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Implementation of offline signature verification based on LBP and LDP techniques on Beagle Board XM

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Abstract-The main objective is to design and implement offline signature verification based on LBP and LDP technique on BegalBoard-XP hardware using OpenCV software. This will help you to know the efficiency of the algorithm on a processor. To design efficient algorithm for offline signature verification. To improve performance parameters like FAR, FRR, TSR. Implementation of the algorithm using Begalboard.In off–line signature recognition we are having the signature template coming from an imaging device, hence we have only static characteristic of the signatures. The person need not be present at the time of verification. Hence off-line signature verification is convenient in various situations like document verification, banking transactions etc.

Keywords-LBP,LDP,FAR,FRR,TSR.

I.INTRODUCTION

Recoginizing a person using Biometrics is more secure and reliable means for person identification.Since biometrics are the characteristic feature of every human being it will be impossible or an uphill task for miscreant person for hacking the biometric system.Since biometric traits are natural and god given they will be the permanent source of identification for every human being in the world.Recognition through biometrics is a way of determining identity of every person considering his natural characteristics of a person.Hence biometric serves as a very useful tool in present day world for our day to day activities. Identifying every human being through their personal characteristics and attributes uniquely is very important for smooth function of the society.The set of characteristics associated with the person helps individually in his unique identification in this vast society.People used to generally used to identify the person by physically seeing each other or through the help of listening his/her voice through the communication system such as mobile/telephone. A biometric framework determines one or more physical or behavioral qualities,including fingerprint, print of palm, image of face, retina,odour to confirm his/her identity. These qualities can be called by distinctive terms, for example, characteristics, pointers, identifiers, or modalities.The different traits considered in a biometric system considered with respect to a person were shown in the figure 1.

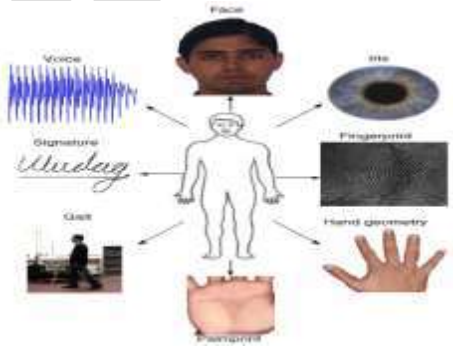


Figure 1:- Different Biometrical traits considered for Person recognition

handwritten signature checking has been widely mulled over & actualized. Its numerous applications incorporate charge card approval, managing an account security frameworks and so on , handwritten signature confirmation can be classified into two sorts.

1. Online verification.

2. Off–line verification.

Online check needs a stylus and an electronic tablet joined with a PC to snatch dynamic mark data. In On–line approach we can gain more data about the signature which incorporates the dynamic properties of signatures. We can remove data about the pace of pen, weight , quickening and strokes and also the static qualities of signatures.This is all that much precise in light of the fact that the dynamic components are extremely hard to copy, yet the framework requires co-operation of client and complex equipment framework. Digitizer tablets or weight delicate pads are utilized to sweep signature alterably. Off–line check, manages signature data which is in a static format.In off–line signature acknowledgment we are having the signature layout originating from an gadget which catches the picture, subsequently we get just static normal characteristics of the signature.At the time of check, the individual ought to be on location. Henceforth offline signature verification is helpful in different circumstances like archive confirmation, saving bank exchanges and so on. As we have a constrained arrangement of components for check reason, offlinesignature acknowledgment frameworks should be composed precisely to accomplish the wanted precision.

II. RELATED WORKS

Earlier they used Robust Off-line Signature Verification taking into account Global Features for irregular and talented manufactured marks. The model concentrates the components which are preprocessed by standardization, diminishing and binirisation.The highlight extraction system incorporates global features, for example, most extreme flat histogram, viewpoint proportion, greatest vertical histogram, level and vertical focus of mark and signature zone.But larger efficiency could not be achieved by this method,so in order to overcome this an alternative method is proposed.that is offline signature confirmation plan taking into account 60 component points acquired from the signaturess geometric focus and contrasts them and the effectively prepared companent points. Highlight focuses are characterized in view of measurable parameters like fluctuation and mean. The above plan separate between two sorts of forged and original signatures. The technique deals with talented and irregular frauds. The point of this work is to decrease the two fundamental parameters called False Acceptance Rate (FAR) and False Rejection Rate (FRR) ordinarily utilized as a part of any signature check plan. At last similar examination has been made with standard existing plans.

