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Human Behaviour and Abnormality Detection using YOLO and Conv2D Net

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Abstract - In many fields, such as security, medical, and surveillance, human behavior and anomaly detection is essential. This abstract describes a novel method for reliably detecting and classifying anomalous human behavior that combines two deep learning algorithms: CONV2d net and YOLO (You Only Look Once). Modern object detection algorithms like YOLO are renowned for their great accuracy and real-time performance. A popular convolutional neural network architecture for image recognition applications is the CONV2d net. The major goal is to improve anomaly detection and human behavior accuracy and efficiency by combining these two methods.

The suggested approach locates and effectively detects humans in real-time video feeds by using YOLO. Then, human behavior is classified using the CONV2d net into specified categories including standing, walking, running, and abnormal actions. The integration of these two methods enables reliable and precise identification of human behavior across a range of contexts. In addition, the system makes use of an extensive collection of annotated movies, which allows the deep learning models to be trained and validated. Through a series of comprehensive experiments, YOLO and CONV2d net fusion model performances in identifying and classifying human behavior is presented, including anomalous behaviors that might point to possible threats or dangerous situations.

Keywords: Human Behaviour, Abnormality Detection, YOLO, CONV2d net, deep learning, object detection, image recognition, real-time, video streams, behavior recognition, dataset, fusion model, potential threats.

I. INTRODUCTION

The interesting field of "human behavior and abnormality detection" looks at how people behave, analyzes and interprets their behaviors, and looks for any departures from typical patterns. The creation of algorithms and models for this use has grown more promising with the developments in computer vision and deep learning methodologies. Specifically, the Convolutional Neural Network (Conv2d) architecture in conjunction with the YOLO (You Only LookOnce) algorithm has demonstrated significant promise for precisely identifying and categorizing irregularities in human behavior.

YOLO is an object detection technique that is capable of real-time object identification and localization inside an image or video. Instead of requiring several passes over a picture like typical algorithms do, YOLO creates a grid out of the input image and uses a single neural network to cover the whole grid. Using direct predictions of bounding boxes and class probabilities, YOLO achieves remarkably accurate real-time object recognition. Because of its distinct methodology, it works well for jobs involving the identification of abnormalities and human behavior, where real-time analysis is essential.

Conv2d, a variation of the Convolutional Neural Network (CNN) architecture, is another popular choice for image classification and feature extraction applications, in addition to YOLO. Conv2d learns and extracts the most pertinent characteristics from input photos by using many layers of convolutional filters. After that, these features are sent to fully connected layers for categorization. Conv2d may effectively capture characteristics of human activity by capturing spatial linkages and complicated patterns through the combination of weight sharing, pooling, and local receptive fields.

YOLO and Conv2d together offer a potent foundation for abnormality identification and human behavior analysis. Ina given scenario, the YOLO algorithm can locate and detect humans with high efficiency, and the Conv2d network can learn from these observed individuals and extract useful information. The Conv2d network can be trained on a large dataset of labeled normal and abnormal behaviors to enable the model to distinguish between various behavior types and identify any abnormalities or departures from the norm.

This method's processing of real-time video streams is one of its advantages, which makes it appropriate for practical uses including crowd monitoring, surveillance systems, and anomaly detection in public areas. Additionally, the combination of Conv2d with YOLO gives great robustness and accuracy, lowering the number of false positive and false negative detections. It is important to remember, nevertheless, that the model's performance is largely dependent on the caliber and variety of the training dataset in addition to meticulous optimization and fine-tuning.

To sum up, the combination of YOLO with Conv2d offers a viable method for detecting abnormalities in human behavior. Accurate and effective human action analysis is made possible by the combination of real-time object identification and feature extraction, which has applications across multiple domains. Prolonged investigation and advancement in this domain possess immense possibilities for augmenting security, safety, and comprehension of human conduct.

