Smart Attendance Management and Analysis with Signature Verification

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Abstract: The main Aim of this project is to make Smart Attendance Management and Analysis System where after getting individual's signature of the student, the signature is scanned and converted into an image file. After segmentation, features are extracted from the signature. Verification of signature is made with the Database of student's Signature and Excel sheet of absence and presence of student's attendance is generated.

Keywords: Contourlet, Moment Invariants, feature extraction, Excel sheet.

I.INTRODUCTION

Signature is one of the most popular and legally accepted biometrics used in one's person identification. A handwritten signature is one of the ways to verify person's identity in legal, financial and administrative areas.

The objective of signature verification is to identify the unique characteristics of person's writing style. It has been widespread nowadays because the collection of the signature is non-invasive and people are also familiar with the signature in their daily life. Handwritten Signature is different from the biometric system is that to identify the correct signature of a particular person. In this system, the user provides signature samples and then classify that signature that it is a genuine or forgery. Forgery Signature can be classified into three types: Random, Skilled and Simple forgeries. In Random forgery, the forger has no information about user signature and randomly done the signature it will present an Overall shape of signature. In simple forgery, forgery knows the user but has no idea about user's signature and do sign in his/her style. In Skilled forgery, forgery knows about user's signature information so to identify skilled forgeries are very hard to identify. Skilled forgery made more practices of user's signature to do forgery signature of the user.

The signature can be acquired in two forms: Online and Offline.In Online signature is acquired by digital devices like it can be biometric technology that signature can be done on digitized devices like tablet or phone. The user can do signature by the digital pen in tablet etc. In Offline, the user needs to do signature in their attendance sheet and then each signature is scanned and sampled in the individual signature. System based Optical Character Recognition (OCR) are now available commercially at an affordable cost and can be used to recognize many printed fonts. In this, OCR has been used to identify the enrollment number of the student.

Handwritten Character Recognition (HCR) system typically involved two steps: feature extraction in which the patterns are identified by a set of features and classification in which decision rules for separating pattern classes are defined. Features can be broadly classified into two different categories: Statistical features (derived from the statistical distribution points like Zoning, Moments, tuples, characteristic loci…) and structural features (like strokes of line segments, loops and strokes relation…). Statistical and structural features appear to be complementary, as they highlight different properties of the characters [2] The Contourlet transform introduced by Do and Vetterli is found to capture smooth contours in the signature.

II. MOTIVATION AND OBJECTIVES

Usually nowadays, attendance has been done in digital type like biometric system. But there are some areas where this system is not there so it's my approach to do analysis of signature in offline way. Attendance sheet of student will be generated at the end of month or year or semester etc after comparing student database with the datasheet. Analysis of student signature will be done and absence and presence of student attendance sheet will be generated .So anyone can analysis the signature .This can be help in academic system and it can be real time implementation. The signature will be analysis with contourlet transform.

