

# A Novel Approach towards Detection of Fake Coins

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**ABSTRACT:** We propose a new approach to detect fake coins using their images in this paper. As large amount of coins are daily traded over the world, it becomes necessary to develop a method to detect these coins in order to prevent the illegal trading of coins. In this paper, we propose an automatic coin recognition method for coins. The proposed method exploits the structure of the coins using a spatially local coding method. Here we represent the image of the coin in the dissimilarity space, which is a vector space constructed by comparing the image with a set of prototypes. Artificial neural network have also been extensively applied to document analysis and recognition. Most efforts have been devoted to the recognition of isolated handwritten and printed characters with widely recognized successful. Due to the limited number of fake coins in real life, one-class learning is conducted for fake coin detection, so only genuine coins are needed to train the classifier. Extensive experiments have been carried out to evaluate the proposed approach on different datasets. The impressive results have demonstrated its validity and effectiveness.

**KEYWORDS:** Fake coins, Fake coins identification, Dissimilarity space, Artificial neural network, Spatial coding.

## I. INTRODUCTION

Coins are widely used in our daily life for various purpose or in various applications. Compared with paper currency, coins tend to have greater resistance to abrasion, and thereby can be used for quite along time. In recent years, a lot of illegal counterfeiting rings manufacture and sell fake coins, which have caused great loss and damage to the society. Thus it has become important to detect these fake coins. The fake coins nowadays are of fairly high quality, so they often have greater resemblance to their genuine counterparts, which makes the detection of fake coins extremely challenging task. Earlier these fake coins were detected through some electronic means. That is, a primary coil that was excited by a signal with a particular frequency was imposed on one side of a coin passage. For the other side of the coin passage, it was associated with a secondary coil that was electromagnetically coupled with the primary coil. When a coin passed through, the attenuating voltage signal coming from the secondary coil could be used to determine whether the coin was genuine or fake. Hence here we present a method to detect these fake coins in such a manner, that is through some image process, and training the machines to recognize the coins. Here we are going to divide the paper into two parts, the first part will be concentrating on training the machine and the next part will be concentrating on how to breakup this task into sub task and extract even the smallest and smallest feature of the coin information, since detailing is much more important.

## II. RELATED WORKS

M.Hida, H. Sato and H.Sugawara, et al. proposed a method in which [1], counterfeit coins were analyzed by both X-ray diffraction (XRD) and X-ray fluorescence (XRF) methods without any pretreatment. The counterfeit coins were clearly classified into two groups using cluster analysis (CA) and principal component analysis (PCA) for XRD peak patterns. One group was made by a pressed method and another one was made by a nickel-plated method. K. Sun, B.Y. Feng and P. Atighechian, et al. [2] proposed a method saying that fake coins can be identified by its shape and lettering

