LeafNet: A Deep Learning Solution to Tree Species Identification

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Abstract

Species identification of vegetation is a key step in plant biodiversity research and conservation biology. Speeding up this process can boost humanity’s ability to mitigate climate change impacts by simplifying species conservation efforts and helping educate the public. In this study, we used a ResNet network to classify 185 tree species from North America using leaf images.

Dataset and Features

LeafSnap dataset:
- 224x224 RGB images
- 185 species
- 23,147 lab images (top)
- 7719 phone images (bottom)

Modifications:
- Geolocation labeling: assign random coordinate pair within the growing region of a species.
- Data augmentation through rotations

Model and Results

INPUT

RGB Image

MODEL

ResNet18 + Parameters (see table)

OUTPUT

ficus carica

APPLICATIONS

Species conservation

Educational Purposes

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Performance Criteria

- Optimizing metric: maximize top-1 precision
- Satisficing metric: model < 100 Mb

System performance:
- Beats the highest performing system on the LeafSnap dataset by 7.5%

Conclusions

The results of our ResNet model show deep learning offers a high precision and throughput solution for leaf species classification.

- Compared to state-of-art methods our system:
  - Has the best precision
  - Uses a relatively small number of layers
  - Requires less epochs to converge

- Novelties of the approach:
  - Deployed on a smartphone
  - Geolocation input feature
  - SGD optimizer with Nesterov momentum
  - Fewer layers

Try it now!

- Open Hangouts with leafnetstanford@gmail.com
- Say “Hi bot” and start using!
- Lightning fast predictions and near real-time performance improvement
- Active internet connection required

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