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Video-Based Human Activity Recognition for Elderly Using Convolutional Neural Network

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ABSTRACT

A typical healthcare application for elderly people involves monitoring daily activities and providing them with assistance. Automatic analysis and classification of an image by the system is difficult compared to human vision. Several challenging problems for activity recognition from the surveillance video involving the complexity of the scene analysis under observations from irregular lighting and low-quality frames. In this article, the authors system use machine learning algorithms to improve the accuracy of activity recognition. Their system presents a convolutional neural network (CNN), a machine learning algorithm being used for image classification. This system aims to recognize and assist human activities for elderly people using input surveillance videos. The RGB image in the dataset used for training purposes which requires more computational power for classification of the image. By using the CNN network for image classification, the authors obtain a 79.94% accuracy in the experimental part which shows their model obtains good accuracy for image classification when compared with other pre-trained models.

KEYWORDS

Activity Recognition, Assisted Living, Computer Vision, Convolutional Neural Network, Skipping Connection

INTRODUCTION

Human activity recognition (HAR) system becomes popular due to the tremendous growth of Artificial intelligence in the smart healthcare environment. The primary aim of the activity recognition is to identify the actions performed by humans from a series of examinations on the action of the human and their environmental condition. The artificial intelligence achieved a big milestone in disease diagnosis, medical image analysis, medication recommendation to the patients and the like. Several machine learning approaches have been proposed to get more insight into the sensor data provides by the various devices that monitor the human in a smart health environment. The most typical application in the healthcare industry is human activity recognition (Subasi, Radhwan, Kurdi, & Khateeb, 2018). The medical application uses a human motion for the study and analysis of orthopedics, neurology,

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musculoskeletal disorders, body posture, and fitness. In a smart health care environment, every piece of information is taken for observations and it makes decisions by deep analysis. HAR helps to predict the early fall of the elderly people and monitoring the activity of the patients.

In the past few decades, several solutions were proposed for human activity recognition of elderly people in the healthcare environment. The most commonly used technology practiced so for is wearable sensor devices. The most commonly used sensors are an accelerometer, gyroscope, proximity sensor and the like. These are available in various wearable forms like, belt, wrist band, pendent, watch which can be easily worn by the people and transmits the data sequentially to the remote system to process and provide a necessary alert to the patients as well as caregivers (De Miguel, Brunete, Hernando, & Gambao, 2017). Some advanced devices incorporate multiple sensor technologies to obtain multiple features for accurate activity recognition. Later by seeing the advantage of computer vision in many fields, video-based activity recognition was introduced. Vision-based human activity recognition is the process of labeling image sequences with action labels. Vision-based activity recognition is a systematic approach to understand and analyze the movement of the people in camera-captured content. It comprises various technologies such as machine vision, image processing, artificial intelligence and pattern recognition. The human activity recognition system conventionally follows a hierarchical manner. In the videos, based activity recognitions, background subtraction, feature extraction, tracking, and detection comes under the lower level.

The main objective of this research work is to develop a video surveillance based human activity recognition system for elderly people. Videos are to be extracted into the frames to create an image repository and the preprocessing techniques are applied to remove noise and normalize the images for activity recognition Our contribution to this work is to design a fully convolutional network model to classify the sequential frames of video and recognize the action performed.

The remaining sections of this article are structured as follows: the detailed study of the state-of-the-art methods for human activity recognition is present in section 2. The architectural design and the behavior of the proposed methodology were elaborated in section 3. Extensive experiments and their results are demonstrated in section 4. Section 5 focuses on the performance of the proposed system and discuss the comparison of other methodologies. Finally, section 6, concludes the paper with the scope of further enhancements in the future.

RELATED WORKS

This section discusses the detailed study of state-and-art-of-the solutions for human activity recognition with pros and cons in the perspective of three major approaches as follows.

Sensors Based HAR

The current generation of portable mobile devices, such as smartphones, music players, smartwatches or fitness trackers incorporates a wide variety of sensors that can be used for human activity and behavior analysis. Some advanced devices incorporate multiple sensor technologies to obtain multiple features for accurate activity recognition. This motivates the researches to develop new intelligent applications that make use of this sensor data for extensive inferences about different aspects of human life. In the earlier past decade, several statistical approaches and machine learning techniques were proposed to analyze these data and achieved great success in decision making, pattern recognition, and various complex tasks. In recent years deep learning methods convolutional neural network and the recurrent neural network has achieved tremendous success in human activity recognition. TAHAR system in (Reyes-Ortiz, Oneto, Samà, Parra, & Anguita, 2016) predicts the activity by considering transitions directly learning or by unknown activities. The authors employed SVM with a heuristic filter method for probabilistic output for action recognition.

Chernbumroong, Cang, Atkins, and Yu (2013) proposed a classification method for the detection of activity of daily living of elderly people in the assisted living environment. It applied the neural