III RELATED WORK

Muhammad Reza Pourshahabi , Mohamad Hoseyn Sigari, Hamid Reza Pourreza [1] proposed Contourlet transform is used as a feature extractor and Signature image is enhanced by filtering noise and then normalise the image by its size.After preprocessing ,contourlet transform is computed and feature vector is created.Euclidean distance is used as a classifier. K N Pushpalatha, Supreeth Prajwal S, A K Gautam, K B Shiva Kumar [2] proposed signature identification and verification is done by contourlet and HMM used as classifier Contourlet transform and concatenated with textural features and compare with HMM classifier using HTK tool.The proposed system achieved 93.4% rate with better FAR and FRR when compared with existing systems. Priyanka Baguli & Leena Ragha "Offline Signature Verification Using HU'S Moment and Gabour Wavelet Transform[3] proposed Hu's transform extract features from signature and make it invariant to translation, rotation and scaling. Radon transform gives projected an image of signature at a different angle. And on image applying Hu's transform gives more features at various angles. Minh N. Do and Martin Vetterli[4] proposed The statistical framework has been applied successfully in a wavelet-based texture retrieval application, where wavelet coefficients in each subband are independently modeled by a generalized Gaussian density (GGD). Yaser S. Abu-Mostufa and Demetri Psaltis[5] proposed Moment Invariants used as feature space for pattern reorganisation in terms of power and noise tolerance. The notion of complex moments is done by moment invariants. Complex moments are characterised by moment invariants Aspects like information loss, redundancy, suppression are encountered in moment invariants and results are derived. M. S. Shirdhonkar, Manesh Kokare[6] proposed Curvelet transform is used for identifying and verifying the signature for feature extraction. The results obtained that the proposed system is able to identify signature with great accuracy even when part of the signature is missing. The feature is extracted from the signature and retrieval of the signature is done by characterising edges and compare the results with discrete wavelet transform. Discrete wavelet transform decomposes the image into four sub-images when one level of decomposing is used. One of the image is smoothed and other are high pass that represents horizontal, vertical edges Based on comparing images retrieval performance is calculated. Ozgunduz et al have presented [6] an off-line signature verification and recognition system using the global, directional and grid features. SVM has been used in order to verify and classify the signatures and a classification ratio of 95% has been obtained. For the recognition of signatures is accounted as a multi-class problem type, one-against-all SVM method has been used. In addition, this method's performance has been compared with MLP. This comparison shows that SVM has better performance than MLP. Martinezet al [7] have presented an efficient offline human signature recognition system based on SVM and have compared its performance with an MLP. In both cases, two approaches have been used: (1) construction of each feature vector using a set of global geometric and moment-based characteristics from each signature and (2) construction of the feature vector using the bitmap of the corresponding signature. Sheikh Faisal Miskhat et al., [12] proposed a distinctive feature set for precise classification of signature like column sum, row sum, windowed dot count, horizontal slice, gradient histogram. Along with this special features such as windowed height and width of signatures, mean and median of the windowed dot count is also used. They have used two classifiers SVM and ANN. Both of these classifiers worked well for their distinctive feature set. Muhammad Reza Pourshahabi et aI., [7] proposed a system in which is Contourlet Transform is used as a feature extractor. Signature image is pre-processed by removing noise and normalizing the size. The Contourlet Transform has five significant features like multi-resolution, localization, critical sampling, directionality, and anisotropy. The feature vector has two parts. One part of feature vector contains all of the coefficients in the sub-bands and all other sub bands are converted into binary using Otsu's method which forms the second vector. All images of size 256*256 are divided into four blocks. Contourlet Transform is applied on each block separately and a feature vector is obtained for every block. Concatenating all the four created feature vectors final feature vector is obtained. Euclidean distance is used as a classifier to compare feature vectors with each other.

IV PROPOSED SYSTEM

In this paper, we propose a new offline signature recognition system. Our system consists of three stages: pre-processing, feature extraction and classification. In pre-processing stage includes image binarization and noise reduction we used the curvature and orientation as features by using contourlet transforms then simple distance used as a classifier. The signature samples from Database are used for training and testing. During training, the signature samples are pre-processed to filter unwanted noise and the features extracted are stored. In testing, the preprocessed and extracted features are used for classification. Figure 1 shows proposed a model of signature verification.
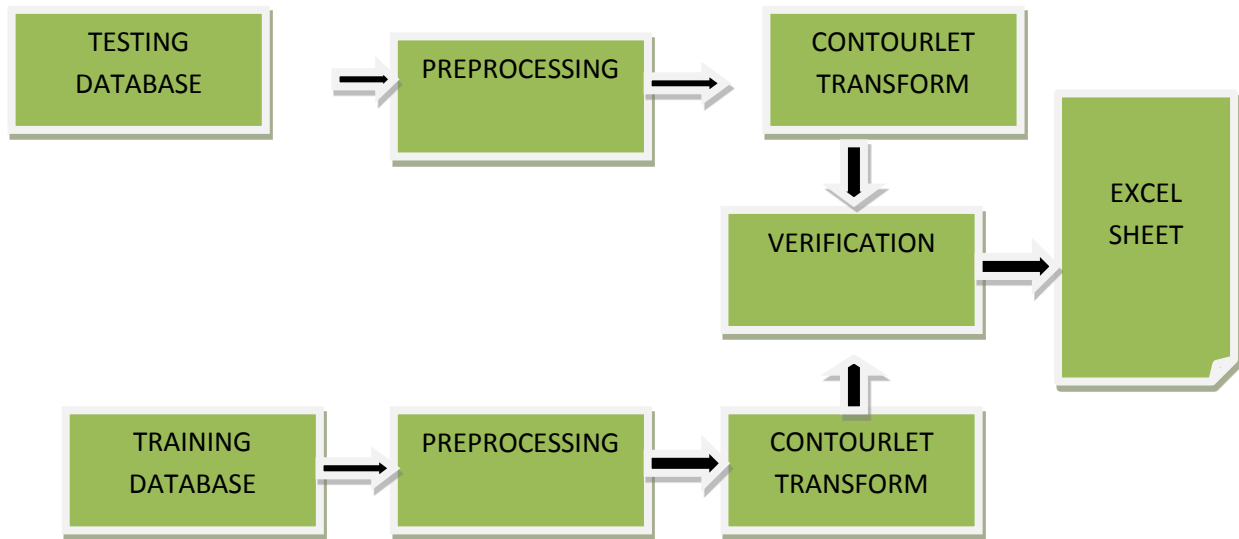
fig 1   block daigarm

