

Tree Ring Identification

Jacob Karon

Based off a paper by: Anna Fabijanska (2017)

Motivation

- Tree rings contain a lot of information
 - Check out the Wikipedia article on [Dendrochronology](#)
 - Charles Babbage was into dendrochronology

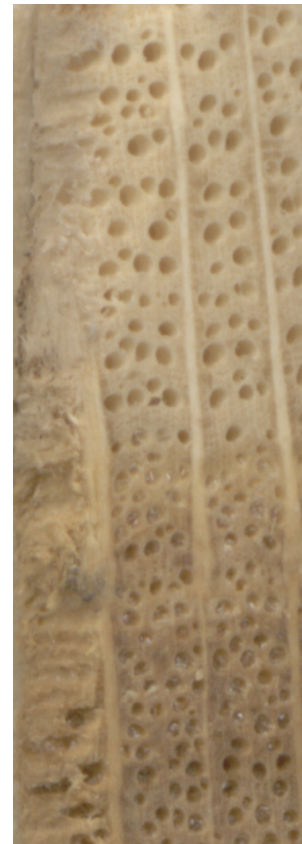
Problem

- Manually identifying rings is slow
- Need a professional dendrochronologist
 - They are hard to find!

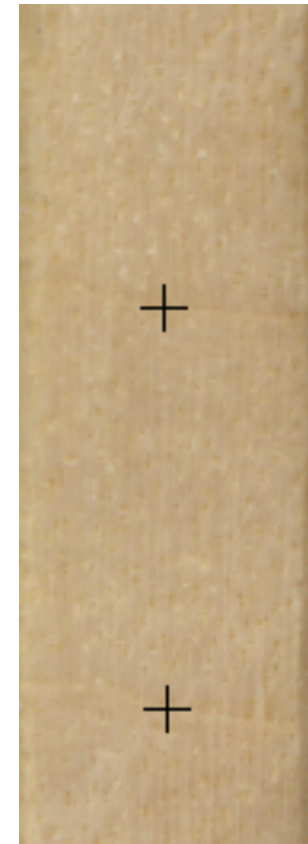
Dataset

- 215 images
 - Unprocessed wood samples
- 13 species
 - Some much easier than others
- Only 10 with marked rings
 - Manual marking is hard

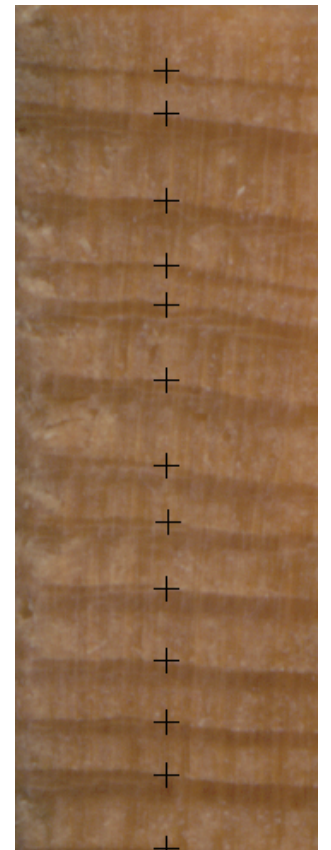
Quercus



Betula



Larix



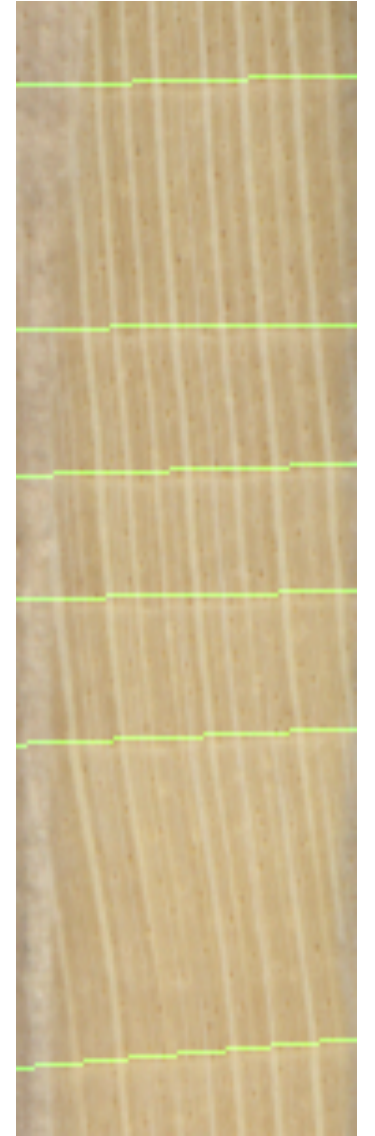
Method Overview

- Preprocessing
- Filtering
- Gradient Map
- Binary Thresholding
- Edge Extraction

