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AI based Identification of Students Dress Code in Schools and Universities

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Abstract

Automatic dress code verification (ADCV) uses advanced technology to quickly and fairly check if people are following the dress code. It is more accurate than humans and does not have personal biases. This can be helpful in places like schools, universities, and offices where dress codes are important for safety. One of the great things about it is that it saves time and money. It does not require people to manually check the dress codes, which can be slow and not always consistent. This technology can be adjusted to fit different dress code rules, whether it's a formal office dress or a school uniform. The technology can be customized for different dress code rules, from formal office attire to school uniforms. One notable advantage of ADCV is its capacity to save both time and financial resources. The system gets rid of the requirement for people to manually check dress codes, which can be slow and inconsistent. The technology's flexibility extends to customization for different dress code rules, addressing the unique needs of diverse settings. It is important to highlight the evolution of ADCV from previous models, where limitations existed in terms of singular application focus. In earlier iterations, functionalities such as face recognition or object detection could only be implemented individually, creating a gap in the comprehensive identification of individuals that encompassed both facial features and attire. The proposed system aims to rectify these shortcomings by integrating capabilities, ensuring a more holistic approach to dress code verification. This enhancement signifies a significant stride toward a more versatile and

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effective solution for monitoring and enforcing dress codes in various environments. In the previous models the only one application could be designed. For instance, the face recognition or the object detection is only possible individually. It cannot do both identification of person's face and attire of the person. Considering these disadvantages, the rectification of these problems will be achieved through the implementation of the proposed system. ADCV's impact extends beyond its immediate application in dress code enforcement. As a pioneering example of the intersection between computer vision and artificial intelligence.

Keywords: Face Recognition, Object Detection, Deep Learning, Computer Vision

1. Introduction

Automatic Dress Code Verification (ADCV) is a cutting-edge technology that leverages the advancements in computer vision and artificial intelligence to enforce dress codes in a more accurate, objective, and efficient manner. The traditional approach of manual dress code enforcement often suffers from subjectivity, inaccuracies, and inefficiencies, making it challenging for organizations to maintain their dress codes and enforce them effectively. ADCV solves these problems by automatically processing images of individuals and evaluating them against predefined dress codes to ensure compliance. This technology has a wide range of applications, from schools and offices to events and other settings where dress codes play a crucial role. With its ability to provide real-time and accurate results, ADCV offers organizations a reliable and effective solution for maintaining their dress codes. The technology's potential extends beyond dress codes, impacting the broader field of image recognition and analysis. As advancements continue, it's poised to shape a future where automated systems ensure compliance and accuracy in a multitude of visual contexts, heralding a new era in image recognition technologies.

1.1 The Concept of Dress Code Verification

Dress code verification is a process of ensuring that employees or attendees adhere to a specific set of clothing standards set by an organization or event. The purpose is to maintain a professional or uniform appearance, align with company culture, or comply with specific requirements for safety, hygiene, or cultural norms. Verification can be done through self-

assessment, monitoring by managers or designated personnel, or through technology such as wearable devices.

1.2 Object Detection

Object detection is a computer vision task that involves identifying and locating objects of interest in an image or video. Object detection algorithms typically use deep learning models, such as convolutional neural networks (CNNs), to extract features from the input image and classify them into predefined categories, such as person, car, dog, etc. Additionally, object detection algorithms also output bounding boxes that indicate the spatial location and size of each detected object in the image. Object detection has many applications in various domains, such as face recognition, autonomous driving, security, surveillance, medical imaging, etc. The implementation of object detection, requires a dataset of images containing the objects to detect, along with their labels and bounding box annotations. The next essential requirement is a deep learning framework like TensorFlow, PyTorch, Keras, etc., and a suitable object detection model such as YOLO, SSD, Faster R-CNN, etc. Using an appropriate loss function and optimization algorithm the model is trained and evaluated on a test set or a new image to obtain the predicted object classes and bounding boxes. Digital technology has made object detection much easier compared to the earlier techniques. It uses code and pixels to learn deeply, combining dreams and information. It supports us as we go, enabling us to bravely and skilfully explore the unknown while making steady progress. Clearly visible, object recognition illuminates the data canvas and leads us on a path of self-discovery that allows us to realize our full potential.

