING COINS IN DISSIMILARITY SPACE

Preselected prototype images are compared to solve a dissimilarity space it is also defined as the vector space. Each coin dimention are measured under commsideration of prototype coins. set of prototype images are Chosen from the image domain. All coins shapes are almost circle and no different shapes coins are available in this study. but some coins have ellipse shape...but that are not well captured. In the prototype coins, we are detect the first one is keypoint its same as the dissimilarity space. The coin image are used DOG detector to detect the key points ,and their descriptor is SIFT[7,8] .The coin images are detect and described using these methods to show their matched and mismatched key points .prototype selection approach is a important to detect their several key points using above methods .SIFT is a efficient method to detect their under consideration of prototype coins. The k medoids are represented as a dimentional vector  $x = \{d(1,lp1), D(1,lp2), \dots, D(1,lpk)\}$ . The dissimilarity between two coins are measured  $d(.,.)$  Based selection of prototype coins. Two prototype approaches are in the method.

##### Random selection:

Random selection is a set of genuine coin images are randomly compared with the prototype coins.

##### Clustering based selection:

Clustering based approach is a group of selection method. it is also defined as k-medoids [4]. The matches and mismatched are identified at image representation. Mismatched key points between two images are connected by the lines. Each key points will be measured as the  $(r, \theta)$ . After prototype selection, the training and testing sets are available in their dataset. ...training samples are  $p_1, p_2 \dots p_l$ . Where  $l$  is a size of the training set, and finally using a svm(support vector machine) to detect the coin

are fake or real[9][10]. Now the growing popularity of smart phone image processing approach is highly desired it benefits from low cost and ease of use the image capture from a coin and the detection of fake coins was carried out by template matching .coin reorganization is used to evaluate the sensitivity to the variation among the coin from the same class .the first step for fake coin detection is image representation here vector representation facilitate the access to a rich repository of machine learning tools such us networks. . Array is used to store that proto type Hariss features, scale invariant features transform or the attribute used to compare two coins proto type[3]. Feature point is invariant under view changes, zoom, lighting conditions etc. Local key point detector and descriptor is used to describe an image because of their superb discriminative power. To construct the dissimilarity space, each coin image to be detected will be compared with some proto type coins that are genuine and selected beforehand, based on which the image can be represented as a vector. Finally SVM classifies the coin real are fake. Promising results have conformed the potential of the proposed approach. Image processing is a popular approach.

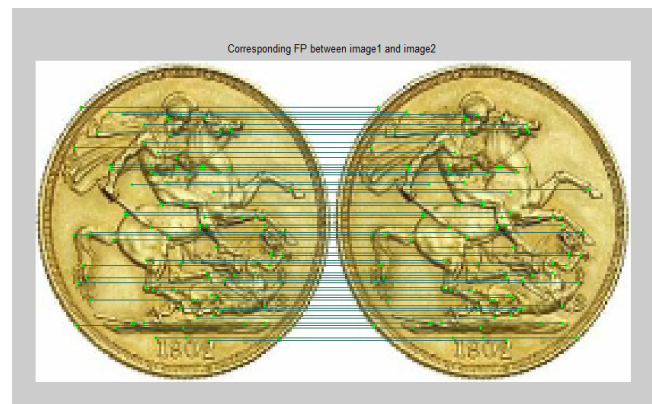


Fig 3: Features points between images

#### 5. DETECTING FAKE COINS BASED ON ONE-CLASS LEARNING

In real life usually on imbalanced with respect to number of genuine and fake coin. Easy to compare with genuine and fake coins. The main issue is imbalance hampers the generalization ability they have commonly used two class classifier the two class classifier have positive and negative samples in training dataset, so these issue was overcome using the technique one class SVM [5]. It is used only genuine coins only. In anti-counterfeiting techniques aim was particular type of counterfeiting but the particular type of counterfeiting make a take coins this coins are totally differ from the another coins. Therefore the anti-counterfeiting technique was tooling them. Therefore this type of counterfeiter coins is addressed using these technique. The take coins have multiple classes but genuine coins have only one class. The oneclass svm only focus on genuine coins. It is not distracted by the Diversities of fake

