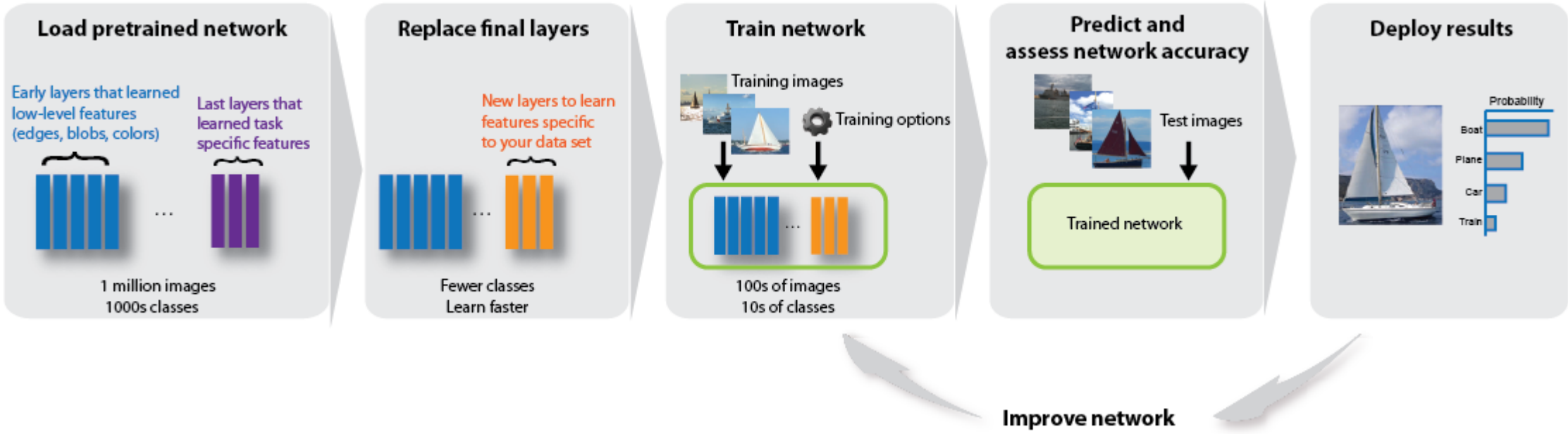
Object recognition

1. Train classifier
   - Several different algorithms
   - Annotated images
   - Feature extraction etc.
2. Suggest proposal areas
   - Several different algorithms
3. Classify proposal areas
   - Several different algorithms

Example (first try)

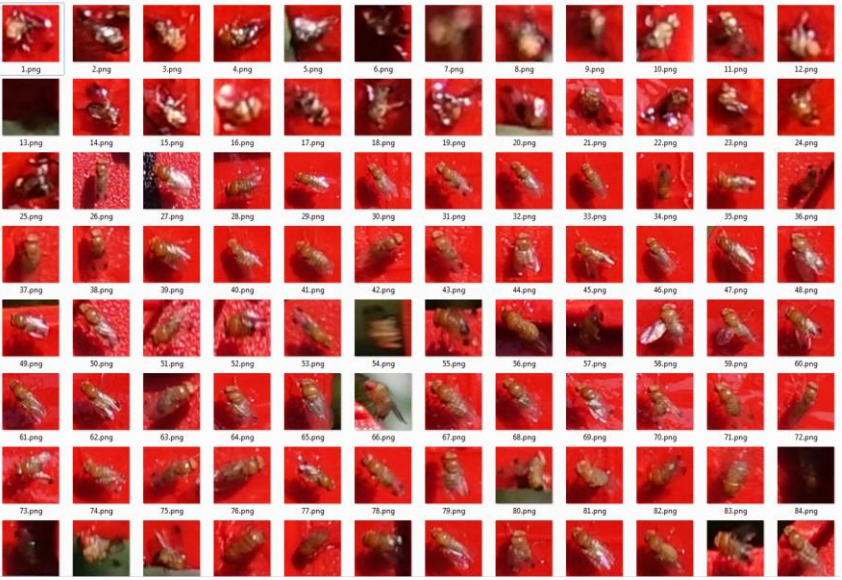
- Transfer learning (Alexnet)
  - Deep convolutional neural network
  - Trained on millions of annotated images in thousands of categories
  - Retrain the last layers for specific classification task



