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Human Posture Analysis (Deep Learning / Machine Learning)

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ABSTRACT

In the field of human-computer interaction, the use of skeletal data for human posture detection is a hot topic.The angle and distance properties are specified in terms of the local relationship between joints as well as the joint's global spatial location. The rule learning method is then combined with the Bagging and random subspace methods to create different samples and features for improved classification performance of sub-classifiers for diverse samples during human posture classification. Finally, four human posture datasets are used to evaluate the performance of our proposed method.The experimental findings show that our algorithm can effectively recognize a wide range of human postures, and the project's outputs are more interpretable.Deep learning is a branch of Machine Learning and Artificial Intelligence that mimics how humans acquire knowledge. It's essentially a three- or more-layer neural network. Deep learning aids in the development of numerous artificial intelligence applications that aid in the improvement of automation, the performance of analytical and physical activities without the need for human participation, and so develops disruptive applications among methodologies. Human Pose Detection is one such application where deep learning takes the place of traditional methods.

Keywords — Human posture Analysis · Tensorflow · Machine learning

INTRODUCTION

a. *About Project*

The use of skeleton data for human posture detection has become a popular research issue in the field of computer vision in recent years. This technique has a lot of potential for use in human-computer interaction.

Medicine, multimedia applications, virtual reality, robot control, and other fields are only a few of the possibilities. In general, postures and actions differ in that the former is static while the latter is dynamic. A human posture serves as a foundation for activities and is frequently used as the primary frame in action recognition algorithms. A human posture is also more significant than an action in several domains, such as physical training, rehabilitation therapy, and sign language communication. In noisy workshops and risky working conditions, posture recognition is far superior than keystroke control and voice interaction as a human-computer interface mode because it is more accurate, efficient, and natural.

b. *About posture*

Posture is a manner of holding one's body such that muscles are not overworked during movement. Many health problems are caused by poor body position. Incorrect posture can cause difficulties ranging from back pain to weariness, which can interfere with our everyday tasks. The majority of the population nowadays suffers from back pain, injuries, neck pain, and shoulder difficulties, among other things, necessitating the development of a device.

c. *The main aim*

The system's main goal is to detect whether a person's posture is proper or incorrect by sensing changes in their posture. Changes in different directions (i.e., right, left, forward, backward) are identified by calculating angles based on a body's tiltation, and the time when stress is applied to a certain back location is sensed using push buttons. In addition, the user will be alerted to their poor posture, and the findings will be displayed on the screen. The device is made for human comfort and excellent posture, both of which are necessary for keeping the body and mind healthy.

TECHNOLOGIES USED

A. TENSORFLOW.JS:

Tensorflow.js is a Google-developed JavaScript library for training and using machine learning (ML) models in the browser. It's a companion library to Tensorflow, a popular Python machine learning toolkit. Continue reading to learn more about its characteristics, future prospects, and how it can assist you.TensorFlow.js allows you to write ML models in JavaScript and utilize them in the browser, on the server with Node.js, on mobile with React Native, on the desktop with Electron, and even on IoT devices with Node.js on Raspberry Pi.

B. POSENET.JS

PoseNet can estimate single or multiple poses, implying that there is a version of the algorithm that can detect only one person in an image/video and another that can recognize many people in an image/video. What's the difference between the two versions? The one person posture detector is faster and easier to use, but it only works if there is just one subject in the image (more on that later). Because it's easier to follow, we'll start with the single-pose one. Pose estimation is divided into two phases at a high level:

• Poses, pose confidence scores, key point positions, and key point confidence scores are decoded from the model outputs using either a single-pose or multi-pose decoding algorithm.

C. ML5.JS:

ML5.js is an open-source, user-friendly high-level interface to TensorFlow.js, a library for GPU-accelerated mathematical operations and memory management in machine learning algorithms. It's also a high-level JS package that makes machine learning easier for beginners by using TensorFlow.js behind the scenes.

