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# Fabric Stain Detection using YOLO Algorithm

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**ABSTRACT:** The capacity to recognize and classify stains on fabric surfaces is crucial for a number of applications, such as automated garment inspection and quality control in the textile industry. Here, we describe a unique approach for fabric stain detection using the YOLO algorithm, a state-of-the-art object recognition framework renowned for its remarkable precision and real-time performance. We build a dataset with an array of stain types and sizes on different materials in order to train our algorithm. The YOLO algorithm is adjusted and improved to find and classify stains in pictures of cloth more effectively. This leads to dependable performance in a range of lighting conditions and fabric textures. The reason our proposed technique performs faster and more accurately in real-world computer vision applications is because experimental results support our theory.

**KEYWORDS:** YOLO -You Only Look Once

## I. INTRODUCTION

Fabrics are considered an essential part of clothing for humans and are used extensively in industrial settings. Natural resources may be utilized to manufacture textile fabric, such as wool, cotton, nylon, or a polyester composite. The textile industry uses advanced machinery to make this cloth, and defects are discovered during the process of inspection. Machine vision and visual classification models are used to industry-based problems and other relevant domains. In human civilization, the field of textiles has existed for as long as there have been clothes.

Hand inspections are the conventional approach used to guarantee the fabric's quality. Marketed cloth prices are according to the regularity of co-occurring imperfections; the more defects there are, the more expensive the cloth becomes. Immediately upon discovering a fault, the person operating the equipment stops the manufacturing procedure and logs the issue's location and details. Manual inspections have the following main drawbacks:

- Due to human negligence, tiny difficulties may go undiscovered while major flaws are easily detected. The training needed to become a fabric inspector is required.
- It is labor-intensive for humans to find flaws in the material.
- Fabric inspectors may find it incredibly challenging to concentrate on the weaving procedures continuously for longer than five minutes, which may lead to low production efficiency.

## II. LITERATURE REVIEW

Researchers are attempting to increase efficiency and automate stain identification techniques. A review of the literature on artificial vision and identification of objects methods for fabric stain detection makes this clear. A small number of research have examined the usage of neural network models with convolutions (CNNs) and the YOLO (You Only Look Once) algorithm as examples of deep learning strategies for fabric stain detection applications.

Research undertaken by authors such as Redmon et al. (2016) and Bochkovskiy et al. (2020) has substantially benefited in the further development and refining of YOLO-based models by providing insights on model design and optimization. These studies demonstrate how YOLO is advantageous for instantaneous object recognition in fabric stain detection, which requires prompt and accurate identification.

Moreover, research by Kumar et al. (2021) and Li and Ye (2019) shows how effectively deep learning models manage an array of stain types and fabric textures. These kinds of studies often combine complex strategies for data improvement with transferable learning to improve the framework's ability for abstraction.

Additionally, the research emphasizes how useful carefully selected datasets containing labeled fabric photos are for developing and testing stain detection algorithms. Researchers have applied stain detection techniques to assess and improve them by using datasets like the Original Stained Dataset (OSD).

While the literature now in existence provides valuable insights, more research is necessary in the context of YOLO-based fabric stain detection, especially in relation to concerns about scalability, real-time responsiveness, and adaptability to various industry-specific requirements. The goal of this research project is to apply and optimize a YOLO-based system created especially for fabric stain recognizing for the purpose to create computerized techniques for quality assurance in sectors related to fabrics. This will add to the corpus of existing knowledge in this field.

### III. METHODOLOGY

#### Image Acquisition:

Taking digital photos using cameras, scanners, or other image instruments is the beginning in the whole procedure. The qualities and attributes of the collected photos may have a big impact on further processing interpretations.

#### 1. Image Preprocessing:

Preprocessing methods have been employed for collecting visuals to enhance their quality and prepare them for further analysis.

Noise reduction: To reduce noise, techniques for filtering such as symmetrical, median, and blurred Gaussian are applied.

To enhance the clarity and visual attractiveness of photographs, among the methods for improving images are contrast alteration, histogram equalization, and sharpened filters.

Picture Resizing: Resizing the graphic to a standard size can simplify processing and need less sophisticated computers.

#### 2. Feature Extraction:

Finding and removing pertinent data or patterns from the previously processed photos is known as feature extraction. Different features can be retrieved based on the application, such as:

Texture features, such as uniformity, roughness, and smoothness, are characterized using statistical measures, such as co-occurrence matrices.

- Shape Features: The structure of objects or areas appealing to a picture is described by geometric attributes (such as area, perimeter, and circularity) that are calculated.
- Color Features: Color patterns and features have been measured through the computation of histograms or color moments.
- Edge Features: Using edge detection techniques (e.g., Canny edge detector), abrupt variations in intensity that may correlate to object borders or corners have been found

#### 3. Image Segmentation:

Edge-Based Segmentation: Using identification of edges methodologies, boundaries dividing different regions of the picture are located.

#### 4. Defect Recognition:

The method of detecting defects involves finding and recognizing particular patterns of interest inside the partitioned regions.