SIGNATURE DATABASE: Each student's 5 signature samples are taken by signing them on the sheet and after signing the attendance sheet has been scanned at 100 dpi and after scanning the sheet all the signature has been cropped by line segmentation and samples are saved and 9 individual's   signature samples are saved in the database.

Fig 2 Scanned Sheet

After scanning the sheet the signature samples are cropped and database is created. All the signature are scanned and cropped by line segmentation and signature samples are obtained. By OCR the enrolment number is extracted and signature sample will be obtained.

Fig 3 Cropped Signature

PREPROCESSING OF SIGNATURE: After getting individuals signature samples the signature samples before verification the samples have been pre-processed. In pre-processing the feature has been extracted from the samples .The signature features extracted like gray scale, noise removal etc.
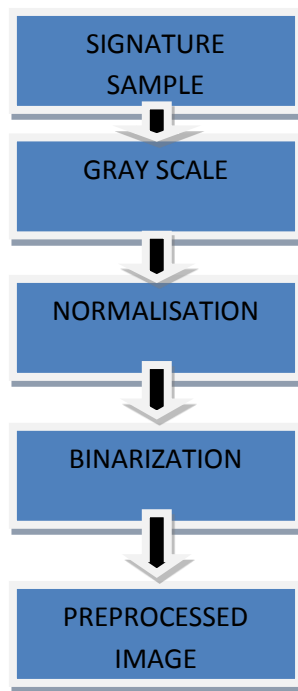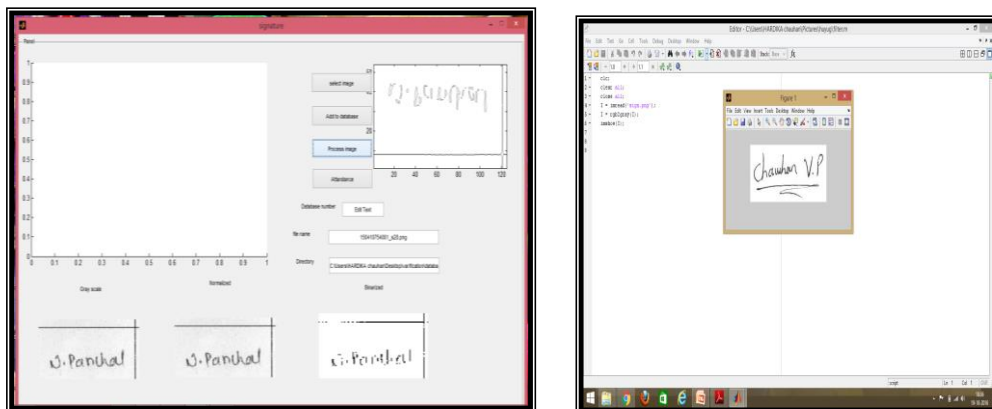
Fig 4 Flowchart Of Preprocessing

Fig 5 Preprocessing Steps

Here, GUI interface has been designed where the image has been selected, added to the database, pre-processed the image and saved in the database. Fig 5 shows the GUI interface of the signature sample. Fig 6 shows the pre-processing process which is grayscale

FEATURE EXTRACTION: After pre-processing the features are extracted from the signature using Contourlet transform and Moment Invariants.