1. Train classifier

- Class(es) of interest
- Not class(es) of interest

D. Suzukii

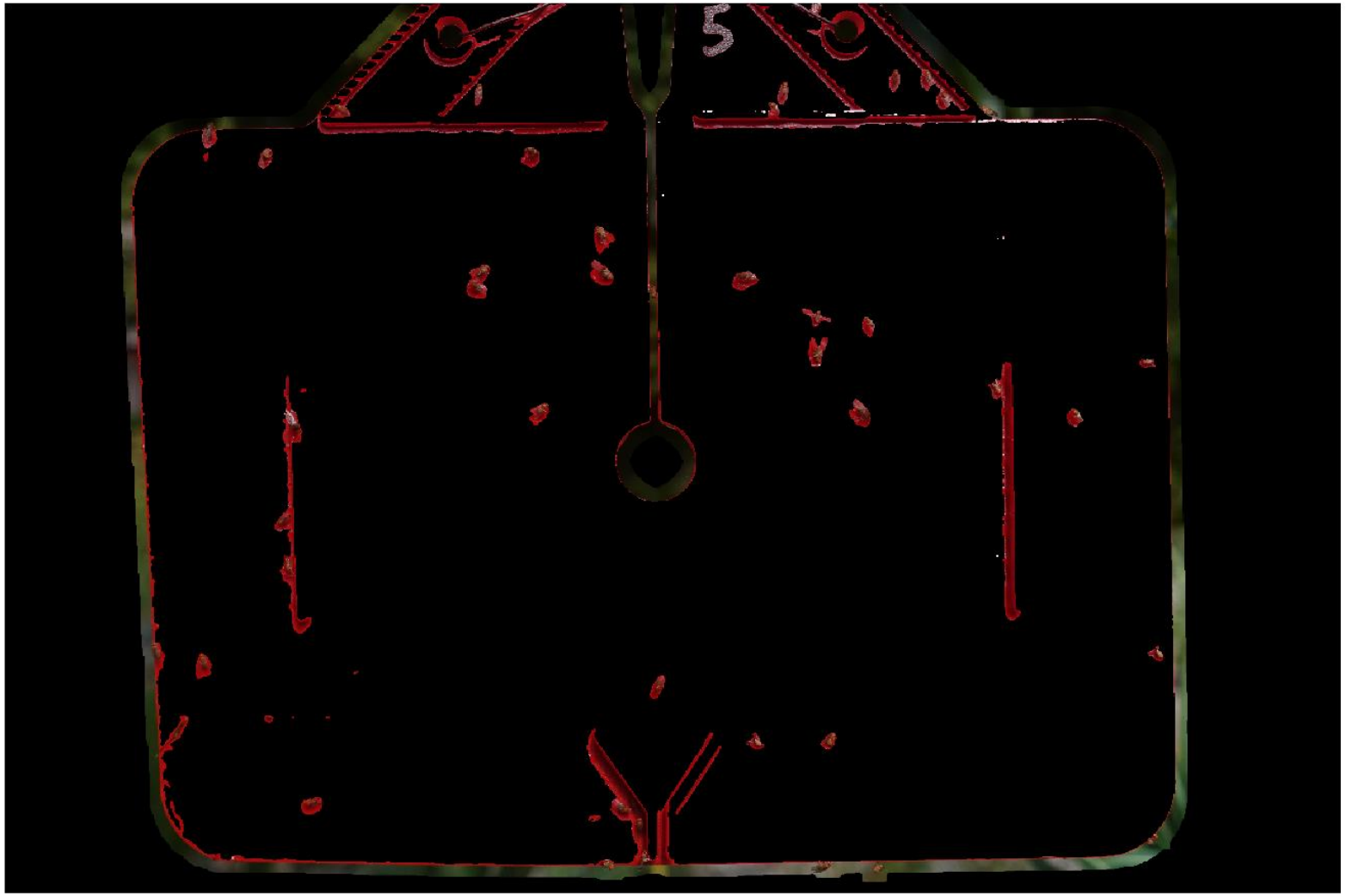


Background

D. Melanogaster

Image (DSC00180.jpg)