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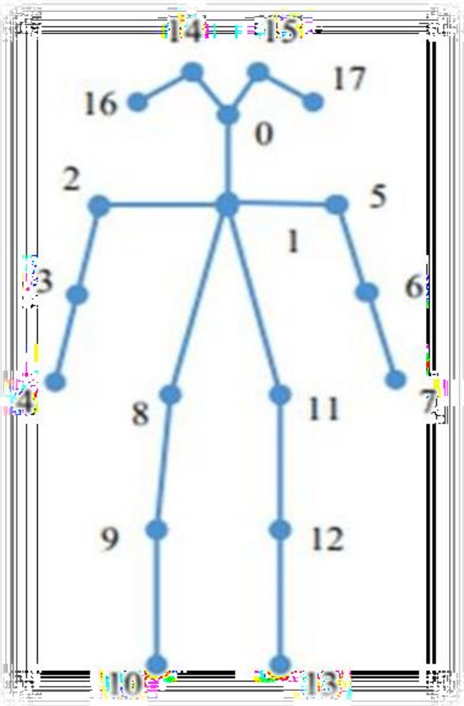
D. P5.JS:

p5.js is a JavaScript framework for creative coding that aims to make coding accessible and inclusive to artists, designers, educators, beginners, and everyone else! Because we believe that software and the tools to understand it should be available to everyone, p5.js is free and open-source. p5.js includes a comprehensive set of drawing functionality, analogous to a sketch. You are not, however, restricted to your drawing canvas. Your entire browser page, including HTML5 elements for text, input, video, webcam, and sound, can be thought of as your sketch.

PROPOSED APPROACH



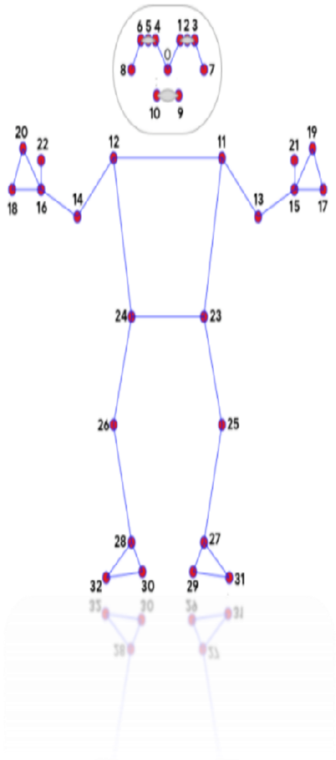
The label of each joint points

The skeleton information generated from a Kinect sensor is used in the suggested approach for human posture recognition. The stages of this method are depicted in Figure 1. To begin, several features were defined, including angle features and joint distance features. The RIPPER rule learning technique was then utilized to generate rule ensembles based on bagging and random subspace approaches, which allowed training 100 rule sets that made up a rule ensemble for final classification by majority voting.

Pose Estimation Technique

Id	Part
0	nose
1	leftEye
2	rightEye
3	leftEar
4	rightEar
5	leftShoulder
6	rightShoulder
7	leftElbow
8	rightElbow
9	leftWrist
10	rightWrist
11	leftHip
12	rightHip
13	leftKnee
14	rightKnee
15	leftAnkle
16	rightAnkle

