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TEXTILE FABRIC DEFECT DETECTION USING ML AND DL

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ABSTRACT

The effectiveness of various machine learning (ML) and deep learning (DL) models in detecting defects in textile fabrics, an essential aspect of ensuring quality control in the textile industry. The studyinvolves the creation of a comprehensive dataset of fabric images with annotated defects, serving as a benchmark for model evaluation. Our findings indicate that while traditional ML models pro- vide satisfactory results for simpler defect types, DL models, particularly CNNs, outperform in detecting complex and subtle defects due to their superior feature extraction capabilities. The research underscores the potential of deep learning in advancing textile defect detection, recommending its integration for improved accuracy and reliability in industrial applications. The research highlights thepotential of intelligent fabric detection systems to enhance operational efficiency, reduce costs, and ensure higher standards of prod-uct quality in the textile industry. Future work aims to expand the fabric database, refine the detection algorithms, and explore the ap- plication of this technology in related domains such as apparel manufacturing and textile recycling.

Keywords: Machine Learning, CNN, Deep Learning, Accuracy.

I. INTRODUCTION

In the textile industry, maintaining high-quality standards is paramount, and the de-tection of defects in fabric is a critical aspect of quality control. Traditional methodsof fabric inspection are often, time-consuming, and prone to human error. Conse- quently, there has been a significant shift towards automated defect detection systems powered by Machine Learning (ML) and Deep Learning (DL) techniques. Among these techniques, Convolutional Neural Networks (CNNs) have emerged as a highlyeffective tool for image-based defect detection due to their ability to learn and extractintricate features from data. CNNs, a class of deep learning models, have revolution- ized the field of image processing and computer vision. Unlike traditional methods, CNNs automatically learn hierarchical feature representations from raw image data,eliminating the need for manual feature extraction. This capability makes CNNs particularly well-suited for defect detection in textile fabrics, where defects can varywidely in shape, size, and texture.

II. METHODOLOGY

Anaconda:

Anaconda is a free and open-source distribution of the Python and R programming languages for scientific computing (data science, machine learning applications, large-scale data processing, predictive analytics, etc.), that aims to simplify package management and deployment. The distribution includes data-science packages suitable for Windows, Linux, and macOS. It is developed and maintained by Anaconda, Inc., which was founded by Peter Wang and Travis Oliphant in 2012. As an Anaconda, Inc. product, it is also known as Anaconda Distribution or Anaconda Individual Edition, while otherproducts from the company are Anaconda Team Edition and Anaconda Enterprise Edition, both of which are not free.

SPYDER :

Spyder is a powerful scientific environment written in Python, for Python, and designed by and for scientists, engineers and data analysts. It offers a unique combination of the advanced editing, analysis, debugging, and profiling func-tionality of a comprehensive development tool with the data exploration, in- teractive execution, deep inspection, and beautiful visualization capabilities ofa scientific package.

