Detection of fabric Productional Defects in a Apparel Industry Using Machine Learning Algorithms

Submitted in partial fulfillment of the requirements for the degree of

Bachelor of Technology

in

COMPUTER SCIENCE AND ENGINEERING

by

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VIT,

Vellore.

05,2023

DECLARATION

I hereby declare that the thesis entitled "Detection of fabric Productional Defects in a Apparel Industry Using Machine Learning " submitted by me, for the award of the degree of B.tech in C.S.E to VIT is a record of bonafide work carried out by me under the supervision of Dr.Kopperundevi.m

I further declare that the work reported in this thesis has not been submitted and will not be submitted, either in part or in full, for the award of any other degree or diploma in this institute or any other institute or university.

Place : Vellore

Date:15/05/2023

CERTIFICATE:

This is to certify that the thesis entitled "Detection of fabric Productional Defects in a Apparel Industry Using Machine Learning " submitted by Veerendra amaravathi,19BCI0238, VIT, for the award of the degree of B.tech C.S.E WITH SOL.I.S is a record of bonafide work carried out by him / her under my supervision during the period, 01. 07. 2022 to 30.04.2023, as per the VIT code of academic and research ethics.

The contents of this report have not been submitted and will not be submitted either in part or in full, for the award of any other degree or diploma in this institute or any other institute or university. The thesis fulfills the requirements and regulations of the University and in my opinion meets the necessary standards for submission.

ACKNOWLEDGEMENTS

Student Name

Executive Summary

Summary of the thesis

One page and not exceeding 200 words

Times New Roman, 12

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1.INTRODUCTION:

1.1 Theoretical Background :

Furthermore, by using deep learning algorithms, fabric defects can be identified in real-time, enabling faster response and more efficient corrective measures. Overall, the use of machine learning algorithms for fabric and defect detection offers an efficient and effective way to reduce costs associated with manual inspection.

First, this review briefly introduces the significance and ineluctability of fabric defect detection towards the period of manufacturing of artificialintelligence.

Second, defect detection methods are distributed into traditional algorithms and literacy- grounded algorithms, and traditional algorithms are farther distributed into statistical, structural, spectral, and model- grounded algorithms. The learning based algorithms are further divided into conventional machine learning algorithms and deep learning algorithms which are veritably popular lately. A methodical literature review on these styles is present.

Thirdly, the deployments of fabric defect detection algorithms are discussed in this study.

1.2Motivation:

Fabric and defect detection using machine learning algorithms is a powerful way to reduce the costs associated with manual inspection. Machine learning algorithms can detect defects in fabrics using image processing techniques and can help detect anomalies in fabrics quickly and accurately. By using supervised machine learning algorithms to classify defects, human errors in inspection can be drastically reduced. Additionally, the use of unsupervised machine learning algorithms can be used to identify patterns in fabrics that may be indicative of a defect. This can help identify defects before they are visible to the human eye.

1.3Problem definition:

The work failed to develop a complex ensemble model for fusing the data. The required computational time is high. The work failed to get accuracy of the filtered image. We need to improve the accuracy of segmentation. Failed to prove effectiveness of the segmentation system by implementing various measures. Failed to improve dimensionality.

TEXTILE DEFECTS: The most common defects in fabrics during production include reverse fabric seam indentation, bird's eye, bows, color breaks, fading, color spots, wrinkles, missed threads, print dye lines, holes, cramps, knots, yarn blends, lice, needlework, can be considered straw. opening, pinholes, recesses, etc.

Inspectors are often given the responsibility of inspecting finished garments, but they are not adequately trained in defects and their causes. Of course the final solution is to provide real samples or pictures of major and minor defects.

This section provides a list and description of defects and simplifies the terminology and decisions used when performing visual inspection of fabric. Quality Control Managers can provide these lists to auditors as useful tools for making consistent audit decisions.

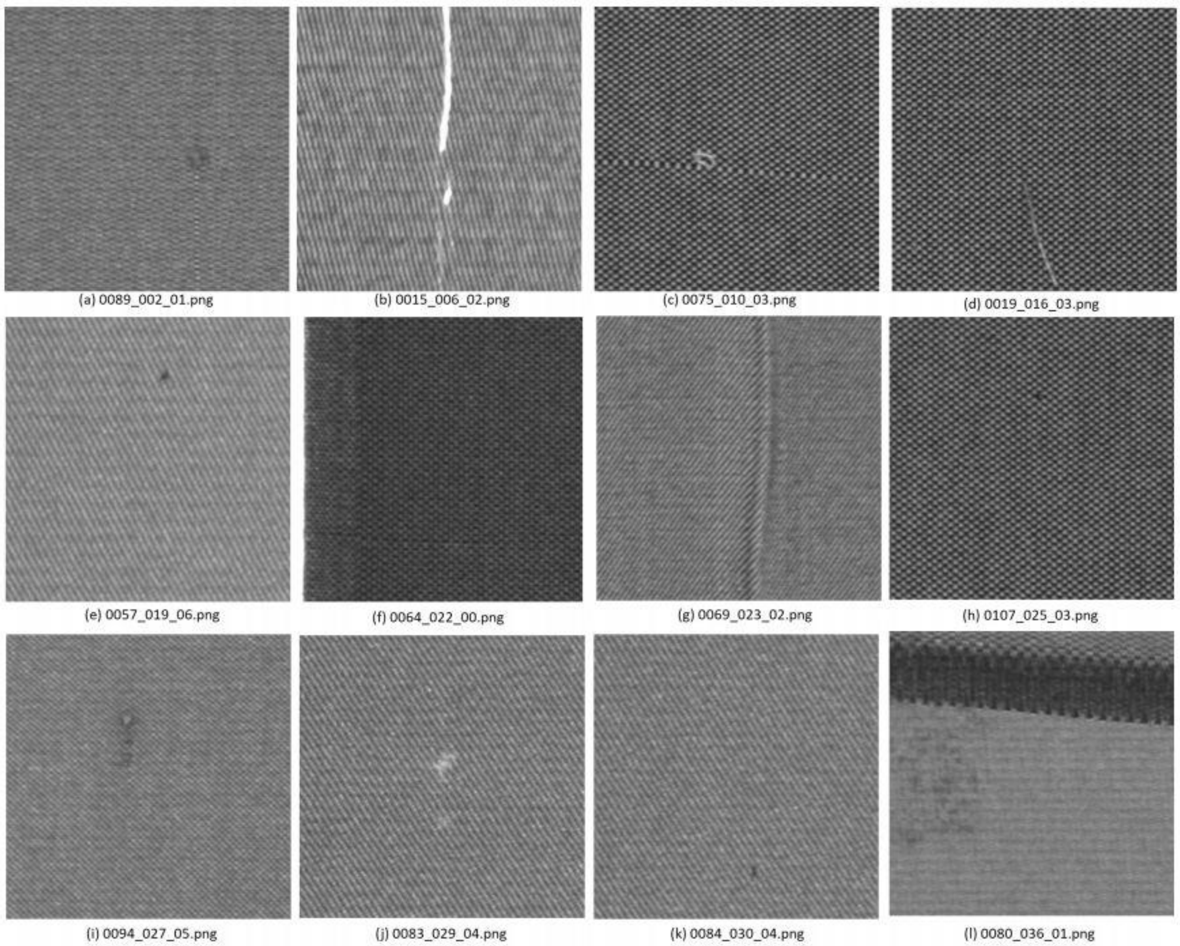
1.4 Aim of the Proposed Work:

Fabric defects correspond to defects on the surface of the textile fabric.

