# Using Deep Learning to Determine Honeysuckle Bark

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**Abstract**

The objective of this project is to build a convolutional neural networks which can accurately classify based on a learned images set.

This specific project will build a model capable of spotting several species of invasive Honeysuckle in the wild. The model will try to determine which species is invasive out of the many desired forest plants in the Illinois/Missouri habitat.

## 1 Problem To Be Solved

The Engineering and Biology Departments at Principia College are teaming up to build a autonomous rover that will poison unwanted species of plants.

After a year of work, they have demonstrated the ability to maneuver around a space, then when manually activated, chemically treat a unwanted plant.

The Biology department has identified a herbicide that is only poisons to Honeysuckle – the main plant which they want to eradicate.

The problem with the herbicide is that it must be delivered into the stem. Thus, to treat a plant, the rover lowers a grinder boom, which takes some of the bark off the plant. Next, a few drops of the herbicide is sprayed into the plant. Correctly applied, the plant dies within days ([Web20]).

The last big problem for the team to solve is how to autonomously determine if the plant is a target Honeysuckle.

This project is an attempt to see if the species of plant can be accurately identified from other plants in the target area.

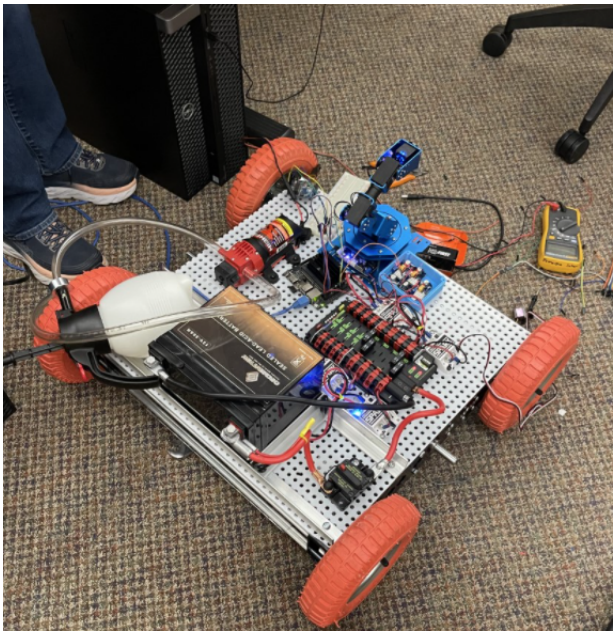

Figure 1: A view of the early rover prototype

### 1.1 Honeysuckle

Honeysuckle is an invasive species brought into the United States in the early 1900's as an ornamental plant. It has been used for erosion control, but quickly became invasive to many other species of native plant. It invades areas that have been disturbed such as forest fire scorched areas and flood plains. It rapidly out competes native plants for nutrients and sunshine ([Wik22]).

Further, Honeysuckle produces a thick canopy that prevents sunlight from getting to lower levels of the forest and effectively chokes off new growth.

For these reason, eradication of the honeysuckle in wild areas is an important goal for botanists ([oC20]).

## 2 Data Preparation

After selecting the project, the problem was to find images of both the target Honeysuckle bark and other species to differentiate against.

Figure 2: Honeysuckle bark

Pictures were taken of several on-site species. However, due to the weather only approximately 100 were taken.

To supplement the on-site photos, pictures were downloaded from the web from Alamy.com. The photos are covered under their Personal Use license. Images can only be used for non-commercial purposes.

## 2.1 Target Species Examples

An example of the target Honeysuckle species the project is trying to identify is shown in Figure 2.

During this first phase of training, the neural network will be trained with four other non-invasive species meant to be differentiated against. The four species are Oak (Fig 3), Ash (Fig 4), Maple (Fig 5), and Cedar (Fig 6).


Figure 3: Oak tree bark


Figure 4: Ash tree bark


Figure 5: Maple tree bark


Figure 6: Cedar tree bark

## 2.2 Index File

In addition to the images, a csv file was built to index all the images. It includes and index, filename, and species ID. It will act as a source of labels for the images during training, testing and validation. Species are hard-coded with the following id's:

| ID | *TreeType* |
|---|---|
| 0 | *Honeysuckle* |
| 1 | *Oak* |
| 2 | *Maple* |
| 3 | *Ash* |
| 4 | *Cedar* |

The following is a view of the top five lines of the datafile, *TreeImageMaster.csv*.

| id | image | treetype |
|---|---|---|
| 1 | ./Images/Oak/oak125.jpg | 1 |
| 2 | ./Images/Oak/oak133.jpg | 1 |
| 3 | ./Images/Oak/oak42.jpg | 1 |
| 4 | ./Images/Oak/oak56.jpg | 1 |
| 5 | ./Images/Oak/oak81.jpg | 1 |

## 2.3 Data Distribution

Figure 7 shows the data distribution for the initial image set. Data is distributed favoring the Honeysuckle images. In the near future, additional images will be added that equally represents all the species. This should help to better equalize the data distribution among all the species that will be tested.

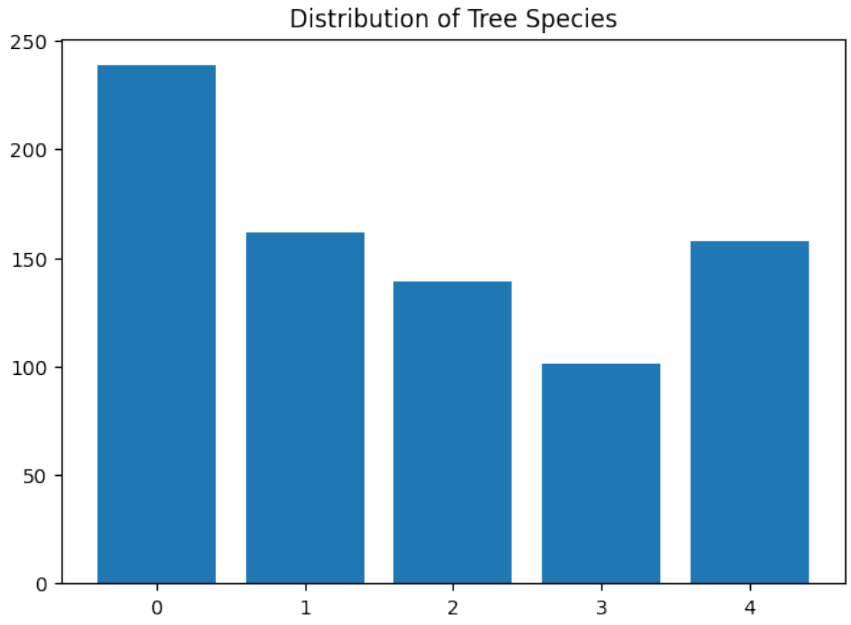


Figure 7: Initial Species Image Distribution

# References

[oC20] Missouri Department of Conservation. Bush honeysuckle control. https://mdc.mo.gov/trees-plants/invasive-plants/bush-honeysuckle-control, 2020.

[Web20] Integrated Pest Management Website. Weed of the month: Bush honeysuckle—an ornamental gone wrong. https://ipm.missouri.edu/ipcm/2015/9/Weed-of-the-Month-Bush-honeysuckle-an-ornamental-gone-wrong/, 2020.

[Wik22] Wikipedia. Lonicera japonica. https://en.wikipedia.org/wiki/Lonicera_japonica, 2022. Invasive Honeysuckle Species Description.