Object Recognition With Contextual Reasoning Based Fuzzy Neural Networks for the Uncertainty Output

Yang, Andy (School: Dutch Fork High School)

Object recognition is an important task in image processing and a fuzzy neural network (FNN) is a popular tool for object recognition. However, when applied to datasets that present complex and fuzzy features, the accuracy of such FNN is degraded, and their uncertainty of output is increased. To tackle this problem, we propose a contextual reasoning based fuzzy neural network. The proposed method, called CR-FNN, is composed of two phases. In the first phase, the CR-FNN algorithm is a classifier for object recognition, which outputs the predicted value of the FNN. In the second phase, the categories of images are used as the basis for context comparisons. We embed the network output with a local search strategy to determine the object category by the features ranking and the distance between the contextual knowledge and the object. The performance of the developed algorithm has been evaluated on three datasets. The datasets both present the characteristics of complex and fuzzy image features. Further analysis is made with parameter metrics such as accuracy (ACC), Hamming loss (HL), average precision (AP), weighted accuracy (WA), recall, and Area under the ROC Curve (AUC). The proposed FNN with contextual reasoning has better performance over the traditional FNN and existing baseline algorithms. The experimental results show that the accuracies of CR-FNN are 19.8%, 9.8%, and 11.2% higher than the traditional FNN on the three datasets respectively, and provide a new solution to the uncertainty of the output of FNNs.

Awards Won:
Fourth Award of $500