

# Iraqi Currency Recognition and Identification Using SIFT

Raghad Khalid Mohammed<sup>1</sup>, M.Sc.

<sup>1</sup>Lecturer at the Department of Basic Science, College of Dentistry, University of Baghdad, Iraq

**Abstract:** Many currencies belong to different countries worldwide, currency recognition via visible and invisible watermarks in paper currency is a new technology used for good currency classification, Currency recognition can be used to help human for easily detection the currency and if able convert it to another currencies without any supervision. Iraqi currency is used in this paper for recognition and identification. All the Iraqi paper currencies are tested and recognized. The sampled used (different view sides and blurry images tested), complex designs used for currency security, thus the recognition is difficult, Scale Invariant Feature Transform (SIFT) for feature extraction and detection is used for this purpose which provide efficiency, high speed, min complexity and can be used with different currencies.

**Keywords:** Iraqi Currency; Currency Recognition; Digital Image Processing; SIFT

## 1. Introduction

The design of currency is different from one to another in size, color and pattern [1]. The recognition of currency is not that the easy mission especially for those who work in banks and exchange offices, vending machines that is used for coffee and fast food and ATM machines need recognition for currency. [2] Proper software will make the mission of such people and machine easier, this system aim to do this job. In this paper image processing and SIFT algorithm for recognition and identification for currency with proper neural network. The Iraqi currency has its features like (color, denomination and shapes), top of any Iraqi currency contain fixed denomination with common touch sensitively.

## 2. Scale Invariant Feature Transform (SIFT)

The operation of using the feature extracted from image for matching is considered very difficult problem in image processing, the SIFT can work in different environment (scales, Viewpoint, Illumination or rotation) and do the matching operation correctly [3].

### 2.1 SIFT Algorithm [3]

- **Scale space construction:** first step in SIFT algorithm generating the scale space that is used for scaling the invariance. Figure (1)

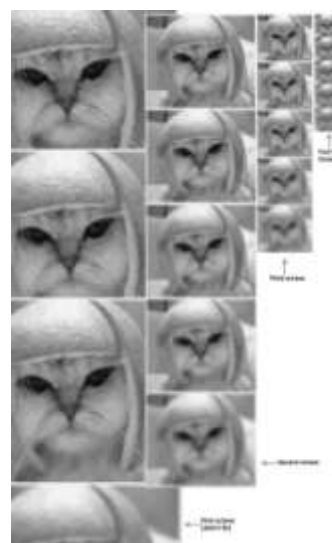


Figure 1: Scale space construction

- **Laplacian of Gaussian:** finding the key points by Applying many computations. Figure (2), (3). [4]