III. PROPOSED METHODOLOGY

In this, the signature identification is used to recognize a person. The signature samples are preprocessed and features are extracted using Local Binary Pattern and Local Directional Pattern techniques. The block diagram of proposed model is given in Figure 2 Here both LBP and LDP features are compared and both should match the original signature. The GPDS300 signature database is considered. Signatures are extracted from users on a white sheet at various periods depending upon his intrest level and pressure levels and are scanned to get pictures of 96 dpi resolution in png format to build a database. Test Signature Preprocessing LBP/LDP features Feature Vector Signature Database Preprocessing LBP/LDP features Feature Vector Euclidean Distance Match/Mismatch

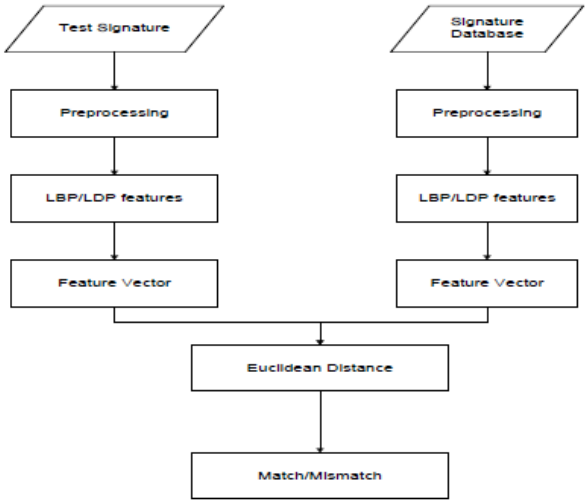


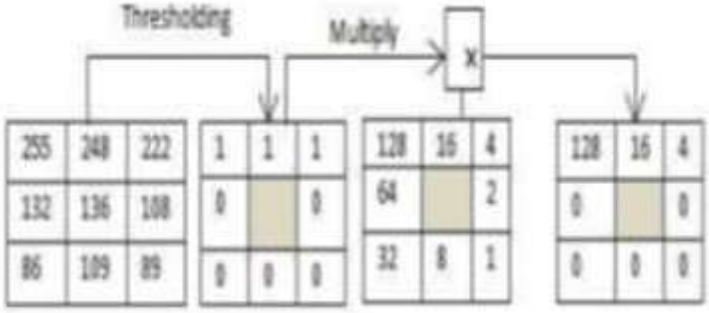
Figure 2:-Block diagram of the proposed Model for LBP/LDP

3.3.1LOCAL BINARY PATTERN: The Local Binary Pattern (LBP) highlight is characterized as measure of grey level composition in a nearby neighborhood. The essential characterstic of the LBP administrator is its invulnerability against varieties in monotonic grey level . Additionally similarly essential is its effortlessness included in processing. LBP administrator fundamentally portrays the neighbourhood of a pixel. Each ILBP(x, y) code is carried out as given: the eight encompassing pixels are binarized considering as threshold the middle grey level worth I(x, y), creating a binary 1 if the neighbor is more higher than or equivalent to the threshold ; else it delivers a binary 0. The eight binary number are indicated by 8-bit number which are stored in ILBP(x, y), it ought to be in the scope of 0 to 255

$$I_{LBP}(x,y) = \sum_{n=0}^{7} s(I_N(n) - I(x,y)) \cdot 2^n,$$

where $s(l) = \begin{cases} 1 & l \geq 0 \\ 0 & l < 0 \end{cases}$ the unit step function

Eg of LBP operator



In this case I (x,y) =136.IN(n) = {89,108,222,109,248,86,135,255 }, IN(n) > I(x,y) =1 or else 0.so we get the set as {0,0,1,0,1,0,0,1}, so ILBP(x,y)=4+16+128=148. LBP could also be further used to rotation invariant operator and generalized gray level operator. The main drawback of LBP is it gets easily affected by noise and dependency on pen. Everyone must write using the same pen since LBP is more capable to acquire the distribution of personal ink when all signers use the same pen. But when the personal ink distribution involves variations of pen, in such a cases the efficient algorithm could be LDP.