Most fabric defects are caused by machine or process faults and malfunctions.The existence of fabric defects greatly reduces the sale and use of textiles. Textile manufacturing companies need to upgrade equipment and technology to maintain growth and competitiveness.

The sensing, storage, and computing capabilities of automated fabric detection systems based on computer vision will continue to improve. The development of hardware and algorithms will greatly affect the accuracy of detection and the ease of deployment.The algorithms used were converting to grey scale image, sharpening filter, median filter, smooth filter, binary mask, RGB extraction, and histogram and Sobel operator. The RGB values of the images are extracted before converting it into a Gray scale image. Sharpening filter is applied to the Gray scale image in order to sharpen the details of the infected region. Advanced feature will be added such as Entropy,kwotsis,Skewness etc..

Datasets:



2.**Literature Survey**

2.1Survey of the Existing Models/Work:

EXISTING METHOD:

The new filter is an edge-preserving filter especially when images are polluted by mixed noise containing Gaussian noise, Poisson noise, and impulse noise. The structural features are obtained from multi resolution analyses which are used to discriminate the structures as borders, dots and streaks. On the other side, the textural features computed by LBP operators are used to 3 discriminate the local variation of colours, the pigment network etc. Later, these features are fused in multiple combinations to investigate the influence of each combination in the performance of detection.

Manually checking process. (Svm) supports vector machine algorithms. SVMs are machine learning algorithms that are commonly used for classification tasks. They work by finding the best hyperplane that separates different classes of data. SVMs can be trained on labeled images of defective and non-defective fabrics and products to identify patterns and features that distinguish between the two classes. Random Forests: Random Forests are ensemble learning algorithms that combine multiple decision trees to make predictions. They can be used for image classification tasks, including defect detection in fabrics and products. Random Forests can be trained on labeled images to identify patterns and features that distinguish between defective and non-defective samples.

2.2Summary/Gaps identified in the Survey :

A Fabric Defect Detection Method Based on Deep Learning :

QIANG LIU , CHUAN WANG , YUSHENG LI, MINGWANG GAO, AND JINGAO LI School of Mechanical Engineering, Shandong University of Technology, Zibo 255049, Chin

The model proposed in this paper has been bettered for small cloth disfigurement areas that are close to the background shape, and has overcome the low effectiveness of the traditional homemade findings. Compared with the original YOLOv4, the bettered YOLOv4 upgrades chart by 6%, while FPS only diminishments 2. Grounded on expansive exploration and a detailed analysis of fabric blights, our network model is the most suitable for fabric disfigurement discovery.The model proposed in this paper has high precision and excellent real-time performance, and can be effectively applied for defect detections in industrial fabrics.

A Universal and Adaptive Fabric Defect Detection Algorithm Based on Sparse Dictionary Learning

Authors: XUEJUAN KANG AND ERHU ZHANG.YEAR:December 22, 2020.

In this paper, we proposed a universal meager wordbook Learning algorithm for detecting colorful blights of different fabric texture. It depends on the setting of two parametersthe dictionary infinitesimal number K and the image block size $m * n$. These two parameters are nearly related to background, texture characteristics and lightness of the fabric.The algorithm shows good universality in the experimental results and has wide operation value in the factual fabric disfigurement discovery.

FABRIC DEFECT DETECTION BASED ON FASTER RCNN WITH CBAM

AUTHORSlYuan He, Han-Dong Zhang, Xin-Yue Huang and Francis Eng Hock Tay

In this paper, we compared Faster RCNN and CBAM performance in fabric blights discovery area. The trial result proved CBAM can get better delicacy and recognizable rate in our fabric disfigurement database. Dueto the difference in image quality and pattern complexity, some blights can not be successfully detected. Collecting fruitfulness high- quality fabric disfigurement and disfigurement-free image, streamlining being network model will be the focus of unborn exploration. The different training time between CBAM and Faster RCNN is negligible. still, compared with the traditional approaches, the training time is further time- consuming. Reduce the needed timefor training the model, realize real- time discovery is pivotal to whether this technology can be applied in artificial product, which is also the focus of unborn exploration.

Sub image based eigen fabrics method using multi-class SVM classifier for the detection and classification of defects in woven fabric

Authors: Anushree Basu ,Jayanta K. Chandra, Pradipta K.Banerjee,Sandipan Bhattacharyya, Asit K. Datta

Therefore this paper gives a result of this problem by developing an automatic fabric disfigurement discovery system, based on the computer vision.For the paper it can be concluded that the advanced system works satisfactorily for different types of fabric blights taking place on different types of fabric. The image of the fabric is captured by a CCD camera assuming the constant illumination. The major problems those do are usually associated with the image of the fabric with non invariant illumination since the variations in illumination induce sharp tones on the fabric images which may be treated as blights by the system So in the real time system the normalization of the illumination must be done veritably precisely.

Entropy-Based Active Learning for Object Recognition

Authors:Alex Holub, Pietro Perona, Michael C. Burl Jet Propulsion Laboratory, Caltec

We've developed a novel ” active literacy ” algorithm that enables hundreds of complex object orders to be honoured with a minimum quantum of labelled training data.Our approach uses a principled, information-theoretic cri teria to elect the most instructional images to be labelled.The fashion is well- defined for any underpinning classi fier(kernel nearest neighbor, SVM,etc.), extends naturally to multi-class and multi-return settings, and can automatically determine when enough labelled training data has been acquired to ensure near-minimal recognition performance. Against unresistant literacy and a variety of indispensable active literacy approaches, our system constantly achieves near-minimal performance with one- half to one-third the number of training and in some cases the enhancement is 10x or further.