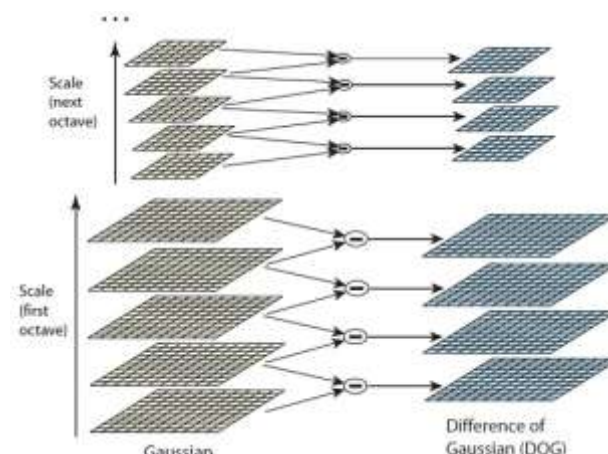


Figure 2: DOG

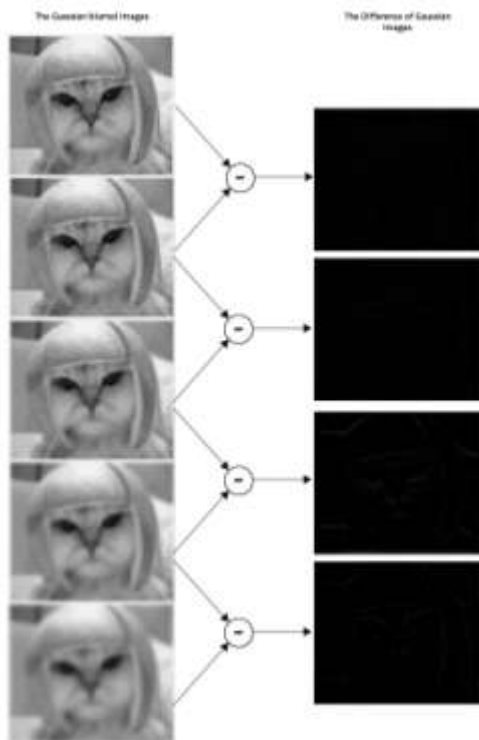


Figure 3: applying DOG

- **Fast approximation for key points finding:** the maxima and minima is applied the key points. Figure (4). [5]

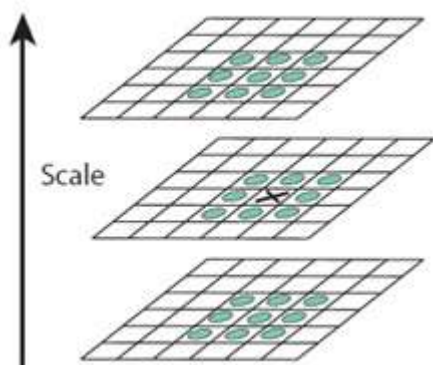


Figure 4: finding keypoints

- **Weak keypoints eliminating:** eliminate the keypoints that is considered to be weak.
- **Keypoints orientation:** The orientation of every keypoints is calculated in this step, the rotation of keypoints is invariant and do not affect the system.
- **Feature generating:** The feature is generated and extracted and each unique feature can be used separately for detection and identification.[6]

### 3. Proposed System

System algorithm:

- The currency is obtained by using camera and scanner
- Image preprocessing used.
- Region of Interest is extracted using SIFT.

- Features are extracted.
- Features are compared with features extracted from original image (stored in system).
- Outputs are displayed.

Algorithm main steps that are applied in our system:

#### ▪ Getting the image (Acquisition)

The currency image is acquired from the scanner or by using camera or mobile camera, digital form of currency is saved and it is ready for preprocessing.

#### ▪ Edge Detection

This important step in image processing is applied in SIFT, the edge of image usually contain the baggiest information in image and the intensity of image is change rapidly every time an edge is found, in our system the edge detection is used for set up the region of interest.

#### ▪ Image Segmentation

The paper currency image is segmented many times to subdivide the region of interest and made the feature identification and matching easier, it is applied inside SIFT.

#### ▪ Feature Extraction

Each feature in currency image should be extracted and used later in matching step, nevertheless paper currency image is damaged or rotated or seems to be old or have different light situation the feature should extracted and the SIFT used for this paper and work perfectly under such situation.

#### ▪ Matching Algorithm

The recognition or identification is done in this step by using the extracted feature and the exact feature that is saved in database.

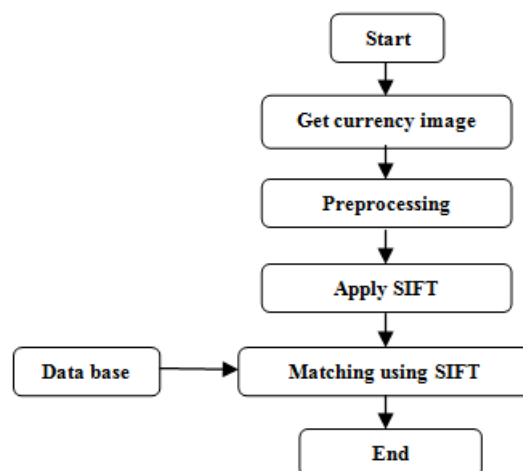


Figure 5: Proposed system

#### 4. Results

The 25000 currency paper has many features to be extracted the two sides of this currency contain many shapes and curves as shown in figure (6).



