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Recognizing 3D actions with shallow convolutional neural networks and quad-joint relative volume maps

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Abstract

In this study, we present a new set of feature maps for use with a Circular convolutional neural network (CCNN) that overcomes the shortcomings of the prior maps and allows for superior pattern discrimination. By leveraging the local relationships among joint movements represented by three-dimensional quadrilaterals constructed for every conceivable set of four joints, these novel characteristics calculate the volumes of these time-varying quadrilaterals. As a result, they produce color-coded images known as spatio temporal quad-joint relative volume maps (QjRVMs).

1.Introduction

Compared to other works already in existence, the average recognition accuracy of the prior one is 90.32%. By expanding the number of joints included in the research from 2 or 3 to 4, and then running the results through a circular convolution neural network (CCNN), this work provides a deeper dive into the issues that have arisen in prior research. The design, findings, and potential evaluations are all laid out in this study. The figure.1 depicts the proposed comparison and joint selection method. Multi-tensor images, which are the physical embodiment of features extracted manually from 3D spatiotemporal activity data, must be used as input to CNNs. Joint, edge, angle, surface, and distance maps (JDMs) and their variants are only a few examples of existing feature maps that can be used singly or in tandem. Therefore, color-coded maps derived from these characteristics are insufficient for capitalizing on multi-joint linkages in critical action sequences. When compared to relative volume feature maps, feature maps tend to be weaker. The proposed features are computed volumes on a set of four joints that create a time-varying 3D quadrilateral over the action sequences in a video series. During actions, quadrilaterals are constructed from all conceivable sub-joint orientations. The collected quadrilateral volumes from a 3D video stream are used to generate color-coded feature maps known as quad joint relative volume

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(QjRVM). In Figure 1(j), we contrast the currently used features.1. (a)-(i) with our proposed volume features.