### System Design

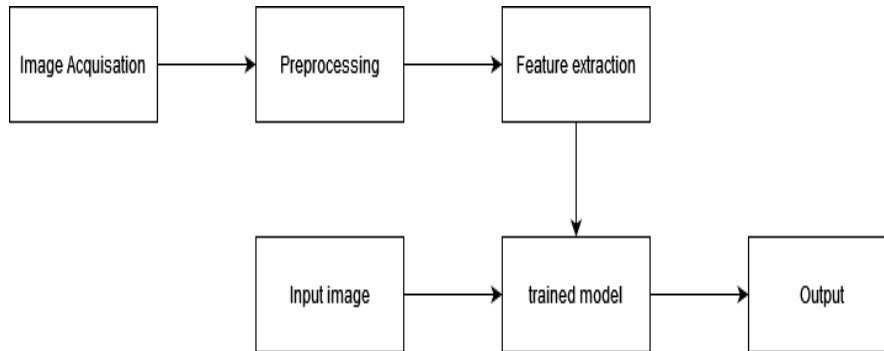


Figure 1: Block Diagram

The network obtains the source image data after collection. The supplied image is converted to a grayscale image following preprocessing. The Yolo method is employed for model training. Model files will be created during the training phase. By comparing the input picture should be analyzed with the model that was instructed from the file, any stains in the rolls will be identified.

### IV. ALGORITHM

#### YOLO algorithm

This algorithm is well-liked because of its speed and precision. In a range of contexts, it has been employed to identify people, animals, parking meters, and traffic lights. This article explains how the YOLO object detection method works. A couple of its useful applications are also demonstrated.

#### YOLO algorithm version 3

An algorithm known as YOLOv3 (You Only Look Once, Version 3) is able to recognize an object in real-time in films, live feeds, or pictures. The YOLO machine learning approach uses features obtained by a neural network with deep convolution (CNN) to identify an item. Versions 1-3 of the YOLO predictive modeling technique were created by Joseph Redmon and Ali Farhadi; version 3 is a more precise version of the initial ML method. The initial iteration of YOLO was created in 2016, and version 3 was made available after two years. In 2018; this version is discussed in great length in this article. YOLOv3 is an improved version of YOLO and YOLOv2.

### V. RESULTS

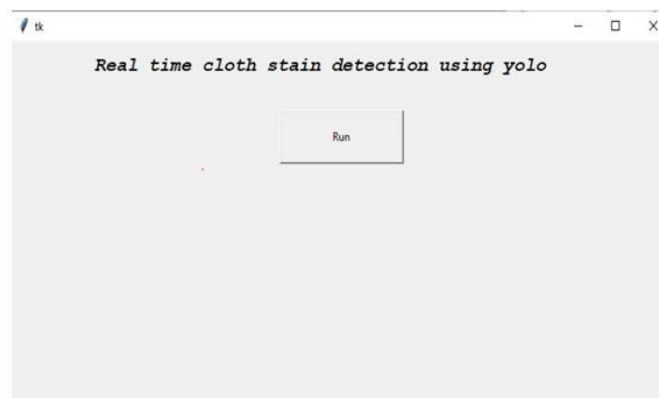


Figure 2: TK Interface

This is TK interface, by clicking Run button it opens video page as shown below



**Figure 3 : Test Screen 1**

According to machine learning it is false positive .because it is detecting flowers in cloth as stain



**Figure 4: Test Screen 3**

Because there is no stain on the fabric's surface, machine learning indicates that this is a true positive, allowing us to market this product.



Figure 5 : Test Screen 4

This is a stained cloth that displays CHEAP BAZARS if the stained area is larger than 5000 or smaller than 30000.

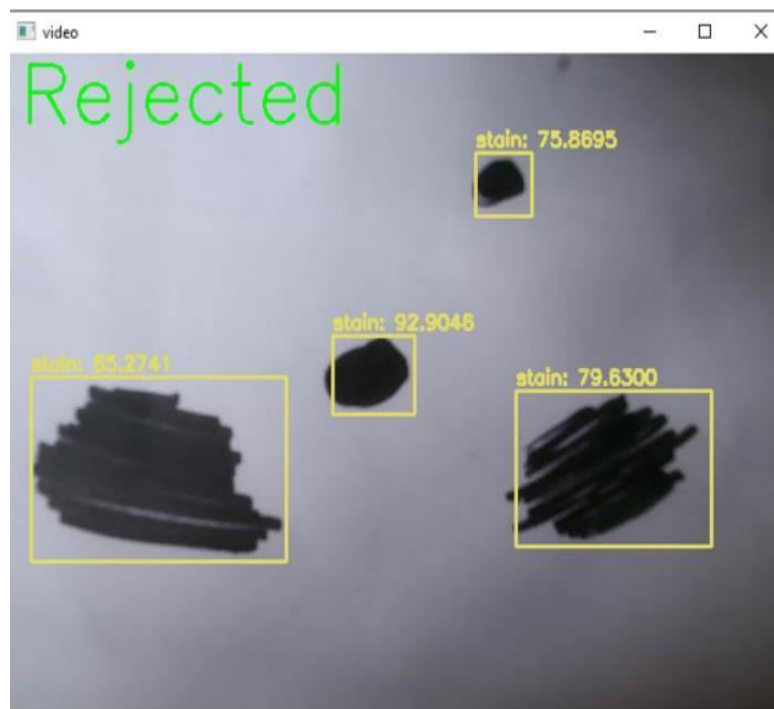


Figure 6: Test Screen 5

This fabric is discolored; if the discolored area exceeds 30,000, the fabric will be rejected

## VI. FUTURE ENHANCEMENT

- Making the framework for detect stains in the patterned clothes.
- Databases can be added to store the stain counts.

•Future enhancements for fabric stain detection using the YOLO algorithm may involve integrating multi-modal sensing and exploring advanced deep learning architectures, aiming to enhance accuracy, adaptability, and usability in real-world scenarios

## VII. CONCLUSION

Yolo Algorithms are utilized to identify fabric stains, which may be applied in the textile industry at a minimal cost. The outcomes are efficient and precise. Items that have more stains are returned. It will be shipped into the marketplace in light of how many of stains.

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