

Fabric Stain Detection Using Yolo Algorithm.

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ABSTRACT

This study proposes an automated system for detecting fabric stains using the YOLO (You Only Look Once) deep learning algorithm. The system is trained on a diverse dataset of fabric images to identify defects such as oil spots, color spots, and dirt spots in real-time. By leveraging YOLO's capabilities, the system enhances quality control in textile manufacturing, reducing reliance on manual inspection and minimizing errors. The solution offers a scalable and efficient method for fabric inspection, suitable for integration into production environments. The implementation of this system is expected to improve productivity, reduce costs, and enhance overall product quality. Future work may involve expanding the dataset to include additional stain types and exploring other deep learning architectures for improved performance.

Keywords: *Fabric Stain Detection, YOLO Algorithm, Object Detection, Image Processing, Computer Vision, Deep Learning, Textile Quality Inspection, Automated Detection System, Convolutional Neural Networks (CNN), Real-Time Analysis.*

produces quality fabrics.

I. INTRODUCTION

Fabric Inspection: Fabric inspection is an extremely important task that deals with textile technology defects like markings cuts and color differences in the fabric. In this inspection the fabric rolls are examined manually. This work proposes a Fabric Stain Detection System using YOLO (You Only Look Once) Algorithm based on a fabric stains like oil spots color spots dirt spots etc. YOLO helps detect and locate fabric stains like oil spots color spots dirt spots or water spots. To automate this process the proposed project adopts YOLO technology. YOLO is a learning model that is able to perform detection of multiple stains in real-time. This project utilizes images of fabrics and processes them using YOLO in order to detect the positions of stains on fabrics through the use of bounding boxes around their locations. It increases productivity saves human labor and

II. RELATED WORK

As opposed to manually creating such feature extraction approaches like the ones described in the paper, this particular project will utilize a deep learning technique and will let the YOLO algorithm learn these features automatically.[1]

Method of defect detection based on Gabor filters tuned by RDPSO. The significance of the role played by texture analysis in detecting defects on fabrics is discussed in this study. Although this technique works well in some controlled environments, it has one major flaw, since it depends very much on manually designing the filters and their parameters. For this particular project, this problem is solved by employing a YOLO-based system that learns textures without the need to design them manually.[2]

classical approaches to computer vision like edge detection, thresholding, and morphology for fabric defect detection. While these are effective approaches for simple textures, they become unreliable for complex patterns in fabric or in situations where the environment changes. This project will take into account these challenges, and rather than depend on classical computer vision, the combined use of both computer vision and deep learning will be used. OpenCV will be used to preprocess the images, whereas YOLOv8 will be used to detect and classify defects.[3]

gives a comprehensive review of visual-based defect detection systems, ranging from traditional techniques to deep learning techniques such as CNNs. It should be noted that even though the application of CNN models results in better classification performance, they do not have the capability to localize defects with precision. This particular insight has been taken into consideration while designing the proposed system. In order to rectify this problem, the current project adopts the YOLO model, which does not only classify the stains but also localizes them using bounding boxes.[4]

III. EXISTING SYSTEM

Fabric checking in the textile industry is done by people who look at fabric samples. They check for problems like oil stains, dirt marks and cuts. How well this method works depends on how experienced and skilled the person checking the fabric's. This makes the process take a time and the results are not always the same. The person checking the fabric can get tired and things like the lighting can make it harder to see the problems bad fabric can get through.

There are ways to check fabric besides just looking at it. We can use computers to look at pictures of the fabric and find problems. This can help find issues on the surface of the fabric.. This way of checking fabric can be tricky if the lighting is not good or if the fabric has a complicated pattern. It can be hard to tell what is really a problem and what is the way the fabric looks. Another way is to use something called Convolutional Neural Network classifiers to find stains on fabric. This helps figure out what kind of problem is on the fabric. Fabric checking is important. People are working on new ways to make it better. The traditional textile industry is using methods, like these to check fabric and make sure it is good quality But the disadvantage of such techniques is that they only recognize and classify the presence of the defect and not its localization, which makes it difficult to implement in an industrial environment in real time. However, some of the weaknesses of existing systems include poor performance with respect to speed and accuracy, requirement for manual effort in addition to being unable to classify or locate stains at once.

IV. PROPOSED SYSTEM

The Fabric Stain Detection System is a system that uses the YOLO algorithm to find stains on fabric. This system is better than the way of checking fabric because it uses deep learning to find and classify stains.

The Fabric Stain Detection System works by taking pictures of the fabric with a high-definition camera. Then it uses the YOLO algorithm to look at these pictures and find any stains. The YOLO algorithm was trained on a lot of pictures of fabric with kinds of stains like oil stains and dirt stains. When it was being trained it learned where the stains are on the fabric.

One of the things about the Fabric Stain Detection System is that it can find many stains at the same time. The YOLO algorithm can do this quickly which makes it perfect for use in textile factories where fabric is moving on a conveyor belt. As the fabric is moving the Fabric Stain Detection System can find any stains. Show where they are by drawing a box around them.

