AENSI Journals

Australian Journal of Basic and Applied Sciences

ISSN:1991-8178

Journal home page: www.ajbasweb.com

The Feature Extraction Using Surf and Corner Detection for Pill Identification

[1]A.Hema and [2]E.Annasaro

[1]*Associate Professor, Kongunadu Arts and Science College, Department of BCA, Coimbatore, India*
[2]*Director, SNR Sons College, Department of MCA, Coimbatore, India*

ARTICLE INFO

Article history:
Received 8 August 2014
Received in revised form
12 September 2014
Accepted 25 September 2014
Available online 2 November 2014

Keywords:
Image mining, Illicit drugs, Image registration, Feature extraction,SURF, Harris corner detection.

ABSTRACT

In recent years the illicit drugs are widely distributed in national and international markets. This medication error causes human mortality and stimulates criminal activities. So presently, identifying the legal and illegal pills are the key scenarios in today's research to enforce the law and to protect human's life. To assist the foresaid challenge, this work proposes novel methods by coupling the concept of image mining which is an integral part of data mining. The novel approach called Image Registration is encountered in this paper. Also, the de-noising activity is assisted to discard noisy features and to retrieve the valuable features. Moreover, three distinct methods like Surf, Haar wavelet and Harris corner are proposed to enhance the performance and to increase the stability. The Experimental result proves that the inclusion of these methods has improved the pills identification. Thus, this work supports the health care industry in saving human life.

© 2014 AENSI Publisher All rights reserved.

To Cite This Article: A.Hema and E.Annasaro .The Feature Extraction using SURF and Corner detection for Pill Identification. ***Aust. J. Basic & Appl. Sci.,*** *8(16): 220-226, 2014*

INTRODUCTION

In recent years the accidental medication tragedies occurs frequently and specifically due to the usage of illicit pills. The illicit are duplicate or banned pills that are widely sold out in markets. Around 7,000 people die by consuming the illicit drugs unknowingly. Some companies still produce and promote the banned drugs from toddlers to grown-ups. Hence, the medication and safety measures system arouses the necessity in finding the legal and banned medicines that are circulated in the markets. Also, these pills end up the life of human, so it is important to contribute some measures to prevail over the consequences. Thereby, the image mining techniques are incorporated in identifying legal and illicit pills. The legal pills are shown in figure 1 and illegal pills in figure 2.

Normally, the pills are identified by matching its characteristics like shape, size, colour, text. This paper proposes the pre-processing activities that insist on two major tasks where the former is to extract the feature and the later is to detect corner. Corner Detection is an eminent area in pills identification system that identifies the variations in corners of the pills. The feature extraction is obtained through an eminent approach called Image registration which includes SURF feature extraction where de-noising is accomplished to handle large volume of errorless data. On the other hand, Harris corner is used for detecting the corners. It is the pre-processing approach that are performed before matching the other characteristics like shape, text, color, and many others.

The experimental work is carried out on the database provided by the pharmaceutical companies. The brief background support of the work is discussed in the section 2, the elucidation of the proposed work is detailed in section 3, section 4 brings out experimental outcome of this work and section 5 concludes with the findings and the pathway for further innovations.

In recent years the healthcare industry is facing a great challenge in providing the quality treatment due to the circulation of illicit pills. These pills are mere similar to legal drugs in color, shape and many. But these pills do not cure the disease, in turn, it takes out the life of human. As a preventive measure the health care industries are in search of innovative tools for identifying the illegal pills in order to decrease the mortality. Many countries have allocated some funds for preventive measures. The U.S federal government allocated nearly $14 billion dollars for identifying the illicit drugs in the year 2009 (National Drug Threat Assessment,

Corresponding Author: A.Hema, Associate Professor, Kongunadu Arts and Science College, Department of BCA, Coimbatore, India.

