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Dress Code Detection using YOLOV8N,AI and Machine Learning Tool

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Abstract

Object detection based on deep learning has emerged as a potent method for dress code monitoring. But even the most advanced detection models eventually experience missed detections or false alarms, particularly when working with small targets like masks and caps. This study suggests a novel approach to clothing code monitoring that gets beyond these restrictions by utilizing a new dress code assessment criterion, the DeepSORT tracking, and an enhanced YOLOv8n model. Three methods are used to enhance the YOLOv8n model: The model's feature fusion capability is improved by (1) adding a new neck structure called FPN-PAN-FPN (FPF), (2) using Receptive-Field Attention convolutional operation (RFAConv) to better capture the differences in information brought by different positions, and (3) adding a Focused Linear Attention (FLatten) mechanism to increase thereceptive field of the model. This enhanced YOLOv8n model reduces model size while increasing mAP. In order to retrieve instance information over several frames, DeepSORT is then integrated. In conclusion, we implement a novel criterion for judging real-scene dress code compliance. The experimental findings demonstrate that our approach decreases false alarms, increases accuracy, and successfully detects instances of clothing infractions.

Introduction

In recent years, the advancement of intelligent systems capable of analyzing visual data has accelerated significantly, particularly within the field of computer vision. One of the most notable applications of these technologies is dress code detection — the automated identification and classification of clothing in images or video streams. Such systems offer practical solutions across various sectors, including education, corporate environments, hospitality, and event management, where monitoring and enforcing dress code compliance is essential. Manually enforcing dress codes can be inefficient, subjective, and prone to human error. In contrast, automated systems can enhance this process by providing accurate, consistent, and timely monitoring of clothing choices. A robust dress code detection system should not only identify the type of clothing but also comprehend the context in which it is worn — such as formal attire, casual wear, or business outfits. Achieving this requires the application of advanced techniques in object detection, image processing, and machine learning.

LITERATURE SURVEY

TITLE	AUTHOR(S)	YEAR	KEY CONCEPT	METHODOLOGY	FINDINGS
DCMS_journal report	Sangavi N, Dharshani V, Deeksha G, Irfan Basha I, Abdul Ahamed B	2024	Object Detection Using Deep learning. YOLOv4 Algorithm	The Dress Code Monitoring System using YOLOv4 follows a structured approach that integrates deep learning, computer vision, and real-time object detection to enforce dress code policies.	High Accuracy in Real-Time Detection. Improved Compliance Monitoring. Efficient Processing and Scalability
Investigating Students' Awareness and Conformity towards University Dress Code	Roslilee Ab. Halim Mawarti Ashik Samsudin Nurul Nadia Abd. Aziz	2024	Dress Code Compliance, Automated Dress Code Monitoring	The study employed a structured approach to investigate **students' awareness and non-conformity** to the university dress code policy	High Awareness of Dress Code Policies ,Non-Conformity is Prevalent
Dress Code Monitoring Method in Industrial Scene Based on Improved YOLOv8n and DeepSORT	Jiadong Zou, Tao song, Songxiao Cao, Bin Zhou ,	2022	It proposed dress code monitoring system leverages deep learning-based object detection and multi-frame tracking to improve accuracy and reduce false alarms.	Integrates an improved yolov8n model, deepsort tracking, and a novel dress code judgment criterion to enhance accuracy, reduce false alarms, and improve real-time monitoring	The results indicate significant improvements in **detection accuracy, tracking reliability, and false alarm reduction** compared to previous methods.
Automatic Dress Code Verification	MANIKANDAN.K, JEEVASANKAR.K.S, KISHORE ANAND.R,SHARVESH.C	2023	Deep Learning-Based Object Detection, Focused Linear Attention (FLatten) mechanism	It was conducted using a structured methodology involving data collection, model development, implementation, and evaluation.	It revealed several key insights regarding dress code compliance, challenges in enforcement, and the effectiveness of ai-based monitoring systems.

Authors And Their Findings Related Work

Dress code detection systems have appeared as a meaningful application of computer vision and machine learning to automatically identify clothing and maintain compliance with predetermined dress codes within different environments, including workplaces, schools, and events. The aim is to create systems that can properly detect, classify, and grade clothing

according to contextual dress code demands without any intervention

Traditional image processing methods such as edge detection and feature extraction were the initial methods used in clothing recognition. These were not effective enough to deal with sophisticated, varied fashion styles and environmental conditions. With the emergence of deep learning, object detection models like YOLO (You Only Look Once) and Faster R-CNN have been the norm for real-time clothing identification. These models can detect multiple clothing items in images and classify them with high accuracy, making them essential for dress code detection systems.