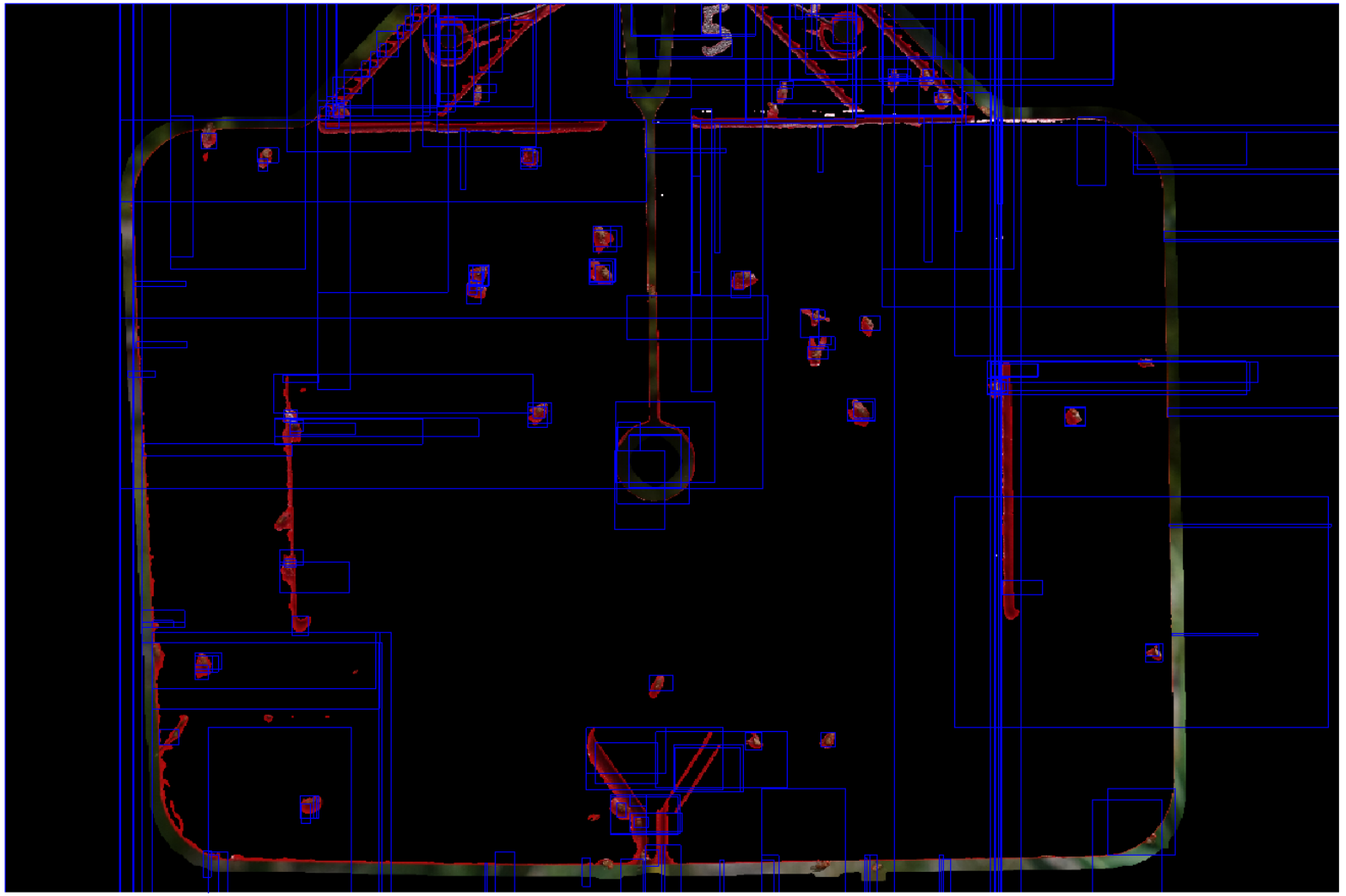
2. Proposal areas



Mask uninteresting areas

Here
Based on red background of the trap

2. Proposal areas



Apply algorithm for proposal areas