2009).Contrary to the pills identification Content Based Image Retrieval (CBIR) were first introduced (J.Walters, 2000) which automatically retrieves the images from the database based on color and shape characteristics. The CBIR was enhanced to QBIC (Query Based Image Content Retrieval) that retrieved the images using user-constructed drawings, sketches, colors, texture patterns and other graphical patterns (Lowe,2004). The CBIR was further enhanced to Tattoo-ID system a domain-specific image retrieval system. It retrieves the appropriate features through Scale Invariant Feature Transform (SIFT) (Aisen, '*et al*',2003) to find the duplicate tattoos from the large database. SIFT is the popular method used for object recognition and CBIR. There are two stages in the local representation SIFT scheme like keypoint extraction and descriptor calculation. To automate the pill image matching system, the variance in the appearance, change in viewpoint, illumination are taken into account. The imprint patterns are characterized through gradient magnitude information (Geradts, Bijhold, 2002). The two-dimensional cross-relation functions were used for matching the orthogonal co-ordinates with log polar data. Orthogonal co-ordinates are the variants of translation, scaled and rotated images (Feng, and Milanfar, 2002).Keyword- based retrieval system was developed to match the imprints on the pills. The major limitation is that the keywords are subjective and do not attain the accurate identification since the system does not capture all information. As a final note, the background complexities in pill identification system are ascertained through the related works and the proposed system is designed and discussed in the next section.

Fig. 1: Legal pills.

Fig. 2: Illegal Pills.

Methods:

The proposed system is organized to identify the legal and illegal pills. This work focus on the pre-processing techniques called Image registration and Corner detection. The former technique includes two distinct methods like SURF feature extraction and HAAR wavelet. The later technique includes the Harris corner method. The complete progression in pills identification system is illustrated in figure 3 and the specific work is illustrated in figure 4

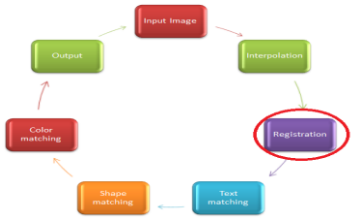


Fig. 3: Steps in Pills Identification system- overview.

The above figure demonstrates five major steps in pills identification process. The initial step after getting the input image is Interpolation that scales the image by reducing the blur, error and jagged edges. In the next step the registration is proposed to handle the noise and to extract the appropriate features. These features are matched by color, shape and imprints characteristic of the original image and the output is determined whether the input pill image is legal or illicit.

To strengthen the identification progression the registration module is enhanced and proposed in this paper. The framework of the proposed work is shown below in figure 4. The two folds in this module is feature extraction and corner detection. In feature extraction the noisy features are discarded and relevant features are selected. The corner detection approach detects the high frequency pixels in the intersection points. Through this the overall performance is improved. The forthcoming sections discuss about the approaches concisely.

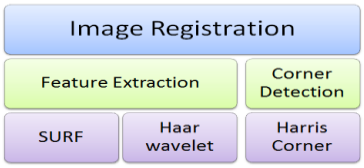


Fig. 4: Framework of the Image Registration module.

This paper emphasis on the registration phase where in the noisy features are discarded and relevant features are selected. Image registration is defined as the process of transforming different sets of data (photograph images, sensors, times, depths, etc) into one coordinate system. It is widely used in the applications like medical imaging, recognition system, biological imaging and many others. This registration phase plays a key role in image mining because it compares and integrates the data obtained from different dimensions. Image registration is the process of finding the correspondence point between two same scene or object images. There are three different concepts associated in finding the correspondences like interest points (detectors),neighbourhood points and descriptor vectors. A wide variety of detectors and descriptors were proposed in the related works but all satisfies in the performance factor, hence the distinctive and fast detector is called SURF (Speeded up Robust Features) is adopted in this paper. Successively, the procedures of SURF feature extraction are discussed.

SURF (Speeded Up Robust Features) is a local feature detection method developed and presented by Herbet Bay *et al*. in 2006. It is mainly used in object recognition and inspired by SIFT (Scale Invariant Feature Transform) descriptor. There are two notions in SURF they are detector and descriptor. Hessian matrix is used for detection and Haar wavelet transform is used for description. These notions are relatively faster than the SIFT descriptor.

In SURF the interest point detection is handled by Hessian Matrix which relies on integral images for fast detection. The Laplacian of Gaussion (LoG) is used in hessian matrix in order to increase the matching speed and robustness.

