A Minor Project Synopsis on

**Anomalous Human Activity Detection**

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**Introduction**We are pleased to introduce our minor project, which uses OpenPose and DenseNet to detect abnormal human behavior (AHAD). In many real-world applications, such as healthcare support, public safety monitoring, and security surveillance, AHAD is essential. It entails spotting odd or suspicious human behaviors that go against accepted standards. The goal of this research is to investigate the possibilities of DenseNet, a deep convolutional neural network architecture, and the pose estimation package OpenPose for efficient AHAD.

Using DenseNet and OpenPose has the following advantages:

1. OpenPose:
   * 1. OpenPose is an excellent tool for tracking the movement of important body joints, such as the knees, shoulders, and elbows, over time. This allows for a detailed portrayal of how the human body moves.
     2. It is appropriate for applications like security monitoring where real-time movement analysis is critical due to its rapid frame processing speed.
2. DenseNet:
   * 1. This deep learning architecture's densely connected layers, which facilitate effective feature learning, enable it to detect even the smallest anomalies in the posture data that OpenPose extracts.
     2. Because of its strong feature extraction capabilities, DenseNet outperforms typical CNNs in terms of accuracy and is more flexible in terms of adapting to a variety of contexts and activity patterns.

Our technology has the potential to significantly develop AHAD by integrating the strengths of both OpenPose and DenseNet.

**Motivation**

In creating this project, we want to ensure that we can live in a safe and secure environment regardless of any sudden abnormal activities such as forced entries, hijackings or kidnappings etc. The motivation for creating this project was also sparked by the shortcomings of present AHAD:

1. Developing an effective AHAD system enhances safety and efficiency in human activity monitoring, benefiting society and individuals.
2. Conventional rule-based systems have a tendency to sound alarms for innocuous actions, which wastes resources and unneeded human intervention.
3. These techniques have trouble changing to fit changing circumstances or shifts in the ways that people behave.
4. On systems with limited resources, real-time performance might be hampered by complex algorithms due to their high computational cost.

DenseNet and OpenPose present viable approaches to accomplish this objective:

* OpenPose: This library provides a detailed representation of human body movements by effectively extracting 2D and 3D human posture estimations from video frames.
* DenseNet: This deep learning architecture is well-suited for anomaly detection due to its effective feature extraction and robust performance in image classification tasks.

Through the utilization of these tools’ strengths, my goal is to create an AHAD system that is more precise and effective, thereby contributing to a range of real-world uses.

**Project Objective**

The primary objective of this minor project is:

* To train a model that identifies and "sounds the alarm" on unusual behaviour in video footage. This will ensure that public spaces are monitored more effectively.
* To reduce false positives by reducing the number of alerts triggered by normal activities.
* To train the model on diverse datasets from diverse settings, enhancing its ability to detect anomalous patterns across different public settings.
* To optimize the model to enable real-time video analysis to detect suspicious activities accurately and immediately.

By using OpenPose and DenseNet on the hardware, the system will be able to examine video material in real-time and respond quickly to anomalies. Our project will lead to a more reliable and effective AHAD solution with broader use in real-world scenarios if these goals are met.

Pros and Cons of Existing Methods:

* Existing methods lack real-time multi-person pose estimation;
* OpenPose overcomes this with part affinity fields, and DenseNet integration boosts accuracy further.

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| Method | Pros | Cons |
| Rule-based Systems | Easy to implement, Low cost | Limited adaptability |
| Statistical | Good for large datasets and Real time applications | Sensitive to data quality and distribution, may struggle with complex or subtle anomalies. |
| Machine Learning | Highly Flexible, handles complex relationships and identify subtle anomalies | Extremely high computational cost and resource requirement |

**Methodology/ Planning of work:**

We will take the following crucial actions in order to meet the project’s goal:

1. Gathering and Preparing Data:

* Gather a wide range of video footage showing different human behaviors, both regular and unusual.
* Preprocess the video data by normalizing pixel values, removing frames, and resizing them.

1. Training Models:

* Create a DenseNet model using extracted pose estimations from OpenPose for anomaly detection.
* Using the labelled dataset, train the model and adjust the hyperparameters to achieve the best results.

1. Validation, Testing, and Documentation:

* Analyze the accuracy and generalizability of the trained model using test data that hasn't been seen before.
* Examine the outcomes, spot any possible mistakes, and make any necessary adjustments to the model.
* Documenting methodologies, implementations, and outcomes for thorough project documentation.

**Facilities required for proposed work:**

The resources of Google Colab will be effortlessly utilized for this project, eliminating the requirement for personal hardware and greatly minimizing the trouble associated with software installation. How to do it is as follows:

1. Hardware:

* Strong GPUs: Colab provides free access to strong GPUs (T4) inside of its runtime environments, which are ideal for effectively training DenseNet through deep learning.
* Scalable Storage: Without limiting local storage, Colab offers a large amount of cloud storage that grows automatically to accommodate the trained model and video dataset.

1. Program:

* Pre-installed Libraries: NumPy, PyTorch, and OpenPose are just a few of the widely used libraries that Colab comes pre-installed with, saving manual installations and guaranteeing compatibility.
* Deep Learning Frameworks: TensorFlow and PyTorch are easily accessible in Colab runtime environments, providing developers with a range of options for developing models.
* Video Processing Tools: To further streamline workflow, Colab provides access to video processing libraries such as OpenCV for data pretreatment activities.

Benefits of Utilizing Google Colab:

* No local setup required: Eliminates the need for local software installation, making it accessible to users with limited hardware resources.
* Accessibility and scalability: Operates within a web browser, accessible from any device with an internet connection. Offers different GPU configurations for scaling computational power.
* Simplified resource management: Handles all hardware and software maintenance, allowing focus on development and execution.

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