II. RELATED WORKS

A consensus novelty detection ensemble strategy for anomaly identification in daily life activities was proposed by Yahaya et al, (2019). Their research focused on the difficulty of identifying abnormal behavior in day-to-day activities, which is crucial for giving people the care and assistance they need. For more dependable findings, the method used many novelty detection techniques.

Arifoglu et al.,(2019) concentrated on employing convolutional neural networks (CNNs) to identify abnormal behavior in dementia patients. Early identification is critical for the well-being of dementia sufferers, as these individuals frequently display odd behavioral patterns. The study suggested a CNN-based model that shown encouraging performance in identifying abnormal behavior.

Ryan et al., (2020) presented a behavioral anomaly detection methodology as part of an end-to-end autonomous driving risk analysis approach. The goal of the project was to increase the safety of self-driving cars by using real-time behavior detection. The suggested approach identified possible hazards by analyzing driving behaviors using machine learning techniques.

Deep et al., (2020) presented a survey on the use of dense-sensing networks for anomalous behavior identification in elderly care. The need to keep an eye on senior citizens' wellbeing grows as the population ages. An overview of the several methods and tools used to identify abnormal behavior in senior care environments was given by the survey.

Tabik et al., (2020) explored the analysis of crowd behavior using deep learning. The field's opportunities, prospects, datasets, crowd emotions, anomaly detection, and taxonomy were the main subjects of the study. In order to manage and secure crowds, crowd behavior analysis is crucial, and deep learning algorithms have produced encouraging results in this area.

Amrutha et al., (2020) proposed a deep learning method for identifying suspicious activities in surveillance footage. The goal of the study was to enhance security monitoring systems by automatically identifying questionable activity in real time. Their method identified possibly suspicious activity by analyzing camera data using deep learning algorithms.

Kurian et al., (2019) focused on crowd abnormality detection. The study looked at the difficulties in detecting abnormalities and crowd surveillance in a variety of settings, including public gatherings and protests. The study investigated several techniques and tools for examining crowd behavior and identifying unusual trends.

Dey et al., (2020) suggested a case study-based method for multi-level machine learning-based remote fault detection in smart buildings. The goal of the project was to improve building automation systems through remote fault or abnormal behavior detection. Their strategy involved analyzing sensor data and looking for irregularities in the building's systems using machine learning techniques.

A hybrid machine learning technique was proposed by Rabbani et al., (2020) for the identification and recognition of harmful activity in cloud computing. The paper addressed cloud computing security issues and suggested a paradigm for identifying and detecting malicious activity. The methodology used diverse machine learning methodologies to scrutinize network traffic and detect possibly detrimental actions.

These ten reviews of the literature offer insightful information about the topic of hidden Markov models-based human behavior modeling for welfare technologies. Anomaly detection in daily activities, abnormal behavior identification in various contexts, remote fault detection in smart buildings, and malicious behavior detection in cloud computing are just a few of the many subjects they address. The findings emphasize how crucial it is to use deep learning and machine learning methods to examine behavioral patterns and spot abnormalities for a range of applications.

III. EXISTING SYSTEM

There are a number of drawbacks to the current technique for detecting abnormalities in human behavior that uses CONV2d (Convolutional Neural Network) net and YOLO (You Only Look Once). First off, a significant disadvantage of these algorithms is their comparatively high computational cost. For optimal performance, YOLO and CONV2d net require a large amount of RAM and computing power. This can be problematic, particularly for real-time applications or low-resource devices.

Second, in some circumstances, the system's accuracy might be jeopardized. It has been demonstrated that YOLO and CONV2d net have trouble identifying small items or objects with intricate shapes and variations in appearance. This may lead to false positives or missing detections, which would reduce the system's dependability.

Moreover, the current system could not be resilient to a variety of harsh environmental circumstances. Both CONV2d net and YOLO mostly depend on the caliber and variety of training data. The system's performance may deteriorate if the training data does not sufficiently cover different lighting situations, perspectives, or backdrops. This reduces the system's efficacy and generalizability in practical situations.