PROBLEM STATEMENT

The growing requirement for automated dress code enforcement in settings such as schools, workplaces, and events has motivated the search for a trustworthy, intelligent system that can recognize and classify clothing according to particular dress code regulations. The key challenge is in creating a system that can properly recognize varied clothing items and evaluate adherence to dress code standards such as formal, casual, or business attire. This is made difficult by a number of salient issues. Clothing variability, which encompasses the huge variety of styles, fabrics, and patterns, makes it hard to uniformly categorize pieces under dress code types. Environmental variables, which encompass changing light levels, ambient noise, and multiple camera positions, have a dramatic effect on the accuracy of detection and necessitate the system's ability to cope with a wide range of real-world scenarios. Third, occlusions of clothing and overlapping items present a third challenge because it can impede the system's ability to identify and attribute objects to the appropriate person correctly. Lastly, the system has to factor in variations of dress code based on location, i.e., business formal for a business setting compared to casual wear for a casual environment. The end objective is to establish a fault-tolerant, real-time system capable of distinguishing, categorizing, and evaluating attire in multiple environments, overcoming these obstacles to offer an effective, automated means for enforcing dress codes.

OBJECTIVE

i. *Precise Clothing Recognition and Identification*: The system must precisely detect and identify a wide range of clothing articles using predefined dress code labels, which could be formal, casual, or business casual. This includes the identification of separate pieces of apparel such as shirts, trousers, dresses, and jackets.
ii. *Managing Clothing Heterogeneity*: The system needs to manage a variety of clothing types, fabrics, and patterns in order to perform consistent and accurate classification under various environments and users. This encompasses managing heterogeneity in clothing design, size, and color.
iii. *Adaptability to Environmental Variables*: The system must be resilient enough to work adequately under various environmental conditions like changing lighting, background noises, and various camera angles. It should be able to cope with these external influences that could otherwise compromise performance.
iv. *Occlusion and Overlap Handling*: The system must be capable of properly recognizing clothing pieces even when partially occluded or overlapping with other clothes. It should be capable of dealing with real-world situations where clothes may not be fully visible because of occlusions or body movement.
v. *Contextual Enforcement of Dress Code*: The system must also be able to work in various contexts and environments, including workplaces, schools, or events, and enforce respective dress code standards in each setting. For instance, it must be able to differentiate between the business outfit necessary in corporate offices.

METHODOLOGY

The methodology for the dress code detection system involves several key steps, from data collection and preprocessing to the deployment of an automated model capable of detecting and classifying clothing according to predefined dress code standards. The approach is outlined below:

i. *Data Collection and Dataset Preparation*: The initial step is to obtain a large and diverse dataset of images of clothes that represent a range of styles, fabrics, and patterns. Such a dataset contains labeled images with clothes categorized based on the standards of dress code (e.g., formal, casual, business wear). Public datasets such as DeepFashion or in-house datasets can be utilized to obtain data from multiple scenarios (e.g., various settings such as workplaces, schools, and events).
ii. *Image Preprocessing*: The images are preprocessed before model training to present them in the same format so that the model can perform efficiently. This

entails:Rescaling images to have a uniform dimension.Normalization of pixel values in order to represent them uniformly. Data augmentation operations (such as rotation, flips, cropping) to synthetically increase the amount of data to make the model invariant to different variations.Color Space Transformation where images are changed to various color spaces (such as HSV) to enhance classification based on color.

iii. *Clothing Detection and Object Localization*: Detecion of clothing items in images comes next. To do this, an object detection model like YOLO or Faster R-CNN is applied to detect clothing items in a bounding box. These models learn to detect different types of clothing like shirts, pants, dresses, jackets, and shoes. Main points of this step are:Bounding Box Prediction: Identifying the coordinates of clothing items in the image.Class Labels: Assigning a class label (e.g., formal shirt, casual pants) to each detected item.Multi-Object Detection: Detecting multiple clothing items within a single image, especially in crowded or occluded scenarios.

iv. *Clothing Classification*: Once clothing items are detected, they must be classified according to predefined dress code categories. This is done using a deep learning classification model, such as a Convolutional Neural Network (CNN) or a Transfer Learning Model like ResNet or VGG. The system uses features extracted from the detected clothing items (e.g., texture, patterns, color) to determine whether the attire is formal, casual, or appropriate for a particular setting.Fine-tuning Pretrained Models: Pretrained models are fine-tuned with a clothing-specific dataset to improve classification accuracy for dress code compliance. Contextual Classification: The classification model may also account for environmental context (e.g., office setting, school uniform) to refine classification and adapt to varying dress code requirements.