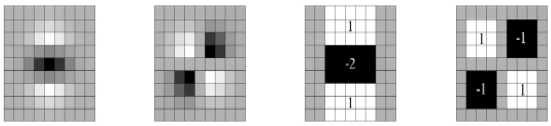
The integral image $I_{\Sigma(x)}$ at a location x=(x,y) is defined as the sum of all pixels in the input image I of a rectangular region that are formed by the point x and the origin and it is represented as

$$I_{\Sigma(x)} = \sum_{i=0}^{i\leq x}\sum_{j=0}^{j\leq y} I\,(i,j) \tag{1}$$

The Hessian matrix $H(x,\sigma)$ in x at scale σ is represented as

$$\mathcal{H}(\mathrm{x},\,\sigma) = \begin{bmatrix} L_{xx}(\mathrm{x},\,\sigma) & L_{xy}(\mathrm{x},\,\sigma) \\ L_{xy}(\mathrm{x},\,\sigma) & L_{yy}(\mathrm{x},\,\sigma) \end{bmatrix} \tag{2}$$

where Lxx$^{(x,\sigma)}$ is the complication of the Gaussian second order derivative $\frac{\partial^2}{\partial x^2} g(\sigma)$ in the image I at the point x. This is similar for Lxy$^{(x,\sigma)}$ and Lyy$^{(x,\sigma)}$. These Gaussian approximations are non-ideal and it is alternated by 9 x 9 box filter that uses Dxx, Dyy and Dxy approximation with $\sigma = 1.2$ as shown in figure 5.



(a) (b) (c) (d)

Fig. 5: 9 x 9 Box filters.

In the above figure 5 (a) represents the Gaussian second order partial derivatives in y-direction, xy-direction in 5(b), box- filter approximation in 5 (c) and zero approximation in 5 (d).Hence, the box-filters smoothen and scale the images. It also highlights the relevant features and allows the extraction to the features of all sizes.

The feature description vector provides a comparable observation between two points. It is handled by Haar wavelets. This wavelet transforms the object into matrix form. It is more efficient to integral images. Wavelet-based feature selection provides substantial improvements in image quality at higher compression ratios. This sequence was proposed in 1909 by Alfred Haar. The Haar wavelet is also the simplest possible wavelet. The

technical disadvantage of the Haar wavelet is that it is not continous, and therefore not differentiable. The haar wavelet is denoted as

$$\psi(t) = \begin{cases} 1 & 0 \le t < 1/2, \\ -1 & 1/2 \le t < 1, \\ 0 & \text{otherwise.} \end{cases} \quad (3)$$

and its scaling function φ(t) is denoted as

$$\phi(t) = \begin{cases} 1 & 0 \le t < 1, \\ 0 & \text{otherwise.} \end{cases} \quad (4)$$

The Haar transform is computed by the following equation

$$\frac{1}{\sqrt{2}}\begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix} \quad (5)$$

Fig. 6: Noisy Features.

Fig. 7: Feature Extraction.

The above figure 6 shows the sample input with the noisy feature and figure 7 shows the output of the feature extraction portion. As a final note, the wavelet scales the images and selects the appropriate features by removing the noise.

Corner Detection method:

Corner detection is an approach used in different applications in order to extract certain kinds of features and infer the contents of an image. Often corner detection overlaps the interest point detection. In this paper it is accomplished by Harris corner detection which is based on function called auto-correlation function. This detection measure the local changes of the input with the features or pixels that are shifted by a small amount in different directions and it is defined as in equation 6 where w represents the window size and I(x,y) represents the intensity value.

$$c(x,y) = \sum_W [I(x_i, y_i) - I(x_i + \Delta x, y_i + \Delta y)]^2 \quad (6)$$

