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Review of Literature for Machine and Deep Learning in Human Posture of Ergonomics

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A B S T R A C T

In the realm of human-computer interaction, one of the hottest topics right now is the utilization of skeletal data for the purpose of human posture detection. Both the local relationship between the joints and the global spatial position of the joint are taken into consideration when determining the angle and distance attributes of a joint. After that, the method of rule learning is combined with the method of bagging and the method of random subspace to create unique samples and features for the purpose of improving the classification performance of sub-classifiers for a variety of samples used in human posture classification. In the final step of this evaluation, the performance of our proposed technique is assessed using four human posture datasets. The results of our experiments demonstrate that our algorithm is able to accurately recognize a diverse range of human postures, and this improvement also results in outputs that are easier to read. Deep learning is a subfield of machine learning and artificial intelligence that attempts to model the way in which humans pick up new information. In its most basic form, it is a neural network with three or more layers. Deep learning helps in the development of a wide variety of artificial intelligence applications, which in turn helps in the improvement of automation, the performance of analytical and physical activities without the need for human participation, and therefore develops applications that are disruptive to existing methodologies. Deep learning has several applications, and one of these is the detection of human poses, which traditionally would have been done using more conventional methods.

Keywords:Ergonomics, Human Posture, Tensor Flow, Machine Learning, Ergomonics

1. Introduction

In recent years, one of the most popular research issues in the world of computer vision has been the utilization of skeleton data for the purpose of human posture detection. The interaction between humans and computers could make good use of this method in many different ways. There is a wide range of potential applications, including but not limited to medicine, multimedia applications, virtual reality, and the control of robots. Postures are considered more static than actions, which are considered more dynamic[1][2][3][4][5][6][7]. This is the primary distinction between the two. It is common practice to employ a human posture as the primary frame in action recognition algorithms because it serves as a foundation for activities and is regularly observed in humans. A human's posture is more important than their actions in a number of contexts, including the realms of physical training, rehabilitation therapy, and sign language communication, to name a few. Because it is more precise, efficient, and natural than keystroke control and voice interaction, posture recognition is by far the best human-computer interface mode to utilize in loud workplaces and dangerous working circumstances.The skeleton data produced by a Kinect sensor is used in the suggested approach for detecting human posture. A variety of features, including joint distance features and angle features, were defined to get things going. Then, rule ensembles based on bagging and random subspace approaches were built using the RIPPER rule learning method. This allowed for the training of 100 rule sets, which were then combined to create a rule ensemble. The rule ensemble was then classified using majority voting. Computer vision deals with the challenge of predicting and tracking the position of individuals while also recognizing, identifying, and tracking semantically significant points. Examples of semantic crucial points are "right shoulders," "left knees," and "left brake lights of autos," among others. The implementation of semantic key point tracking in live video footage necessitates a large amount of processing resources, which has, up to this point, limited the precision of pose estimate computations. Self-driving cars and robotic last-mile delivery services are just

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a couple of the new applications that can now be implemented thanks to technology advancements. Convolutional neural networks are the best image processing models currently available (CNNs). Because of this, state-of-the-art methods typically concentrate on modifying CNN architecture for inferring human stance. Pose estimation is a method for determining a person's location from an image or video by determining the locations of key body joints using a machine learning model. This can be accomplished by reviewing the image or video (key points).

2. Review of Literature

A person's posture is the way in which they position their body so that their muscles are not strained when they are moving. The wrong body position is the root of many different health issues. Incorrect posture can lead to a variety of problems, including back pain and fatigue, both of which can make it difficult to perform the things we need to do on a daily basis. Because the vast majority of people in today's world experience issues such as back discomfort, injuries, neck pain, and shoulder troubles, amongst other things, the creation of a device has become necessary.

By monitoring for shifts in a person's posture, the system seeks to accomplish its primary mission of determining whether or not a person's posture is correct. Changes in various directions (i.e., right, left, forward, backward) are detected by calculating angles based on a body's tiltation, and push buttons are used to sense the moment when stress is applied to a certain back spot. In addition to this, the user will receive a warning about their slouching posture, and the results of the analysis will be shown on the screen[8][9][10][11][12][13]. The product is designed to provide its users with a high level of comfort and perfect posture, both of which are critical to maintaining a healthy body and mind.