coins. The one class svm was check a coins counterpart's are bears great resemblance are given then the coin was genuine otherwise the coin was fake coin. Scholkopf was proposed one class svm. Natural extension of the support vector algorithm the case of unbalanced data. The object belonging to the class are targets. so the out of the class is called outliers a set of training samples from same class. The basic idea of one class svm is learn hyperplane .which enclose most at the training samples are minimizing the volume of. The sphere at the same time. kernel track map the input data to some features second class svm .Then the maximum margin hyperplane separate the training samples from the origin. Spaces. origin only consider the svm is the classification algorithm that separate training samples by margin hyper plane feature points are matched with training coin data sets then after the feature comparison by using svm algorithm it preserves edge while removing noise Harris feature scale invariant feature transform are the attribute used to compare two coin prototype. feature points are invariant under view changes.

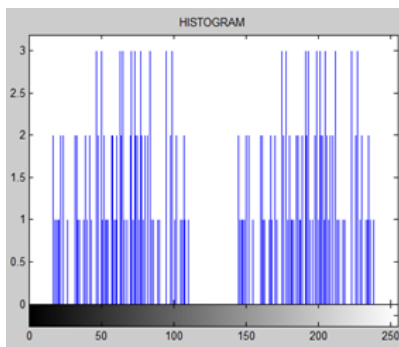


Fig 4: Histogram representation of coin

A set of training samples  $x_1, x_2, \dots, x_l$  is the size of the training set and

$x_i (i=1, 2, \dots, l)$  k dimensional called  $x_i \in R^k$ , the class no any classes are needed. The symbol in bold font:  $\epsilon \in R^k$  it is represent vector or matrix, it is represent each individual element in the vector matrix.

OBJECTIVE :

$$\text{Min } 1/2w^T w - \rho + 1/v_l$$

Subject to (for  $l=1, 2, \dots, l$ );

$$W^T \Psi(x_i) \geq \rho - \epsilon_i \dots \dots \dots (5)$$

$$\epsilon_i \geq 0 \dots \dots \dots (6)$$

w and  $\rho$  represent hyper plane and T represent transpose operation,  $\Psi(x_i), i=(1, 2, \dots, l)$  input data  $x_i$  to the feature space.

V represent the upper bound of the rate of outliers in training set.

It is used to avoid the overfitting. The dual problems were solved using computational burden. OBJECTIVES:

$$\text{Min } 1/2\alpha^T Q \alpha \dots \dots \dots (7)$$

$\alpha$

Subject to (for  $i=1, 2,$

$$0 \leq \alpha_i \leq 1/v_l$$

$\dots \dots \dots (8)$

Where each element  $Q_{ij} (i, j=1, 2, \dots, l)$  of the matrix. Q represent inner product of the input data  $x_i$  and  $x_j$ .)

$$Q_{ij} = \Psi(x_i)^T \Psi(x_j)$$

$Q_{ij}$  means kernel function. It employ the radial basis function (RBF). kernel formed:  $\gamma$  means kernel width. The solution  $\alpha$  used to obtain w and  $\rho$ . sample x means output of the decision function .f(x) indicates its resemblance to the training sample. larger value of (x). It target belongs to the class.