Here
Selective Search

2. Proposal areas

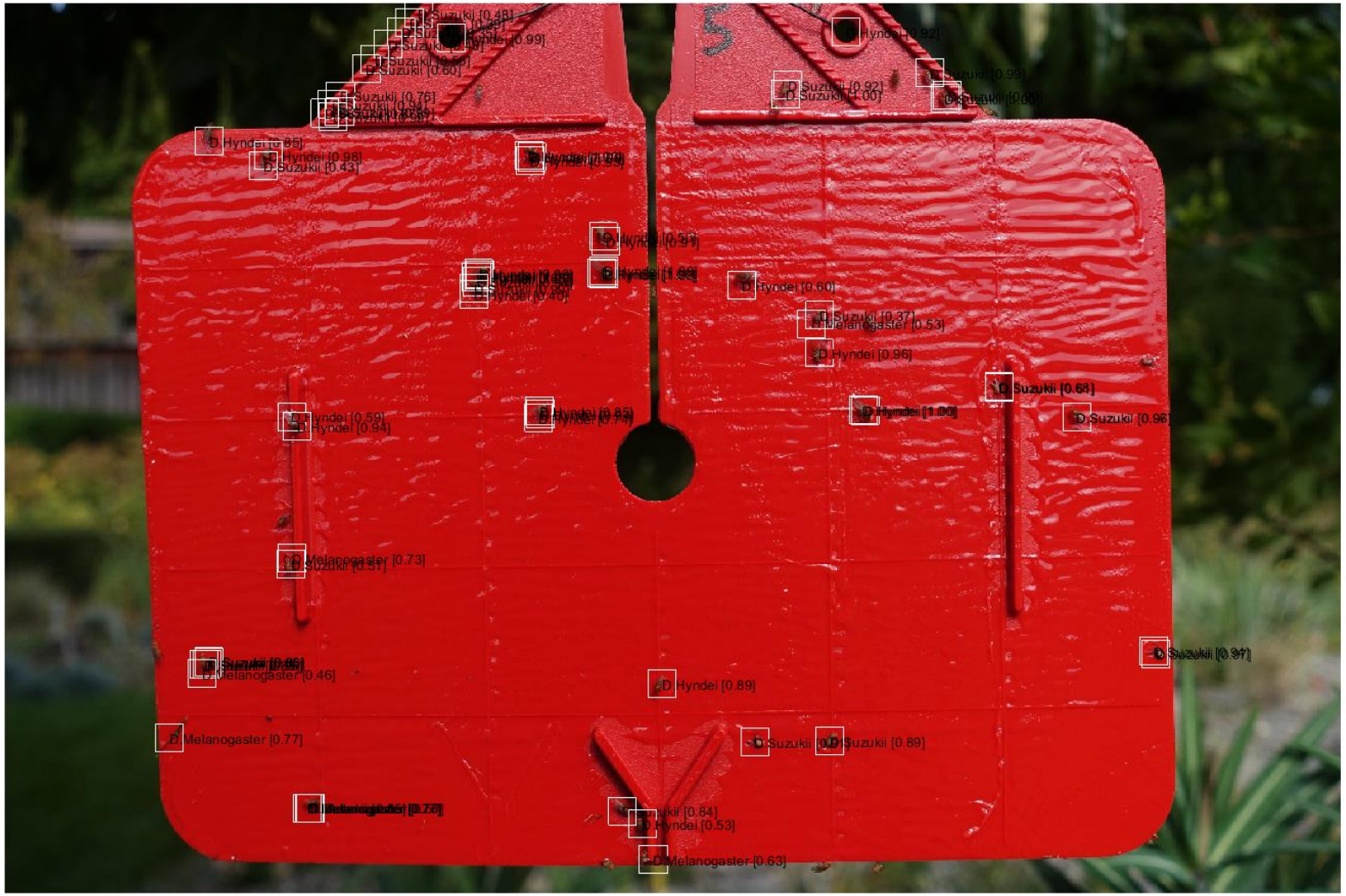
Select only interesting boxes

Here
based on size and aspect ratio

2. Proposal areas

