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One-Dimensional vs. Two-Dimensional based Features: Plant Identification Approach

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Abstract

The number of endangered species has been increased due to shifts in the agricultural production, climate change, and poor urban planning. This has led to investigating new methods to address the problem of plant species identification/classification. In this paper, a plant identification approach using 2D digital leaves images was proposed. The approach used two features extraction methods based on one-dimensional (1D) and two-dimensional (2D) and the Bagging classifier. For the 1D-based methods, Principal Component Analysis (PCA), Direct Linear Discriminant Analysis (DLDA), and PCA+LDA techniques were applied, while 2DPCA and 2DLDA algorithms were used for the 2D-based method. To classify the extracted features in both methods, the Bagging classifier, with the decision tree as a weak learner was used. The five variants, i.e. PCA, PCA+LDA, DLDA, 2DPCA, and 2DLDA, of the approach were tested using the Flavia public dataset which consists of 1907 colored leaves images. The accuracy of these variants was evaluated and the results showed that the 2DPCA and 2DLDA methods were much better than using the PCA, PCA+LDA, and DLDA. Furthermore, it was found that the 2DLDA method was the best one and the increase of the weak learners of the Bagging classifier yielded a better classification accuracy. Also, a comparison with the most related work showed that our approach achieved better accuracy under the same dataset and same experimental setup.

Keywords: Plant Identification, Principal Component Analysis, Linear Discriminant Analysis (LDA), Bagging classifier, weak learners, 2DLDA, 2DPCA, Direct-LDA, Leaf Image, Leaves Images, Small Sample Size (SSS), PCA+LDA

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