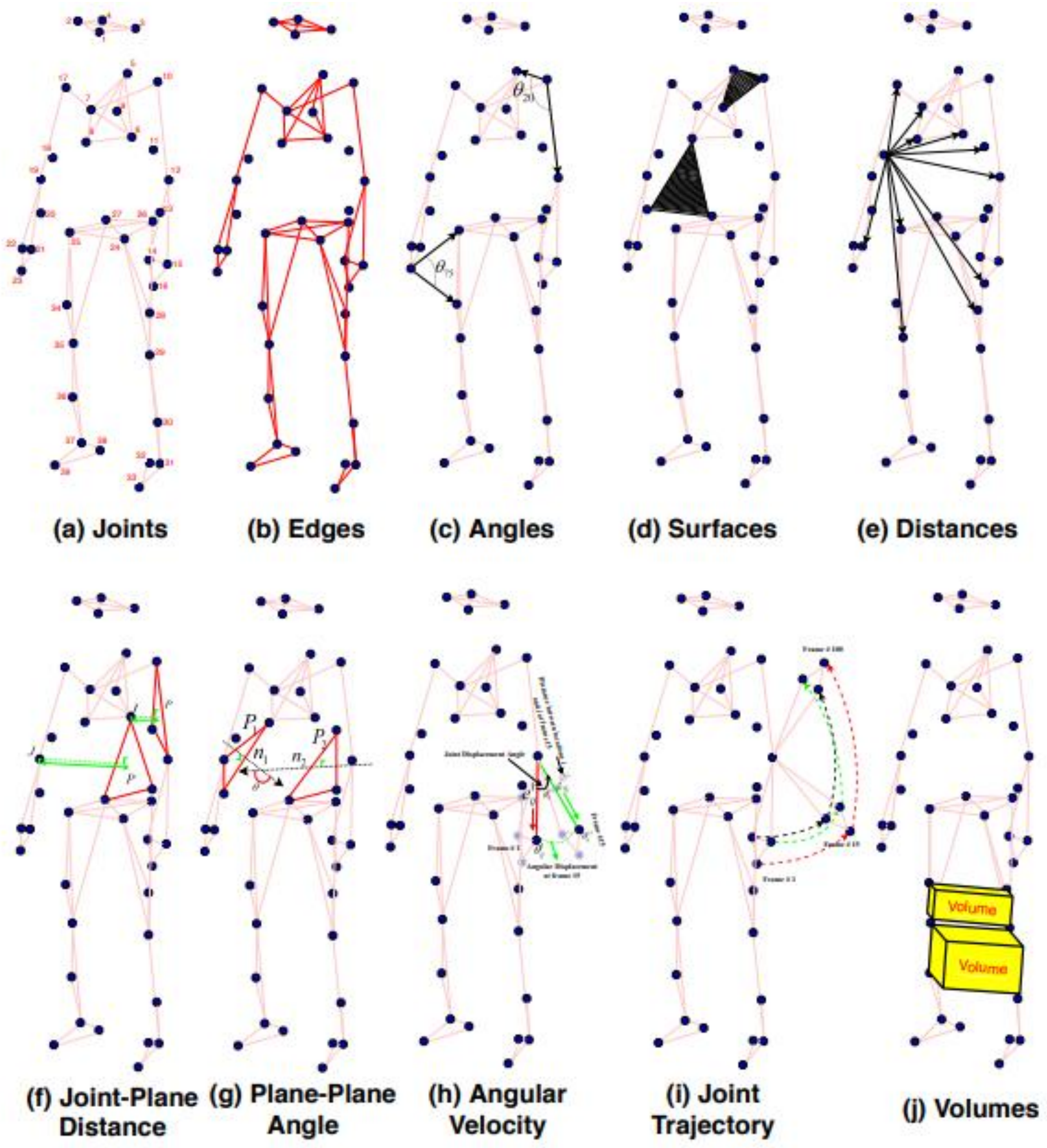

Fig. 1: Feature models used for 3D action recognition. (a) Joints, (b) Edges, (c) Angles, (d) Surfaces, (e) Distances and (f) Joint – Plane distance, (g) Plane – Plane angle, (h) Angular velocity, (i) Joint trajectory and (j) Relative volume features.

To create a 3D tensor image, a proportionate coloring scheme is used to the retrieved features. Visualize a temporal and spatial progression of events with the help of color-coded image tensors. Color-coded maps from different models are compared in Figure 2.

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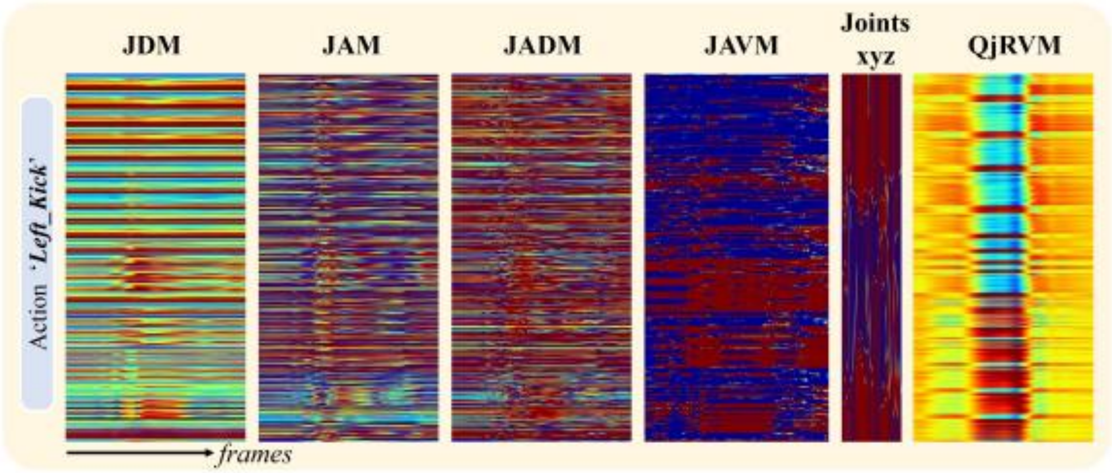

Fig. 2: Showing a formal comparison among color–coded feature maps of our proposed relative quad joint relative volume and the earlier joint feature maps.

