WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Human Activity Detection Using Opencv

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ABSTRACT

Human activity detection is a fundamental challenge in computer vision, with numerous applications in fields such as surveillance, healthcare, and human-computer interaction. This work presents a comprehensive approach to human activity detection using the OpenCV library and Python programming language. The proposed system aims to accurately recognize and classify human actions in real-time by leveraging OpenCV powerful computer vision capabilities. The system's architecture comprises several key components, including data acquisition, pre-processing, feature extraction, activity recognition, and visualization. In the data acquisition phase, video streams from cameras or pre-recorded videos are collected, assuming diverse human activities are captured in different environments. To ensure real-time performance, the system is optimized using multi-threading and parallel processing techniques. By distributing the computational load across multiple cores, the system can process video streams in real-time, making it suitable for deployment on resource-constrained devices.

Keywords— Convolutional Neural Network, Deep Neural Network, Human Activity Recognition, Recurrent Neural Network.

I. Introduction

The Detection of the Human actions involving a person from a video or live camera is the objective of action recognition. The primary objective of our underlying methodology is to improve the accuracy and mean while add some prediction models of tour prediction. Human Activity Recognition is the recognition, interpretation and recognition of human behaviors that Smart Health Care can leverage to actively support users according to their needs. Human activity detection has broad application perspectives, such as monitoring in smart homes, sports, game control, and health care, caring for the elderly, detection and identification of bad habits. It can make our daily life smarter, safer and more convenient

Deep learning and OpenCV advancements with highly trained datasets have opened up new avenues for future research in this subject. These innovations can lead to the practical constructive use of these devices in this digitally connected environment to the well-being of everyone. The application of new and advanced technologies in this field by many researchers and developers has resulted in a wide range of applications for these models. general gatherings of honesty evaluation strategies exist semantic methods The aim of this project is to create a model that can identify the basic human actions like running, jogging, walking, clapping, hand-waving and writing. The model will be shown a series of videos in which people do various actions. The label of a video will be the activity that is being performed in that video After gaining knowledge of this relationship, the model ought to be able to forecast the label of an input that it has never seen before. In theory, given examples of different human actions, the model would need to learn to distinguish between them.

II. Related Works

Research in generalize the best performing hand-crafted features within a data-driven framework. Their main contribution is that they were first to propose a two-stream ConvNet architecture which incorporates spatial and temporal networks [3]. The demonstration of the bag of words framework trajectons can match state of the art results outperforming Histogram of Optical Flow features on the Hollywood actions dataset [4]. Inspired by the fact that the relative geometry between different parts of the body provides a more accurate explanation than their absolute positions for human actions, they specifically model the relative 3D geometry in their skeletal representation of different parts of the body [5]. Describe the evaluation metrics commonly used to assess the performance of transfer learning models in HAR, including accuracy, precision, recall, F1 score, and domain adaptation-specific metrics[6]. In aviation, approaching and landing under low visibility and night vision conditions is the major safety issue. This paper focused only on the runway analysis as it is the prominent region of detection[7]. It involves identifying and classifying human actions or activities from data sources such as video streams, sensor data, or other forms of time-series data. CNNs and LSTMs are popular neural network architectures used in this context.[8].it can

be employed in many applications, such as remote health monitoring for disabled and elderly people. This paper proposes a granular computing-based approach to classifying human activities using wearable sensing devices [9] Challenges may include dealing with noisy sensor data, maintaining user privacy, and ensuring robustness in different environments[10]. Discussing the use of deep learning techniques, such as Time-CNN and Stacked LSTM, in the context of posture classification. This section might include an overview of the architectures, advantages, and challenges associated with these models [11]. The personalization of classification models for human activity recognition is an important research area within the broader field of human activity recognition. It involves tailoring machine learning models to individual users or adapting them to specific contexts [12].