Fabric Defect Detection Algorithm Based on Convolution Neural Network and Low-Rank Representation

AUTHORSl: Zhoufeng Liu, Baorui Wang, Chunlei Li, Bicao Li, Xianghui Liu

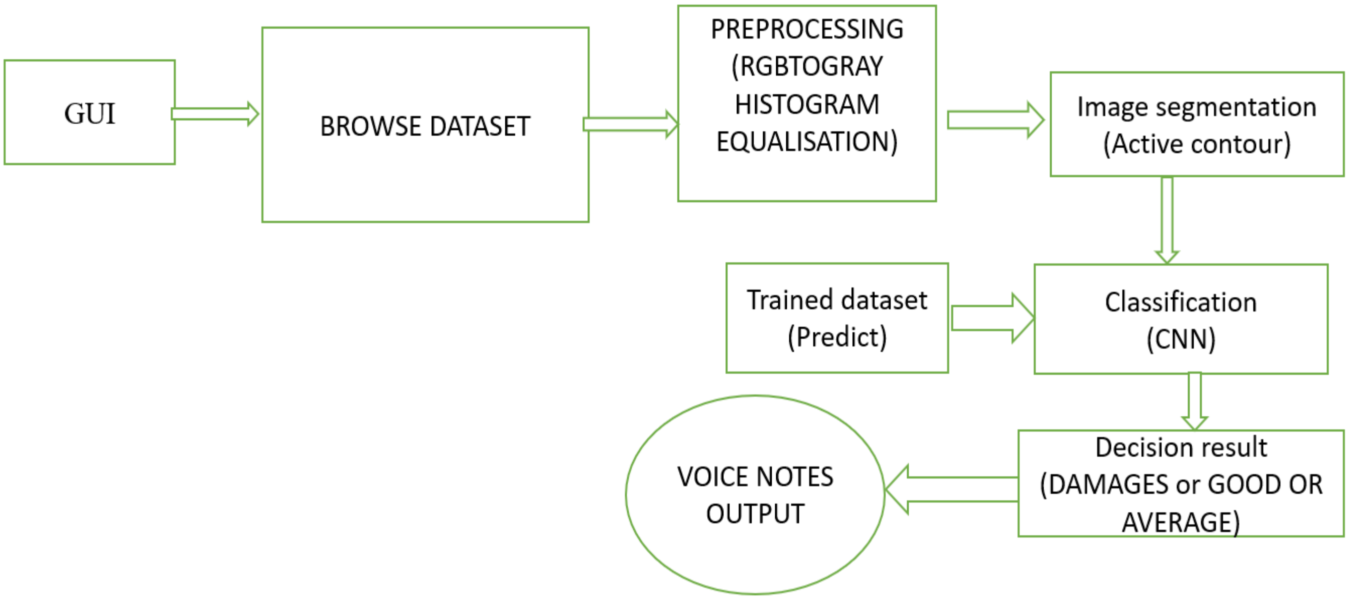
To directly descry the fabric blights in the cloth qual ity control process, this paper proposed a new discovery system grounded on complication neural network(CNN) and low- rank representation(

LRR).The discovery of fabric disfigurement is a crucial element of quality control in the cloth assiduity. This study propos es a new fabric disfigurement discovery algorithm grounded on CNN and low-rank representation. The proposed system has two

1) the fine- tuned CNN is espoused to charac terize the fabric disfigurement image texture

2) low- rank representation is espoused to putrefy the point matrices in to the low- rank and merger corridor. The discovery results are attained by segmenting the saliency chart generated by the merger part. The experimental results demonstrate that the proposed system can directly descry the disfigurement regions in colourful fabric disfigurement images indeed for images with complex textures.

PROPOSED SYSTEM:



WORKFLOW DESCRIPTION:

- Entry Image: The entry image is an image with a textile defect.
- Input Grayscale/Binary: The input image must be converted to 8-bit grayscale values. The grayscale is then converted from scratch to a binary image. Grayscale Images are composed exclusively of shades of gray, varying from black at the weakest intensity to white at the strongest.

- Noise reduction: We use a median filter, Gaussian techniques to reduce noise. We use a 3 x 3 mask to get the

pixel's eight neighbors and their corresponding gray values.

Positioning: So we need to control the sides of the rectangle. MATLAB toolbox functions provide functions called terrain features. Evaluates a set of items for each region registered in the matrix. We use bounding boxes to measure the properties of the image field. After saving the components, regions are extracted from the input image.

Segmentation: We obtain individual and digital images with vertical and horizontal scanning methods and divide the affected area according to the ACM method.

Classification: Custom training to extract and label data based on our results, checking for accuracy tradeoffs, and speeding up training

PROPOSED WORK:

Fabric defects correspond to defects on the surface of the fabric. Most fabric defects are caused by machine or process errors or malfunctions. Defects in the fabric significantly reduce the sale and use of the fabric. Textile manufacturing companies need to upgrade their equipment and technology to maintain growth and competitiveness. The acquisition, storage, and computational capabilities of computer vision-based automated material detection systems will continue to improve. Hardware and algorithm development greatly affect detection accuracy and ease of deployment.

The algorithms used were conversion to grayscale image, sharpening filter, median filter, smoothing filter, binary mask, RGB extraction and histogram, and Sobel operator. The image's RGB values are extracted before it is converted to a grayscale image. A sharpen filter is applied to the grayscale image to sharpen details in the infected area.

The grey scale image It is an image change strategy in advanced photography. It eliminates each frame of colour data and as it clears out distinctive shades of gray; the brightest being white and the darkest of it being black. Its middle of the road shades ordinarily have a break even with level of brightness for the essential colours . On the other hand it breaks even with sums of cyan, yellow and magenta which are the essential colors. Each pixel is a representation of the brilliant concentration of the picture.

Image sharpening will add a signal to the original image to the high-pass filtered version of the real image. The key here is the option for advanced filtering. In the normal method, a filter is used to use the high filter . If the original image is corrupted by noise , the linear method will be wrong for us, which is unexpected. Some people like to use advanced filters or sharp sharpening. Whatever method you use, be sure to use carefully when sharpening, as doing it too much can result in a distorted image with bad pixels. One trick is that it only processes certain areas in the shot, rather than the entire image.

