FABRIC IMAGE DEFECT DETECTION BY USING GLCM AND ROSETTA

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ABSTRACT

Automated visual inspections of industrial goods for Quality control plays an ever-increasing role in production process as the global market pressures put higher and higher demand on quality at lower cost. In most cases, the quality inspection through visual inspection is still carried out by humans. However, the reliability of manual inspection is limited due to fatigue and inattentiveness. The author did the literature survey on textile industry and the most highly trained inspectors can only detect about 70% of the fabric defects.

Keywords

Fabric defect, Gray Level co-occurance matrix (GLCM), Rough Set, Texture.

1 OVERVIEW

Image Analysis consists of two steps the former is feature extraction and the second part is recognition. Various techniques or tools that are presently in research for texture feature extraction are GLCM [1], Markov Random Field [11], Gabor filter[12]. We have used here GLCM with 20 haralick features.

The authors[10] had done a simulation Study for defect detection and estimation by taking 25 nice sample and 25 defective still image samples and then extracted the cloth image GLCM features (Total features 20).The feature are fed to Roseta Software and 52% correct classification was obtained.

2 METHODOLOGY

The co-occurrence matrix method of texture description is based on the repeated occurrence of some gray-level configuration in the texture. We are taking a window of size256 x 256 go on sliding until the completion of the total image.

The texture is measured according to the following formulas.

$P_{0^0},d(a,b) = |\{[(k,l),(m,n)]\} Є D:$

$k-m=0,|l-n|\ (k,l)=a,f(m,n)=b\}|$

Here angle between two pixels $\alpha=0^0$

Distance d=1 ,means all the gray patters at a pixel distances 1 are counted for calculating the frequency count of a particular pattern.

Similarly angles at different orientations are being considered. The Angle positive 135^0 means all the pattern which are lying in the principal Diagonals are being considered

$P_{45^0},d(a,b) = |\{[(k,l),(m,n)]\} Є D:$

$(k-m=d,l-n=-d)$ OR

$(k-m=-d,l-n=d)\ f(k,l)=af(m,n)=b\}|$

$P_{90^0},d(a,b) = |\{[(k,l),(m,n)]\} Є D:$

$|k-m|=d,l-n=0,$

$f(k,l)=a,f(m,n)=b\}|$

$P_{135^0},d(a,b) = |\{[(k,l),(m,n)]\} Є D:$

$(k-m=d,l-n=d)$ OR

$(k-m=-d,l-n=-d),$

$f(k,l)=a,f(m,n)=b\}|$

The input window size for the theoretical purpose, the author has chosen the window size as 5 x 5.

Input window:

0	0	0	1	2
1	1	0	1	1
2	2	1	0	0
1	1	0	2	0
0	0	1	0	1

$P_{135,\ 1}$

8	2	1
2	6	2
0	2	0

It is to be noted that P(0,0)=8,P(0,1)=2,P(0,2)=1

P(1,0)=2,P(1,1)6,P(1,2)=2

P(2,1)=2

All other P values of the 256x256 size array are zero for 135 degree and distance Equal to 1.Similar the case for all other Orientation and distances.

Different parameters to measure texture

- Energy
- Contrast.
- Entropy
- maximum Probability.
- Inverse Difference Moment

2.1 Energy

It is defined as the angular second moment, the more the energy, the image is more homogeneous in the direction Θ .

$$\sum_{a,b} P^2{}_{\theta,d}(a,b)$$

a, b = gray values.

Θ = direction of scanning.

d = distance between two pixels.

2.2 Contrast

$$\sum_{a,b} |a-b|^K P^{\lambda}{}_{\theta,d}(a,b)$$

(a measure of local image variation.)

K = order of moment.

λ = a homogeneous constant

2.3 Entropy

$$\sum_{a,b} P_{e,d}(a,b) \log_2 P_{e,d}(a,b)$$

2.4 Maximum Probability

$$\frac{\max_{a,b} P_{\theta,e}(a,b)}{\sum_{a,b} P_{\theta,d}(a,b)}$$

Pattern (a,b) occurs frequently

2.5 Inverse difference moment

If a-b = 1, a-b = 3 and P(a,b) = 25, the former is large, i.e. homogeneity is large when difference is less.

$$\frac{\sum_{a,b,a\neq b} P^{\lambda}{}_{\theta,d}(a,b)}{|a-b|^K}$$

Here λ=1 and K=1

Larger the inverse difference moment, means the area of the image is more Homogeneous.