v. *Color and Texture Analysis*: Color and texture are important features for distinguishing between different types of clothing and ensuring compliance with dress codes. The system utilizes: HSV Color Space: This helps handle variations in lighting and makes color-based classification more robust.Texture Analysis: Techniques such as Gabor filters and Local Binary Patterns (LBP) are used to analyze fabric texture, which can be useful in distinguishing between different types of materials (e.g., denim, wool, cotton).

vi. *Occlusion and Overlap Handling*: In real-world scenarios, clothing items might overlap, or individuals may be partially occluded, making detection difficult. The system uses advanced techniques such as: Multiple Object Detection Algorithms: Detecting occluded objects through enhanced bounding box prediction and segmentation techniques.Contextual Awareness: It uses the relative position of the clothing items with respect to the person, like associating the pants with the lower body and shoes with the feet, in order to increase the accuracy of detection when the items overlap.

vii. *Person-Clothing Association*: For the proper association of the clothing items detected, the system relies on pose estimation and spatial awareness techniques. These include:Person Detection: It detects and tracks the person within the image or video stream.Spatial Relationship: The clothing items are assigned to the right part of the body, whether the upper body, lower body, or feet, according to the location of the person.Overlap Handling: In cases where clothes overlap each other or with the person's body, there must be an adjustment.

viii. *Real-Time Processing and Deployment*: After training and testing the model, the system is ready for real-time applications. This involves Integration with Camera Systems: The system is integrated with live camera streams to conduct real-time clothing detection.Processing Speed: The model is designed for quick inference to give almost instantaneous feedback for dress code enforcement.Web Interface (Optional): To facilitate user interaction, a web interface can be created to upload images or stream video for detection.

ix. *System Evaluation and Feedback Loop*: After deployment, the system's accuracy can be monitored. Precisely, precision, recall, and F1-score measures check the rate at which the system detects and classifies clothing. Furthermore;User Feedback: A feedback mechanism is created where users can indicate whether the detected item was incorrect or not, thus retraining and improving the system overtime.

x. *Scalability and Efficiency*: The system is designed to handle large-scale

deployments, ensuring that it can scale to monitor multiple individuals in various environments. It should be efficient enough to minimize computational resources and handle high-throughput scenarios without sacrificing accuracy.

CLASSIFICATION

System has two major components that are as listed below:

i. Image Detection:- The drag and drop of files are available in the image detection system.The files are initiated into jpg, png and jpeg format.

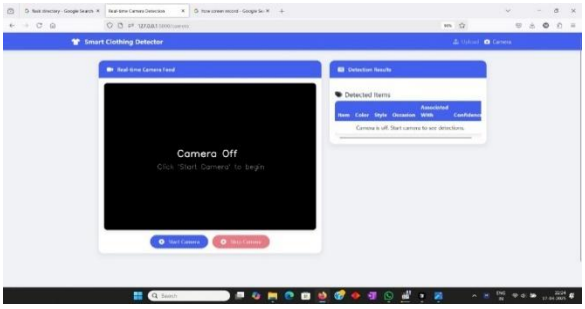

Fig 1. USER INTERFACE

ii. Real Time Camera Feed:- It involves real time detection of dresses via video or image surveillance.It focuses on capturing the image and view the properties of the captured image.

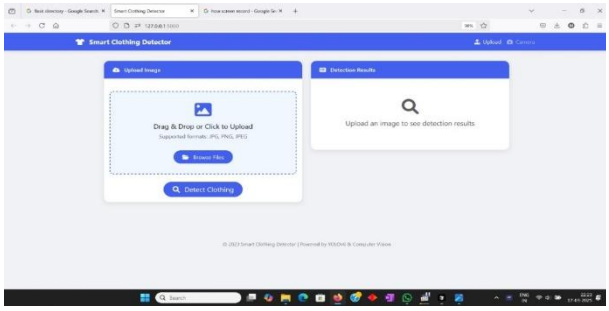

Fig 2. DETECTION PROCESS

CONCLUSION

In summary, the Dress Code Detection System utilizes sophisticated computer vision and machine learning methods to automatically identify and classify clothing based on precise dress code requirements. In overcoming shortcomings such as variability of clothing, environmental influences, and contextual differences, the system guarantees precise and effective implementation of dress codes in real time. With ongoing improvements and flexibility, this system provides a scalable and trustworthy solution for diverse environments, ranging from the workplace to educational institutions, guaranteeing dress code policy compliance without requiring much manual monitoring.

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