MEDIAN FILTER:

The average filter model is designed to remove salt and pepper -like noises without damaging the edge. Pulse noise is removed by averaging the reference value of the pixels in the window and changing the reference value of the pixels in the middle of the window. Even at low noise, SMF removes fine lines and blurry images . SMF does not distinguish between broken pixels and intact pixels. Does not fit the size filter. The main disadvantage of the standard median filter is that the filter can only be used at low noise levels . It does not preserve the content of the original image during playback. The downside of this is that there is a lot of noise in the image that it removes

convolutional neural network (CNN):

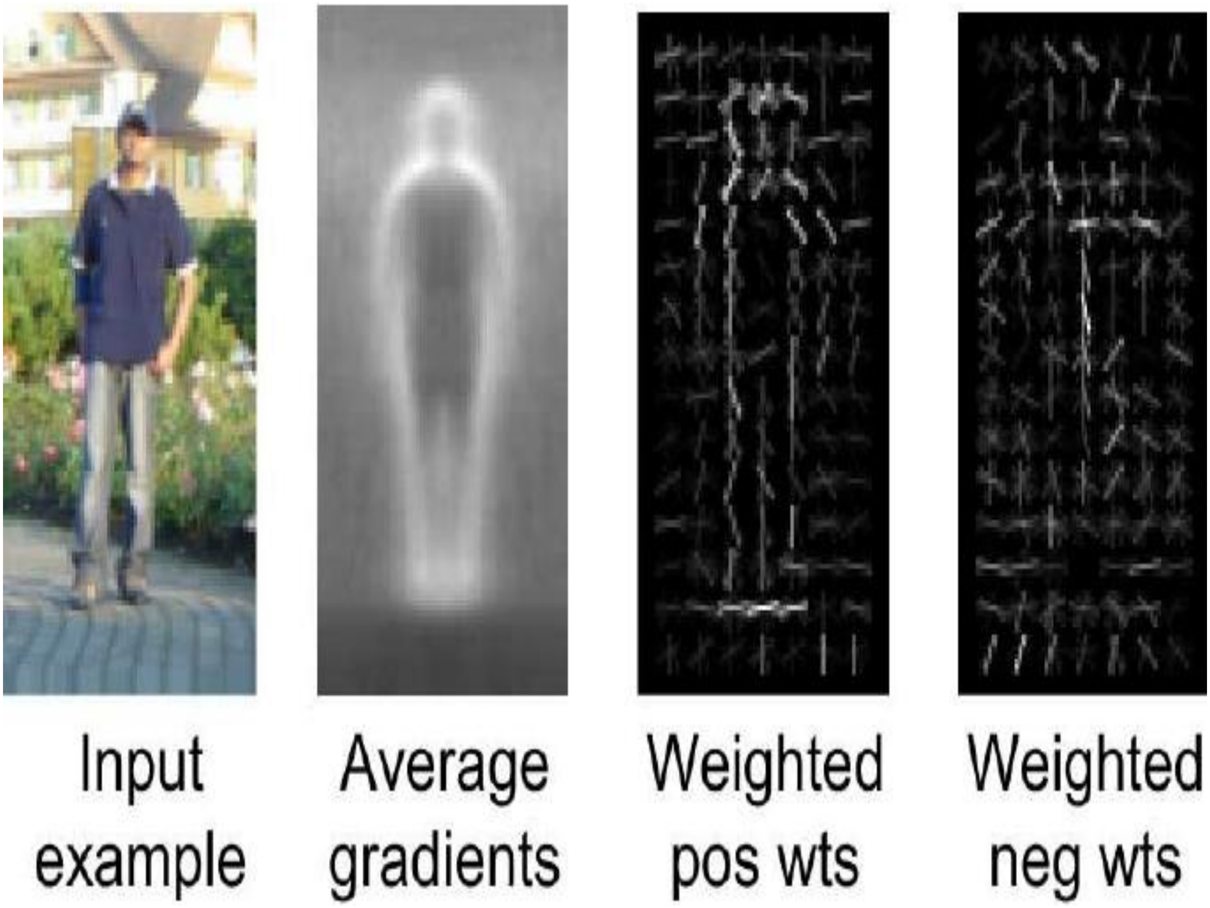
CNN is a neural network with one or more convolutional operations, mainly used for image processing, classification, segmentation and other autocorrelated data. Convolutional neural networks are veritably good at picking up on patterns in the input image, similar as lines, circles, or indeed eyes and faces. It's this property that makes convolutional neural networks so important for computer vision. Unlike earlier computer vision algorithms, convolutional neural networks can operate directly on a raw image and don't need any preprocessing. The usage of convolutional layers in a convolutional neural network mirrors the structure of the human visual cortex, where a series of layers reuse an incoming image and identify progressive more complex features.

Active Contour Method(ACM):

Active contour method is a type of image segmentation algorithm based on the idea of energy minimization. The algorithm works by tracking an outline or "contour" around regions of interest in an image and attempting to minimize an energy function within these regions. To do this, the algorithm will look at various features of the image, such as its shape, texture, and color, and use these features to define an energy function. The algorithm then attempts to minimize this energy function by adjusting the contour around the region until it reaches a global minimum. Once this is achieved, the algorithm can then accurately identify and segment the region from the rest of the image.

HISTOGRAM OF ORIENTED GRADIENTS:

The histogram of oriented gradients is used in computer vision and image processing for the purpose of object detection. This method counts the number of occurrences of gradient directions in the region of the image. This model is similar to the edge orientation histogram and scale-invariant feature transformation (SIFT). The HOG definition focuses on the structure or shape of an object. It is better than edge definition as it uses the size and angle of the gradient to calculate features. For area images, it uses the magnitude and direction of the gradient to create a histogram.



MODULES:

•Graphical user interfaces (GUIs), also known as apps, provide point-and-click control of your software applications, eliminating the need for others to learn a language or type commands in order to run the application.

•You can share apps both for use within MATLAB.

•A user interface (UI) is a graphical display in one or more windows containing controls, called components, that enable a user to perform interactive tasks.

•The user does not have to create a script or type commands at the command line to accomplish the tasks.

•Unlike coding programs to accomplish tasks, the user does not need to understand the details of how the tasks are performed.

GUI:

