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Human Activity Identification and Suspicious Behaviour Detection System[1]

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ABSTRACT

Recognizing human action has been one of the biggest challenges in computer vision for the past two decades. Recently, it has become feasible to extract precise and cost-effective skeleton information. Our proposed system utilizes a cut-based framework to identify human actions using skeleton data. By using a single stationary camera as input, this system can recognize various continuous human activities in real-time, including raising or waving one or more hands, sitting down, and bending over. The recognition process is based on machine learning. Firstly, a dataset with the human body's coordinates is created. Then, a training model is developed using Logistic Regression and an outcome to be achieved. Finally, the model is utilized to identify human activities such as sitting, running, and waking up, as well as recognizing suspicious behaviour.

Index Terms: *Human Activity; Human Coordinates; Logistic Regression; Machine Learning; Random Forest Classifier; Suspicious Behaviour***.**

INTRODUCTION

The field of computer vision and image processing has seen a rise in interest and demand for activity recognition, which is a significant and challenging area of research among scholars worldwide. This surge in demand can be attributed to the fact that recognizing various human activities, such as Walking, Standing, Sitting, Clapping, Fist Fight, Waving, Robbery, has become increasingly important and useful in practical applications such as human-computer interaction, healthcare, video surveillance, and sports. Recognizing suspicious human activities is particularly crucial in preventing unexpected scenarios from occurring.

In recent times, humanity has been subject to unforeseen occurrences and mishaps, which have resulted in significant loss of life. To address this issue, we aim to develop a reliable and cost-effective system that can prevent such unknown and unexpected events. However, detecting and identifying human activity poses a significant challenge. Previous research focused on utilizing Neural Networks to classify objects, perform image segmentation, and create efficient image classification models [4]. In our pursuit of detecting human activity and identifying suspicious behaviour, we have implemented a Classification algorithm that leverages machine learning techniques for dynamic image analysis, as it offers versatile applications.

The LR algorithm is a popular choice for classification tasks in machine learning, as it is effective in handling large datasets and has the ability to provide probabilistic outputs, which can be used to calculate the likelihood of a specific activity [1]. LR is also computationally efficient, making it suitable for real-time processing of streaming data. Therefore, by using LR in a Human Activity Detection System, we can accurately classify and identify various activities, which can be utilized for applications such as security surveillance or healthcare monitoring [4].

Logistic Regression (LR) can be utilized in a Human Activity Detection System to classify and distinguish between different human activities based on a set of features extracted from the input data. For instance, LR can be used to classify activities such as walking, running, and standing based on features such as step length, walking speed, and acceleration. In addition, LR can also be employed to detect suspicious activities, such as fist fights or robbery,

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based on features such as the proximity of individuals, body position, and arm movement [3].

In this study, we introduce a human activity identification and suspicious behaviour detection system utilizing Logistic Regression and Random Forest for enhancing the detection of human activity and suspicious behaviour detection. The system is a live camera feed based, automated, non-invasive tool that can quickly and accurately identify the activity and behaviour to detect and classify activity and behaviour performed.

RELATED WORK

The research paper titled "Detection of Human Activity by Widget" authored by Ghosh, N. S., Majumdar, R., Giri, B., & Ghosh, A. was published in the 8th International Conference on Reliability, Infocom Technologies and Optimization (ICRITO) in 2020. The paper discusses the problem of human activity recognition, which is becoming increasingly important in various fields such as medical organizations, survey systems, security surveillance, and human-computer interaction. The authors present a robust approach to classify six basic human-centered behaviours (walking, walking upstairs, walking downstairs, sitting, standing, and lying) using logistic regression, logistic regression CV, and random forest algorithms. The paper also discusses the use of support vector machines (SVM) for multiclass classification, and how traditional SVM produces significant results in terms of computational costs. The authors compare different models based on position and action performed and report the highest accuracy gained by the behaviour-based model with 88.13% accuracy. The paper also discusses the use of deep convolution neural networks (convents) to measure and utilize human activity recognition by means of smartphone sensors. Finally, the authors suggest that the research on human activity recognition has huge potential and can be used to maintain a healthier lifestyle and monitor the motion of disabled distant patients.[1]

