Industrial Engineering Journal
ISSN: 0970-2555
Volume : 53, Issue 7, No.3, July : 2024

ARTIFICIAL NEURAL NETWORKS BASED FABRIC SEWINGDEFECT DETECTION AND AUTOMATIC STITCH CONTROLSYSTEM

S. Juliet Mercy, Assistant Professor, Er.Perumal Manimekalai College of Engineering,Hosur, TamilNadu ,India.
R. Elavarasi, Associate Professor, Er.Perumal Manimekalai College of Engineering,Hosur, TamilNadu ,India.
C.R. Balamurugan , Professor, Er.Perumal Manimekalai College of Engineering,Hosur, TamilNadu ,India.
R. Aravind, C. Dhayanandhan, H. Sai Raghava,UG SCHOLAR, Er.Perumal Manimekalai College of Engineering,Hosur, TamilNadu ,India.

ABSTRACT
This system proposes a computer vision-based strategy for the imperfection discovery on pictures with occasional fabrics. The inspection of sewing defects is an essential step in the quality assurance of garment manufacturing. Although traditional automated defect detection applications have showngood performance, these methods are usuallyconfigured with handcrafted features designed by a human operator. Recently, deep learning methods that include Artificial Neural Networks (ANNs) have demonstrated excellent performance in a wide variety of computer- vision applications. To take advantage of the ANN's feature representation, the direct utilization of feature maps from the convolutional layers as universal feature descriptorshas been studied.
In this project, we propose a sewing defect detectionmethod using a ANN feature map extracted from the initial layers of a pre-trained model to detect a broken stitch from a captured image of a sewing operation. To assess the effectiveness of theproposed method, experiments were conducted on aset of sewing images, including normal images, theirsynthetic defects, and rotated images. As a result, the proposed method detected true defects with 97.3% accuracyThe results confirm the feasibility of the proposed method's performance as an appropriate manufacturing technology for garment production.
Keywords: Artificial Neural Networks, sewing faultdetection, broken stitch detect.
Domain: Deep Learning.

I . INTRODUCTION
Computer vision and image classification-based models are used in various applied domains including industry-based problems. Clothing is considered as one of the basic requirements forhuman life, and the history of textile industry is as old as human civilization. Fabric is considered as a main element for human clothing and is also used inmany industrial products. Traditionally, inspection process is completed by using manual human effortsto ensure the quality of fabric. The price of fabric that is sent to the market depends on the number of co- occurrence of defects and price increase with theincrease in the number of defects.

OBJECTIVE
We propose an effective sewing defect detection method that uses ANN feature map to detect broken stitches. The sewing defect detection algorithm, we applied simple image processing methods to identify the sewing-stitch region .To automatically find an optimal threshold value for banalization, we use adaptive thresholding method which is suitable for binarizing images To check the continuity of the stitch areas, the extracted area from the feature mapmust be segmented into individual regions.

II . LITERATURE SURVEY
[1]. K. Simony an, A. Zisserman, "Very Deep Convolutional Networks for Large-Scale Image Recognition," Computer Science, 2018.
In this paper, a deep-learning algorithm wasdeveloped for an on-loom fabric defect inspection system by combining the techniques of image pre- processing, fabric motif determination, candidatedefect