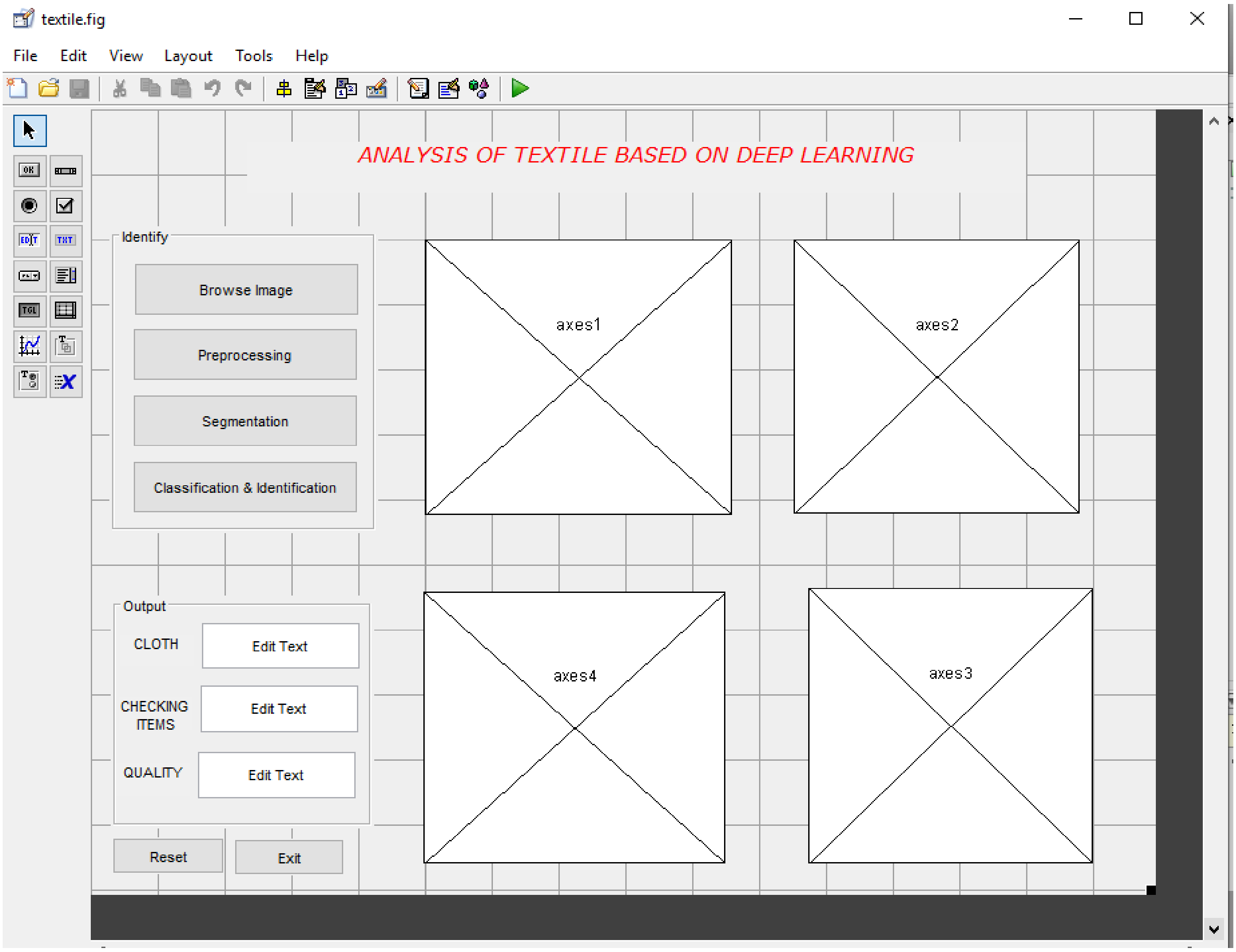


Fig 1: This shows the UI(User Interface) of the project we created,we have two broader sections : Identify and Output

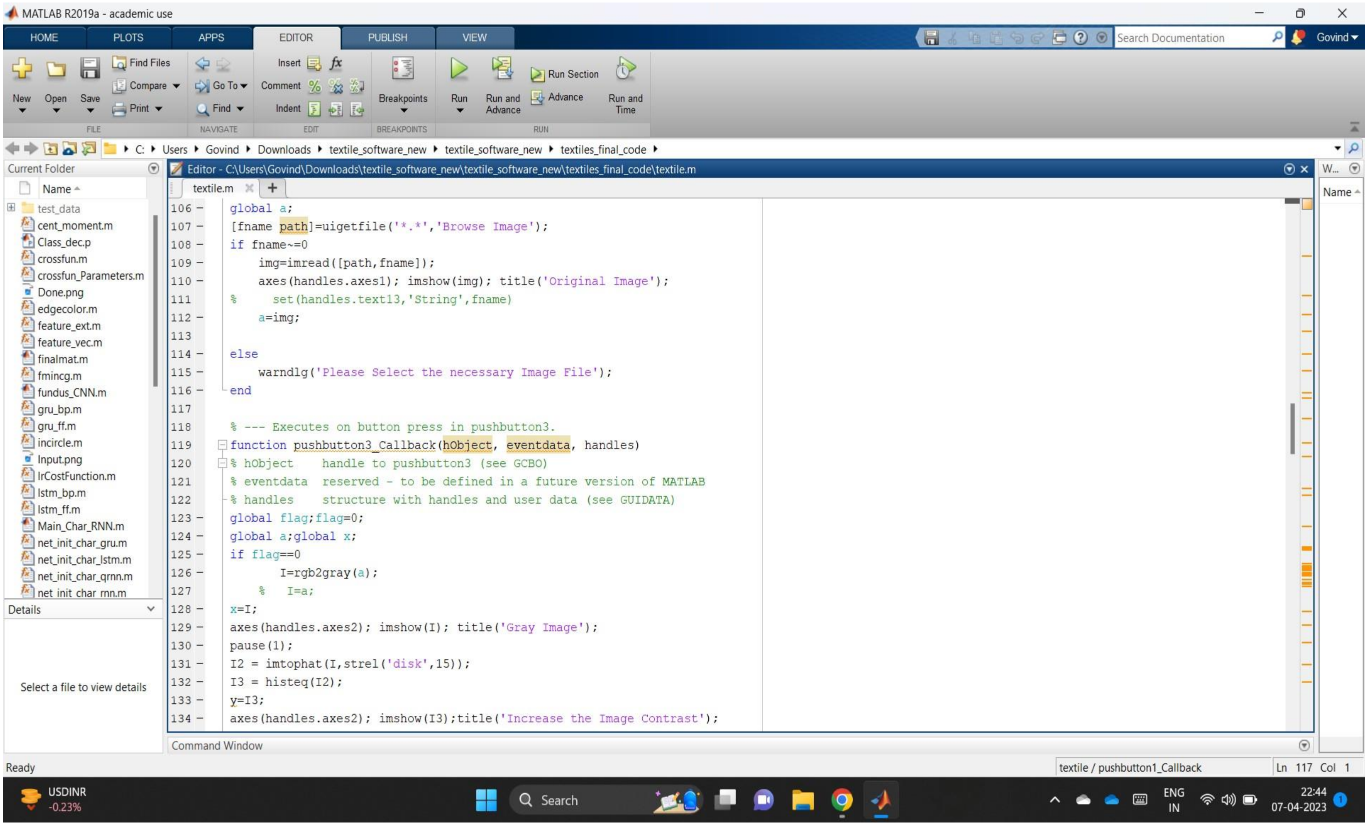
In Identify Section : we have Browse Image(to take the input),Preprocessing (convert to GrayScale image), Segmentation (To identify the boundaries using ACM),Classification and Identification(using the CNN)

Output : Cloth,Checking Items,Quality

MATLAB is a scientific programming language that provides strong mathematical and numerical support for implementing advanced algorithms. For this reason, MATLAB is widely used in the image processing and computer vision community. New algorithms are very likely to be implemented in MATLAB first, and may even be MATLAB-specific.