Keep Select only interesting boxes

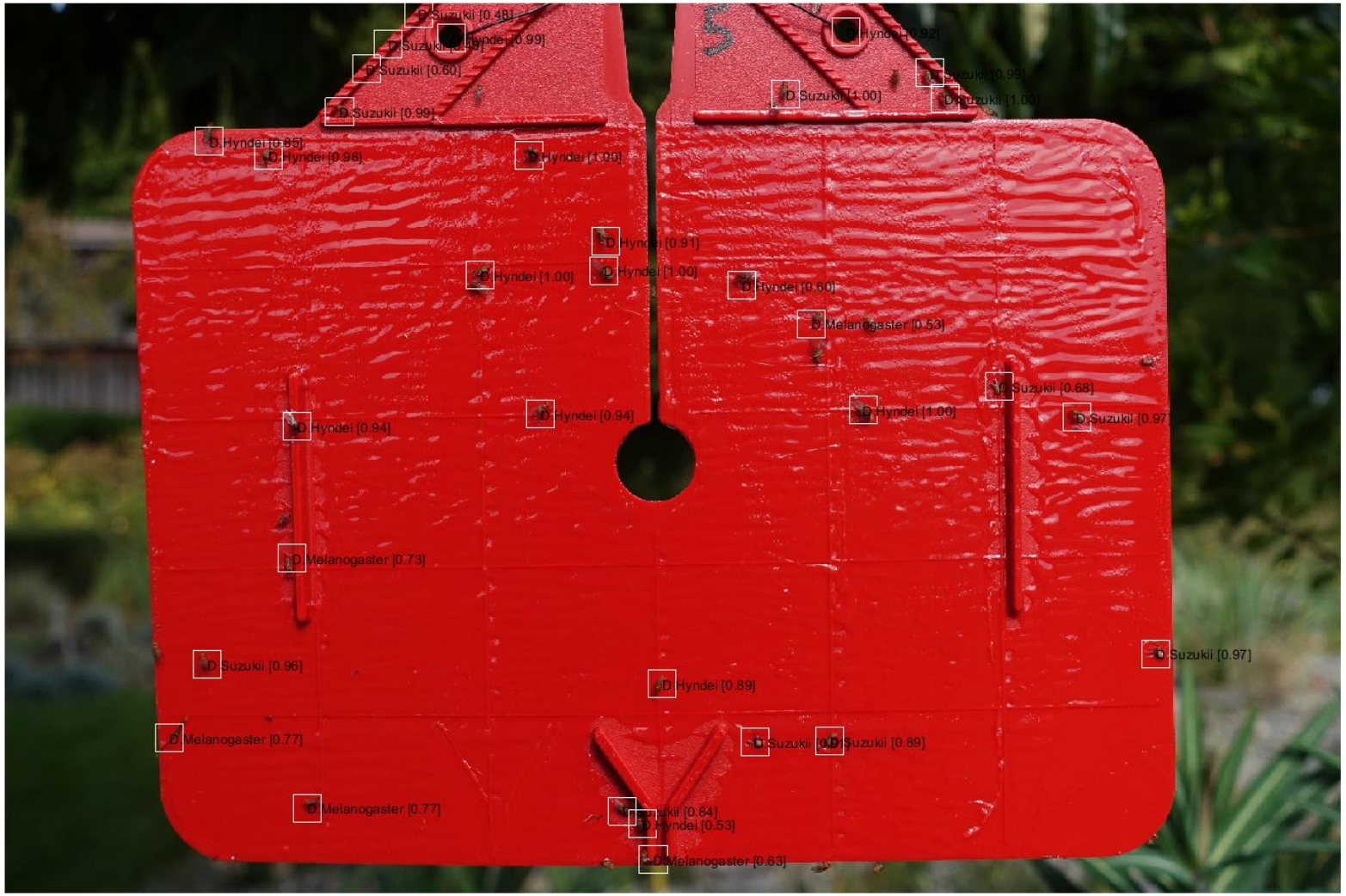
3. Classify boxes



Apply previously trained classifier per box

Here
Classifier trained on 4 species and background

