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An insect classification analysis based on shape features using quality threshold ARTMAP and moment invariant

Abstract

The main objective of this paper is to investigate the use of Quality Threshold ARTMAP (QTAM) neural network in classifying the feature vectors generated by moment invariant for the insect recognition task. In this work, six different types of moment invariant technique are adopted to extract the shape features of the insect images. These moment techniques are Geometrical Moment Invariant (GMI), United Moment Invariant (UMI), Zernike Moment Invariant (ZMI), Legendre Moment Invariant (LMI), Tchebichef Moment Invariant (TMI) and Krawtchouk Moment Invariant (KMI). All the moment techniques are analyzed using the concept of intraclass and interclass analysis. In intraclass analysis, several computation methods are introduced in order to examine the invariance properties of adopted moment techniques for the same insect object. Meanwhile, the classification accuracy of neural networks is adopted to measure the interclass characteristic and the effectiveness of moment technique in extracting the shape features of insect images. Other types of neural networks are also utilized in this research work. This includes novel enhancement technique based on the Gaussian and Mahalanobis function that design to increase its prediction accuracy. All the other networks used to classify the feature vectors are based on the Fuzzy ARTMAP (FAM) neural network. The experimental results indicated that the Krawtchouk Moment Invariant technique generated the highest classification accuracy for most of the networks used and generated the smallest error for the intraclass analysis. Using different normalization technique, the Quality Threshold ARTMAP and Mahalanobis distance function (QTAM-*m*) network gave the highest insect recognition results when compared to other networks.