Sycamore maple



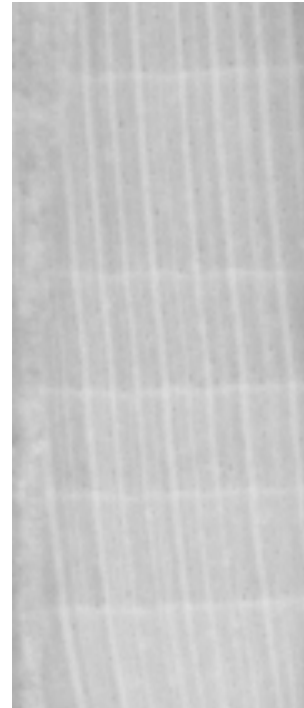
Sycamore maple



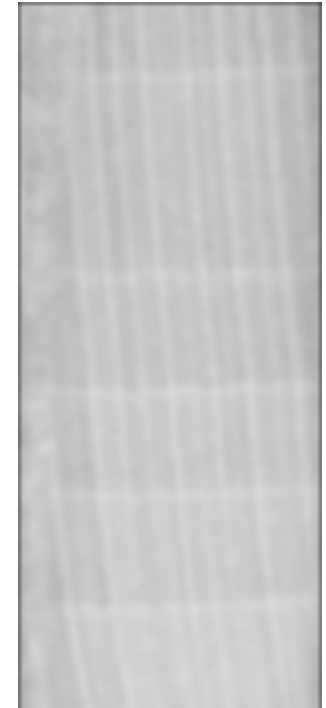
Preprocessing

- RGB Images converted to HSV
- All further steps use only V channel

V Channel



After Filtering



Filtering

- Original paper used a circular averaging filter
 - Mitigates the intensity of small artefacts
 - Very non-aggressive filtering strategy
- More filtering techniques discussed later

Gradient Map

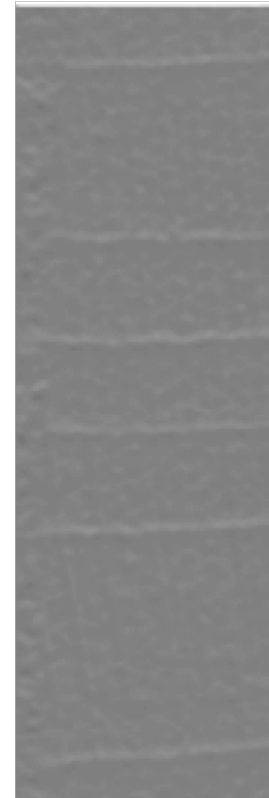
- Scaled up Sobel filter
 - Scaling makes filter less sensitive to noise
 - Free parameter - 9 x 9 gives best result

$$h(i, j) = \frac{-i}{i^2 + j^2}$$

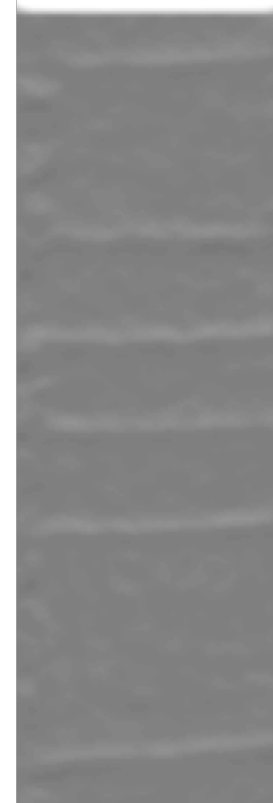
Binary Thresholding

- Processed column by column
- All local peaks greater than the median peak height

Size 3 Sobel



Size 9 Sobel



Thresholded



Edge Linking

- Compute connected components of binary map
- For every component (largest to smallest)
 - Fit a line to the component, thicken the line
 - If the line intersects enough points: keep it
 - Else: assume all intersected points are noise