3. Classify boxes



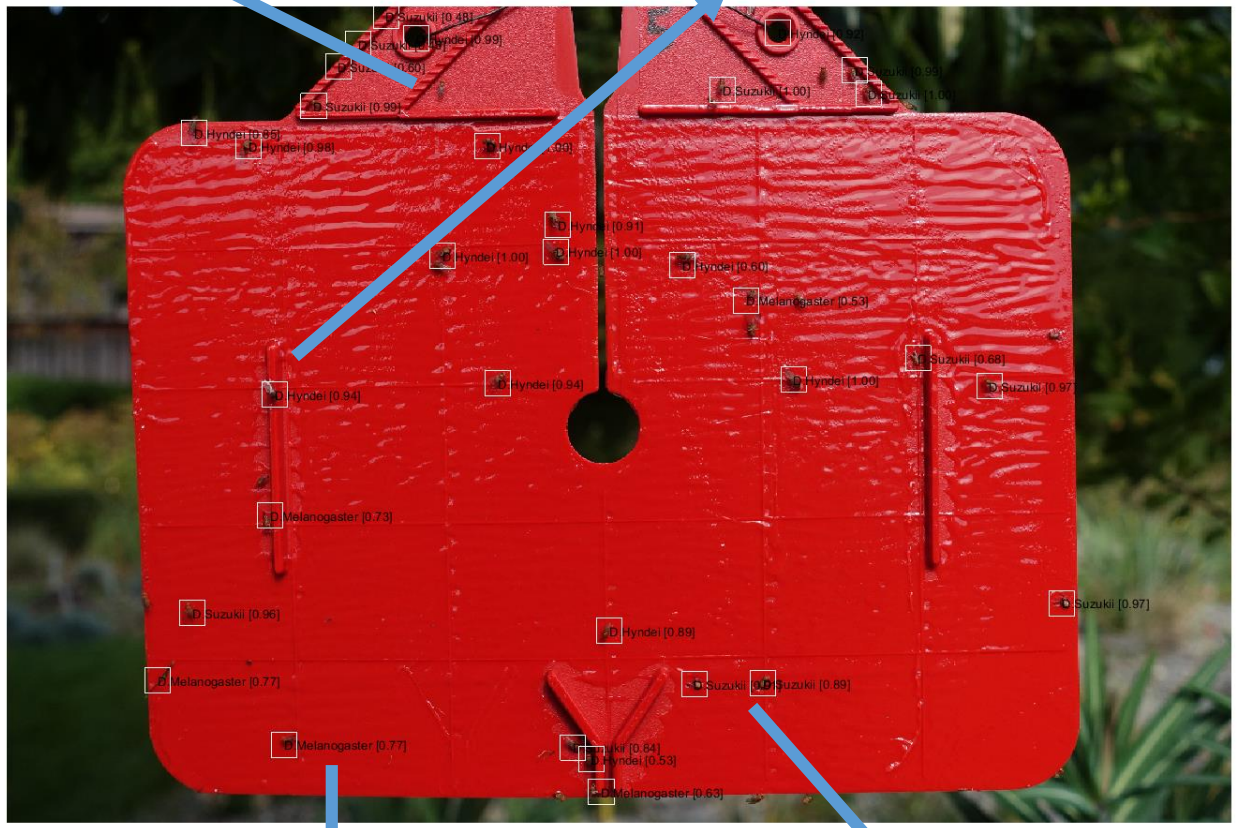
Clean predictions

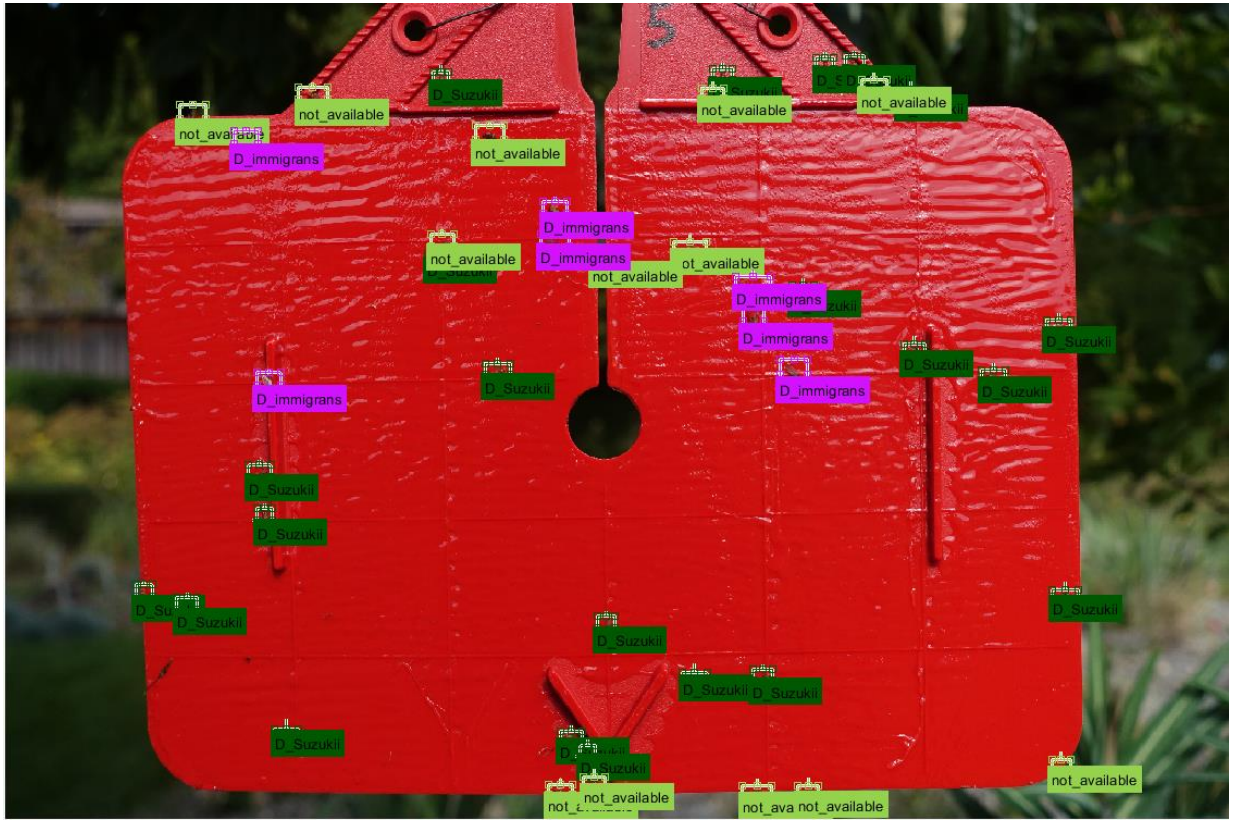
Here
Based on overlap of boxes and probability of class