III. Proposed Method

The System takes input in the live camera or input video. It is used to perform activity detection on an image or live video. It is much faster and a cost-effective solution. This Technology helps the machine to decide and predict what we perform in various activities. For this, we must use a Deep Learning Model and a Dataset. This method can be used, incorporated, or expanded to meet a variety of needs. As a result, it serves as a foundation system for a variety of applications and functions. Furthermore, it can eliminate the requirement for extra data entry personnel. As a result, the companies' costs are significantly reduced.. The Software requirements of the system includes Python is the basic programming language used in the Human Activity detection.

The Human activity detection includes the libraries OpenCV, NumPy, Argparse, Imutils, sys, and PyTorch in python. Pychram is the tool used to execute python language.System requirements: includes Windows 11, Mac OS X, Linux. The libraries can be explained as, Python is a preferred programming language for human activity recognition due to its versatility, extensive libraries, and active community support, making it well-suited for developing, testing, and deploying Human activity detection systems and applications. NumPy plays a crucial role in human activity detection by providing efficient and powerful tools for numerical computation and data manipulation. It is widely used in implementing machine learning algorithms, including those used for human activity recognition. The abstracts mention the use of TensorFlow, which is a popular machine learning framework that relies on NumPy for its numerical computations.

The Argparse module serves a pivotal role in configuring and customizing the Human activity detection application by enabling the definition and parsing of command-line arguments. This flexibility allows researchers and users to easily specify various parameters, such as model settings, data sources, and output directories, ultimately enhancing reproducibility, usability, and the integration of Human activity detection systems into larger data processing workflows. The Imutils library plays a crucial role alongside argparse by simplifying image processing tasks within the HAD application. imutils offers a wide range of utilities for resizing, rotating, and displaying images, aiding in the preprocessing and visualization of data. The sys module assumes a supporting role in conjunction with argparse and imutils. It aids in the seamless interaction between the HAD application and the underlying operating system, allowing for features such as reading input files, configuring file paths, and handling system-specific operations. PyTorch assumes a central role as the deep learning framework of choice. PyTorch empowers the development and training of sophisticated neural network models for activity recognition. It enables the efficient implementation of cutting-edge deep learning architectures, simplifies model training and evaluation, and supports seamless integration with other Python libraries and tools mentioned in the paper, such as argparse for parameter tuning and imutils for image processing.

IV. SYSTEM ARCHITECTURE

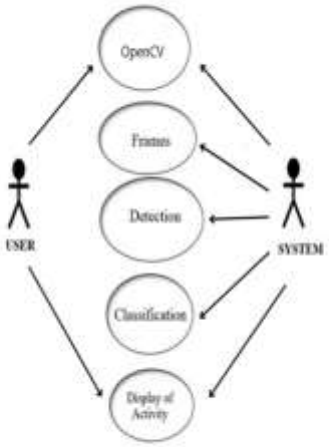

Figure 1 USECASE DIAGRAM

Camera/OpenCV: In the use case diagram input act as the primary module the camera captures a continuous stream of video frames in real-time. Cameras serve as the primary input source for capturing video frames. **Frames:** This use case illustrates how the system uses OpenCV to examine the video frames it has recorded in order to find and separate the signer's hand gestures from the surrounding noise. To concentrate on the signer's hand movements, real-time video frame processing, segmentation, and background subtraction are used. **Activity Detection**: the process of identifying and categorizing specific activities or behaviors performed by humans or objects. . It plays a critical role in a wide range of applications, from surveillance and autonomous vehicles to augmented reality and medical imaging. OpenCV, a popular computer vision library, provides a variety of techniques for activity detection. **Activity Classification:** In this use case, the system utilizes OpenCV and matching algorithms to compare the extracted features to predefined data and activity stored in its dataset. The goal is to identify the activity of the human and display the activity. **Display of Activity:** Once the system successfully identifies the activity of the human in the frame, the "Display Output" use case ensures that the interpretation is conveyed to the user. This may involve presenting detected activity is displayed.