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III. MODELING AND ANALYSIS

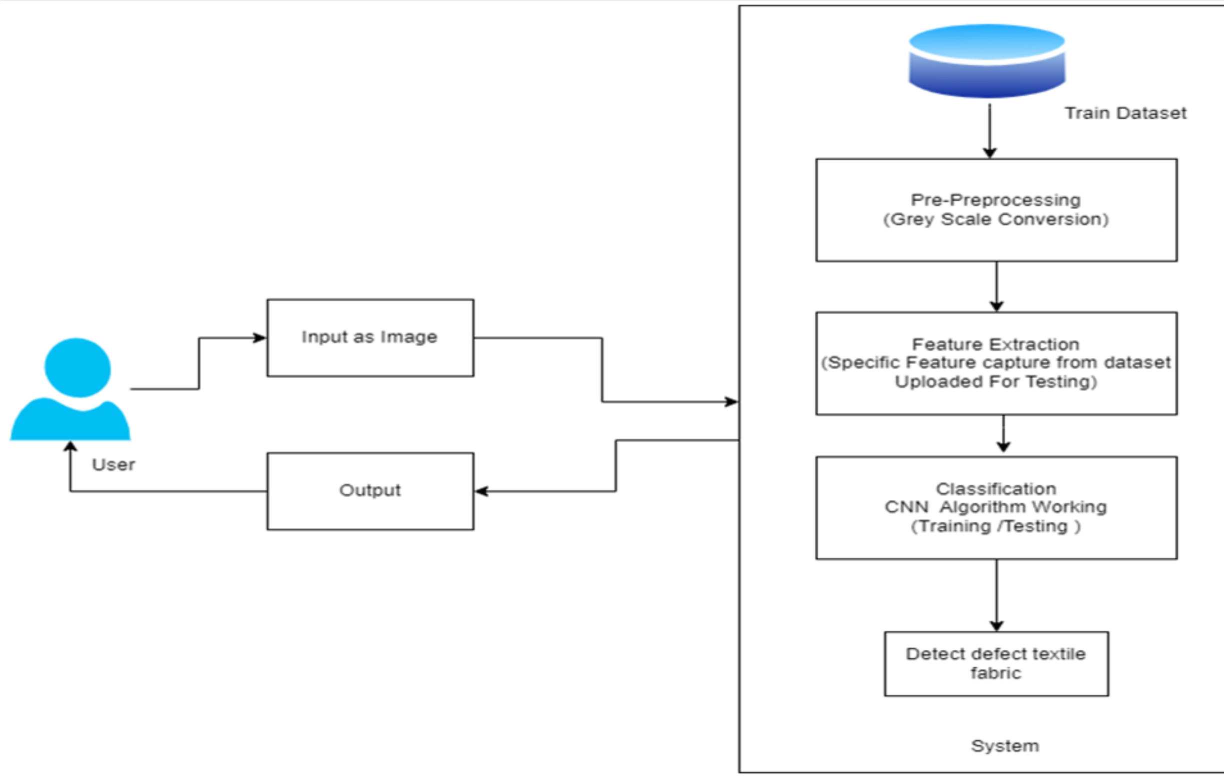

Figure 1: Architecture

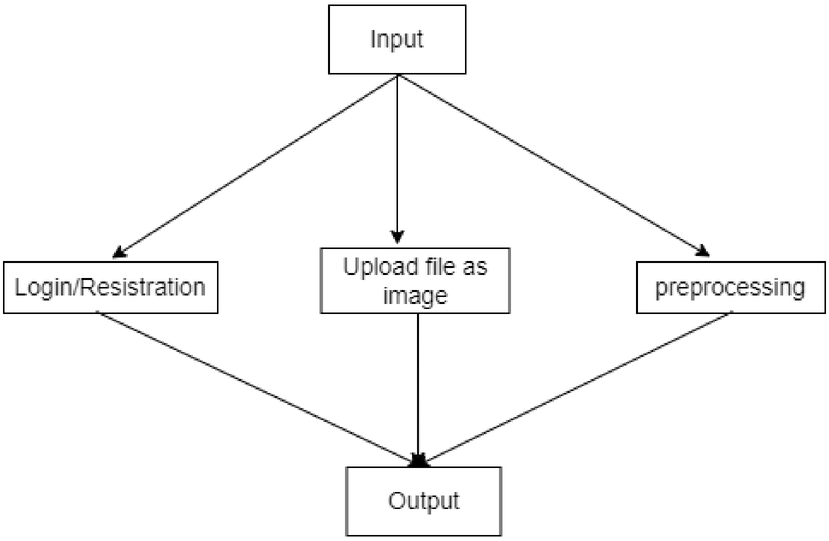

Figure 2: UML Diagram

IV. RESULTS AND DISCUSSION

The CNN algorithm's performance more fully. Only 55 faulty samples and 45 non-defective samples were incorrectly categorized using the CNN algorithm, demonstrating that 945 defective samples and 955 non defective samples were correctly classified. The CNN algorithm's overall accuracy was high, showing its potential as a method for identifying flaws in textile fabrics. The accuracy and detection rate of these algorithms were also assessed for efficiency. Results from the trials are displayed.

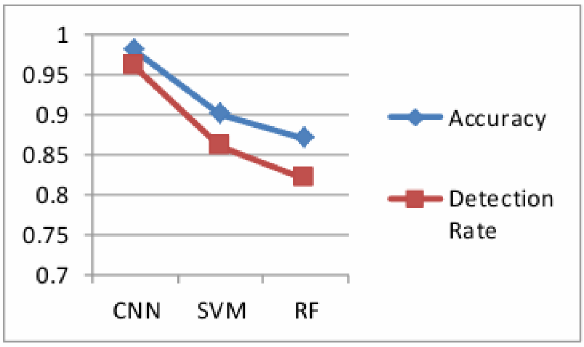

Figure 3: Accuracy and Detection Rate

V. CONCLUSION

In conclusion, identifying and addressing textile fabric defects is essential for maintaining high-quality standards in fabric production. By understanding common surface defects such as holes, stains, and creases, as well as struc- tural issues like misweave and skewing, manufacturers can implement better quality control measures. Additionally, managing color defects such as shade variation and color bleeding ensures consistency and visual appeal in the final product. Effective detection and correction of these defects not only improve the durability and aesthetic of textiles but also enhance customer satisfaction and reduce production costs. Therefore, a systematic approach to defect anal-ysis and prevention is critical for the success and reputation of textile manu- facturers.

VI. REFERENCES

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