SYSTEM REQUIREMENTS :

- Windows 7 (or) higher
- 64 bit operating system
- Disk Space 2 GB for MATLAB only, 4–8 GB for a typical installation.
- No specific graphic card
- Minimum s required 2GB RAM needed



segmentation(we use Active Contour Method to identify the boundaries of the damaged segment in the image) fig 2: snippet of the code used

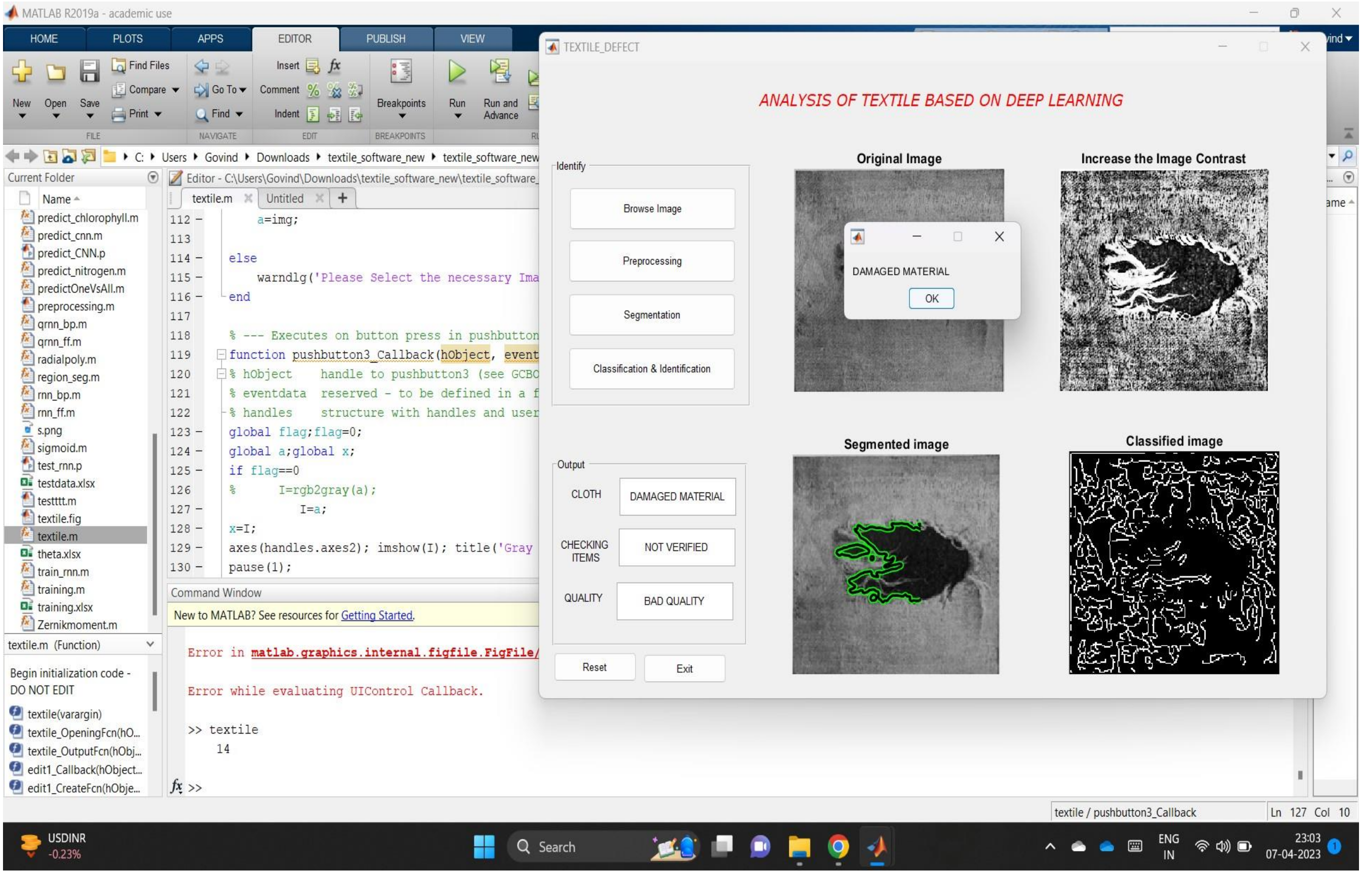


fig 3: preprocessing increase the image contrast(after we take the input, it is converted to gray-scale image)