**Figure 6** Two sides 25000 currency (gray scale)

The features extracted from two sides as shown in figure (7) will be saved to be compared with other currency pictures that is acquires by using camera, scanner or mobile camera.

The system will only recognize the correct paper currency that is saved in system database, and will automatically recognized.

The strong and weak features will be used in recognition and region of interest can be determined by using the SIFT algorithm.

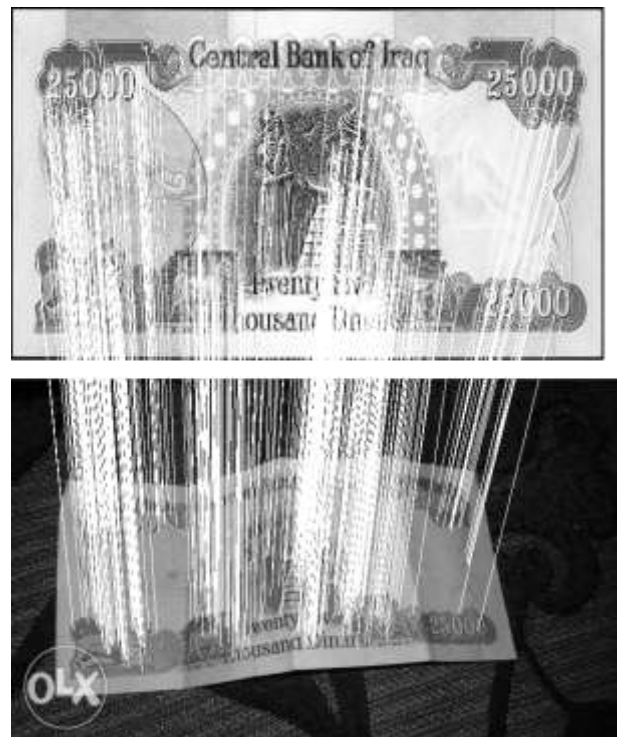


**Figure 7:** Two sides 25000 features extracted

If many Iraqi currencies were entered to system in same picture the system will only recognize each type separately based on saved features in system database (unlimited currency and currency features can be saved in such database), if the paper currency was not fully viewed or fully shown in the picture the system still can recognize this currency based on the other features that is in partial picture nevertheless the picture orientation, illumination, rotation or size as shown in figure (8) and figure (9).



**Figure 8:** Recognition in overlapping currencies



**Figure 9:** Recognition in rotated currency

#### 5. Conclusion

In this paper the recognition and identification of Iraqi paper currency is done by applying different computer vision and image processing techniques, the feature that is



extracted from currency is saved and matched with currency pre-saved data base for currency types.

The paper currency is acquired to the system and features are extracted by using Scale Invariant Feature Transform and applied to all Iraqi currency (25000, 10000, 5000, 1000, 250) dinar.

## References

- [1] Rubeena Mirza, Vinti Nanda, Paper Currency Verification System Based on Characteristic Extraction Using Image Processing, International Journal of Engineering and Advanced Technology, Volume 1, Issue 3, ISSN: 2249 – 8958, February 2012.
- [2] Junfang Guo, Yanyun Zhao, Anni Cai, A Reliable Method for Paper Currency Recognition Based on LBP, Proceedings, 2nd IEEE International Conference on Network Infrastructure and Digital Content, Beijing, 2010.
- [3] Lowe, David G. "Object recognition from local scale-invariant features." Computer vision, 1999. The proceedings of the seventh IEEE international conference on. Vol. 2. Ieee, 1999.
- [4] Lowe, David G. "Distinctive image features from scale-invariant keypoints." International journal of computer vision 60.2 (2004): 91-110.
- [5] Otero, Ives Rey. Anatomy of the SIFT Method. Diss. École normalesupérieure de Cachan-ENS Cachan, 2015.
- [6] Paganelli, Chiara, et al. "Scale invariant feature transform in adaptive radiation therapy: a tool for deformable image registration assessment and re-planning indication." Physics in medicine and biology 58.2 (2012): 287