1. Talk: Adaptive Second Order Self-Organizing Mapping for pattern representation

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The problem of unsupervised classifying a set data and identifying the natural principal direction of each class at the same time is studied. A new adaptive unsupervised learning model called Adaptive Second Order Self-Organizing Map (ASOSOM) is proposed for this problem. ASOSOM consists of SOSOM and the recursive bifurcation technique which combines good features of SOM and KL together. Instead of having one neuron representing each class as Kohonen’s SOM, we define an additional neuron to cooperate with the class neuron for identifying the principal direction.

SOSOM improves traditional SOM by introducing a direction weight in addition to its position weight which is previously the synaptic weight in Kohonen’s SOM. SOSOM is used to search the optimal location of both position weight and direction weight of a second order neuron. SOSOM must employ the two new measurements. These new performance measurements based on the co-variance between the natural principal direction and its perpendicular direction is introduced. The first measurement is to define the optimal location of the position weight that it can be considered as the center of data. The second measurement is to search the appropriate direction weight resembling the principal direction of KL. Therefore, SOSOM combines the advantages of the selforganizing mapping with Karhunen-Loeve (KL) transformation.

By using the recursive bifurcation technique, the number of clusters needs not be specified in advance as in the other approaches. The characteristic of ASOSOM is local and adaptive. ASOSOM can be applied to many applications such as piecewise linear approximation, feature extraction, clustering, and image pre-processing. From the obtained results, it has shown that our method is better than KL and Multi-space KL transformations.

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