The research paper titled "Deep Learning for Human Action Recognition" authored by R. U. Shekokar and S. N. Kale, was published in the 6th International Conference for Convergence in Technology in 2021. This paper aims to develop a model for recognizing human actions such as running, jogging, walking, clapping, hand waving, and boxing using deep learning techniques such as neural networks and support vector machines (SVM). The authors use a dataset consisting of 599 videos, where each video shows an individual performing one of the six actions. The authors preprocess the dataset by extracting a subset of frames from each video, reducing the size of the input data and helping the model to train faster. The authors then create and train a neural network on the training data and test the model on the test data. The results are evaluated using a confusion matrix and show good accuracy in recognizing the different human actions. Overall, the paper presents an effective approach for recognizing different human actions using deep learning techniques. [2]

The research paper titled "Deep Learning Approach for Suspicious Activity Detection from Surveillance Video" authored by Amrutha, C., Jyotsna, C., & Amudha, J.was published in the International Conference on Innovative Mechanisms for Industry Applications (ICIMIA) in 2020. In today's world, Video Surveillance plays a critical role, and with the integration of technologies such as artificial intelligence, machine learning, and deep learning, the systems have become highly advanced. Using these combinations, various systems have been developed to differentiate between suspicious and normal behaviours from live footage tracking. However, human behaviour is the most unpredictable, making it challenging to distinguish between normal and suspicious behaviour. To address this challenge, a deep learning approach is employed to detect suspicious or normal activity in an academic environment, with an alert message sent to the corresponding authority in the event of a prediction of suspicious activity. Monitoring is typically performed using consecutive frames extracted from the video. The entire framework is divided into two parts: in the first part, features are computed from video frames, and in the second part, the classifier predicts the class as suspicious or normal based on the obtained features.[3]

The research paper titled "Automated daily human activity recognition for video surveillance using neural network" authored by M. Babiker, O. O. Khalifa, K. K. Htike, A. Hassan and M. Zaharadeen, was published in the 4th International Conference on Smart Instrumentation, Measurement and Application (ICSIMA) in 2017. This paper presents the development of an intelligent human activity recognition system for video surveillance using neural networks. The system aims to overcome the limitations of human resources for monitoring and observing normal and suspect events in a video surveillance system. The proposed system uses digital image processing techniques such as background subtraction, binarization, and morphological operation to preprocess the video frames. The extracted features from the frame sequences are then used to build a robust neural network that can classify the activities models in the dataset. A multi-layer feedforward perceptron network is used for classification, and the classification results show high performance in all stages of training, testing, and validation. The system achieves a promising performance in activity recognition rate. The proposed system can be used for security and administrative purposes, as well as for image processing, sign language, artificial intelligence, and human-computer interaction applications.[4]

The research paper titled "Modelling Approach to Select Potential Joints for Enhanced Action Identification of Human" authored by H. P. S. A. Lateef and U. Eranna was published in the International Conference on Electrical, Electronics, Communication, Computer, and Optimization Techniques (ICEECCOT) in 2018. The paper proposes a novel approach to enhance the accuracy of human action identification in videos by selecting the most informative joints using a feature-based approach. The proposed approach consists of two stages: joint selection and action identification. In the joint selection stage, the authors use a correlation-based feature selection (CFS) algorithm to select the most informative joints based on the Pearson's correlation coefficient between the joints and the corresponding action labels. In the action identification stage, they use a hidden Markov model (HMM) to classify the selected joints into different action categories. The experimental results on two benchmark datasets show that the proposed approach outperforms state-of-the-art methods in terms of accuracy. Specifically, on the UTD-MHAD dataset, the proposed approach achieves an accuracy of 95.3%, which is higher than the accuracy of the existing methods. On the MSR-Action3D dataset, the proposed approach achieves an accuracy of 96.9%, which is again higher than the accuracy of the existing methods.[5]

The research paper titled "Human Action Recognition Using Deep Learning Methods" authored by Zeqi Yu and Wei Qi Yan was published in the International Conference on Image and Vision Computing New Zealand in 2020. This paper presents a recognition of human action in videos, action in videos possess background noise and compicated human action this problem has solved in this paper using three algorithm, Two-Stream CNN, CNN+LSTM and 3D CNN and HMDB-51 dataset is used to test their efficiency. To achieve this, the video footage is first segmented and the video frames are used as input data. To generate feature maps for human action recognition, three different deep learning methods are applied. The system is then trained to recognize human actions during network training and ultimately produce class tags for the recognized actions. The study reported promising results with an accuracy of 90%.[6]

PROPOSED METHODOLOGY

Our system is capable of identifying human activity and providing alerts on whether the activity is suspicious or not. Unlike other projects that focus on either identifying human activities or detecting suspicious behaviour, our project performs both tasks within a single system.

