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Defect Detection in Pattern Texture Analysis Based on Kernel Selection in Support Vector Machine

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Abstract

Background/Objective: Finding defects in real world application is assorted process. A robust and novel method is designed to select fine distinctions of features and classifying the images lead to improve the quality of products in industrial engineering. **Methods/Statistical Analysis:** Image feature accentuate, feature selection and classification are the different stages in pattern texture analysis. The efficiency of the overall system depends on efficiency of individual stages. **Findings:** Computational complexity of kernel algorithms are more intelligent than features .We analyzed and reviewed linear kernel, Quadratic Kernel, Polynomial Kernel, Sigmoid Kernel of SVM to classify the patterns effectively for classifying the defects. **Improvements/Applications:** Here kernel functions such as the polynomial kernel functions are yield superb performance ratios.

Keywords: Defect Detections, Feature Extractions, GTDM, Polynomial Kernel Functions, SVM

1. Introduction

Texture is he one of the most important characteristics in identifying defects or flaws. The fabric defects are broken filaments, slub float, Gout, hole cut or ear oil stain. Feature of texture analysis are statistical, geometrical, structural and model based.SVM is playing a major role to classify the defects Feature representations and kernel are duals. Features are maps with feature space and learned feature statistics. But kernels use "similarity" with and other examples and learn statistics foe classifications functions. But Computational complexity of kernel algorithms is more intelligent than features. Kernels to compute infinite-dimensional feature spaces with a potentially large number of training examples

A classifier is a function c which maps for the given input sets either 1 or -1 based on the training values C(x) € {-1, 1} Linear classifier features are described in terms feature and weights .C(x)=sign(w.f(x)Sign(y) = +1 if y > 0 and -1 if y < 0

D=((x1,y1)……(xn,yn)) where xi € X and y_i € f{-1,+1}

In 2013 Jagdish Lal Raheja specifies real Time fabric defect detection System on an embedded DSP Platform the sliding window method to move across .if the energy level is less than the threshold it will consider defects. It's not efficient[1]. In 2014 Halimi Abdellah approach serves in the fast detection[2] and extraction of fabric defects from the images of textile fabric based on geometrical analysis of the textile pattern images. But they didn't calculate the false positive analysis. In 2015 Jyoti Nikam proposed Fabric Defect Detection by the Method of Bollinger Band method[3]. Originally used for financial technical analysis, based on Moving average and standard deviation. It was originally extended from 1-D approach to 2-D approach for jacquard fabric inspection. But the accuracy is less .Its only proving the true positive. In 2016 P Y. Kumbhar proposed Textile Fabric Defects Detection and Sorting Using Image Processing[4]. But hardware complexity is there.

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Table 1. Kernel zed classifier using polynomial kernel

$f1(x_i)$	$f2(x_i)$	y_i
-1	-1	-1
-1	+1	+1
+1	-1	+1
+1	+1	-1

Table 2. The polynomial functions

$f1(x_i)$	$F2(x_i)$	y_i	$h1(x_i)$	$h2(x_i)$	h3(xi)	si
-1	-1	-1	+1	√2	+1	-1
-1	+1	+1	+1	-√2	+1	+1
+1	-1	+1	+1	-√2	+1	+1
+1	+1	-1	+1	√2	+1	-1

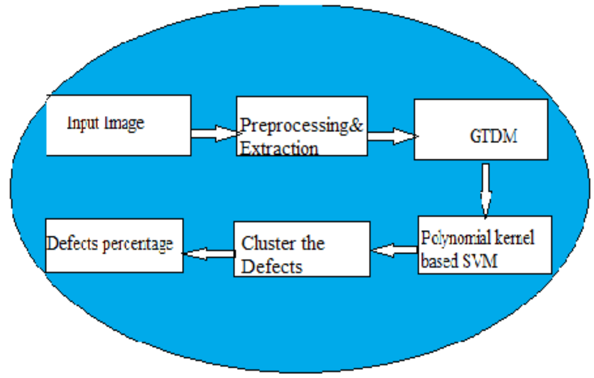

Figure 1. Methodology of proposed system.