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features on it. That is by considering a fake Danish coins based on their image characteristics, it would identify the genuine coin. Although the experimental results were inspiring, the dataset used was extremely small which consisted of only 16 coins. M. Fukumi, S. Omatu and F. Takeda, et al.[3] proposed a method called as pattern recognition, it is often necessary to deal with problems to classify a transformed pattern. A neural pattern recognition system consists of a fixed invariance network with many slabs and trainable multilayered network. The system was used in a rotation-invariant coin recognition problem to distinguish between a 500 yen coin and a 500 won coin.. J. Kim and V. Pavlovic .[4], Roman coins plays a important role to understand the Roman empire because they convey rich informational about key historical events of the time. Moreover, as large amounts of coin are daily traded over internet, it becomes necessary to develop automatic coin recognition systems to prevent illegal trades. S. Marinai, M. Gori and G. Soda.[5], Artificial Neural Networks have been extensively applied to document analysis and recognition. Most efforts have been devoted to the recognition of isolated handwritten and printed characters with widely recognized successful results. However, many other document processing tasks, like processing, layout analysis, character segmentation, word recognition, and signature verification, have been effectively faced with very promising results. L. Liu, Y. Lu and C.Y. Suen.[6], A document image matching approach making use of probabilistic graphical models is proposed. The document image is first represented by a tree with the nodes in the tree corresponding to the regions in the image and the edges indicating the parent-child relationships between them, transforming the problem to tree matching. L. Liu, Y. Lu and C.Y. Suen.[7], proposed duplicate image matching in this paper. An image is represented by a signature, the length of which with respect that we propose a variable-length signature four near to the number of the patches in the image. A new visual descriptor, viz., probabilistic center-symmetric local binary pattern, is proposed to characterize the pattern, is proposed to characterize the appearance of each image patch. Beyond each individual patch, the spatial relationships among the patches are captured. S. Belongie, J. Malik and J. Puzicha,[8] ,presented a novel approach for measuring the similarity between shapes and exploit it for object recognition. In this the measurement of similarity is proceeded by 1) solving the correspondence between points on the two shapes, 2) Using the correspondence to estimate an aligning transform. In order to solve the correspondence problem, we attach a descriptor, the shape context, to each point. I. Amerini, L. Ballan and R. Caldelli, et al.[9], proposed one of the principal problems in image forensics is determining if a particular image is authentic or not. This can be a crucial task when images are used as basic evidence to influence judgment like, for example, in a court of law. To carry out such forensic analysis, various technological instruments have been developed in the literature. S. Lazebnik, C. Schmid and J. Ponce.[10], presents a method for recognizing scene categories based on approximate global geometric correspondence. This technique works by partitioning the image into increasingly fine sub-regions and computing histogram of local features found inside each sub-region. Rabaoui, M. Davy and S. Rossignol , et al.,[11] proposed This paper presents a method aimed at recognizing environmental sounds for surveillance and security applications. We propose to apply one-class support vector machines (1-SVMs) together with a sophisticated dissimilarity measure in order to address audio classification, and more specifically, sound recognition. X. Pan and S. Lyu,[12] proposed Region duplication is a simple and effective operation to create digital image forgeries, where a continuous portion of pixels in an image, after possible geometrical and illumination adjustments, are copied and pasted to a different location in the same image. Most existing region duplication detection methods are based on directly matching blocks of image pixels transform coefficients, and are not effective when the duplicated regions have geometrical or illumination distortions.

However, instead of resorting to the BOVW model for generation of vectorial representation, we represent a image in the dissimilarity space. A block diagram of the proposed approach is as shown below.

The dissimilarity space is constructed based on a very basic operation, viz. comparison. It benefits from mimicking human perception well. When presented a suspectal coins, we human tend to compare it with its genuine counterparts to see whether they are different or not. Likewise, to construct the dissimilarity space, each coin image to be detected will be compared with same prototype.