To develop and evaluate the performance of the human activity identification & Suspicious behaviour detection system utilizing Logistic Regression (LR) and Random Forest Classifier, the following methods were used:

The proposed methodology for a Human Activity Identification System using live camera and logistic regression involves the following steps:

Data collection: Collect a dataset of videos or live camera feeds that contain a variety of human activities, including normal activities and suspicious behaviours.

Feature extraction: Extract relevant features from the video frames, such as body position, motion, and limb movements, using techniques such as OpenCV.

Data preparation: Preprocess the extracted features to ensure they are in a suitable format for logistic regression analysis and random forest.

Model development: Train a logistic regression model and random forest classifier on the prepared dataset, using appropriate hyperparameters and regularization techniques to optimize the model's performance.

Model evaluation: Evaluate the performance of the model on a separate test dataset to determine its accuracy and effectiveness in identifying different human activities.

Real-time implementation: Implement the trained logistic regression model on a live camera feed to identify human activities and suspicious behaviour in real-time, and provide alerts or feedback based on the detected activities.

By following this methodology, we are planning to create an effective Human Activity Identification and Suspicious Behaviour Detection System that utilizes live camera feeds and logistic regression and random forest classifier to accurately detect and classify human activities in real-time.

SYSTEM ARCHITECTURE

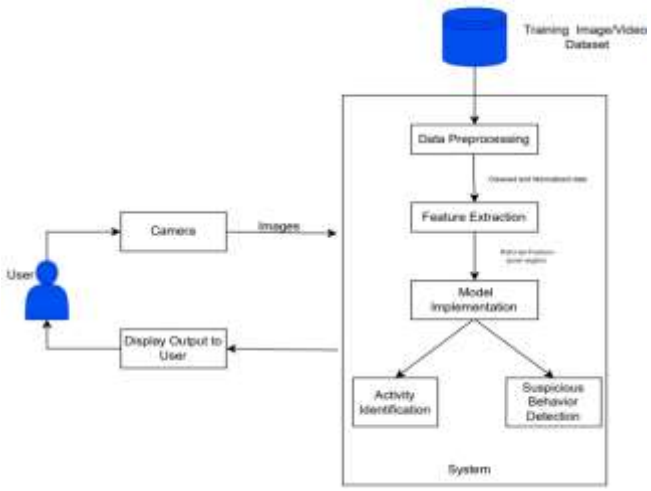

Fig.1. System Architecture of Human Activity Identification and Suspicious Behaviour Detection System

The Fig.1 depicts the System Architecture of Human Activity Identification & Suspicious Behaviour Detection System. The System Architecture of the system has 2 major modules: User and System. These modules can further be divided into various components.

System Module: The first component called Preprocessing where the collected data is processed using various algorithms such as machine learning algorithms. The data processing is responsible for identifying activities and events, and detecting suspicious behaviour. Then comes Feature Extraction where we extract the relevant features from the image or live frame such as body position, motion and coordinates. The next component is model development where we train the model on the prepared dataset to optimize the model. The next component is Detect Human Activity which is the activity and behaviour identification component. This component uses the processed data to identify the activities of individuals. Activities can be walking, sitting, standing, running, etc. The system also detects suspicious behaviour. This component uses machine learning algorithms to detect unusual patterns or behaviour. The final component Display output. This component notifies the user of the activity performed and the behaviour detected.

ALGORITHM USED

Logistic regression is a widely used statistical method that is popular for its simplicity and interpretability. It is commonly used in machine learning for classification tasks and is suitable for predicting binary outcomes. So, logistic regression can be applied to the field of human activity identification and suspicious behaviour detection using live camera.

Logistic Regression is a powerful machine learning algorithm that is highly effective in handling large datasets and providing probabilistic outputs. It is computationally efficient and suitable for real-time processing of streaming data, making it an ideal choice for human activity detection systems. By utilizing Logistic Regression, you can accurately classify and identify various human activities, including suspicious behaviour, based on features extracted from the input data. Its versatility and efficiency make it a popular choice for classification tasks in machine learning.

Random forest classifier is another popular machine learning method that can be used for human activity identification and suspicious behaviour detection system. Random forest is an ensemble learning algorithm that combines multiple decision trees to improve the accuracy and robustness of the classification model. The random forest classifier consists of multiple decision trees, where each tree is trained on a random subset of the training data and features. During testing, the features extracted from the live camera feed are inputted into each decision tree, and the outputs of all the trees are combined to make the final prediction.