4. Compare classification to ground truth

Fly missed

Species mixed up



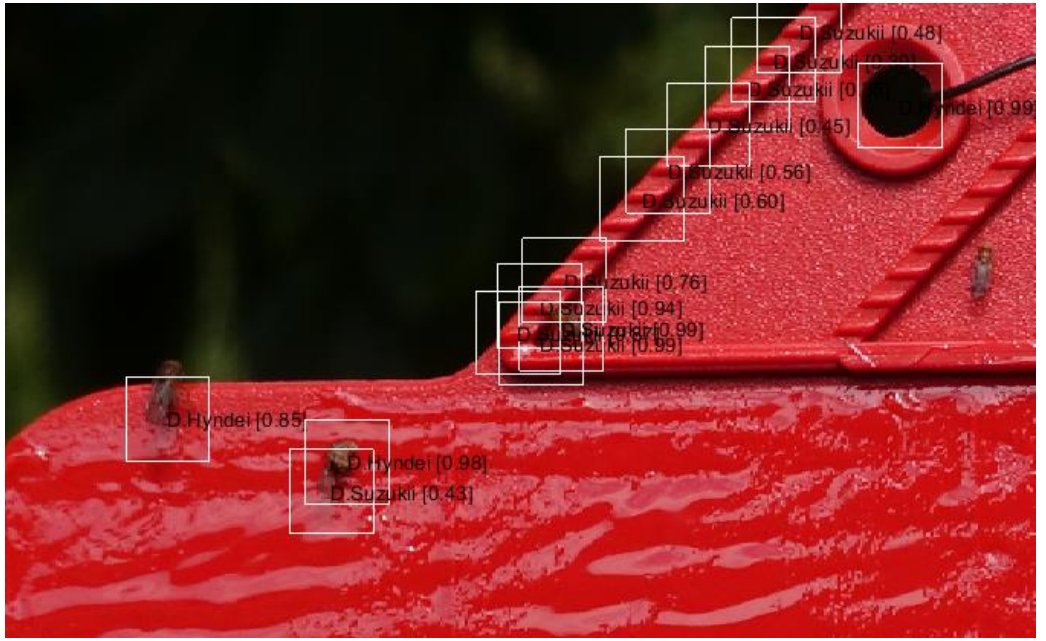


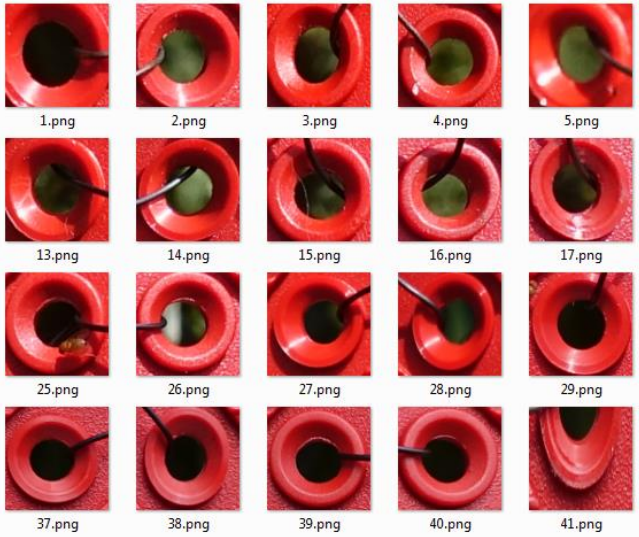
Suzukii classified as other species

Correctly classified as Suzukii (true positive)