Component



Thickened Line



Intersection

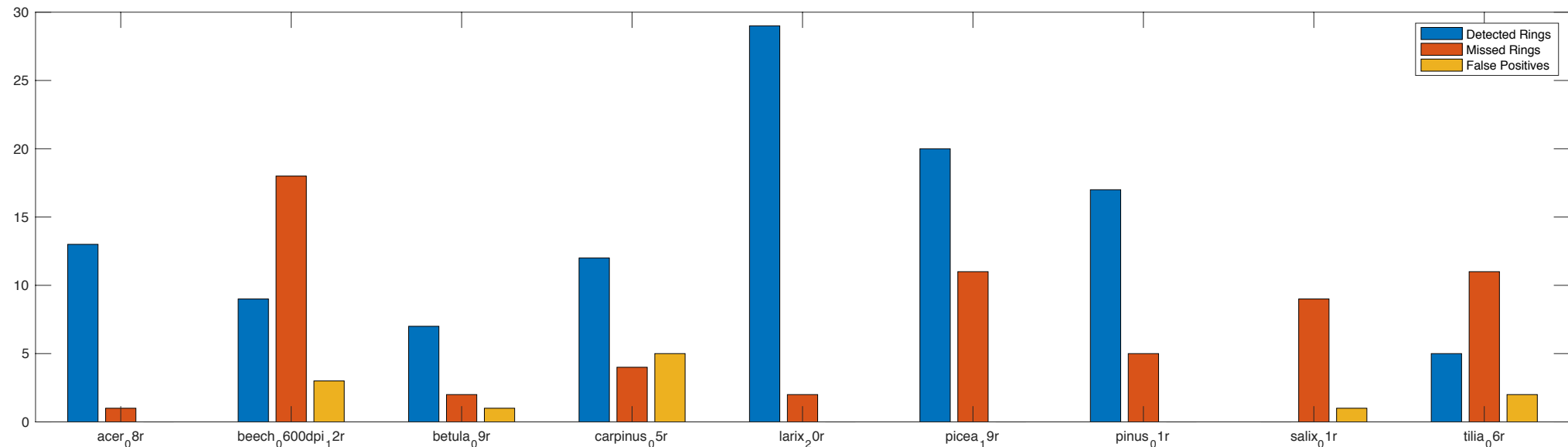


Final Line



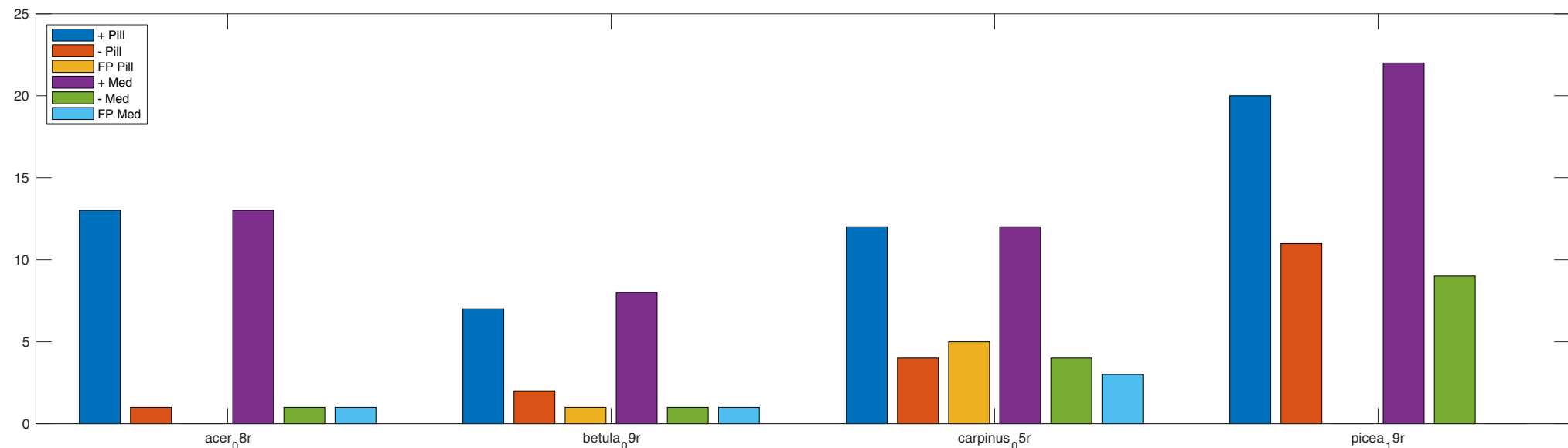
Results

- Results were positive
- Not as good as original paper
 - Probably due to imperfect selection of free parameters



Other Filtering Techniques

- Non Isotropic Gaussian
- Rectangular Neighborhood Median Filter
 - Performed slightly better than pill filter



Comparing Results of Pill Filtering and Median Filtering

Further Work

- Nail down free parameters
 - Sobel size
 - Edge threshold
 - Filter Parameters
- Limit slope of lines
 - Anything too far off horizontal is probably incorrect
- Determine best filtering technique