### 6. EXPERIMENTS

To validate and evaluate it on different coin dataset. To investigate proposed approach thoroughly because impact parameters are involved in the proposed approach. All coins are demonstrated the effectiveness of the proposed image representation in the dissimilarity space. The comparisons commonly used BOWW model. Further compare proposed approach with at all

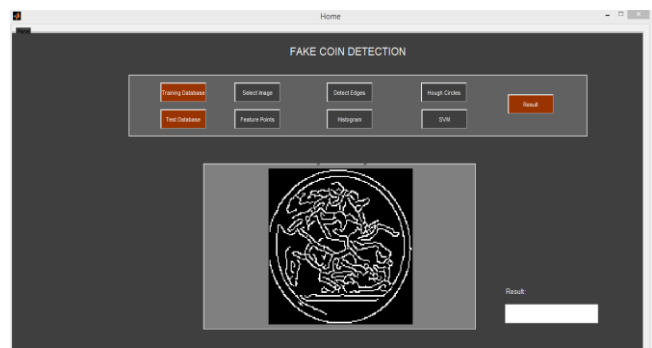


Fig 5: Canny's edge detection

### A. DATASETS:

Four datasets are used in the proposed system, namely Danish coin 1991, Danish coin 1996, danishcoin 2008 and chinese coin 1912. The three dataset coins are same it is represent Denmark 20 kroner of different years. The chinese coin 1912 consist one yuvan coins there was issues in 1<sup>st</sup> yesa of the republic of china. the gray scale and JPEG format images are used in our proposed system. The images are same dataset are subject to different distortion. they are varies from different resolution

illumination and orientation etc..The resolution of the image range from  $\sim 100 \times \sim 100$  to  $\sim 300 \times \sim 300$ .the all iamges are differ from the two levels one is communication amnd another one is wear.all data sets are randomly split into and independent training sets two sets are used in our proposed approach there are validation sets and test sets.validation sets used to select the parameter involed in proposed system.to evaluate the proposed system the employee resever operating character curve(ROC).it is apply different threshold to the summarize the single figure measure the equal error rate(EER)is used.The training sets are can made ten different splits.



Fig 6: Harris corner detection

### B.CONFIGURATION:

Proposed approach used various configuration have been tried and compared on the validation set.configuration achives the lowest EER on the validation set is then selected and applied to the test set. Two keypoints are used for comparison these are detect are and described.these keypoints are mainly used compare the performance of the prposed approach there are two operation are appyed one is DOG detector and another one is SIFT described. Normalized radius difference threshold  $V$  defined in section have been tesated and compare it .  $V=0$ .consists keypoints with exactly same normalized radius .poor coins are extremely sensitive and segmentation result in poor performance .more and more keypoint consider  $V$  values. $V$  becomes,too big consider more keypoints will distract the search of the closest neighbou r  $V$  set is equal to 0.05 shown to perform well on four data sets.

### C.ANGLE DIFFERENCE THRESHOLD: $T_a$

The proposed approach consider different values of the angle and different threshold  $T_a = 0$  suffer from belong to strigent to,based on some matched key point are removed mis matched keypoints fail to be removed resulting too big  $T_a$ ,which will decrease the performance the posy processing technique used to remove the mismatched keypoints

### D.NUMBER OF PROTOTYPE AND PROTOTYPE SELECTION METHOD AND KERNAL FUNCTION:

All coin image must needed the  $K$  prototype image with dissimilarity space the  $K$  value consist the performance of the proposed approach demonstrate effectiveness of the proposed coin two prototype method are used there are random selection.clustering based selection.

### 7. CONCLUSION

A fake coin detection method exploiting the characteristic of coin image. vector representation facilitate the access to a rich repository of machine learning tools such as support vector machine and neural nnetworks.Single vector usually lacks sufficient descriptive power so the dimension of the vector is determined by the number of prototypes.Scale invariant features transform(SIFT),Harris detector are the algorithm which used to detect local keypoints and describe an image a visual word vocabulary is built through clustering the local descriptor obtained from a training set.Arbitrary descriptor is represented by its nearest visual word in the vocabulary .SVM is the classification algorithm that separates training samples by margin hyperplane .Features points are matched with training coins dataset then after the feature comparision by using svm algorithm will be generated the result. Promising results have conformed the potential of the proposed approach.

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