

# 1 Related works

plant identification by leaf images  
a lot of work use remote sensing  
color, texture

## 2 Dataset

crowd sourcing images

Outdoor Greenery  
Outdoor non-Greenery  
Indoor  
Other-modified  
Not available

Finally, we build a positive set with images in category "Outdoor Greenery" and a negative set with images in categories "Outdoor non-Greenery" and "Indoor". To learn a image classification model, we build a training set with 4000 images and a testing set with 1900 images. In training and testing set, there are equal number of positive and negative samples.

## 3 Method

### 3.1 Vision model

Vegetation has the characteristic of signature green color, and the leaves of plants have distinctive visual texture. So we employ SIFT feature to analyze the local gradient distribution. And we also extract GIST feature to describe texture feature and global context.

**Color SIFT histogram.** We extract dense SIFT feature on each of the RGB color plane, and concatenate them to build color SIFT feature. The dense SIFT feature is extracted from every 2 pixels by 2 pixels bin, with a step size of 5 pixels. In this way, we achieve representative key points and reasonable computation complex.

From training data set, We build 2000 dimensional centers of color SIFT feature using K-means clustering. With these centers, a 2000 dimensional histogram is built from all the key points of each image.

Using SIFT histogram, a model is trained and tested with SVM using RBF kernel. The performance

is 78.10%.

**Color GIST.** Similar to color SIFT feature, we also extract GIST feature from each of the RGB color plane.

The performance is 82.58%.

**Combine visual features.** The combined visual feature is built from concatenating the normalized GIST feature and SIFT histogram. A new model is learnt based on the combined feature. The performance is 85.9%.

### 3.2 Deep learning

## 4 North America vegetation coverage detection

We consider north America area has more images uploaded to photo-sharing website, and is also where Ecologists in the US would be interested in the changing color of vegetation. In our work, we define north America as latitude  $10^{\circ}$  to  $70^{\circ}$  and longitude  $-130^{\circ}$  to  $-50^{\circ}$ .

### 4.1 Ground truth of NDVI index

The ground truth is specified for every 16 days period. And geometrically, north America area is divided into bins of 0.5 by 0.5 degree. This makes the north America area a  $120 \times 160$  grid map. Only the days and bins with clear enough cloud coverage can be count as useful units. As in [?], a green bin must be covered by at least 50% of green vegetation while a non-green bin only has less than 5% of coverage.

### 4.2 Confidence score

For an image taken from a place covered by green vegetation at that time, the probability of this image being a green image is 27%. On the other hand, it's only 3% probability to see a green image in a place not covered by enough green vegetation at that time.

measuring the ratio of log likelihood of being a vegetation bin at each time period.