AUTOMATIC FABRIC FLAW DETECTION USING IMAGE PROCESSING TECHNIQUES

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ABSTRACT

The textile industry is a significant revenue generator, but the presence of fabric defects can greatly impact the price and quality of the final products. Manual inspection for defects, even with skilled inspectors, is time-consuming and often not accurate enough, with a very small percentage of defects being detected. An automatic defect detection system offers a solution to this problem by increasing the defect detection rate, reducing fabrication costs, and being economically beneficial considering labor costs and associated benefits. In this paper, an artificial neural network (ANN) is employed to detect defects in woven fabric. The images are acquired, filtered, pre-processed and normalized then a structural feature is extracted. Features like homogeneity, entropy, contrast are calculated.The ANN classifies the type of defects, identifying and locating issues such as holes, oil spots, missing threads, and scratches. This automated defect detection algorithm significantly improves the accuracy and efficiency of defect identification in fabric manufacturing, ultimately enhancing production quality and reducing costs.

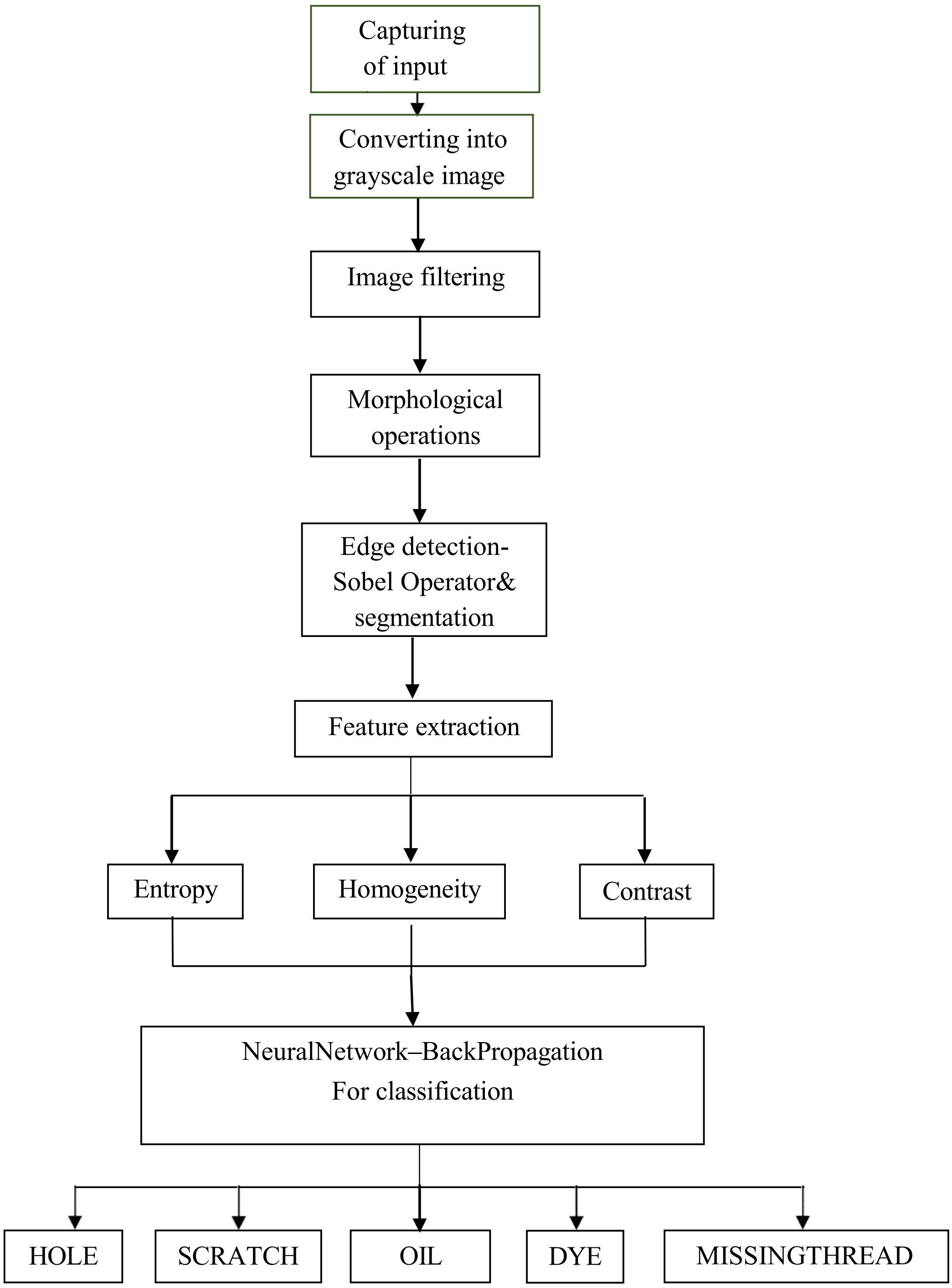
Key words: fabric, defect, Artificial Neural Network, features, thread