3.3.2 LOCAL DIRECTIONAL PATTERN: This feature converts the input image I(x, y) to ILDP(x, y), $2 \leq y \leq M-1$, $2 \leq x \leq N-1$, Where the edge response is represented by ILBP(x,y) . accordingly determines edge response values in 8 different directions for I (x, y) using masks which is referred as Kirch in all possible eight angular directions.

KIRCH COMPASS MASKS

Here we characterize the mask by taking a solitary mask and pivoting it to eight conceivable compass directions: North, West, South, East, northwest, northeast,southeast,southwest .The masks are characterized as : The edge reaction is the most extreme value found by convolution of every mask with the picture. The heading is given by mask that creates the crest size.

$$M_0=\begin{bmatrix}-3 & -3 & -3\\ -3 & 0 & 5\\ -3 & 5 & 5\end{bmatrix}\quad M_1=\begin{bmatrix}-3 & -3 & -3\\ 5 & 0 & -3\\ 5 & 5 & -3\end{bmatrix}\quad M_2=\begin{bmatrix}-3 & -3 & -3\\ -3 & 0 & -3\\ 5 & 5 & 5\end{bmatrix}\quad M_3=\begin{bmatrix}5 & -3 & -3\\ 5 & 0 & -3\\ 5 & -3 & -3\end{bmatrix}$$

$$M_4=\begin{bmatrix}5 & 5 & -3\\ 5 & 0 & -3\\ -3 & -3 & -3\end{bmatrix}\quad M_5=\begin{bmatrix}5 & 5 & 5\\ -3 & 0 & -3\\ -3 & -3 & -3\end{bmatrix}\quad M_6=\begin{bmatrix}-3 & 5 & 5\\ -3 & 0 & 5\\ -3 & -3 & -3\end{bmatrix}\quad M_7=\begin{bmatrix}-3 & -3 & 5\\ -3 & 0 & 5\\ -3 & -3 & 5\end{bmatrix}$$

$$m_l=\sum_{i=0}^{2}\sum_{j=0}^{2} I(x-1+i,y-1+j)\cdot M_l(i,j),$$

$$0\le l\le 7$$

peak output values in each particular orientation is determined by The existence of edges and corners and their directions. ILDP(x, y) gives the k most required orientations. As a result, the top k magnitude values |m| are assigned to 1 and the rest of values are reset to 0. The obtained binary value is indicated by an 8-bit code word. In the given example k=3, so the LDP feature is obtained as shown below:

$$I_{LDP}(x,y)=\sum_{l=0}^{7} s\left(|m_l|-m_{l,3}\right)\cdot 2^n$$

E.g. I(x, y) = 136,m0 = M0(0, 0) I(x-1,y-1).+ M0(1, 0) I(x, y-1).+ xM0(2, 0) I(x, y-1).+ M0(0, 1) I(x- 1,y).+ M0(1, 1) I(x, y).+ M0(2, 1) I(x+1, y).+ M0(0, 2) I(x-1,y+1).+ M0(1, 2) I(x,y+1).+ M0(2, 2) I(x+1,y+1). here m is the third largest value of the sequence.{|m0|, |m1|, |m2|, …, |m7| when the values are equal, which means there are several values same as ml,3, the most significant bit is set to 1.

Kirch Mask	M_7	M_6	M_5	M_4	M_3	M_2	M_1	M_0
m_l value	-385	877	2053	1333	37	-1131	-1465	-1283
Rank	7	6	1	3	8	5	2	4
Code bit	0	0	1	1	0	0	1	0
LDP code	50							

calculation of the LDP code $I_{LDP}(x, y)$: I(x, y) =136.