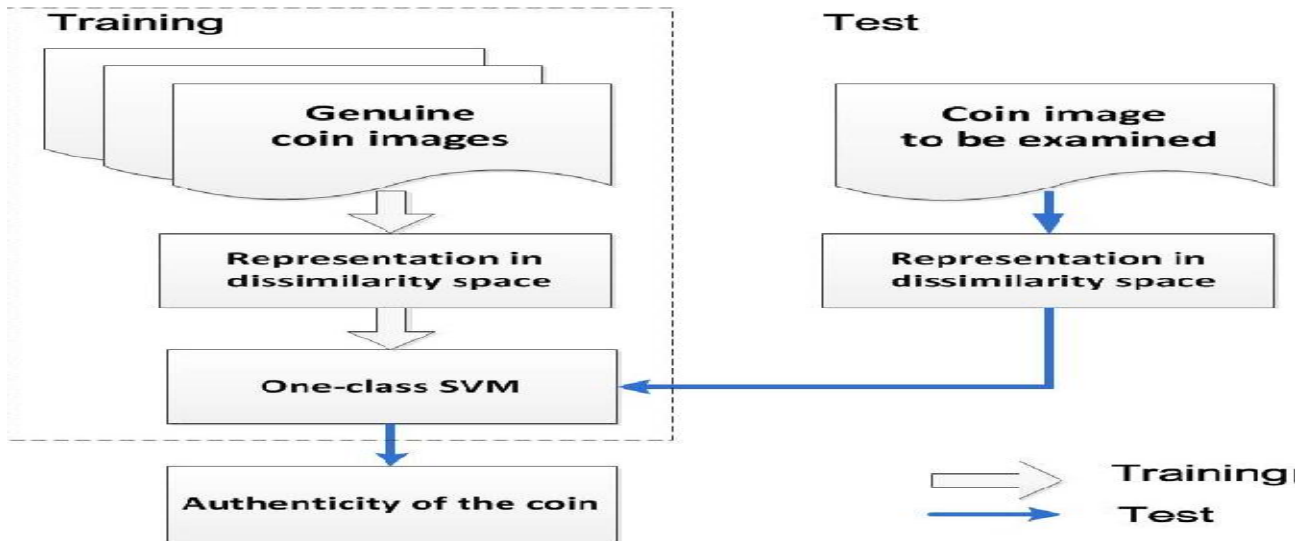


Fig. 1: Block diagram of the proposed approach

### 3.Existing Research Contribution

Problem	Technology	Advantage	Limitations
Coin-detection recognition, it is still a challenging task, especially for coins in natural scene.	multi-layer convolution neural network is used to classify proposals and get the final recognition result, Hough detection, radius ratio, color feature.	Proposed a method to detect and recognize the coins in natural scene	Due to its diversity in species various rotation especially complex background in the real world images, coins recognized by image processing is faced with many difficulties.
Detection and study of patterns of coin images is still a challenging task.	In this study, it is aimed to count the total amount in an image of coins using machine vision methods.	Textural details are removed from the image using bilateral filtering and circles are detected.	The process of signal conversion and comparison is difficult.
The frequencies of these vibrations depend on the object's properties (mass, shape, material type),	Identify coins by detecting the sound generated when they hit a hard surface, using a neural network. This paper focuses on the acoustic method,	A pattern recognition system, which are insensitive to rotation by any degree and expanding usual system, which are of same size.	The performance of the system changes little, when the initial units of the neuron units in the system changes.
They perform best when the text is aligned horizontally.	Optical Character Recognition (OCR) methods	special class of unconstrained natural images, namely, images of ancient Roman coins,	The number of training images for them are relatively lower than the others and their appearances are similar to the others so they are easy to be confused.
Coin recognition is a difficult task in machine	Multi-layered BP neural network.	Work is to find whether the object is coin or not if so denomination of the coin is	Problems because of its various rotations and widely changed patterns.

intelligence and computer vision problems		found.	
The problem is to resort the trees to strike a balance between the representative power and the computational complexity	Pair wise Markov Random Field (MRF) and Maximum a Posterior (MAP).	These random variables can assume discrete values corresponding to the number of each node in the other tree to be matched. Thus realizations of the random variables indicate node mapping between two trees.	Document images that are lack of distinct structures, the proposed tree representation is limited in its discriminability and is being enhanced
Two key issues are involved in image matching: image Representation and image similarity measurement.	A visual descriptor named Probabilistic Center-symmetric Local Binary Pattern (PCSLBP) is proposed.	Different primitives can be employed to represent an image such as raw pixels, key-points and so on. Patches is used for image representation.	Extracting stable patches from an image is a challenging issue. Sometimes, even small variations of the images render different patches, which will hamper the subsequent matching process.
Information integrity is fundamental in a trial, but it is clear that the advent of digital pictures and relative ease of digital image processing today makes	Scale invariant features transform (SIFT), used to detect and describe clusters of points.	Photo can be detected, that is if a certain region has been duplicated and determine the geometric transformation applied to perform such tampering.	In most cases, when the final fake photo is available, to the forensic analyst for inspection, the image is often undeterminable.

### III.CONCLUSION

By learning about the properties of the coin image detection of fake coins is done. Dissimilarity space is used for representing the coin image. The prototypes determines the different dimensions of the coins. By considering the dimensions, dissimilarity is found between the coins. DOG detector is used for detecting the dissimilarities and the key points on coin images. SIFT descriptor is used for describing the dissimilarities and key points of the image. Now based on properties the similar keypoints between the coins can be found very effectively. The incompatible key points can be removed by using a method called post processing. In real time there is less number of fake coins so we use one class learning method. To train classifiers, we are going to use only genuine samples. As it requires genuine coin samples it is difficult to find these because some of the coins that we test is very old. This is the only drawback of the proposed work. To overcome this problem, we are going to focus and try to solve the issue in the future.

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