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CLASSIFYING 3-DIMENSIONAL POINT LIGHT ACTORS' GENDER USING STRUCTURE-ADAPTIVE SELF-ORGANIZING MAP

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Abstract. *As a basic step to understand human behavior, we search for an optimal classifier to recognize the biological movements using moving point lights attached on actor's bodies. Classifying the patterns with self-organizing map often fails to get successful results with its original unsupervised learning algorithm. This paper presents a structure-adaptive self-organizing map (SASOM) which adaptively updates the weights, structure and size of the map, resulting in remarkable improvement of pattern classification performance. Two physical input features of the movement patterns have been used: positions and velocities of six locations. We have compared the results with those of conventional pattern classifiers and human subjects by obtaining the recognition accuracy, discriminability and efficiency. SASOM turns out to be the best classifier producing 97.1% of recognition rate on the 312 test data from 26 subjects.*

Keywords: Human movement categorization, Moving point lights, Gender recognition, Structure adaptive self-organizing map, Neural network classifier

1. **Introduction.** Understanding human behavior is an important problem for both psychologists and computer scientists. Investigating the way human behaves and takes in these people's act, psychologists may get important clues to work out the problem of human consciousness and perception. Also, it can provide a good idea with the engineers who want to utilize the characteristics of human behavior to the practical fields: designing intelligent systems, such as humanoid robots, 3D avatars of the internet, etc. One basic step of understanding human behavior is to extract certain rules from biological motion patterns.

Self-organizing map (SOM) proposed by Kohonen [1, 2] is well known for its topology preserving capability and clustering performance and has been applied in many fields of data mining, visualization and so on. However, in real-world problems, especially for the classification tasks, there exist difficulties of how to determine the structure and size of the map.

Several researchers have dealt with the problem of structure adaptation of SOM [3, 4, 5]. Some proposed tree-structured neural networks, but this approach could represent the global order of nodes consistently because the learning takes place only in the sub trees. Fritzke proposed a "growing cell" which inserted another columns or rows of nodes on the map to adapt the structure, but this also might lead to too many extra nodes. In the previous work [6], we proposed the node-splitting scheme which let SOM adjust its structure adaptively by splitting only nodes where different class labels were mixed, and presented the usefulness by showing the experimental results of the unconstrained handwritten digit recognition.