V. Modules

DATA ACQUISITION: This module is responsible for collecting sensor data from wearable devices or smartphones. The data may include accelerometer and gyroscope readings. A data acquisition module has been developed for human body action function detection. It uses depth camera equipment to acquire human body motion videos and establishes a simple human skeleton model for analysis. Spatial coordinate data of human skeletons are obtained, and spatial data among the articulation points are calculated. The spatial data is then matched with a posture library template obtained through machine learning, and limb movement recognition is performed. This module enables synchronous detection of motion data of multiple body parts during functional action detection and allows for quantification of functional action detection data. Processing Module:

DATA PREPROCESSING: Processing modules are used in the detection of human activity to analyze video sequences and make rational decisions about people actions. These modules are designed to detect and classify patterns of human Based on acquired signals, activity is carried out. Several approaches have been suggested. For that purpose, including the use of Neural Networks with Pruning and Edges detection mechanisms, as well as the use of convolutional networks with incremental learning.

Feature Extraction Module: The feature Extraction Module and

its function in improving the accuracy of Human pastime popularity structures. Its pivotal role by transforming preprocessed information, obtained from digicam or OpenCV, into informative feature vectors. This process encompasses the selection and derivation of temporal, frequency-domain, and statistical features from the information. Temporal features seize time-based totally traits, while frequency-domain capabilities monitor spectral records. Statistical features provide insights into information distribution. The extracted features are assembled into function vectors, which serve as the foundation for next deep learning models.

Human Detection Module: The Human Detection Module is an essential component in computer vision systems, tasked with identifying and locating humans within image or video frames. Leveraging object detection algorithms such as Haar cascades, deep learning-based approaches, this module creates bounding boxes around detected humans and may provide confidence scores. Preprocessing steps 32 enhance detection accuracy, and post-processing techniques, like nonmaximum suppression, optimize results. The module's output, typically bounding boxes and associated information, serves as a critical input for various applications, including surveillance, security, and human activity recognition, with the choice of detection method impacting system perform.

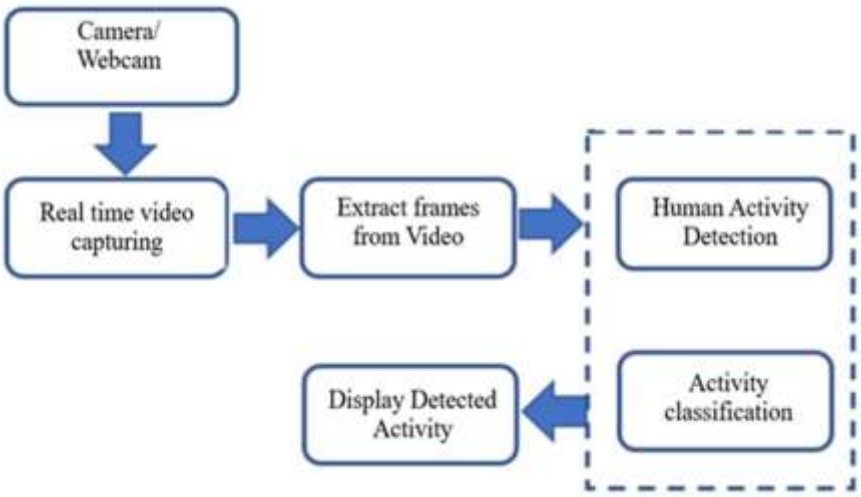

Figure 2 System Architecture

VI. Conclusion

The Human activity detection systems provide several benefits in a variety of areas, including security, healthcare, automation, and user experience. It is crucial to address the ethical and privacy issues these technologies raise as they develop further. With continued study and development, we can anticipate that these systems will advance in sophistication, dependability, and adoption, enhancing our quality of life and the effectiveness of several industries. Recognition of human activity has many applications due to its effect on well-being.It is becoming a fundamental tool in healthcare solutions such as preventing obesity or caring for elderly persons. It is essential in surveillance, smart environment, and man-machine conversation

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