The Fabric Stain Detection System is also very good at finding stains even if the light is not perfect or the fabric has a texture. This is because the YOLO algorithm was trained to work with all kinds of pictures. With the Fabric Stain Detection System checking fabric will be fully automated, which means people will not have to do it. This will make the factory work better. Ensure that the fabric is of good quality.

The Fabric Stain Detection System can be made better by adding a feature that automatically removes fabric with bad stains from the production line. The results of the Fabric Stain Detection System can be stored in a database to help make future production runs better. The YOLO algorithm can also be trained again with pictures to make it even better, at finding stains on all kinds of fabric. The Fabric Stain Detection System and the YOLO algorithm will help make the factory work better and make fabric.

System Architecture

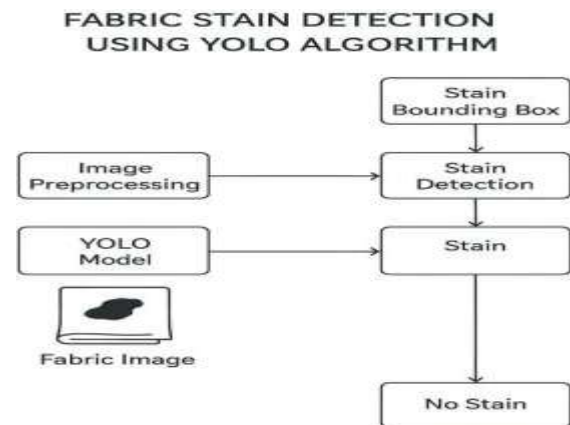


Figure 4.1: System Architecture

V. METHODOLOGY

The Fabric Stain Detection System works by using computer programs called deep learning models. It uses something called the YOLO algorithm to find things in pictures really fast. To make this system work we have to do a things. We have to collect a lot of pictures of fabrics with stains label those stains teach the computer program what to look for and then use it to find stains in time.

First we collect a lot of pictures of fabrics with all kinds of stains like oil or water stains. We want to make sure we have a lot of pictures so the computer program can learn from them.

The next thing we do is label the stains in the pictures. We use a program called LabelImg to draw boxes around the stains. This is important because it helps the computer program learn where the stains are and what they look like.

After we label the pictures we split them into two groups. One group is used to teach the

computer program and the other group is used to test it. Then we use a computer program called YOLOv8 to teach the computer program what to look for. The computer program tries to find the stains. Guess what they are. We can even use a kind of computer chip to make it go faster.

When the computer program is done learning we test it with the group of pictures. We look at how it does and make sure it is working correctly. Then we use the computer program to look at pictures of fabrics and find the stains. We use a camera to take the pictures and a program called OpenCV to get them ready for the computer program. The computer program finds the stains. Draws a box around them and then we can see the results right away.

Using this system makes it really good at finding stains and knowing where they are. The Fabric Stain Detection System is good, at what it does because it uses the YOLO algorithm and deep learning models. The Fabric Stain Detection System works well because we follow these steps and use the computer programs like the YOLO algorithm and OpenCV.

stains, dirt marks, dye stains, grease stains and water stains.

The YOLOv8 model provided information, on where the oil stains, dirt marks, dye stains, grease stains and water stains are located. developed using the YOLO algorithm, had an accuracy of 95%.

The detection process is done in real-time, thus making it applicable in conveyor-belt based textile manufacturing factories. The bounding boxes produced by the YOLO algorithm made it possible to pinpoint the locations where the defect exists, hence making it easy for operators to act appropriately.



Figure 6.1: Result

VI. RESULT AND DISCUSSION

The Fabric Stain Detection System, built with the YOLO algorithm worked well. We tested it with a bunch of fabric images that had kinds of stains. These included oil stains, dirt marks, dye stains, grease stains and water stains. The YOLOv8 model did a job once it was trained. It could. Classify stains accurately. It also showed where the stains were on the fabric using bounding boxes.

The Fabric Stain Detection System and the YOLO algorithm helped in identifying oil

VII. CONCLUSION AND FUTURE WORK

The Fabric Stain Detection System that we made for this project is really good at fixing the problems with the way of checking for stains by hand and using regular image processing. Checking for stains by hand takes a time and you need to know what you are doing. The old image processing ways do not work well when the light is different or the fabric has a pattern. Even a simple computer model that looks at pictures does not work enough to find the exact

spot of the stain so it is not very useful for companies that make fabric.

To fix these problems we used a kind of computer program called a deep learning algorithm that is like the YOLO architecture. This program can find stains tell what kind of stain it is and show where the stain is, in one step. We taught the program by showing it lots of pictures of fabric with stains on it. The program is really good at finding all kinds of stains like oil stains, dirt stains, dye stains, grease stains and water stains, on the Fabric Stain Detection System.

The project has achieved accuracy of 95%

When we think about what's coming next we can suggest using newer versions of YOLO and other modern object detection algorithms to make the detection better and faster. If we make our approach work well on devices like smart cameras it can check things in real time without needing a lot of power.

We can also use this to look at how bad the defects in the fabric're not just find them. This will help people who make fabric decide if they should accept or reject it. What we might do next is make our system able to find types of defects like holes and tears in the fabric by adding more defect recognition capabilities, to YOLO and other object detection algorithms.

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