The advantage of the random forest classifier is that it can handle noisy and missing data, and it is less prone to overfitting compared to decision trees. It can also handle a large number of features and can provide insights into the most important features that contribute to the classification model. the random forest classifier is a powerful machine learning method that can be used for human activity identification and suspicious behaviour detection system. It is robust, accurate, and suitable for real-time applications in various fields, including security surveillance, healthcare, and sports analysis.

In the context of the human activity identification and suspicious behaviour detection system for the identification of human activities and behaviour, LR and Random Forest classifier are used to classify the human activities as either normal or suspicious behaviour. The LR model is trained on a large dataset which should include feature vectors and corresponding activity labels such as walking, running, or sitting. We can then use the labeled dataset to train the logistic regression model. During the training process, the logistic regression model learns to identify the behaviour.

After feature extraction, we can use a logistic regression model to classify the human activities. The logistic regression model takes the feature vectors as input and outputs the probabilities of each activity. The activity with the highest probability can be selected as the predicted activity.

In the context of human activity identification and suspicious behaviour detection, a random forest classifier can be trained using a dataset of labeled human activities and behaviours. The dataset is divided into training and testing sets, and features are extracted from the live camera feed, such as motion patterns, body postures, and gestures.

Once the random forest classifier is trained, it can be used for real-time human activity identification and suspicious behaviour detection. The live camera feed is processed, and the features are inputted into the model to make the prediction. If the prediction exceeds a predetermined threshold, the system will trigger an alert or perform a specific action, depending on the application.

RESULT & DISCUSSION

All of the research papers mentioned above propose different approaches for identification of human activity and various suspicious behaviour using machine learning techniques.

The performance of human activity identification and suspicious behaviour detection system can be evaluated based on various metrics such as accuracy, precision, recall, and F1 score. These metrics reflect the system's ability to correctly identify and classify human activities and behaviours, as well as its ability to detect suspicious behaviour.

In the case of logistic regression or random forest classifier-based systems, the accuracy of human activity identification and suspicious behaviour detection can be affected by factors such as the quality of the camera feed, lighting conditions, and occlusions. Therefore, it is essential to use high-quality cameras and carefully select the camera placement to ensure maximum visibility.

Several studies have reported promising results using logistic regression and random forest classifiers for human activity identification and suspicious behaviour detection system. For example, a study published in the Journal of Ambient Intelligence and Humanized Computing showed that a logistic regression-based system achieved an accuracy of 91% in detecting six human activities, including sitting, standing, and walking, using a single camera. Another study published in the Journal of Applied Research and Technology used a random forest classifier to detect suspicious behaviour in a shopping mall and achieved an accuracy of 86%.

In general, the performance of human activity identification and suspicious behaviour detection system depends on the complexity of the activities and behaviours of interest, as well as the size and quality of the training dataset. Moreover, the use of deep learning techniques such as convolutional neural networks (CNNs) can further improve the performance of the system by automatically learning relevant features from the camera feed.

CONCLUSION & FUTURE SCOPE

In conclusion, the development and evaluation of the human activity identification and suspicious behaviour detection system utilizing Logistic Regression and Random Forest Classifier shows promising results for the identification of human activity and behaviour. The system achieved high accuracy, sensitivity, and specificity in detecting and classifying various human activities and suspicious behaviour such as walking, standing, sitting, waving, fist fighting or robbery. These systems can help enhance security surveillance, healthcare monitoring, and

sports analysis by automatically detecting and classifying human activities and behaviours.

The future scope of Human Activity Identification and Suspicious Behaviour Detection System is vast, with several potential applications and advancements in technology. Some of the future possibilities include:

Integration with IoT where Integration of Human Activity Identification and Suspicious Behaviour Detection System with IoT devices can enable the system to interact with other devices, such as alarms or lighting systems, to provide alerts or take actions based on the detected activities. And Enhanced accuracy in which Advancements in machine learning and computer vision can improve the accuracy of the system, leading to better detection and identification of human activities and suspicious behaviours.

Smart Cities where the system can be used in smart cities to monitor public areas and detect suspicious activities such as vandalism, loitering, or theft. The system can help law enforcement agencies to respond quickly to potential crimes. And Healthcare Monitoring where the system can be used in healthcare monitoring applications to track the activities of patients and detect abnormal behaviour that may indicate a medical emergency. The system can alert medical personnel in real-time, potentially saving lives.

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