A) Contourlet transforms: Introduced by Do and Vetterli [13] is a discrete filter bank structure where the smooth contours of the image are effectively represented and extracted. The directional discrete filter bank has a convenient tree structure in which the aliasing can be eliminated by suitable design of filters. The contourlet transform has significant features such as localization, critical sampling, Multiresolution, directionality, and anisotropy. Figure 7 shows the contourlet transform with which is a double filter bank consisting of Laplacian Pyramid (LP) and Directional Filter Bank (DFB). The input image is $x = a_0[n]$. The output after one level LP is two subbands – low-pass subband $a_1[n]$ and a bandpass sub-band $b_1[n]$. Similarly, if the iterations are continued on the corresponding outputs of LP and after J levels of the LP, we get J band passes images $b_j[n]$, j = 1, 2, 3, ... j_m (fine-to-coarse) and a low pass image $a_j[n]$. Then each band pass image $b_j[n]$ is decomposed by an I_j-level DFB into i band pass directional images $C_{j,k}[n]$, k = 1, 2, 3, ... 2^{Ij-1}. The Feature vector has two parts. As approximation sub-band contains overall information of the image, all of the coefficients in this sub-band are considered as one part of the feature vector. But, there is a need for some more detailed information. Therefore textural features such as Homogeneity, contrast, energy and correlation values were also extracted and the two vectors were concatenated to get the final feature vector. All signature images are 256 x 256 pixels size. Figure 8 shows the output of the Contourlet transforms applied on two different signatures.
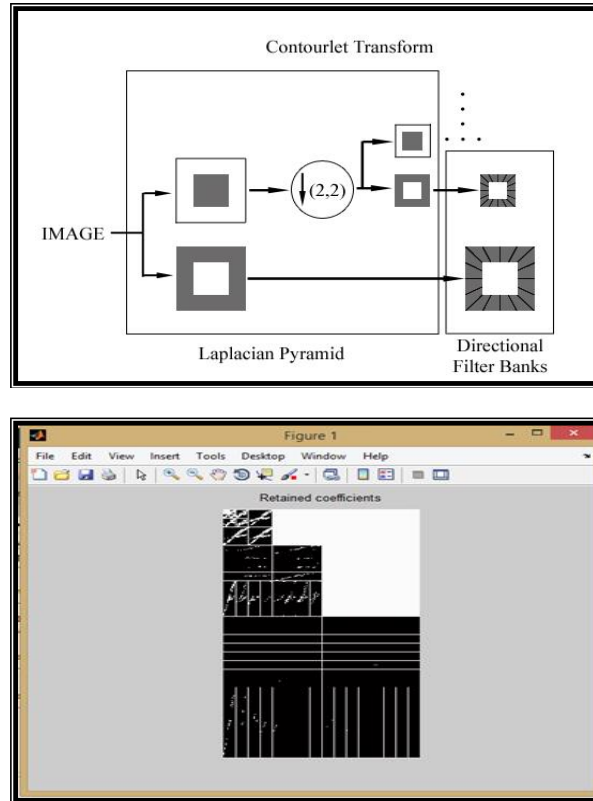
Fig 6 Contourlet Transform

Contourlet transform is applied on each block separately and a feature vector is created for that block. With putting the 4 created feature vectors together, the final feature vector is obtained [1].

After feature extraction by Contourlet Transform it is also done by another method Moment Invariant is applied to binary image and analysis were done and compare its results with contourlet transform which gives better results.

B) Moment Invariants: After contourlet , the feature is extracted by moment invariants and seven values of each sample give seven values of signature will be obtained. Seven moments are obtained and then feature vector is compared with the contourlet transform.

An essential issue in the field of pattern analysis is the recognition of objects and characters regardless of their position, size and orientation. The idea of using moments in shape recognition gained prominence when Hu (1962), derived a set of invariants using algebraic invariants [6]. They consist of groups of nonlinear centralized moment expressions. The result is a set of absolute orthogonal (i.e. rotation) moment invariants, which can be used for scale, position, and rotation invariant pattern identification [7].

In particular, Hu (1962), defines seven values, computed by normalizing central moments through order three, that are invariant to object scale, position, and orientation is as follows:

$$\emptyset_1 = \eta_{20} + \eta_{02}$$

$$\emptyset_2 = (\eta_{20} - \eta_{02})^2 + 4\eta_{11}^2$$

$$\emptyset_3 = (\eta_{30} - 3\eta_{12})^2 + (3\eta_{21} + \eta_{03})^2$$

$$\emptyset_4 = (\eta_{30} + \eta_{12})^2 + (\eta_{21} + \eta_{03})^2$$

$$\emptyset_5 = (\eta_{30} - 3\eta_{12})(\eta_{30} + \eta_{12})[(\eta_{30} + \eta_{12})^2 - 3(\eta_{21} + \eta_{03})^2] + (3\eta_{21} - \eta_{03})(\eta_{21} + \eta_{03})[3(\eta_{30} + \eta_{21} + \eta_{03})^2]$$

