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Plant leaf tooth feature extraction V.3

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Protocol status: Working

We use this protocol and it's working

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Keywords: leaf tooth features, curvature, corner detection, plant leaf tooth feature extraction, plant leaf tooth feature extraction previous study, measurement of leaf teeth, characteristics of the leaf teeth, leaf structure classification system in botany, leaf structure classification system, leaf teeth, automatic retrieval of plant leaf, binary map of plant leaf, leaf structure, leaf tooth apex, definition of the leaf structure, tooth shape, leaf database, plant leaf, accuracies of various feature extraction method, various feature extraction method, extraction, number of teeth, botany, curvature scale, teeth, orders of teeth, tooth, inflection point from the edge, image preprocessing, edge, sinus shape

Abstract

Previous studies extract features that are not strictly defined in botany; therefore, a uniform standard to compare the accuracies of various feature extraction methods cannot be used. For efficient and automatic retrieval of plant leaves from a leaf database, in this study, we propose an image-based description and measurement of leaf teeth by referring to the leaf structure classification system in botany. First, image preprocessing is carried out to obtain a binary map of plant leaves. Then, corner detection based on the curvature scale-space (CSS) algorithm is used to extract the inflection point from the edges; next, the leaf tooth apex is extracted by screening the convex points; then, according to the definition of the leaf structure, the characteristics of the leaf teeth are described and measured in terms of number of orders of teeth, tooth spacing, number of teeth, sinus shape, and tooth shape.

Experiments

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To verify whether the proposed leaf structure feature description algorithm is scientific and effective, we implemented the algorithm using MATLAB 2017 (MathWorks, Natick, MA, USA) on a standard desktop PC (4.2 GHz CPU, 24 GB RAM). Processing of a single leaf took approximately 1.4 s. This could undoubtedly be improved through further optimization and/or using parallel computing.

Command

Experiment_1 (windows 10)

```
data=toothFeature_finished('D:\ExperimentData_1\leaf_1.mat')
```

Command

Experiment_2 (windows 10)

```
accuracy=Classification_SVM('D:\Experiment_2_data\Our_method_data')
accuracy=Classification_LDA('D:\Experiment_2_data\Our_method_data')
accuracy=Classification_SVM('D:\Experiment_2_data\Proposed_in[20]_data')
accuracy=Classification_LDA('D:\Experiment_2_data\Proposed_in[20]_data')
```

We have uploaded the code and data of this study, please reference to:



https://github.com/hollyprince/Leaf_tooth_feature