1.3 Classical Face Detection

Classical face detection is a computer vision task that aims to locate and identify human faces in digital images. It is a fundamental step for many applications, such as face recognition, face tracking, facial expression analysis, and face editing. Classical face detection methods typically rely on handcrafted features, such as Haar-like features, Histogram of Oriented Gradients (HOG), or Local Binary Patterns (LBP), and machine learning classifiers, such as Support Vector Machines (SVM), Ada Boost, or Random Forests. These methods are fast and robust, but they have limitations in handling variations in pose, illumination, occlusion, and expression. Moreover, they require manual design and tuning of the features and parameters,

which can be time-consuming and domain-specific. The proposed work aims to devise a fast and accurate method for detecting dress code violations in educational institutions. The remaining manuscript is organized as follows: Section 2 explains existing methods and their limitations, Section 3 details the proposed work, Section 4 highlights the performance of the proposed system and its advantages, and Section 5 summarizes the complete work.

2. Related Work

MD. Tahmid Hasan Fuad et.al., has proposed the application of deep learning (DL) techniques to enhance face recognition (FR) systems. Face recognition is essential for various real-world tasks, including social communication, security, surveillance, and entertainment.[6] to explore the potential benefits of combining the strengths of both fields. The paper provides a comprehensive survey of this emerging research area. It starts with an introduction to attention mechanisms and then delves into popular deep architectures that use attention. Ran Tao et.al. [1] has proposed the application of artificial intelligence (AI) technology in the clothing industry, specifically in the development of intelligent clothing. Intelligent clothing integrates advanced technologies from electronics, sensors, textile science, and material science to enhance traditional clothing with smart features. Bohan Zhuang et.al. [3] has proposed the challenge of using web images and their associated labels, which are easier to obtain than manually annotated datasets, for training deep neural networks in visual recognition. While web images offer convenience, they often come with noisy or incorrect labels, which can degrade the performance of recognition models. Iordanis Fostrio poulos et.al. [5] has proposed the challenge of utilizing web images with their associated labels for training deep neural networks in visual recognition. [7] Obtaining web images is more convenient than manually annotating large datasets, but it comes with a significant drawback: the labels on web images are often noisy or incorrect [8-10].

3. Proposed Work

The main use of this research is to find out the student who don't follow the institution's uniform rules, so the student can be liable to the particular actions by the institutions. Deep learning methods like CNN and YOLO algorithms are used to not only trace out the student but also to identify the student by name. The prototype model is implemented with the

maximum possible accuracy. It takes input in the form of video or images. The captured input are processed by the ADCV system, which uses computer vision and machine learning algorithms to extract relevant information, such as facial features, clothing, and accessories. The processed images are then compared against a predefined dress code to determine compliance. The ADCV system then generates a verification result indicating whether the individual is in compliance or not. The result may also include information about specific dress code violations, such as the type of clothing or accessory that is not in compliance.

The verification result is then used to provide feedback to the individual. The YOLO algorithm is used in identifying the object and CNN algorithm is used to identify the target. During the demonstration, attendees can observe the ADCV system in action and see how it processes images, evaluates them against the dress code, and generates a verification result in real-time. The demonstration can also highlight the accuracy and efficiency of the technology, as well as its potential applications in different industries and settings. The Figure.1 below illustrates the architectural diagram of the proposed system for dress code identification,