$\{|m_l|, 0<=k<=7\} = \{1283, 1465, 1131, 37, 1333, 2053, 877, 385\}$

$m_{l,3}=1333, |m_l|>m_{l,3}=\{0, 0, 1, 1, 0, 0, 1, 0\}$

So $I_{LDP}(x, y)$ = 2+16+32 = 50

3.3.3 COMBINATION OF LBP AND LDP LBP features of pattern are obtained and given as input to Local Directional Pattern proposed in 3.3.4 and features are extracted, using these extracted features Euclidean Distance is calculated for match/mismatch of signature. Combination of LBP and LDP takes the advantage of both intensity information and directional edge response. IV RESULTS The performance parameters like FAR, FRR, EER, TSR are calculated using the Euclidean distances between the final feature coefficients of the test and database signatures. The database is created by considering 10 persons from GPDS 300 with five genuine signatures per person, i.e., fifty signatures are available in the database. In the test section genuine signatures are considered to compute FRR and TSR. The forged signatures are considered in the test section to compute FAR. The values of FAR, FRR and TSR for ten persons are tabulated in table. As threshold value increases FAR and TSR increases, whereas FRR decreases. Threshold FRR FAR TSR 0.520000 1.000000 0.000000 0.000000 0.530000 0.800000 0.000000 20.000000 0.690000 0.700000 0.200000 30.000000 0.710000 0.400000 0.200000 50.000000 0.810000 0.200000 0.600000 60.000000 0.830000 0.000000 0.600000 60.000000

Threshold	FRR	FAR	TSR
0.520000	1.000000	0.000000	0.000000
0.530000	0.800000	0.000000	20.000000
0.690000	0.700000	0.200000	30.000000
0.710000	0.400000	0.200000	50.000000
0.810000	0.200000	0.600000	60.000000
0.830000	0.000000	0.600000	60.000000

Table 1:- FAR, FRR, TSR for different thresholds calculated for 10 persons using LBP technique.

Threshold	FRR	FAR	TSR
0.440000	1.000000	0.000000	0.000000
0.460000	0.800000	0.000000	20.000000
0.600000	0.700000	0.000000	30.000000
0.640000	0.600000	0.200000	40.000000
0.660000	0.400000	0.200000	50.00000
0.700000	0.300000	0.300000	60.000000
0.720000	0.200000	0.400000	70.000000
0.770000	0.100000	0.400000	80.000000
0.810000	0.000000	0.900000	80.000000

Table 2:- FAR, FRR, TSR for different thresholds calculated for 10 persons using LDP technique.

Threshold	FRR	FAR	TSR
0.420000	1.000000	0.000000	0.000000
0.430000	0.900000	0.000000	10.000000
0.460000	0.800000	0.000000	20.000000
0.540000	0.700000	0.000000	30.000000
0.640000	0.300000	0.200000	60.000000
0.680000	0.200000	0.300000	70.000000
0.730000	0.100000	0.500000	80.000000
0.790000	0.000000	1.000000	90.000000

Table 3:- FAR, FRR, TSR for different thresholds calculated for 10 persons using combination of LBP and LDP

V. CONCLUSION AND FUTURE WORK

An Off-line Signature Verification System (OSVS) has been described is developed using a feature set comprising the Local Binary Patters and Local Directional Patterns features of the image. The Local Binary Patter will differentiate the genuine and forged signatures of different persons using intensity values whereas the Local Directional Patterns features will differentiate the genuine and forged signature of the person using directional response (edge detection). And their combination is used to overcome the limitation of the both the technique to verify the signature. The results have been tabulated and have been shown that it combination of both gives better EER and TSR when compared to the LBP and LDP technique. In future the results are expected to be further improved with the use of neural networks or SVM (Support Vector Machines), PCA (Principal Component Analysis) in the place of Euclidean distance classifier.

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