Multimed Tools Appl
DOI 10.1007/s11042-013-1749-5

Motion recognition for 3D human motion capture data using support vector machines with rejection determination

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Abstract This article presents a motion recognition strategy with rejection ability to extract the meaningful actions according to a given set of motion classes, or categories or types and reject such input patterns whose categories are not known. During the online recognition phrase, the multiple one-versus-one support vector machines are aggregated with the majority voting strategy over the most recent frames in a sliding window to predict the most probable type at each instance. And then, the corresponding index motion map is utilized to determine whether the predicted type should be accepted or not. The motion will be considered to be unknown when consecutive multiple frames are rejected. As a contribution, an adjusted self-organizing map algorithm is proposed to automatically learn the index motion map for each motion class, where the map size and topology are dynamically tuned by the intrinsic characteristics of the trained motions dataset. At the postprocessing step, the procedure is enhanced by an efficient key patterns-based verification strategy, which significantly improves the recognition precision. As a further contribution, we introduce a genetic algorithm learning algorithm to automatically learn the necessary key patterns for each class base on the previous learned index motion map. We evaluate our motion recognition model on various experiments conducted on synthetic data and real data from the freely available sets of motion capture database (HDM05). Experiment results show that the proposed strategy can not only classify motions correctly, but also identify the existence of unknown motion types.

Keywords Human motion recognition · Support vector machines · Self-organizing map · Rejection determination

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Published online: 19 November 2013