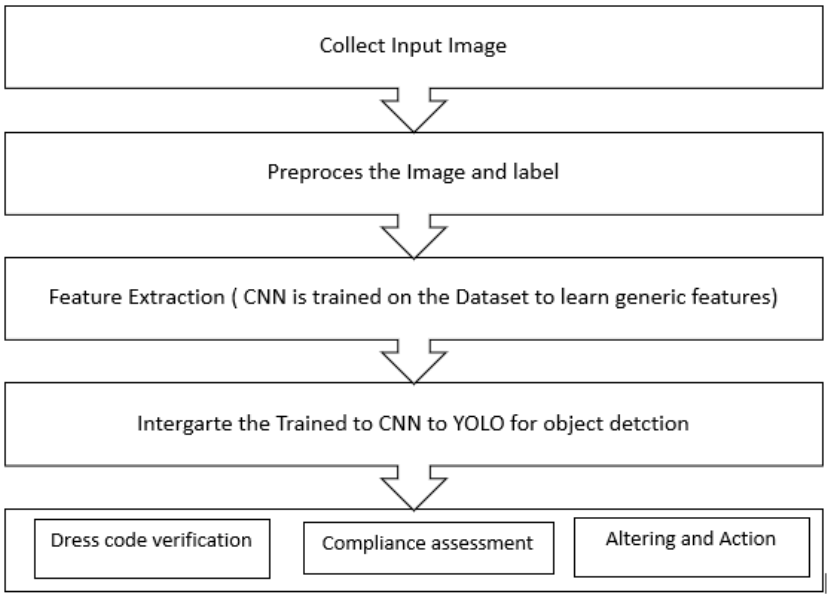

Figure 1. Architecture Diagram

3.1 Modules

This section presents the different modules of the proposed work and the general description that state how the modules were developed.

- Data Collection and Labelling.
- Training CNN for Dress Code Features.
- Object Detection with YOLO.
- Dress Code Verification Process.

3.1.1 Data Collection and Labelling

Creating a diverse dataset for dress code adherence involves assembling a wide variety of images featuring individuals in different clothing styles. This dataset should include examples of both compliance and non-compliance with specific dress code policies. The dataset should encompass various contexts and settings, such as workplaces, schools, and public places, to make the deep learning model adaptable to different environments. Each image in the dataset should be meticulously annotated with precise bounding boxes outlining specific clothing items or uniform components. The annotations should clearly distinguish between compliant attire, such as uniforms and identification badges, and instances of non-compliance with dress code regulations. The dataset should represent a wide range of attire variations, including different clothing styles, colours and accessories, to ensure the model's ability to handle diverse scenarios effectively. Real-world examples in the dataset enhance the model's understanding of nuanced differences in dress code adherence, making it more robust. By using this carefully curated dataset as the foundation for training the deep learning algorithm, the model can reliably assess dress code adherence in different environments and contexts. This dataset can be instrumental in enhancing security measures and enforcing dress code policies across diverse organizational contexts, ensuring accurate and consistent results.

3.1.2 Training CNN for Dress Code Features

To develop a robust dress code verification system choose a suitable Convolutional Neural Network (CNN) architecture like VGG, ResNet, or Inception known for their deep learning capabilities. Preprocess the dataset by standardizing image sizes, normalizing pixel values, and applying data augmentation techniques like rotation and flipping. Implement transfer learning, fine-tuning specific CNN layers for dress code recognition, and add a custom output layer for classification. Use an appropriate loss function and optimization techniques.

Split the dataset into training and validation sets to monitor performance and prevent overfitting. Conduct multiple fine-tuning iterations, adjusting hyperparameters and layers as needed. Evaluate the model on a separate test dataset using metrics like accuracy, precision, recall, and F1-score. Deploy the model in real-world scenarios by integrating it into existing security or access control systems for dress code compliance verification.

3.1.3 Object Detection with Yolo

Integrating YOLO (You Only Look Once) into the dress code verification system enhances its capabilities. YOLO's real-time object detection efficiently identifies specific dress code items like uniforms, badges, and footwear, allowing a detailed assessment of attire compliance. This real-time aspect is valuable in high-traffic environments, ensuring immediate monitoring and reducing unauthorized access risks. It not only enforces dress code policies but also provides valuable data for informed decision-making.

3.1.4 Dress Code Verification Process

The dress code verification system captures images of individuals entering restricted areas, employing a trained Convolutional Neural Network (CNN) to analyze attire. The CNN, proficient through diverse dataset training, identifies dress code elements like uniforms and badges. Simultaneously, YOLO, a real-time object detection algorithm, enhances precision by swiftly and accurately pinpointing clothing items and accessories. This combined analysis ensures comprehensive attire assessment, facilitating quick decision-making on entry permissions.

4. Results and Discussion

The proposed method utilizes a total 1500 diverse dataset that contains both compliance and non-compliance with specific dress code policies. The datasets were collected from the internet using the key search terms like students in uniform, students in non-uniform, students in color dresses, student without school shoes, students in slippers and footwear, etc. the cliparts of students images were collected. Further the redundant images and unwanted images were removed and labeled manually based on the categories. The proposed model utilizes the CNN with YOLOv5 to detect the objects, identify the student by name. The system was configured with 8 GB of RAM, an Intel i5 processor or higher, and a 1 TB hard disk and

detection of dress code violations and the identification of students by name were implemented using PyCharm (an integrated development environment), along with the libraries OpenCV, NumPy, OpenVINO, and Ultralytics., . The performance of this model surpassed that of other algorithms previously implemented, particularly showcasing innovation for educational and institutional applications. The performance analysis presented here in Table.1 is based on a comprehensive review of the literature and an analytical study conducted.