Tensorflow.js is a JavaScript library that was developed by Google and is used for the training and utilization of machine learning (ML) models in the browser. It is a library that works in conjunction with Tensorflow, which is a popular machine learning toolkit written in Python. Keep reading to gain further insight into its qualities, upcoming opportunities, and the ways in which it can be of use to you. You are able to write machine learning models in JavaScript with the help of TensorFlow.js, and then use those models in the browser with Node.js, on the server with Node.js, on mobile with React Native, on the desktop with Electron, and even on Internet of Things devices with Node.js on Raspberry Pi.

PoseNet is capable of estimating either a single stance or numerous poses, which suggests that there is a version of the algorithm that can recognize only one person in an image or video and another that can identify many persons in an image or video. What are the key distinctions between the two different versions? The one person posture detector is more convenient and quicker to operate, but it can only analyze an image for a single subject if there is only one of them there (more on that later)[14][15][16][17][18]. We'll start with the single-purpose one because it's simpler to understand and follow. At a high level, the assessment of pose can be broken down into two phases: The model outputs are sent into either a single-pose or multi-pose decoding algorithm in order to decode poses, pose confidence scores, key point positions, and key point confidence scores.ML5.js is a high-level interface to TensorFlow.js, which is a toolkit for GPU-accelerated mathematical operations and memory management in machine learning algorithms. ML5.js is open source and user-friendly. It is also a high-level JS package that, by leveraging TensorFlow.js in the background, makes machine learning simpler for novice users. p5.js is a JavaScript framework for creative coding that strives to make coding accessible and inclusive to artists, designers, educators, beginners, and everyone else! p5.js was developed by the P5.js Foundation. Because we think that everyone should have access to software and the tools necessary to understand it, we have made p5.js open-source and free to use. p5.js comes with an extensive collection of drawing functionality, which is comparable to a sketch. You are not, however, limited to the sketching canvas you have in front of you. You can think of the entirety of the page that loads in your browser as your sketch. This includes all of the HTML5 components for text, input, video, webcam, and sound.

3. Discussion

The proposed method for human posture detection makes use of the skeleton information that is generated by a Kinect sensor. To get started, a number of features, such as angle features and joint distance features, were defined. The RIPPER rule learning method was then used to construct rule ensembles based on bagging and random subspace techniques. This made it possible to train one hundred rule sets that were combined to form a rule ensemble, which was then classified using majority voting. The difficulty of estimating and tracking the position of humans while simultaneously detecting, identifying, and tracking semantic important points is one that falls under the purview of computer vision. There are several examples of semantic essential points, such as "right shoulders," "left knees," and "left brake lights of cars." The fact that a significant amount of processing resources are required for the execution of semantic key point tracking in live video footage has, up to now, hampered the accuracy of pose estimate calculations. Recent technological developments have made it possible to implement new applications that have real-time requirements, such as self-driving automobiles and robots that do last-mile deliveries[19][20][21][22][23][24]. The most effective image processing models available today are known as convolutional neural networks (CNNs). As a consequence of this, techniques that are considered to be state-of-the-art frequently concentrate on tailoring CNN architecture for human pose inference. The technique of predicting a person's position from an image or video by calculating the spatial locations of significant body joints using a machine learning model is known as pose estimation. This can be done by analyzing the picture or video (key points).

4. Summary

Access to the application was also made possible for people with visual impairments by utilizing the Speech-to-Text API provided by Azure Cognitive Services. The user can initiate their actions remotely by employing Azure Translator Speech API in a range of languages, which is more convenient and user-friendly for the audience that we are aiming to attract. The application makes advantage of Azure Cognitive Services in order to convert text to speech. This is helpful for people who are visually impaired because it allows them to hear if they are in the correct position. If they are not, the

application will alert them to adjust their posture if they are not in the ideal position.When establishing the angle and distance properties of a joint, both the local relationship between the joints and the joint's overall spatial position are taken into account. Then, in order to develop distinctive samples and features and improve the classification performance of sub-classifiers for a variety of samples used in human posture classification, the method of rule learning is combined with the methods of bagging and random subspace. The performance of our suggested technique is evaluated using four human posture datasets in the final stage of this assessment. Our experiments' findings show that our system can recognize a wide variety of human poses accurately, and this advancement also produces outputs that are simpler to read. A branch of artificial intelligence and machine learning called "deep learning" aims to simulate how people learn new knowledge. It is a neural network having three or more layers in its most basic form. Deep learning contributes to the creation of a wide range of artificial intelligence applications, which in turn increase automation, the ability to do physical and analytical tasks without human involvement, and the creation of applications that challenge established methodologies. The detection of human poses, which was formerly accomplished using more traditional techniques, is one of the applications of deep learning.

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