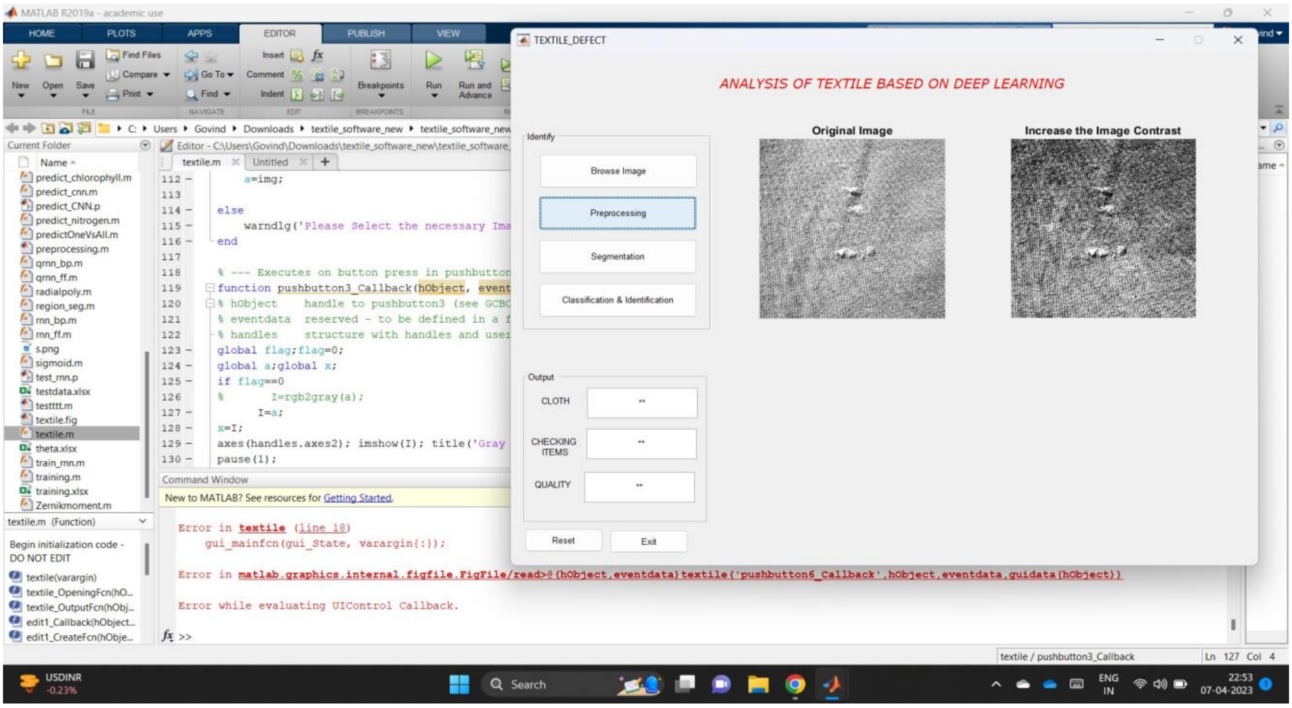
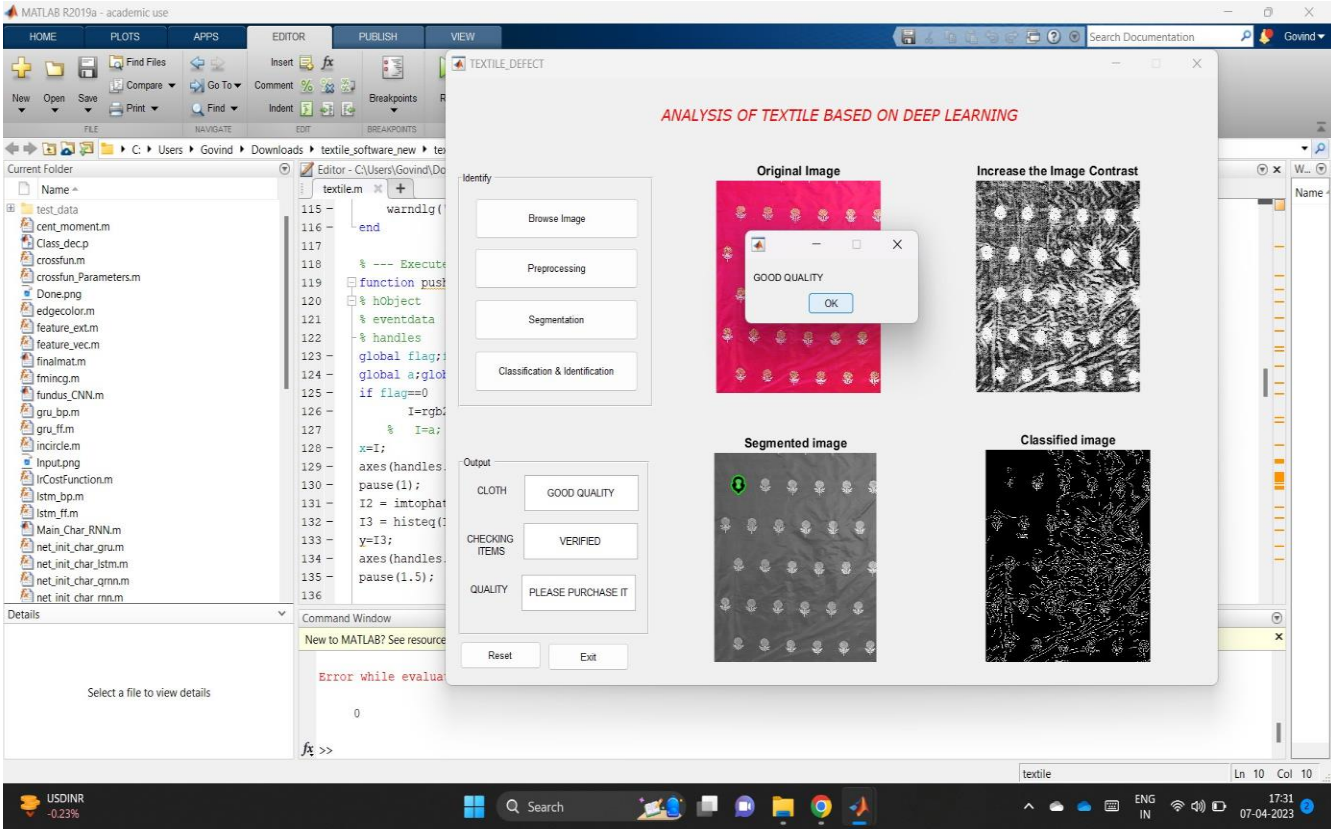


fig 5: classification and identification(we have used CNN method to classify and identify whether to purchase the cloth or not based on the result)