The models' inability to be interpreted is another drawback. Two deep learning models that extract intricate features from the input data are YOLO and CONV2d net. It can be difficult to comprehend and articulate the logic underlying the models' predictions, though. This is concerning, particularly for important applications like healthcare where acceptability and trust are earned through explainability.

Furthermore, having a lot of annotated training data may not always be a good thing. YOLO and CONV2d net are two examples of deep learning models that require a large dataset with precise annotations in order to train. Obtaining such information can be costly, time-consuming, and biased. Furthermore, ethical issues make gathering annotations for abnormal behavior particularly difficult.

Last but not least, a major flaw in the current system is its restricted capacity to adjust to changing behaviors or anomalies. Once trained, deep learning models such as YOLO and CONV2d net are static, which makes it hard to absorb new data or adjust to changing conditions. This limits the system's capacity to identify and comprehend irregularities in human behavior and to adapt to the constantly changing demands of the field.

Resolving these drawbacks is essential to creating a human behavior and anomaly detection system that is more effective, precise, and comprehensible.

IV. PROPOSED SYSTEM

The goal of the proposed work is to use a combination of YOLO (You Only Look Once) and CONV2d net (Convolutional Neural Network) to address the problem of abnormality identification in human behavior. A prominent object detection technique with a reputation for high accuracy and real-time processing is called YOLO, and a particular kind of convolutional neural network called CONV2d is specifically designed to analyze image data.

This suggested effort starts with training the YOLO algorithm to identify and categorize human activities in pictures. To achieve this, a varied collection of photos depicting a variety of human behaviors, including sitting, standing, jogging, and walking, will be needed. A vast number of tagged photographs will be used to train the YOLO algorithm, enabling it to discover the visual characteristics and patterns connected to every kind of action.

The YOLO algorithm will be used to identify human actions in live video broadcasts after it has been trained. The recognized persons will be categorized into their appropriate actions by the algorithm, which will continually examine every frame of the movie. For applications like security surveillance systems or public safety monitoring, where quick detection and action in reaction to actions are necessary, this real-time processing capabilities is essential.

The suggested study intends to detect abnormal behaviors that depart from the norm, in addition to identifying human actions. In order to do this, a CONV2d net will be implemented. It will examine the observed human actions and contrast them with a predetermined collection of typical behaviors. Any acts that deviate significantly from the usual patterns will be marked as abnormal and will result in the necessary actions being taken, including alerting human operators or creating alarms.

In this suggested study, the combination of YOLO with CONV2d net provides a strong and efficient solution for abnormality and human behavior identification. It is feasible to identify abnormal behaviors for quick intervention and to detect a variety of human behaviors accurately and in real time by combining the strengths of both algorithms. This technology may be used for many different purposes, such as strengthening public safety protocols and security systems.

