

Image Classification of Paddy Field Insect Pests using Gradient-based Features

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Abstract

Agriculture is one of the principal economic activities of the Jaffna peninsula in the Northern Province of Sri Lanka. Over 60% of the work force in the peninsula depends on agriculture for their livelihood. Paddy cultivation in the peninsula contributes substantially to the gross national income of the country. Such Paddy crops are affected by the attack of insect pests. Therefore paddy field insect pest identification is an important task to the sustainable agricultural development in the Jaffna peninsula. This paper offers a framework to classify images of paddy field insect pests using gradient-based features through the bag-of-words approach. Images of twenty classes of paddy field insect pests were obtained from Google Images and photographs taken by the Faculty of Agriculture, University of Jaffna, Sri Lanka. The images were then classified through the system that involves identification of regions of interest and representation of those regions as scale-invariant feature transform (SIFT) or speeded-up robust features (SURF) descriptors, construction of codebooks which provides a way to map the descriptors into a fixed-length vector in histogram space, and the multi-class classification of the feature histograms using support vector machines (SVMs). Furthermore, the histograms of oriented gradient (HOG) descriptors were applied in classification. As a baseline classifier the nearest neighbour approach was used and compared with SVM-based classifiers. Testing results show that HOG descriptors significantly outperform existing local-invariant features: SIFT and SURF in paddy field insect pests classification. HOG descriptors when combined with SURF features yield around 90% accuracy in classification. For simplicity and speed, linear SVM was used as a classifier throughout the study.

Author Keywords

Bag-of-words, Paddy Field Insect Pests, HOG, SIFT, SURF