$$\emptyset_6 = (\eta_{20} - 3\eta_{02})[(\eta_{30} + \eta_{12})^2 - (\eta_{21} + \eta_{03})^2] + 4\eta_{11}(\eta_{30} + \eta_{12})(\eta_{21} + \eta_{03})$$

$$\emptyset_7 = (3\eta_{21} - 3\eta_{03})(\eta_{30} + \eta_{12})[(\eta_{30} + \eta_{12})^2 - 3(\eta_{21} + \eta_{03})^2] + (3\eta_{12} - \eta_{30})$$
$$(\eta_{21} + \eta_{03})[3(\eta_{30} + \eta_{12})^2 - (\eta_{21} + \eta_{03})^2]$$

Regular moments are defined as

$$M^{pq} = \iint X^p Y^q f(X,Y) \ldots\ldots\ldots\ldots(1)$$

Where for p, q = 0,1,2,….and Mpq is the (p+q)th order moment of the continuous image function f(x,y). If the image is represented by a discrete function, integrals are replaced by summations. Equation (1) can be written as follows,

$$M^{pq}= \sum \sum X^p Y^q f(X,Y)\dots\dots\dots\dots\dots(2)$$

The central moments of f(x,y) are defined by the expression. The normalized moments are invariant under translation, rotation, scale change and reflection. Moment Invariant is applied to pre-processed image and analysis done to obtain results.

$$\mu_{pq} \square\square \sum_X \sum_Y (X - \overline{X})^P (Y-\overline{Y})^q f(X,Y)\dots\dots(3)$$

Where and $\overline{X} = m_{10}/m_{00}$ $\overline{Y} = m_{10},/m_{00}$ which are the centroid of the image

$\mu_{10}= 0$

$\mu_{01} = 0$

$\mu_{11}= m_{11}-\overline{Y}\,m_{10}$

$\mu_{20} = m_{20}-\overline{X}m_{10}$

$\mu_{02} = m_{02}-\overline{Y}m_{01}$

$\mu_{30} = m_{30}-3\overline{X}m_{20}+2\overline{X}^2 m_{10}$

$\mu_{03} = m_{03}-3\overline{Y}m_{02}+2\overline{Y}^2 m_{01}$

$\mu_{21} = m_{21}-2\overline{X}m_{11}-\overline{Y}m_{20}+2\,\overline{X}^2 m_{01}$

$\mu_{12} = m_{12}-2\overline{X}m_{11}-\overline{X}m_{02}+2\overline{Y}^2 m_{10}$

The normalized central moment to shape and size of order (p+q) is defined

$$\mu_{pq} = \mu_{pq} / \mu_{00}^{\gamma} \dots\dots\dots \text{ for p,q= 0,1,2}$$

Where $\gamma =\dfrac{p+q}{2} + 1\dots\dots\dots\text{for p+q =2,3}$

Moment invariants are features of the image which are calculated in terms of ordinary moments and have the property that they retain their exact values (i.e., they are invariant) when the image is shifted, scaled, or rotated.

Moment invariants were originally established from the relation between moments and the mathematically developed algebraic invariants. The moment invariants (MIs), are used to evaluate seven distributed parameters of a numeral image. In any character recognition system, the characters are processed to extract features that uniquely represent properties of the character. The MIs are well-known to be invariant under translation, rotation, scaling and reflection.