Changes in the intensity for the shift (u,v) is given by

$$\boldsymbol{E(u,v) = \sum_{x,y} w(x,y)[I(x+u, y+v) - I(x,y)]^2} \quad (7)$$

The harris corner derivation are given by

$$\sum [I(x+u,y+v) - I(x,y)]^2 \quad (8)$$

$$\approx \sum [I(x,y) + uI_x + vI_y - I(x,y)]^2 \quad (9)$$

$$= \sum u^2 I_x^2 + 2uvI_xI_y + v^2 I_y^2 \quad (10)$$

$$= \sum \begin{bmatrix} u & v \end{bmatrix} \begin{bmatrix} I_x^2 & I_xI_y \\ I_xI_y & I_y^2 \end{bmatrix} \begin{bmatrix} u \\ v \end{bmatrix} \quad (11)$$

$$= \begin{bmatrix} u & v \end{bmatrix} \left(\sum \begin{bmatrix} I_x^2 & I_xI_y \\ I_xI_y & I_y^2 \end{bmatrix} \right) \begin{bmatrix} u \\ v \end{bmatrix} \quad (12)$$

Fig. 8: Corner Detection in pills identification.

Thus the Harris corner algorithm detects the corner points and accelerates the performance of further process.

RESULTS AND DISCUSSIONS

The experiment is carried on the pharmaceutical database and the results are shown as follows. The outcome of the pill identification system is determined by using MATLAB.

1.1 results for matched pill:

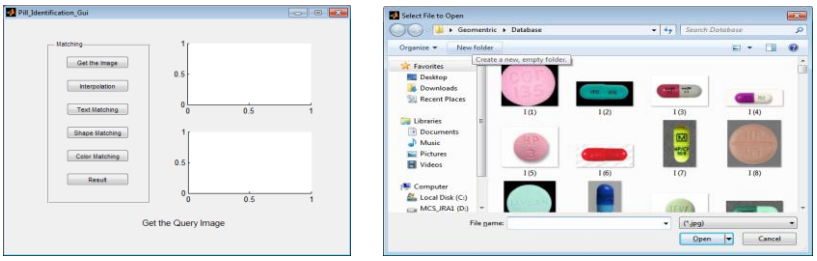


Fig. 9: Input Process.

Fig.10: Interpolation, Registration and Text matching Phases.

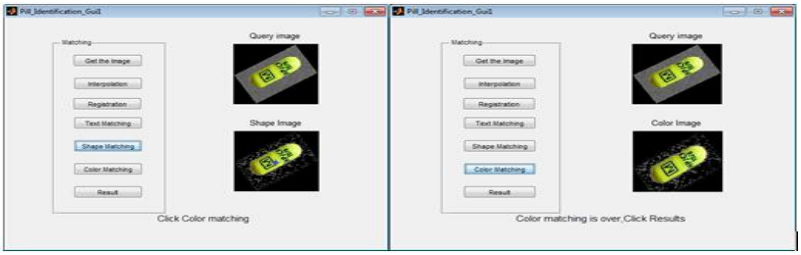


Fig.11: Shape matching and Color Matching.

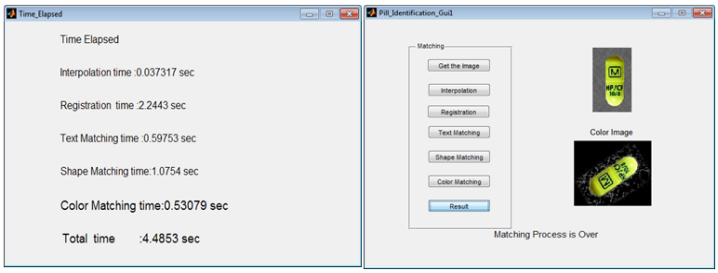


Fig.12: Result for matched pills with processing time.

1.2 Results For Not -Matched –Pill:

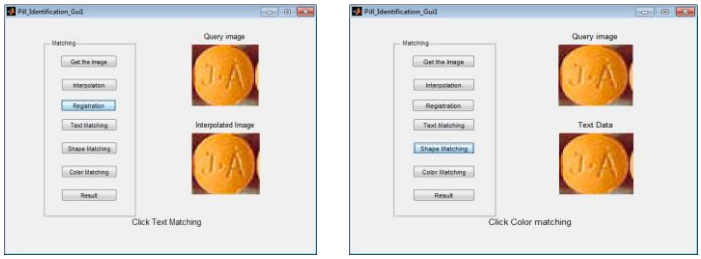


Fig.13: Input process.