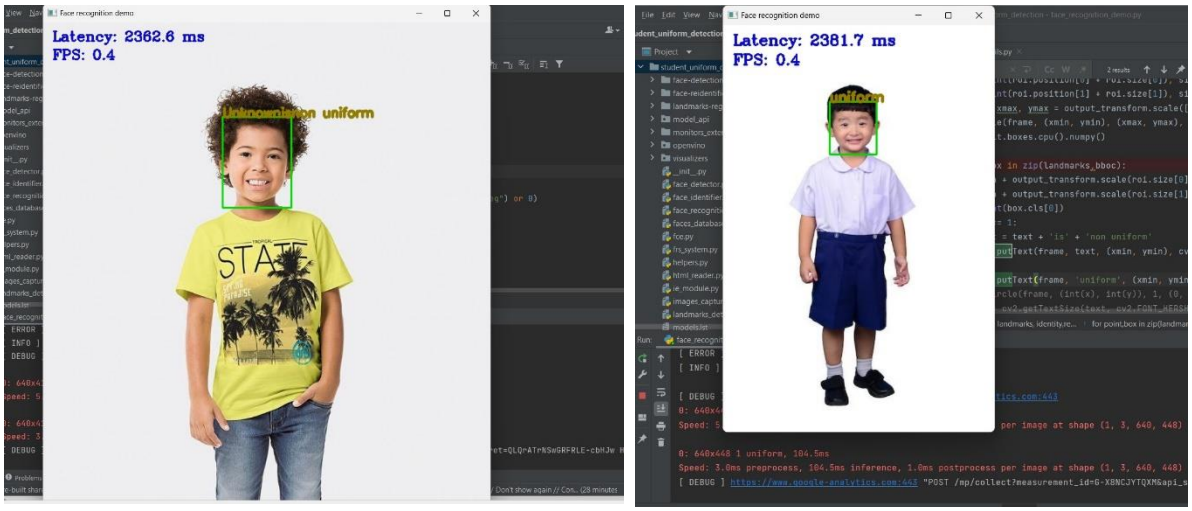

Figure 2. Dress Code Detection

Table 1. Performance Analysis

Algorithm	Precision	Recall	Accuracy
Proposed	**98**	**98**	**99**
LSTM [11]	**95**	**96**	**94**
BIGRU [12]	**89**	**90**	**88**

4.1 Advantages

The proposed model enables to Verify adherence to dress code policies in restricted areas, Prevent unauthorized access by ensuring compliance, Does rapid processing of images and video streams, reduces manual checks and operational costs, Recognizes diverse clothing items and styles accurately, handles complex scenarios with precision, automates workplace dress code compliance monitoring, and improves employee morale with clear guidelines

5. Conclusion

In conclusion, the integration of Convolutional Neural Networks (CNN) and YOLO (You Only Look Once) for dress code verification represents a highly effective and versatile solution for ensuring compliance with dress code policies in various settings. This innovative approach combines the capabilities of deep learning with real-time object detection to provide accurate, efficient, and automated dress code assessment. By leveraging CNNs, organizations can train models to recognize specific dress code-related features, such as uniforms, badges, or attire components. This enables the system to make informed judgments about the compliance of individuals' clothing choices. Simultaneously, YOLO, with its exceptional object detection capabilities, assists in identifying and locating clothing items and accessories in real-time, ensuring comprehensive coverage and swift decision-making. The benefits of this integrated approach are numerous. It enhances security by reducing the risk of unauthorized access, improves workplace compliance by automating the monitoring of dress code policies, and contributes to the fashion industry by offering innovative tools for trend analysis and recommendation systems. Moreover, the system's scalability and adaptability allow it to be seamlessly integrated into various organizational infrastructures, making it suitable for both small-scale and large-scale deployments. Regular updates and continuous learning ensure that the models remain accurate and relevant as dress code policies evolve .In essence, dress code verification using CNN and YOLO is a technological advancement that not only streamlines dress code enforcement but also enhances overall operational efficiency. It represents a valuable solution for organizations and industries where adherence to dress code policies is paramount, ultimately contributing to a safer, more compliant, and well-managed environment.

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