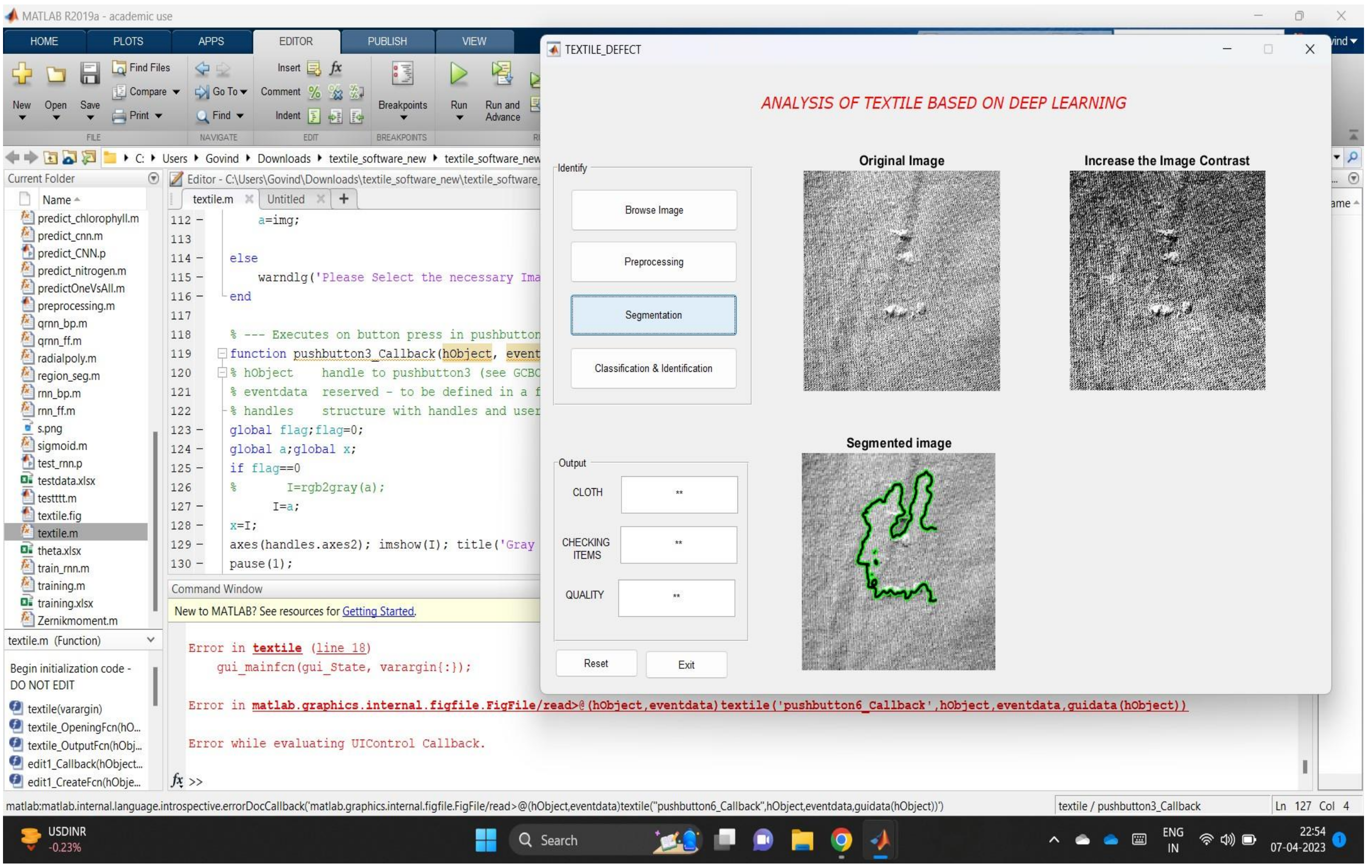
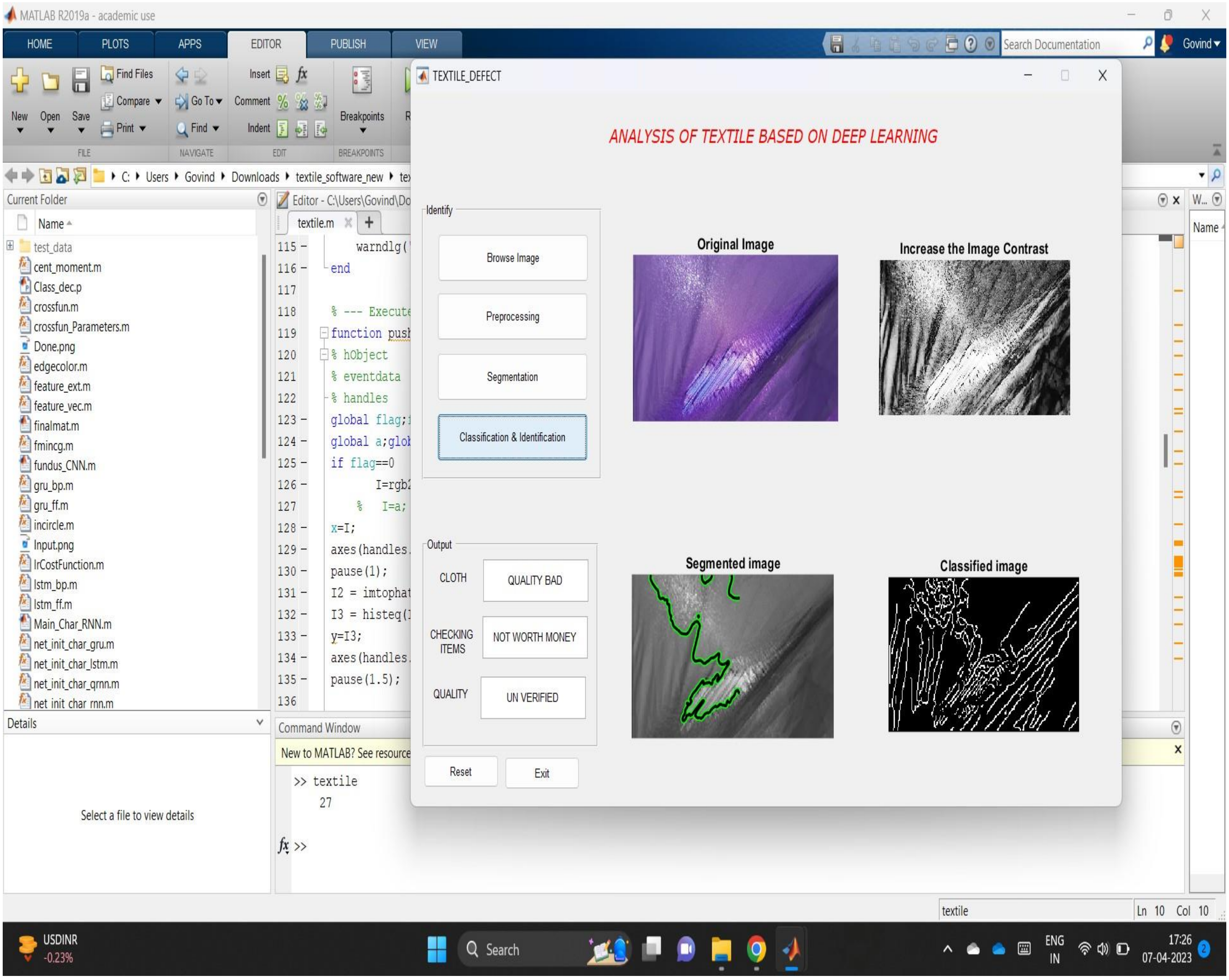


fig 7: This is an example of the Bad quality Material and at the end it says “Not worth buying”.



FUTURE SCOPE:

The use of machine learning algorithms for fabric and defect detection has shown promising results. Using Convolutional Neural Networks (CNNs) to segment fabrics and detect defects has been able to effectively identify and classify defects with high precision. The active contour method for defect detection, which uses an energy minimization technique, has also been effective in segmenting fabrics and detecting defects.

In the future, further research can be done to improve the accuracy of these methods. For example, combining CNNs with other neural networks such as recurrent neural networks or generative adversarial networks could help improve the performance of fabric and defect detection. Additionally, research into developing new novel machine learning algorithms specifically designed for fabric and defect detection could further increase the accuracy of these systems.

Overall, the use of machine learning algorithms for fabric and defect detection is a promising area of research with potential applications in many industries. With further development and optimization, these algorithms could lead to significant improvements in efficiency and quality when it comes to fabric and defect detection.

CONCLUSION:

The conclusion of this project is that using machine learning algorithms such as CNN and active contour method can effectively detect fabric defects in images. The methods were successfully tested on a variety of fabric images using MATLAB and the results showed that there was a high accuracy rate in detecting defects. In conclusion, this project has demonstrated that machine learning can be used for efficient and accurate defect detection in fabric images.

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