map generation, and convolutional neural networks (CNNs). A novel pairwise-potential activation layer was introduced to a CNN, leading tohigh accuracy of defect segmentation on fabrics withintricate features and imbalanced dataset. The average precision and recall of detecting defects in the existing images reached, respectively, over 90and 80% at the pixel level and the accuracy on counting the number of defects from a publiclyavailable dataset exceeded 98%.
[2]. K. He, X. Zhang, S. Ren, J. Sun, "Deep Residual Learning for Image Recognition", IEEE Conferenceon Computer Vision and Pat-tern Recognition (CVPR), 2017. Fabric defect detection is now an active area of research for identifying and resolvingproblems of textile industry, to enhance the performance and also to maintain the quality of fabric. The traditional system of visual inspection byhu-man beings is extremely time consuming, high on costs as well as not reliable since it is highly errorprone. Defect detection classification are the major challenges in defect inspection. Hence in order to overcome these drawbacks, faster and cost effectiveautomatic defect detection is very necessary.
Considering these necessities, this10
paper pro-poses wavelet filter method. It also explains in detail its various techniques of getting final output like preprocessing, decomposition, thresholding, and noise eliminating.
[3]. Golick, ˙I. (2020). An interval type-2 fuzzy reasoning model for digital transformation project risk assessment. Expert Systems with Applications,159, Article 113579.
In the manufacturing sector, DT has been implemented in the form of smart factories that aimto maximize the added value of data, optimize process operations, and improve quality control by utilizing Artificial Intelligence (AI), the Internet of Things, big data, robotics, and digital twin design techniques.
[4]. GonzalezR. C., & Woods R. E. (2019). Digital Image Processing, 2nd Ed. Upper Saddle River, N.J. This paper presents a novel approach to the fast detection and extraction of fabric defects from the images of textile fabric. Automated visual inspection systems are much needed in the textile industry, especially when the quality control of products in textile industry is a significant problem. In the manual fault detection systems with trained inspectors, very less percentage of the defects are being detected while a real time automatic system can increase this to a maximum number. Thus, automated visual inspection systems play a great role in assessing the quality of textile fabrics. For thedetection of fabric defects, we first decompose the image into its bit planes. The lower order bit planes are found to carry important information of the location and shape of defects.
These methods are effective but require a largemeans of mathematical morphology.11
[5]. T. S. Newman and A. K. Jain, "A survey of automated visual inspection," Computer Vision Image Understanding, vol. 61, no. 2, pp. 231–262,
Mar. 2020.
However, it is very difficult to get a large amount ofactual defect data in industrial areas. To overcome this problem, we propose a method for defect detection using stacked convolutional autoencoders.The autoencoders we proposed are trained by usingonly non-defect data and synthetic defect data generated by using the characteristics of defect based on the knowledge of the experts. A key advantage of our approach is that actual defect data is not required, and we verified that the performanceis comparable to the systems trained using real defect data.
[6] A. D. H. Thomas, M. G. Rodd, J. D. Holt, and C.
J. Neill, "Real-time industrial inspection: A review," Real Time Imaging, vol. 1, no. 2, pp. 139–158, Jun. 2017.
This paper proposes a method based on deep adoptive transfer learning for cloth defectsdetection. In this paper, collected cloth images are cut, marked to create the datasets, and the image classification method is used to determine the defects of the cloth. The experimental results show that the proposed method has outstanding performance on classifying the cloth defects. The classification accuracy of 95.53% and 93.82% is achieved on the InceptionV3 and DenseNet121 transfer learning models respectively. By featurelearning heat map of samples, it verifies that the models have strong learning ability and generalization ability for the characteristics of the cloth defect.

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III. EXISTING METHOD

Fabric fault detection is very popular topic of automation moreover quality control is one of the important features in textile industry. The performance of the projected idea is evaluated by using different techniques of patterned fabric images with different types of common fabric defects. Moreover, detection methods were also evaluated in real time using a model automation specification system. This existing system both researchers and practitioners in the field of image processing and computer vision to understand the uniqueness of the different defect detection methods. The recognition receives a digital fabric image from the image acquisition device and transforms it to a binary image using the restoration and threshold methods. This research presents a technique that decreases physical exertion. Therefore, this study uses a textile fault detector with a systematic vision approach for image processing.

DISADVANTAGE

- The accuracy obtained through this method is comparatively low of about 70 percent.
- The training and execution takes a lot of time.
- The whole process is tedious as it requires more datasets of each features.

IV . PROPOSED SYSTEM

In this project, we proposed a sewing defect detection method that uses a ANNs feature map to detect broken stitches based on machine learning and image-processing method. With image-based defect detection, it is essential to obtain an accurate target image. Hence, a camera can be used to capture the high-quality images needed for analysis. The feature map was extracted from the initial layers of a pre-trained calculation of area. We implemented a strategy for determining a broken stitch from a captured image of the sewing operation using feature map extraction and other processes (e.g., binarizing the feature map, segmenting contour areas of the sewing stitch, and detecting the broken-stitch defect).To assess the effectiveness of the proposed method, experiments were conducted on a set of sewing images, including normal images with synthetic defects.

3.2.1 ADVANTAGE

- The system can detect sewing defects with greater accuracy and efficiency.
- In the textile industry, we can detect the damage in the real picture and we can repair the damage with the help of advanced management systems.
- The method which is used in this research work categorizes 90% of faults in the cloth. Improvement and enhancement of visual system performance can generally be done with the proposed algorithm to detect common defects in normal textures.