2. Methodology

Steps1: Collect the input image
Steps2: De noise the image using preprocessing level
Steps3: Convert binary image using GTDM
Steps4: Apply the polynomial kernel based SVM to classify the defects
Steps5: calculate true positive, true negative, false positive, false negative for defects

2.1 Grey Tone Difference Matrixes

A GTD[5] matrix image is with array A, where A(x,y) assigned as the grayness intensity variations. The array A(x,y) is Nx is number of possible gray level and Ny is number of possible neibours to a pixel in an image . if d=1, consider the adjacent neibhours either identical or difference to assign a binary value. The average intensity computed over a square window centered at the pixel

2.2 SVM Classifier

This method has been successfully applied to detection, verifications, identifications, recognitions of defects, objects, text, texture and retrieval of images .SVM[6–8] are Optimal hyper plane for linearly separable patterns linearly separable by transformations of original data to map into new space – Kernel function.

Training phase: Now, the output of feature extraction is furnished as the input of the training phase[9]. The input function furnishes the set of values which cannot be separated. Almost all the potential segregations of the point set are realized by means of a hyper plane. In the Lagrange configuration, it is possible to locate the separation of the hyper plane normal vector through the dissimilar kernel function. In this connection, a kernel represents any function, which relates to a dot product for certain type of feature mapping. Nevertheless, mapping a point into a superior dimensional space is likely to lead to excessive evaluation duration and huge storage needs. With the result, in actual practice, a novel kernel function is introduced which is capable of directly evaluating the dot product in the superior dimensional space. The common version of the kernel function is furnished as follows.

$$K(U,V)=\varphi(U)^T\varphi(V)$$

In this regard, the most extensively employed kernel[10,11] functions include the linear kernel , Polynomial kernel, Quadratic kernel, Sigmoid and the Radial Basis function. Given below are the expressions for the various kernel functions.

For Linear Kernel: $linear_k(U,V)=u^T v+c$

Where u,v represents the inner products in linear kernel and c is a constant.

For Quadratic Kernel: Quad $_k$(U,V) = 1- ||u-v||/||u-v||+c

vectors of the polynomial kernel function in the input space are u,v

for Polynomial Kernel: $poly_k(U,V)=\left(\lambda u^T v+c\right)^e, \lambda>0$

for Sigmoid Kernel: $sig_k(U,V)=\tanh\left(\lambda u^T v+c\right), \lambda>0$

The efficiency of the SVM invariably relies on the choice of the kernel. In the event of the feature space being linearly inseparable, it has to be mapped into a superior dimensional space by means of the Radial basis function kernel, in order that the issue emerges as linearly separable. Moreover, the combination of any two kernel functions is competent to yield superlative precision than that obtained by employing any single kernel function.

2.3 Algorithms://GTDM and SVM

Step1:

Function [Q] =calculate Gray Dep Matrix (A, a, d)
nei = 2*d+1;//Calculate rows and columns of neighbor
ntn =nei*nei; //Calculate total no of pixels
mr = ceil (/ntn/2);//to find middle row
B =im2col (A,[nei,nei]);// make coloum
Cdiff =abs (bsxfun@minus, B B(middlerow)
C=Cdiff <=a;
D=sum(C-1) -1;//each neighborhood add them
Ng=B(mr);
nr=d+1;
Q=accumarray [ng,nr],1,1 [max [ng],mtn]);
end

Step 2: Train the SVM classifier

Step 3: Cl=fitcsvm(data, the class, kernel function,rbf);
//predict the scores over the grid
//plot the data and boundary
//form the cluster of damaged images

Step 4: Calculate the false positive, false negative, true positive, true negative

3. Results

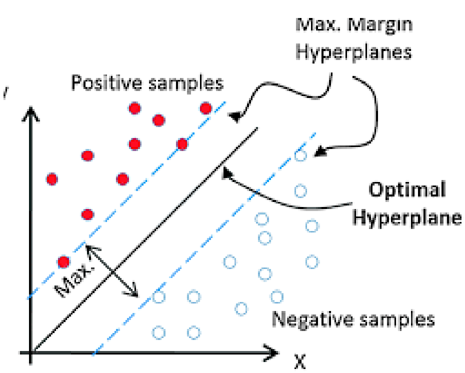

Figure 2. SVM classifier hyper plane.