*SIGNATURE VERIFICATION***:** After feature extraction, the last step of the analysis is to compare the signature with training data and take the threshold that which method gives better results and better identification rate FAR and FRR. After verifying the signature the excel sheet is generated where presence and absence of student are done and automatically attendance sheet is generate
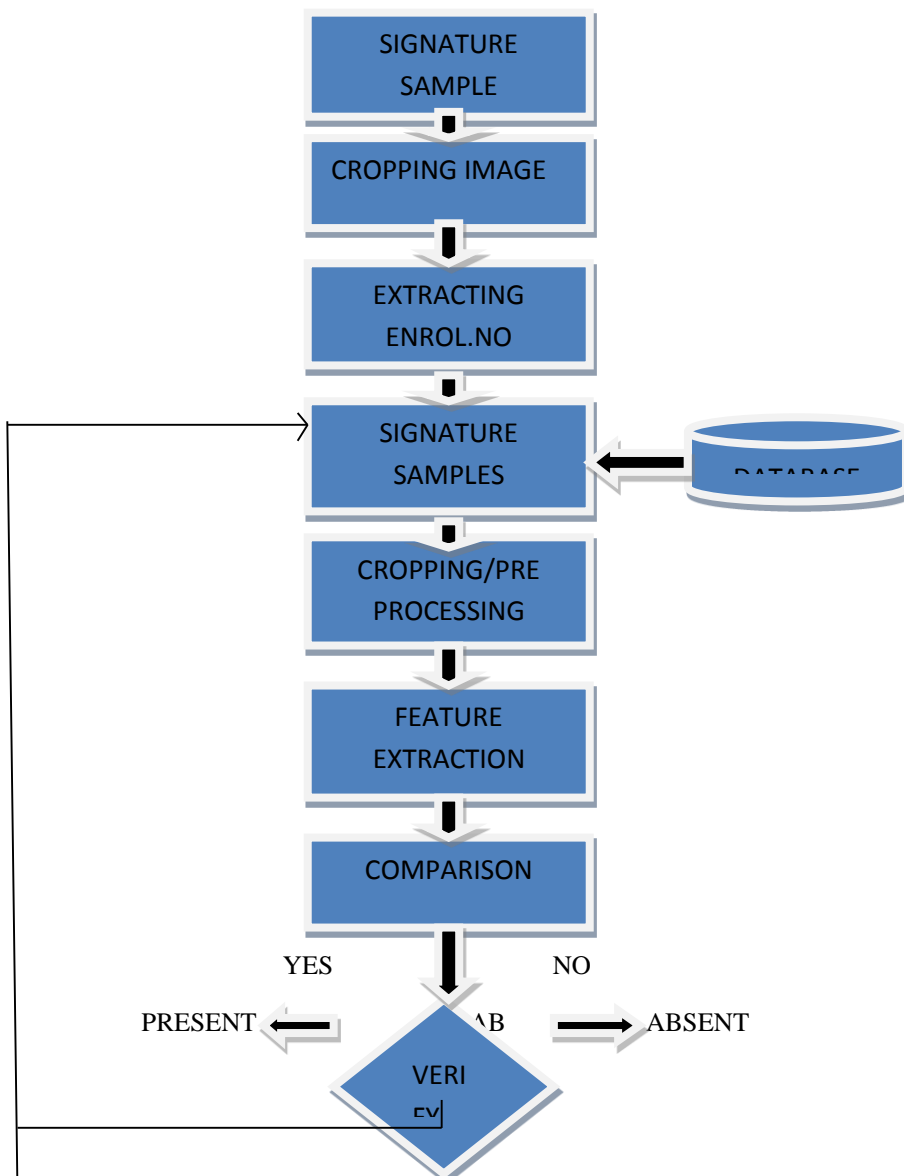
Fig 7 Flowchart of System

V SIMULATION AND RESULTS

Here GUI has been designed for signature added to the database, pre-processing of signature and results are obtained In this GUI, the image can be added to the database, enrolment number can be added, the title of the image can be added and pre-processed the image. First, the attendance sheet is scanned and cropped into image and enrolment number is traced by OCR.

After cropping the signature, the database is created in MySQL so that database can be further globally accessed if needed in future. Simulation is done on this signature image and methods are applied to pre-processed image. Methods like Contourlet transform is applied and we obtained a reconstructed image from the original image.
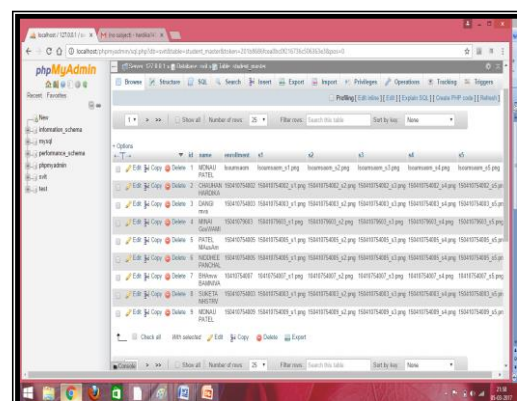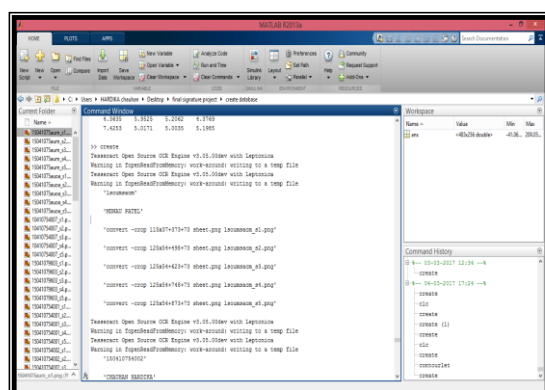
FIG 8 CROPPING IMAGE