2.Model for Identifying Human Actions, Version

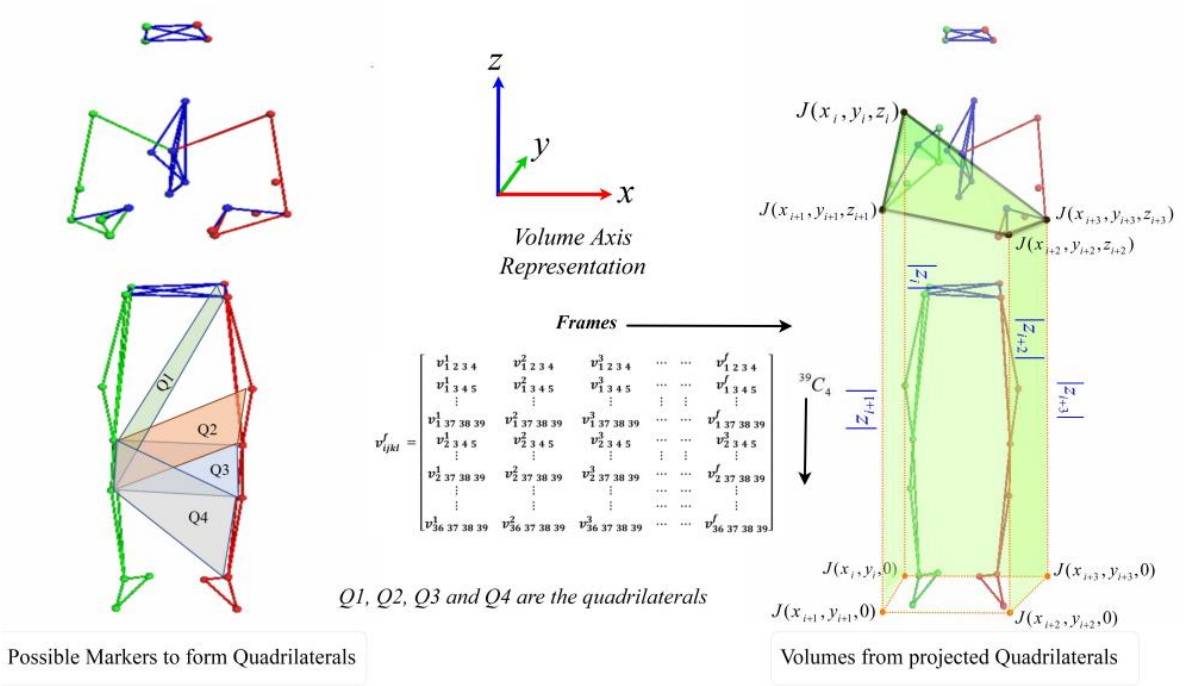

Fig. 3: Construction of relative QJRVMs are designed

As the skeleton rotates and flexes in a 3D film, the resulting shapes and orientations of the joints reflect this relationship. Using these versions, we can build the QjRV matrices to represent the relative volumes of four joints. To find the volume of a quadrilateral given its coordinates {(xi,yi , zi),(xi+1, yi+1, zi+1),(xi+2, yi+2, zi+2), (xi+3, yi+3, zi+3)} of its vertices, this procedure is as follows: The relative QJRVMs are designed in figure.3

3.Conclusion

In this paper, we offer a new method for visualizing 3D motion capture data. In addition, 102 lessons covering five topics were incorporated into the project's preexisting data set. The technique involves the development of computationally effective QjRVMs for all skeleton joints, which are then used to generate color-coded images indicating spa tiotemporal variations in 3D sequences of motion. These QjRVMs disclose relative local changes in joint positions during activity as a color shift in the pixels, whereas previous maps are unrelated and more focused on the location of joints with distance information. In order to extract patterns from these QjRVMs, a DNN architecture called CCNN was developed for this study. During training, CCNN's four streams, each having its own set of filters that cycle cyclically from bottom to top, are used to detect different spectral properties.

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