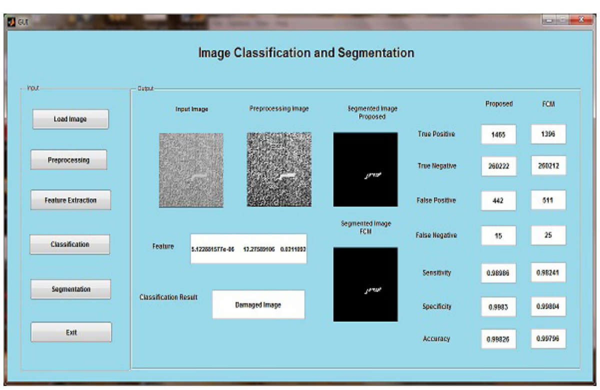

Figure 3. Image classification and segmentations.

4. Conclusion

The efficiency of our approach to categorize the defects level is very high in digital image process[12]. The SVM play an important role to classify the defects in Quality control system in textile industry. This kernel method to find defects is better complexity. But using this kernel methodology is investigated in all possibilities of discriminating defects in terms of true positive ,true negative, false positive, false negative

The main contributions are

- we proposed the novel kernel method to find the defects and improve the quality of products
- Calculations of defects percentage in terms in terms of detections success rate, detection rate, false alarm rate, sensitivity, specificity.

In future we should analyzed and select concerns kernel selections based on applications

5. References

1. Raheja JL, Ajay B, Chaudhary A. Real time fabric defect detection system on, embedded DSP platform optik. International Journal for Light and Electron Optics, Elsevier. 2013; 124(21):5280–4.
2. Abdellah H, Ahmed R, Slimane O. Defect detection and identification in textile fabric by SVM method. published IOSR Journal of Engineering (IOSRJEN). 2014 Dec; 4(12):69–77.
3. Nikam J, Biadar MS. Patterned fabric defect detection using bollinger band method. International Journal of Electrical and Electronics Engineers. 2015 Jan – Jun; 7(1):474–80.
4. Kumbhar PY, Mathpati T, Kamaraddi R, Kshirsagar N. Textile fabric defects detection and sorting using image processing. International Journal for Research in Emerging Science and Technology. 2016 Mar; 3(3):19–24.
5. Nurzyńska K, Kubo M, Muramoto KI. Grey scale texture classification method comparison considering object and lighting rotation. International Journal of Computer Theory and Engineering. 2013 Feb; 5(1):19–23.
6. Srivastava DK, Bhambhu L. Data classification using support vector machine. Journal of Theoretical and Applied Information Technology. 2009; 1–7.
7. Abdellah H, Ahmed R, Slimane O. Defect detection and identification in textile fabric by SVM method. IOSR Journal of Engineering (IOSRJEN). 2014 Dec; 4(12):69–77.
8. Anand P, Ajitha T, Priyadharshini M, Vaishali MG. Content based image retrieva using multiple features for textile images by using SVM classifier. International Journal

of Computational Science and Information Technology (IJCSITY). 2014 May; 2(2).

9. Priya S, Kumar T, Paul V. A novel approach to fabric defect detection using digital image processing. International Conference on Signal Processing, Communication, Computing and Networking Technologies. IEEE Explore Digital Library; 2011 Sep 23.
10. Xu KJ, Chen B, Zeng L. On-line defect detecting method based on kernel method. Key Engineering Materials, Scientific.Net. 2011; 474–476:858–63.
11. Okutan A, Yıldız OT. A novel regression method for software defects predictions with kernel methods. Proceedings of the International Conference on Pattern Recognition Applications and Method; 2013.
12. Azim GA. Identification of textile defects based on GLCM and neural networks. Journal of Computer and Communications. 2015;3:1–8.