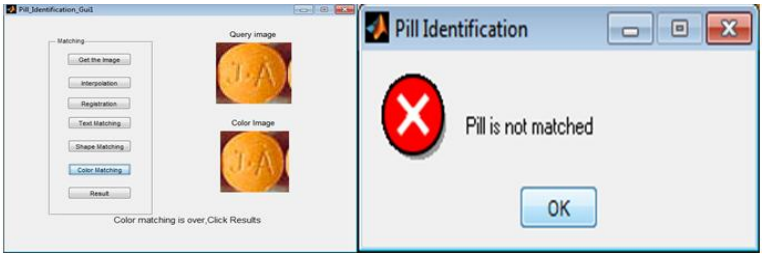


Fig.14: Result for the unmatched pills.

The number of valid features selected by the proposed methodology is compared against the other wavelets methods. Table 1 and Figure 16 shows the result obtained by the Haar wavelet method and the features selected by this method are comparatively high towards the other wavelets.

Table 1: Features selected by Haar and other methods.

Number of valid features points					
Image	Haar	Daubechies(4)	Symlets(5)	Coiflet(5)	Discrete Meyar
Image1	178	152	163	147	125
Image2	203	195	184	169	140
Image3	112	68	73	59	53
Image4	124	117	119	105	96
Image5	148	136	140	124	118

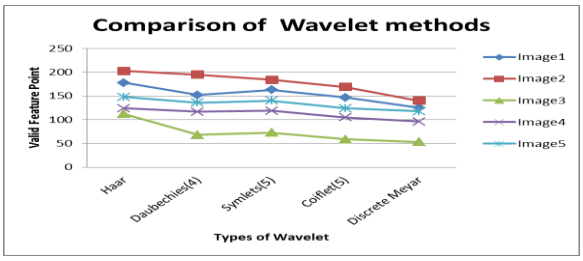


Fig. 16: Haar Wavelet Comparison.

As a final note the outcome of the experiment shows that the Identification process is simplified through the registration phase. The time taken by each phase is shown in Figure 12.

Conclusion:

The paper proposes the pre-processing techniques that insist on the two major concepts such as Image registration and Corner detection. Through this result analysis it is observed that the registration phase incurs more time than other phases because it simplifies the process of other phases. This phase removes the redundant and noisy features and detects the corners. Conclusively, the amalgamation techniques make the further process fast, robust and accurate. In future the consequence faced in this work can be focused.

REFERENCES

AGS, Expert Panel, 2012. Guiding Principles for the Care of Older Adults with Multimorbidity: An Approach for Clinicians, American Geriatrics Society Expert Panel on the Care of Older Adults with Multimorbidity, JAm Geriatr Soc, Special Articles,1-25.

Aisen, '*et al*., 2003. in, Automated storage and retrieval of thin-section CT images to assist diagnosis, System description and preliminary assessment, Radiology, 228: 265-270.

Feng, and Milanfar, 2002. Multiscale principal components analysis for image local orientation estimation, Proceedings of the (36th Asilomar) Conference on Signals, Systems and Computers, 478-482.

Geradts, Bijhold, Content based information retrieval in forensic image databases, Journal of ForensicScience, 47(2): 285-292.

Hsu, '*et al*., 2009. A Web-based image retrieval system for large biomedical databases, International Journal of Medical Informatics, 78: S13-24.

Lee, *et al*., 2012. Pill-ID: Matching and retrieval of drug pill images, Pattern Recognition Letter, 33(7): 904-910.

Lowe, 2004. Distinctive image features from scale invariant key points, International Journal of Computing Vision, 60(2): 91-110.

National Drug Threat Assessment, 2009. National Drug Intelligence Center, U.S. Department of Justice.

Ojala,*et al*., 2002. Multi-resolution gray-scale and rotation invariant texture classification with local binary patterns, IEEE Transaction on Pattern Analysis Machine Intelligence., 24(7): 971-987.

Pill identifier - drugs.com. (Online). Available: http: // www. drugs.com/pill identification.html.

Walters, J., 2000. Drug Policy Information Clearinghouse Fact Sheet, Office of National Drug Control Policy.