SYSTEM FUNCTION

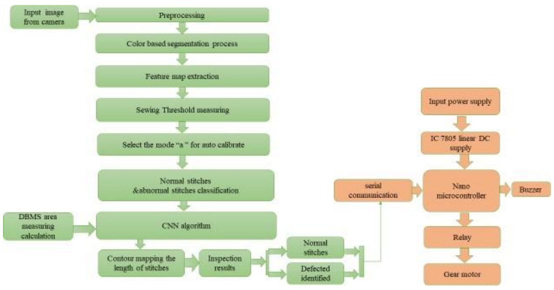

Fig.no:1 Block Diagram CIRCUIT DIAGRAM

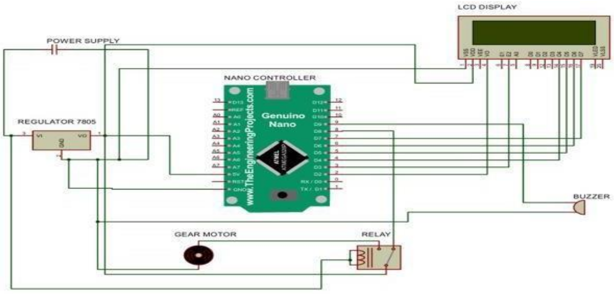

Fig no:2 Circuit diagramMemory in Nano

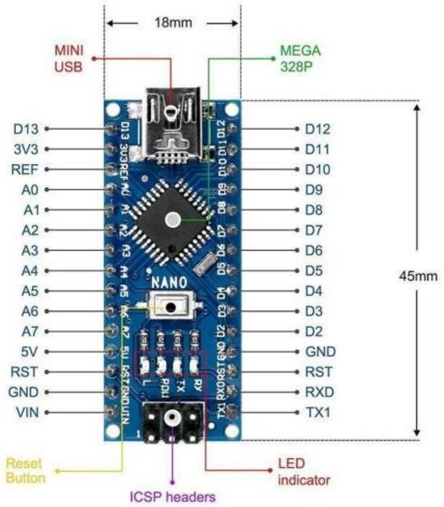

Fig no:3 pin Diagram for Nano controller
High Endurance Non-volatile MemorySegments

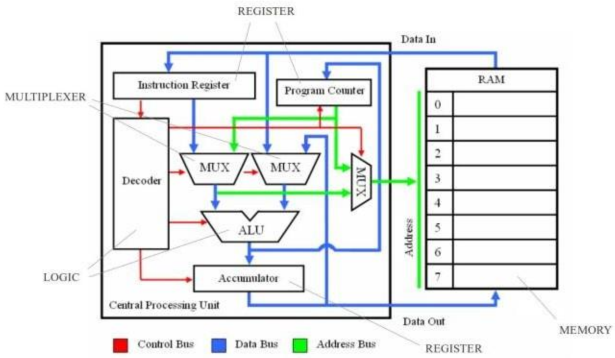

Fig no:4 Architecture design formicrocontroller

V . SYSTEM SPECIFICATIONHARDWARE REQUIREMENTS:

➢ Nano microcontroller
➢ IC 7805 linear DC supply
➢ Input power supply
➢ Relay
➢ Gear motor
➢ Buzzer

SOFTWARE REQUIREMENTS:

➢ Python
➢ Pychram

ARTIFICIAL NEURAL NETWORK (ANN)

An artificial neural network (ANN) is the piece of a computing system designed tosimulate the way

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the human brain analyzes andprocesses information. It is the foundation of artificial intelligence (AI) and solves problemsthat would prove impossible or difficult by human or statistical standards. ANNs have self-learning capabilities that enable them to produce better results as more data becomes available.
A single neuron can be imagined as a Logistic Regression. Artificial Neural Network, or ANN, is a group of multiple neurons at each layer. ANN is also known as a Feed-Forward Neural network because inputs are processed only in the forward direction. Aswe can see here, ANN consists of 3 layers – Input, Hidden and Output. The input layer accepts the inputs, the hidden layer processes the inputs, and the output layer produces the result. Essentially, each layer tries to learn certain weights.

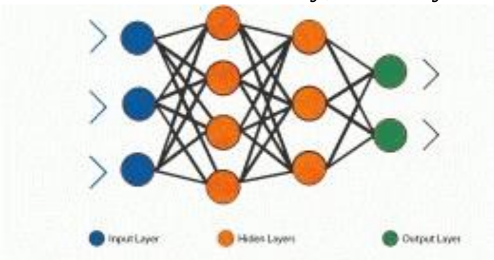

Fig no: 5 ANN

VI . SYSTEM SOFTWARE

PYCHARM

PyCharm is a dedicated Python Integrated Development Environment (IDE) providing a wide range of essential tools for Python developers, tightly integrated to create a convenient environment for productive Python, web, and data science development.
Supported languages
To start developing in Python with PyCharm weneed to download and install Python from python.org depending on our platform.
PyCharm supports the following versions of Python:
- Python 2: version 2.7
- Python 3: from the version 3.6 up to theversion 3.10