3 DEFECT DETECTION BY MINIMUM DISTANCE CLASSIFIER

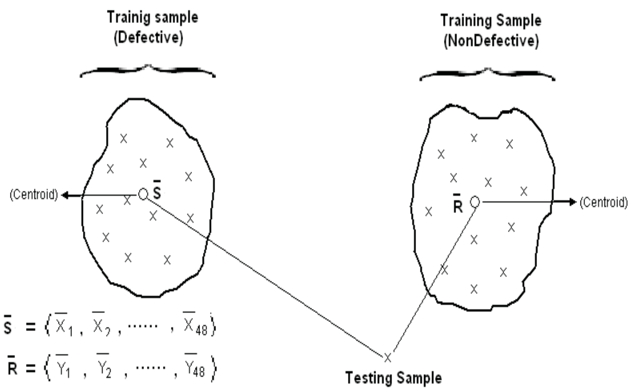
1.0e+008*

48 Features

50 Samples

0.065	**0.062**	… … … … … … … … … … …	**0.118**	**0.124**
0.051	**0.048**		**0.156**	**0.159**
• • •				
0.019	**0.018**		**0.688**	**0.718**
0.034	**0.032**		**0.361**	**0.383**

Fig-1 Feature Data Base



(Fig-2 Cluster Diagram)

TRAINING PHASE

$$\bar{S} = \left\langle \bar{X}_1, \bar{X}_2, \ldots\ldots, \bar{X}_{48} \right\rangle \qquad \bar{R} = \left\langle \bar{Y}_1, \bar{Y}_2, \ldots\ldots, \bar{Y}_{48} \right\rangle$$

$$\bar{X}_1 = \sum_{j=1}^{12} X_{1,j} \qquad \bar{Y}_1 = \sum_{j=1}^{12} X_{1,j}$$

$$\bar{X}_2 = \sum_{j=1}^{12} X_{2,j} \qquad \bar{Y}_2 = \sum_{j=1}^{12} X_{2,j}$$

$$\vdots \qquad \vdots$$

$$\bar{X}_{48} = \sum_{j=1}^{12} X_{48,j} \qquad \bar{Y}_{48} = \sum_{j=1}^{12} X_{48,j}$$

$$d_a = \sum_{i=1}^{48} (\bar{X}_i - X_i')^2$$

$d_a =$ Distance for a th Sample, Initially a=13 th Defective Sample.

$$d_b = \sum_{i=1}^{48} (\bar{Y}_i - Y_i')^2$$

$d_b =$ Distance for b th Sample, Initially b=13 th Nice Sample.

Algorithm For Minimum Distance Classifier

Procedure MDC( )

begin

count=0;

while (count <=13+13)//1st 13 for defective and 2nd13 for non defective

if ($d_a < d_b$) then

begin

print X_i "is Defective"

else

print X_i "is Non Defective"

end if.

count ++

end while

end //MDC

4 RESULT AND DISCUSSION

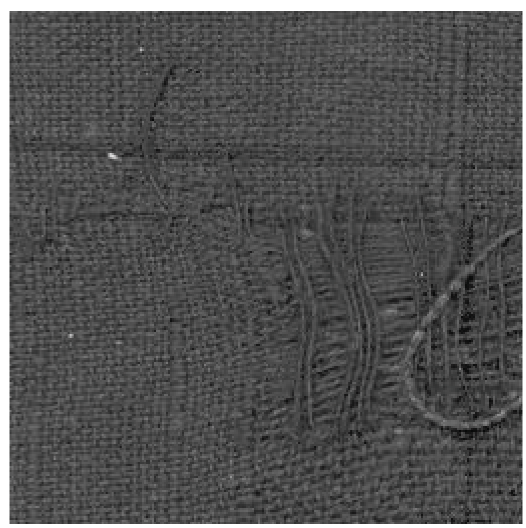
We have taken five features in four Orientations at a unit distance. So five features and four orientation will give us 5*4 =20 features. We have taken 25 good image and 25 defective images.

For training in the rough set we have (ROSETTA software) taken 25 samples and for the purpose of testing. We have taken 25 samples. We got 52% result. We are trying now for different distances for improving the Result.

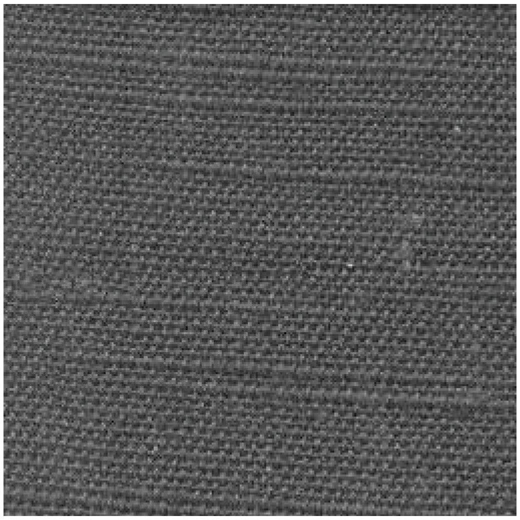
Coding of Minimum Distance Classifier is being investigated as a further research.

Predicted			
	1.0	2.0	
1.0	8	7	0.533333
2.0	5	5	0.5
	0.615385	0.416667	0.52

(Fig-3 ROSETTA Result 0.52*100 =52%)



Defective fabric image



Depicting a regular texture An Ideal Fabric Image

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