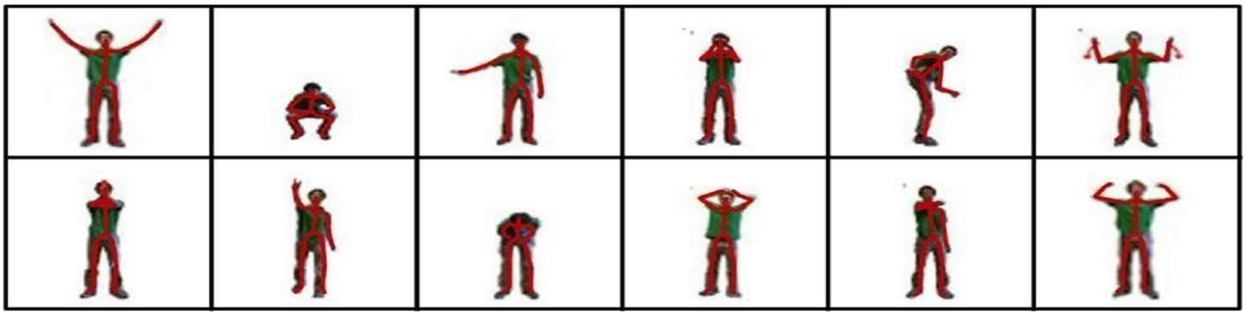
The label of each joint points



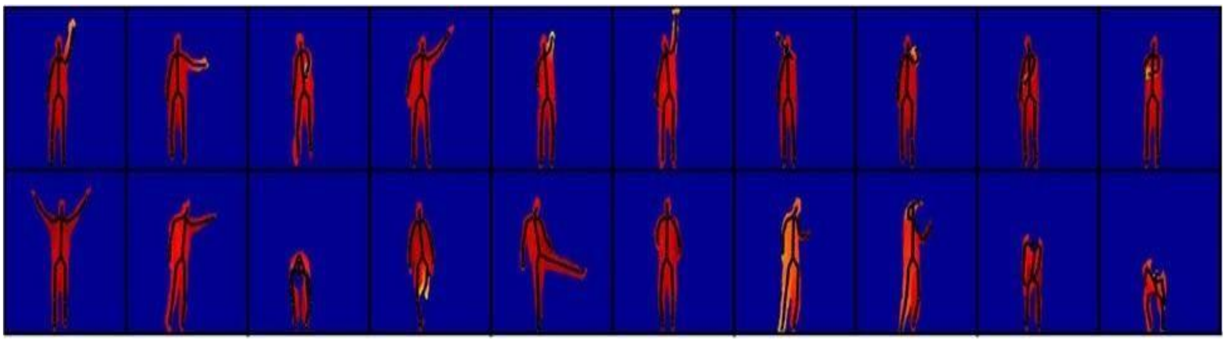
Detecting, associating, and tracking semantic key points is a computer vision problem that includes human position estimate and tracking. "Right shoulders," "left knees," and "left brake lights of cars" are examples of semantic crucial points. The execution of semantic key point tracking in live video footage necessitates a large amount of processing resources, which has hitherto limited pose estimate accuracy. New applications with real-time requirements, such as self-driving cars and last-mile delivery robots, are now viable thanks to recent advancements. Convolutional neural networks are the most powerful image processing models today (CNNs). As a result, state-of-the-art approaches are often focused on customizing CNN architecture for human pose inference. Pose estimation is the process of predicting a person's pose from an image or video by calculating the spatial locations of important body joints using a machine learning model (key points).

DATASETS

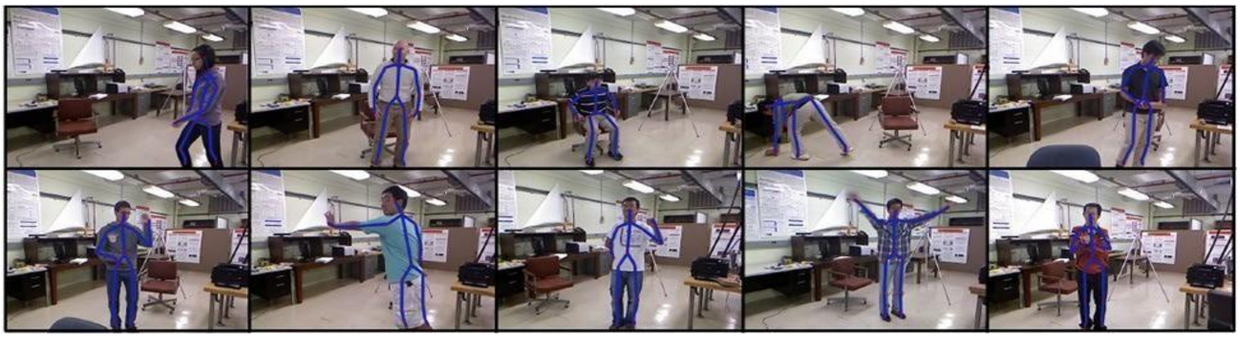
This part contains all of the information and photos needed to complete the project's testing.Using four datasets, we conducted a thorough evaluation of our suggested technique. The MSR-Action3D, Microsoft MSRC-12, UT Kinect-Action, and Baduanjin posture action databases were used to create all four datasets.