INTRODUCTION

One common technique to implement multi resolution analysis is to use wavelet transforms. Gabor filters can also decompose the image into components corresponding to different scales and orientations. Gabor filters achieve optimal joint localization in spatial and spatial frequency domain. Here the detecting fabric defects with 1-D projection signals become harder as the size of the defects increases [1]. To detect and recognize the defects in the Texton-based fabric, an image is divided into several blocks in which features based on filter banks are extracted from them. According to these features, the algorithm determines defective windows and their defect types. The other domains such as remote sensing image processing can employ textons as appropriate features being extracted from different regions[2]. The technique for design and implementation of real time fabric defect detection the Multi-Channel Gabor filtering algorithm is used along with FPGA and PCI data bus. The defect detection can be done only for monochrome images and its not ideal to detect defects in large range[3]. An algorithm with linear filtering and morphological operations is applied off-line and real-time to denim fabric samples. The proposed system was designed to extract minimal-sized defects without classifying the kinds of defects because of the speed [4]. The recent advancements in fabric defect detection, emphasizing machine learning and deep learning techniques, and discusses the performance and applicability of these methods in real-world scenarios[5]. machine learning-based methods for fabric defect detection, highlighting the latest trends and future research directions[6].The implementation method for different types of defects is discussed next.

METHODOLOGY

Fabric for the process is captured using a digital camera and stored in jpeg, png format in the memory unit. Later the captured image would be converted into gray scale image for the further process. Median filter is used order to reduce the noise that is present in image. Now dilation and erosion process is performed for obtaining the exact defect area by leaving the defectless area. Erosion process would erode the extra values that would be added while dilation process. Structuring



element namely square shape for dilation and disk shape structuring element for erosion are used for this purpose.

Edge detection

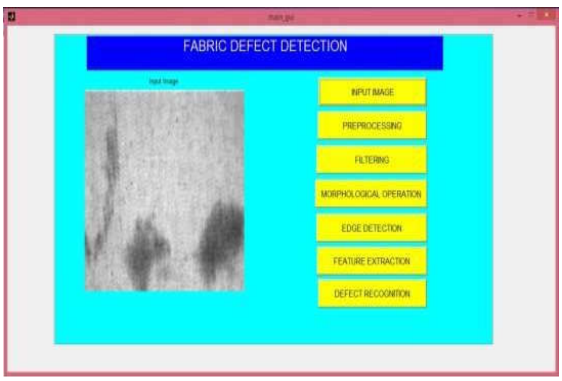
Edge detection process is done for obtaining the exact shape and structure of the defect that is present in the fabric. Sobelmask is used for edge detection purpose. This process would help us in increasing the accuracy of identifying the defect portion. Sobel mask is used for edge detection purpose. Feature extraction process is done for extracting the features like homogeneity, entropy, contrast which would serve as the input for the neural network for classification purpose. The extracted features have been given as the input for the neural network and these features differs for each type of defects. Now the output of the extracted features will serve as the input to the neural network. Here weights are defined which will then classify the type of defect that is present in the fabric. Back propagation algorithm is implemented for defect classification.

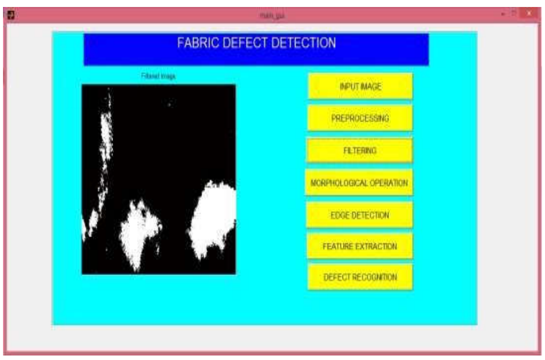
Graphical User Interface

A GUI is a type of interface that allows users to interact with electronic devices through graphical icons and visual indicators such as secondary notation, as opposed to text-based interfaces, typed command labels or text navigation. GUIs were introduced in reaction to the perceived steep learning curve of command-line interfaces (CLIs),which require commands to be typed on the keyboard. The actions in a GUI are usually performed through direct manipulation of the graphical elements.

Results and Discussion

The results of the grease, dye, oil spot and hole detection is shown in the figures from figure 2 to 6 and the performances are shown in table 1 and the plot is given.





