論文 / 著書情報
Article / Book Information

題目(和文)	モーションキャプチャーデータを利用したスケルトン基盤のモーション認識とモーションの回復方法に関する研究
Title(English)	A study of motion recognition and its recovering method using motion capture data
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出典(和文)	学位:博士(工学), 学位授与機関:東京工業大学, 報告番号:甲第10272号, 授与年月日:2016年6月30日, 学位の種別:課程博士, 審査員:長橋 宏,新田 克己,中本 高道,長谷川 晶一,小野 功
Citation(English)	Degree:Doctor (Engineering), Conferring organization: Tokyo Institute of Technology, Report number:甲第10272号, Conferred date:2016/6/30, Degree Type:Course doctor, Examiner:,,,,
学位種別(和文)	博士論文
Category(English)	Doctoral Thesis
種別(和文)	論文要旨
Type(English)	Summary

（博士課程）
Doctoral Program

論 文 要 旨

THESIS SUMMARY

専攻： Department of	知能システム科学　専攻	申請学位（専攻分野）： Academic Degree Requested	博士 Doctor of　(Engineering)
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要旨（英文 800 語程度）
Thesis Summary（approx.800 English Words ）

In this thesis, we propose a skeleton based online motion recognition system. With release of RGB-D cameras such as Kinect, skeleton-based motion recognition has attracting an attention. Human motion recognition is very challenging research topic. The aim of motion recognition is to interpret the human motion using mathematical algorithms. This technique has done the bridge role of human and machine. The research in motion field has been studied in various types, such as the identification and recognition of posture, gesture, gait and human behaviors. Until now, we deliver the message to machine using the input devices such as keyboard, mouse, touchscreen and so on. Motion recognition technique enables us to communicate with the machine naturally without any mechanical devices. Using this technique, input methods will be replace by more simple ways. This technique can apply to various types of application in real world, such as Internet of Things (IoT), Human Computer Interaction (HCI), robotics and so on.

In the past decades, many approaches have been proposed to solve the motion recognition problems on RGB video sequences and temporal skeletal information from motion capture (MoCap) system. Feature description is important in the field of motion recognition. The type of feature description is classified according to the various input devices. A successful recognition requires an efficient feature description. A wide variety of feature description method have been proposed for motion recognition system. In this paper, we propose a skeleton-based new feature description method Major Joint Selection (MJS). A human motion can be represented in the form of 3D positional and rotational information of joints in space over time. Motion data comprises a frame sequence and each frame records a posture at a given time, so a motion sequence can be regarded as a multivariate time series. The information of the joint coordinates is an important element for representing motions. Some joints are more important than the other joints. Thus, we use the set of Major Joints (MJ) in order to extract the features more efficiently. The process of determining major joints is based on the following steps：As a first step, we divide the joint angle time series of an motion sequence into a number of congruent temporal segments. Then, we calculate the variation of the joint angle time series of each joint over each temporal segment. After this step, we make a descending sort based on the variation of joints within each segment. Lastly, we repeat these steps to get orderings of joints for all the represented action sequences of category.

Then, we extract features such as an angle and a distance from selected joints. The proposed feature description method achieve higher classification accuracy than other state-of-the-arts methods.

As the next step, we apply the online learning algorithm to motion recognition system. An online algorithm is an algorithm having a structure that have an immediate response to input data. This algorithm is optimized about the input data that is arrived piece by piece. Generally, systems constructed by offline mode are difficult to update them incrementally. Because offline mode should be given the entire training data in advance. Hence the training and testing phases are separated. In contrast, in online mode, training data arrives incrementally or the underlying distribution is continuously changing. In conclusion, it shows the low classification result in the case of system having a small amount database. Because the number of learning data is not enough. We experiment using top three prediction of ORF. This method temporarily improve result of ORF with small amount of learning data. Thus, it can be considered as one way to overcome this kind of problem. Online algorithm is utilized efficiently at the system composed of a large amount database and unknown the input data in the future. For example, stock market prediction, management in operating systems, scheduling and so on. Thus, it can be utilized in a system using a high-dimensional data, such as motion data.

Recently, the RGB-D camera such as Kinect has been released. The Kinect come up with the estimated skeleton data without marker. However, the skeletal data from Kinect provides more unstable joint coordinates than MoCap data. Sometimes, Kinect sensor loses the target point and incorrectly recognizes the target. In contrast, MoCap data offers more natural and accurate joint coordinates. Thus, we propose Kinect motion recovering method using MoCap data and 3D space division method. As a result, the recovered motion showed more natural movement and more good classification results for the motion recognition.

We have researched skeleton-based motion recognition. Recently, we can acquire the various motion information (e.g., RGB, depth and skeleton) simultaneously. Thus, it will be possible to create a more strong motion recognition systems if we use not only skeletal information but also RGB and depth information.