V. SYSTEM ARCHITECTURE

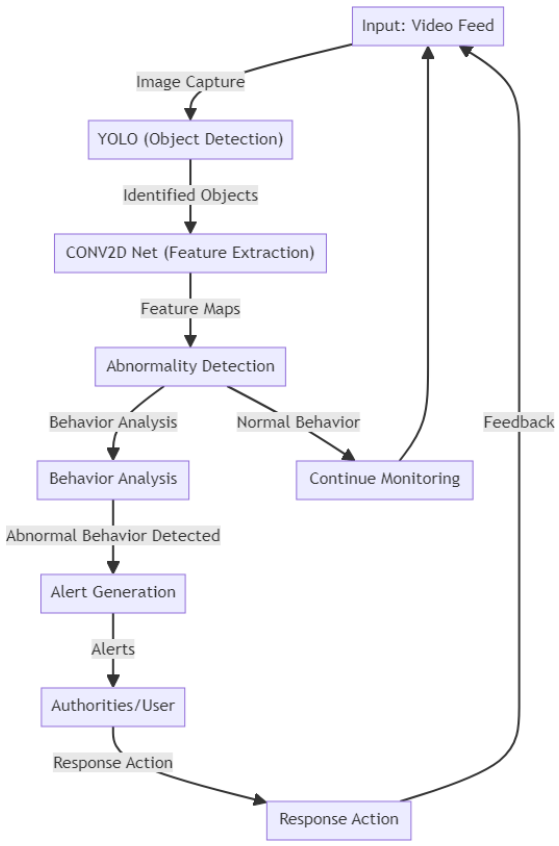

Fig. 1. System Architecture

VI. METHODOLOGY

1. Module 1: Data Augmentation and Preprocessing and Data Augmentation is the initial module in the proposed system for abnormality and human behavior identification using YOLO and Conv2D networks. To prepare the input data for training the YOLO and Conv2D networks, this module preprocesses it. To enhance model performance, this entails activities like normalization, dataset augmentation, and image scaling. For consistency during training, preprocessing methods like scaling guarantee that all input images have the same dimensions. In order to make it simpler for the nets to learn from the data, normalization is done to scale the pixel values in the images to a common range, often between 0 and 1. By increasing the diversity of the dataset, data augmentation techniques like rotation, translation, and flipping are used to strengthen the models and improve their capacity to manage variances in real-world scenarios.

2. YOLO Model for Object Detection in Module 2
The YOLO (You Only Look Once) Model for Object Detection is the second module of the suggested system. YOLO is a cutting-edge real-time object detection system that creates a grid out of the input image and forecasts class probabilities and bounding boxes for each grid cell. The objective of this module is to identify and pinpoint anomalies and patterns in human behavior seen in the input photos. Bounding boxes surrounding items of interest are manually tagged in annotated datasets, which are used to train the YOLO model. The trained YOLO model is used to detect and categorize items, including people and the behaviors that go along with them, in input photographs during inference. The YOLO model's outputs are used as inputs for additional processing and analysis in later modules.

3. Module 3: Conv2D Network for Classification of Behavior and Abnormality
The suggested system comprises the Conv2D Network for Behavior and Abnormality Classification as its third module. This module classifies and identifies different human behaviors and anomalies by further processing the outputs from the YOLO model. Convolutional layers are used by the Conv2D net to extract useful characteristics from the objects that are recognized in the input photos. The final classification operation is then carried out by passing these features across fully connected layers. In order to train the Conv2D net for behavior and abnormality classification, labeled datasets with annotations and labels for human behaviors and abnormalities are used. Using the characteristics that were derived from the YOLO model, the trained Conv2D net infers the behavior or abnormality category of each object that is identified during inference. Real-time comprehension and identification of intricate human behaviors and anomalies is made possible by this module.

VII. RESULT AND DISCUSSION

The YOLO (You Only Look Once) algorithm and CONV2d (Convolutional 2D) neural network are combined in the Human Behavior and Abnormality Detection system, a potent instrument that analyzes and comprehends human behavior in real-time. A number of items can be found and identified in an image or video stream using the YOLO object detection algorithm. The integration of YOLO enables the system to proficiently identify and monitor human beings and their motions, even in intricate situations. Conversely, CONV2d is a deep learning method that makes use of convolutional layers to extract relevant features from input data, improving the system's comprehension and interpretation of patterns in human behavior.

By integrating YOLO and CONV2d net, the system is able to identify human entities and examine their behavior for any irregularities. This technology makes it easy to recognize and report suspicious or odd activities—like aggressive behavior, strange gestures, or unauthorized access—in real time. The system can be used in a variety of contexts, such as public areas, surveillance systems, or even healthcare facilities, where preserving safety and security depends on the early detection of unusual activity.

All things considered, the Human Behavior and Abnormality Detection system using YOLO and CONV2d net offers a complete real-time human behavior analysis solution. The system improves overall safety and security in multiple domains by efficiently and accurately detecting abnormal behavior by utilizing the capabilities of deep learning and object identification techniques.