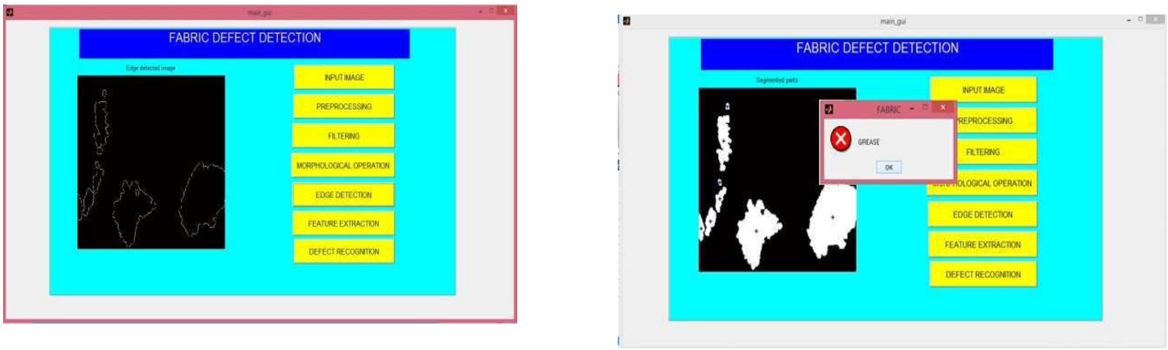


Fig 2. Grease affected image detection

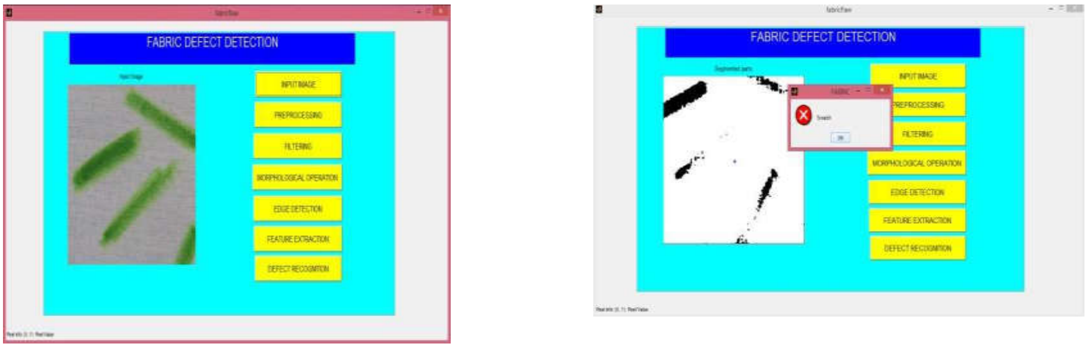


Fig 3.Dye spot detection

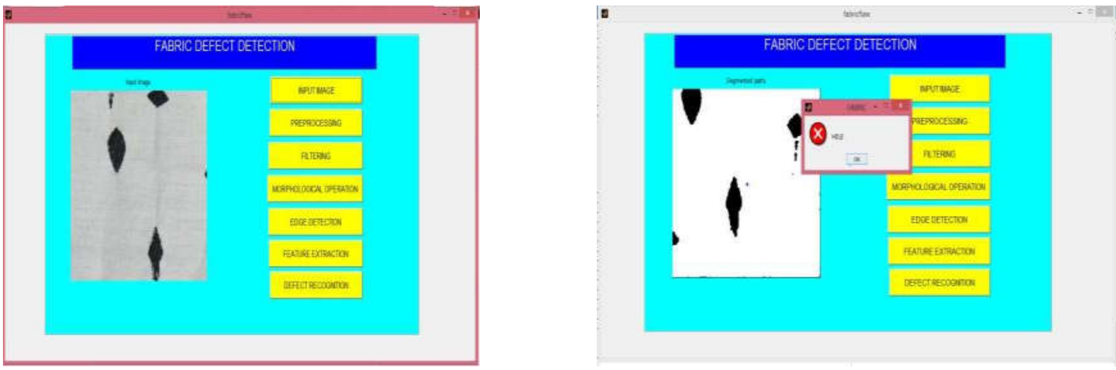


Fig 4.Hole in the fabric detection

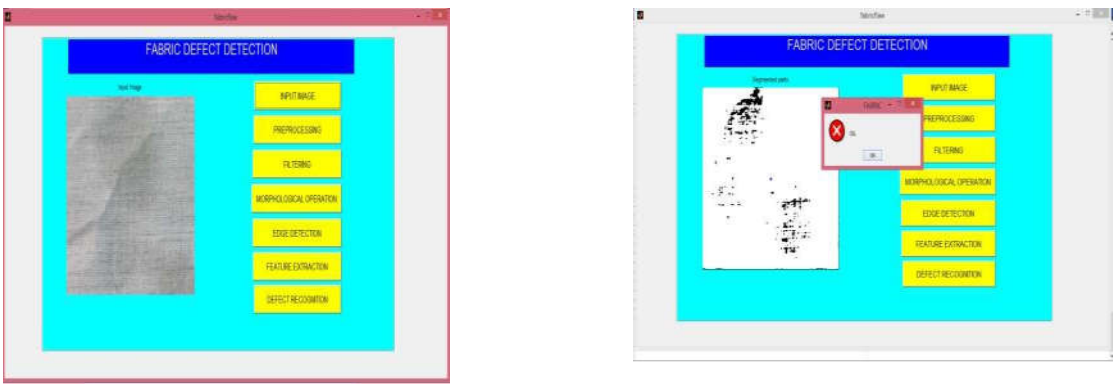


Fig 5.Oil spot detection

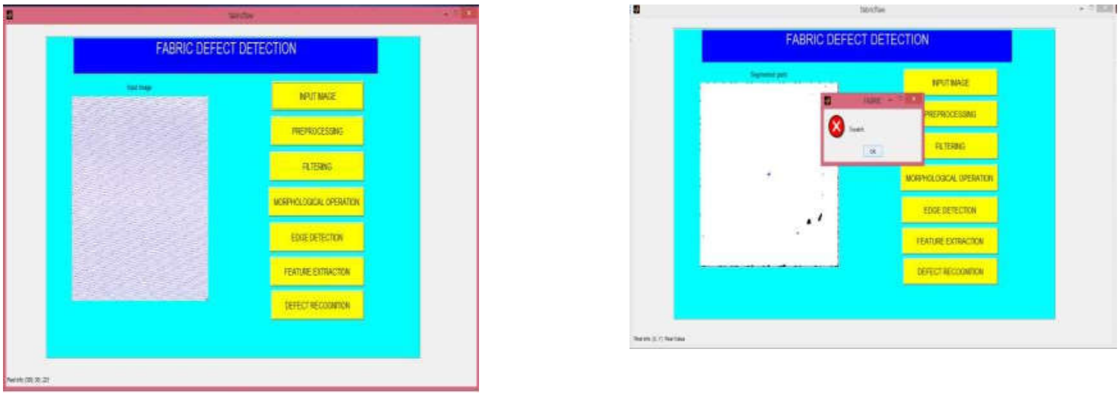
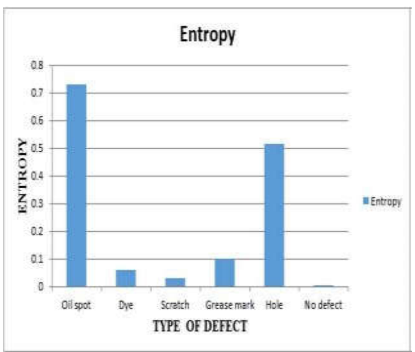
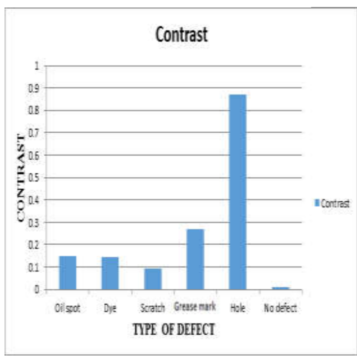


Fig 6.Scratch in the fabric

Table 1: Type of defect Vs Features

Type of defect	Entropy	Contrast	Homogeneity
No defect	0.0032	0.0085	0.9998
Grease Mark	0.1023	0.2707	0.9944
Dye	0.0589	0.1464	0.9967
Scratch	0.0320	0.0913	0.9981
Oilspot	0.7301	0.1504	0.9755
Hole	0.5146	0.8686	0.9595





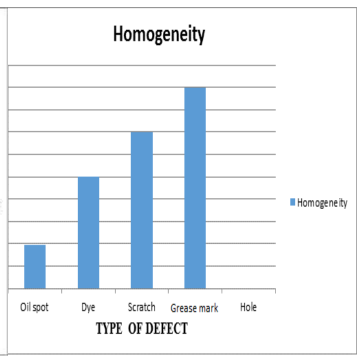


Fig 7.Performance parameters vs defects

CONCLUSION

In this paper ,an intelligent fabric defect inspection model is presented. The recognizer acquires digital images by image acquisition device i.e. using digital or web camera. The obtained image is then converted into binary image and further filter is applied to remove the noise. Now the output of processed image is used as input to the Neural Network(NN) which uses back propagation algorithm to calculate the weighted factors and generate the desired classification of defects as an output. The output of the neural network gives an indication of the defect like oil spot, dye, iron defect, holes etc. The experiment results show that this method is feasible and applicable is textile production factories for defect detection and classification. Here the defect classification for single colour fabric is alone done. In future, this can be expanded for different colour fabrics and also for fabrics with various other kinds of defects.

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