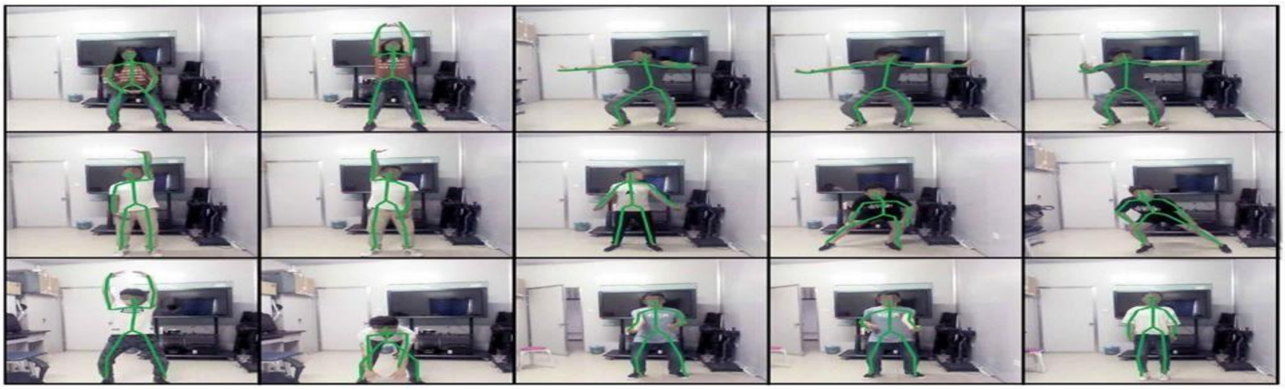
MSRC-12 posture RGB image



MSR-action3D posture depth image



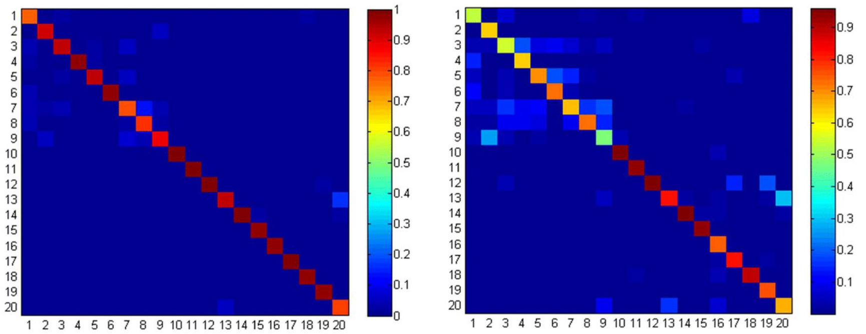
UT Kinect action posture RGB image



Baduanjin action posture RGB image

RESULTS

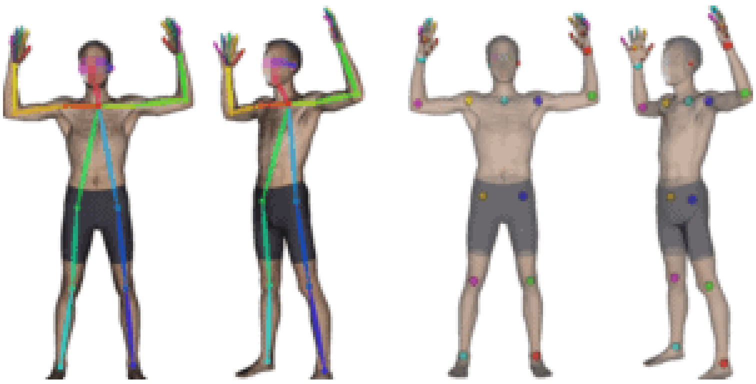
Contrast matrix between Baduanjin algorithm and the SVM algorithm



(a) **(b)**

CONCLUSION

The Speech-to-Text API from Azure Cognitive Services was also used to make the app accessible to the visually handicapped. The user can start their activities remotely utilizing Azure Translator Speech API in a variety of languages, which is more convenient and user-friendly for our target audience. For text-to-speech, the application uses Azure Cognitive Services. This is beneficial for the visually impaired since they can hear if they are in the correct position, and if they are not, the program will notify them to change their posture.



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