The another feature extractor is used as moment invariants, on done in the signature and remain invariant and seven values are obtained from each sample and there are 9 samples we would get 35 samples and each sample will obtain seven values as a feature vector and compared with the contourlet transform.
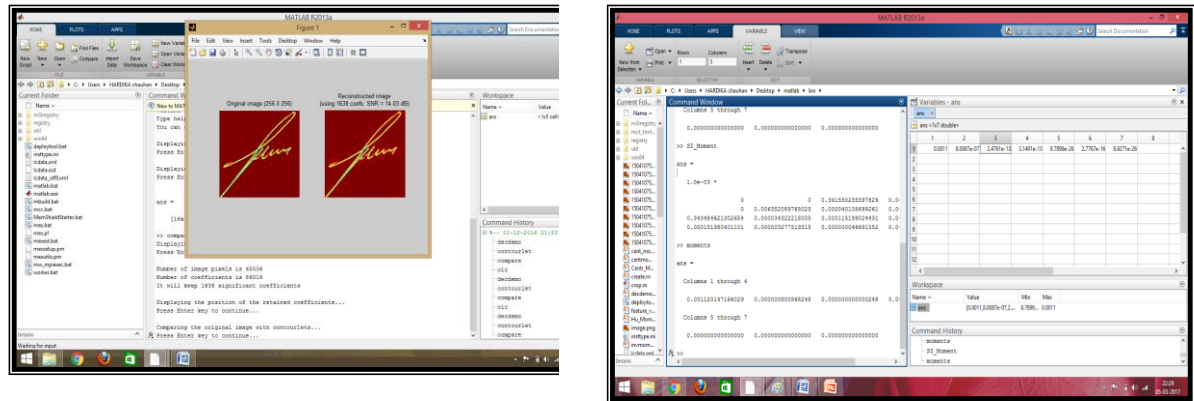

Fig 9 Contourlet Transform And Feature Vector

As above the seven values of the, each sample will be obtained after the moment invariant the comparison is done between contourlet and moment invariant.
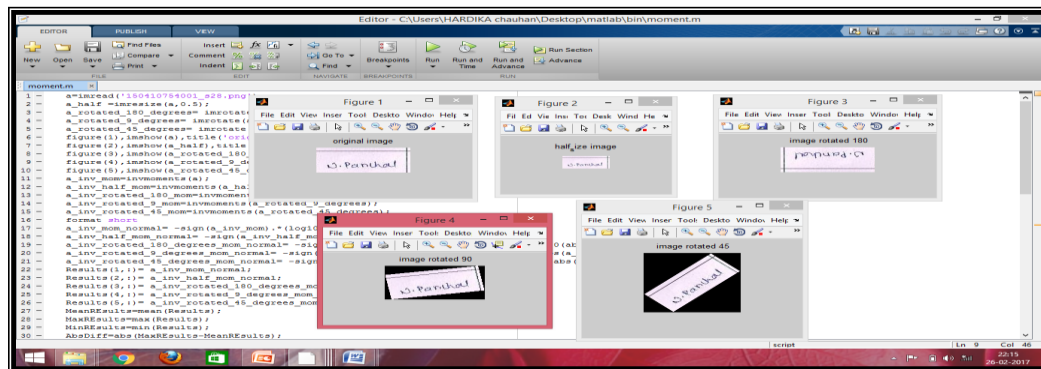

FIG 10 MOMENT INVARIANTS

ENROL NO	3/1/2017	4/1/2017	5/1/2017
150410754001	P	P	P
150410754002	P	A	A
150410754003	P	A	A
150410754004	A	P	P
150410754005	A	A	P
150410754006	P	P	P

After comparison presence and absence of student are done and excel sheet is generated.

FIG 11 ATTENDANCE SHEET

VI CONCLUSION

In this paper, signature verification of student is done and after each signature scanned and the feature is extracted from contourlet transform and moment invariant from there feature vector are obtained and compared with both methods with testing and training data. After comparison, the presence and absence of student are done in excel sheet.

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