Besides, in the Professional edition, one can develop Django, Flask, and Pyramid applications. Also, it fully supports HTML (including HTML5), CSS, JavaScript, and XML: these languages are bundled in the IDE via plugins and are switched on for we bydefault. Support for the other languages and frameworks can also be added via plugins (go to Settings | Plugins or PyCharm | Preferences |Plugins for macOS users, to find out more or setthem up during the first IDE launch).
Supported platforms
PyCharm is a cross-platform IDE that works on Windows, macOS, and Linux. Check the system requirements:
We can install PyCharm using Toolbox or standalone installations. Start with a project in PyCharm
Everything we do in PyCharm, we do within thecontext of a project. It serves as a basis for coding assistance, bulk refactoring, coding style consistency, and so on. We have three options to start working on a project inside the IDE:
- Open an existing project
- Check out a project from version control
- Create a new project Open an existing project

Begin by opening one of our existing projects stored on our computer. We can select one in thelist of the recent projects on the Welcome screenor click Open:

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Fig no: 6 Pycharm window page

Otherwise, we can create a project for our existing source files. Select the command Open on the File menu, and specify the directory where the sources exist. PyCharm will then create a project from our sources for we. Refer to the section Importing Project from Existing Source Code for details.

Check out an existing project from Version Control

We can also download sources from a VCS storage or repository. Choose Git (GitHub), Mercurial, Subversion, Perforce (supported in Professional edition only), and then enter our credentials to access the storage.

Then, enter a path to the sources and clone the repository to the local host:

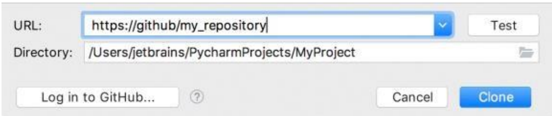

Fig no: 7 Link URL

To create a project, do one of the following:

- **From the main menu, choose File | New Project**
- **On the Welcome screen, click New Project**

In PyCharm Community, we can create only Python projects, whereas, with PyCharm Professional, we have a variety of options to create a web framework project.

Fig no: 8Window Page

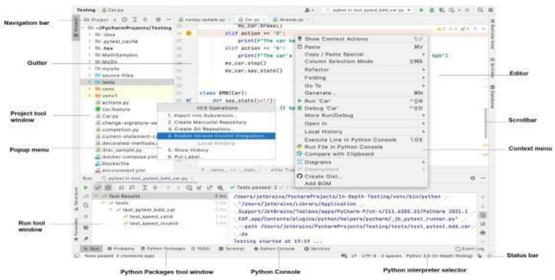

Fig no: 9 Tool BarRESULTS

The computer vision-based strategy utilizing Artificial Neural Networks (ANNs) for detectingsewing defects, particularly broken stitches, in garment manufacturing. Departing from traditional methods reliant on handcrafted features, this approach leverages deep learning techniques, specifically ANNs and convolutional layers' featuremaps. Experimentation yielded a 97.3% accuracy indetecting true defects across various conditions, including normal, synthetic defect, and rotated images. Additionally, optimization efforts targeting computing resources and deep learning libraries were explored to facilitate real-time computation. The promising results affirm the proposed method's efficacy, indicating its potential as a valuable technology for enhancing garment production quality.

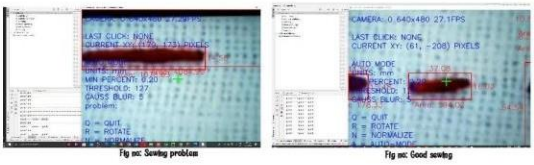

Fig no: Sewing problem Fig no: Good sewing

Fig 10 : Images of Synthetic Defect

VII . CONCLUSION

In this project, we proposed a sewing defect detection method that uses an ANN feature map to detect broken stitches while solving related image- processing method limitations. We proposeda new fabric defect detection system which can dealwith various types of fabrics. Our method does directly use the original image as input. Instead. Ouralgorithm achieved an average accuracy of 97.3% for results, which can achieve accurate detection of defects. Compared with traditional shallow learning approaches, the experimental results demonstrate that our proposed method caneffectively learn defect features by adaptively adjusting the parameters. In addition, our method can improve efficiency, shortening the time of obtaining an accurate defect image.

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