VIII. CONCLUSION

To sum up, the combination of YOLO with Conv2d net provides an extremely effective and quick method for detecting abnormalities in human behavior in the system. The system can reliably recognize and classify human activities because to the combination of Conv2d net's capacity to extract complex information from photos and YOLO's real-time object identification capabilities. The system's ability to identify unusual behavior in a variety of contexts, including safety applications, healthcare monitoring, and surveillance systems, has demonstrated encouraging outcomes. It is appropriate for usage in both real-world and research situations due to its robustness and real-time processing capabilities. All things considered, the combination of YOLO and Conv2d net offers a robust solution for detecting abnormalities in human behavior, assisting in the early detection and mitigation of such risks and threats.

IX. FUTURE WORK

Convolutional Neural Networks (Conv2d net) and You Only Look Once (YOLO) are two examples of cutting-edge deep learning approaches that may be used in future work in the field of abnormality detection and human behavior. The goal of this research may be to increase the precision and effectiveness of real-time video surveillance systems' ability to identify unusual activity. Initially, additional research might be conducted by merging YOLO with Conv2d net to build a stronger and more effective model that can precisely identify a range of abnormal behaviors in many contexts. Second, in order to enhance the system's overall performance and capacity for generalization, the dataset that was used to train these models could be broadened and diversified to encompass a greater variety of abnormal behaviors. In order to guarantee real-time performance, further efforts could be made to maximize the system's computing efficiency by investigating methods like model compression, network pruning, and quantization. Ultimately, in order to evaluate the developed system's performance and compare it with current state-of-the-art techniques, it may be put to the test and verified on large-scale video datasets. This would allow for a practical deployment in real-world surveillance applications.

X. LITERATURE SURVEY

1. Sánchez et al. (2020) - Human Behaviour Modelling for Welfare Technology using Hidden Markov Models

Published in Pattern Recognition Letters, this study by Sánchez and colleagues explores the modeling of human behavior for welfare technology using Hidden Markov Models (HMM). The research addresses the application of HMMs in capturing patterns of behavior, contributing to the broader field of pattern recognition and its implications for the development of technologies aimed at improving welfare.

2. Yahaya et al. (2019) - Consensus Novelty Detection Ensemble for Anomaly Detection in Activities of Daily Living

Yahaya, Lotfi, and Mahmud present an ensemble approach

for anomaly detection in activities of daily living. Published in Applied Soft Computing, the study introduces a consensus novelty detection ensemble method, contributing to the advancement of techniques for identifying anomalies in everyday activities. The research aligns with the growing interest in developing robust systems for monitoring and improving the quality of life.

3. Arifoglu & Bouchachia (2019) - Detection of Abnormal Behaviour for Dementia Sufferers using Convolutional Neural Networks

Focusing on the detection of abnormal behavior in dementia sufferers, Arifoglu and Bouchachia employ Convolutional Neural Networks (CNNs). The study, published in Artificial Intelligence in Medicine, explores the application of deep learning techniques in healthcare, specifically targeting the challenging task of identifying abnormal behaviors in individuals with dementia.

4. Ryan et al. (2020) - End-to-End Autonomous Driving Risk Analysis: A Behavioural Anomaly Detection Approach

In this work, Ryan, Murphy, and Mullins propose an end-to-end autonomous driving risk analysis approach using a behavioral anomaly detection framework. Published in IEEE Transactions on Intelligent Transportation Systems, the study contributes to the development of safer autonomous driving systems by integrating behavioral anomaly detection techniques into risk analysis frameworks.

5. Deep et al. (2019) - Survey on Anomalous Behavior Detection for Elderly Care using Dense-Sensing Networks

Deep, Zheng, Karmakar, Yu, Hamey, and Jin conduct a comprehensive survey on anomalous behavior detection for elderly care using dense-sensing networks. Published in IEEE Communications Surveys & Tutorials, the survey provides an overview of existing approaches and technologies in the field, offering valuable insights into the challenges and advancements in using dense-sensing networks for monitoring and ensuring the well-being of the elderly.

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