Some observations

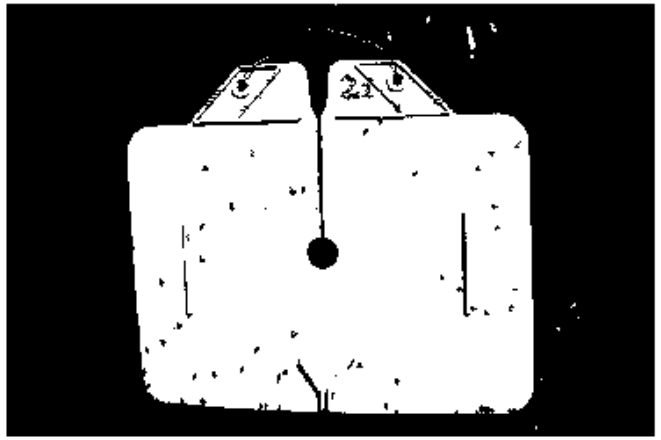
- Miss classifications
  - Mixed up classes (flies, trap)
  - More training data / classes
- Flies missed
  - Selective search algorithm not good / not good parameterized



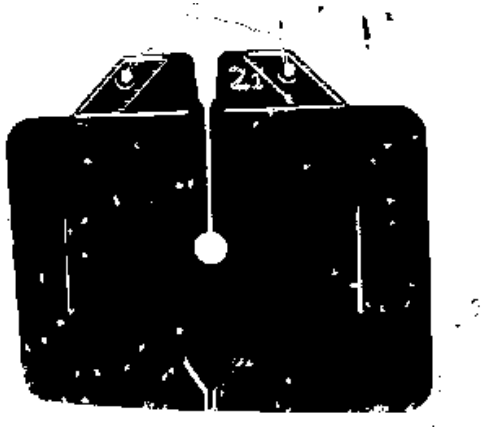


Second try
1. get proposal areas

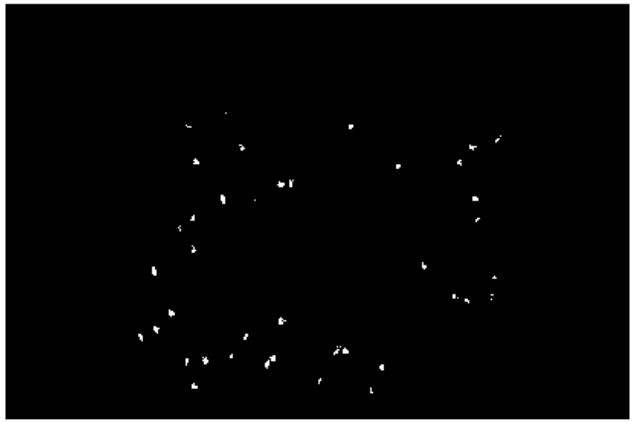
Red filter



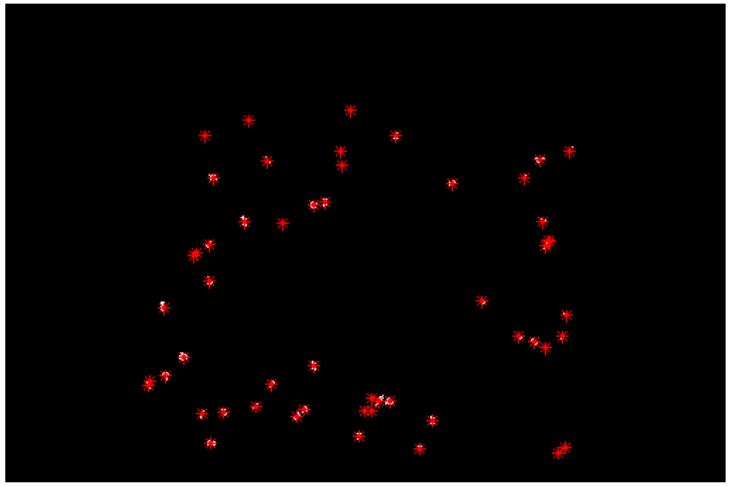
Inverse



Select pixel clusters



Find cluster centers



Draw boxes

Still some problematic areas:

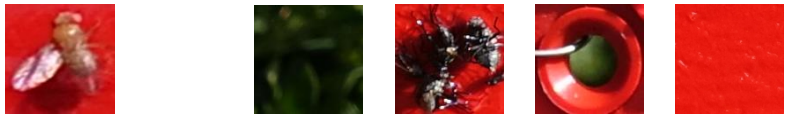
- edges
- overlap
- shadow

(for later)

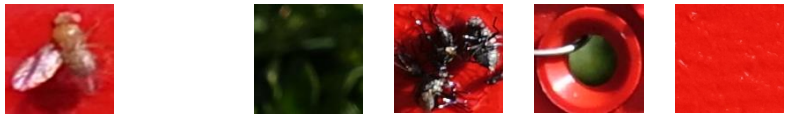
Precision = #correctly classified / #classified as Suzukii

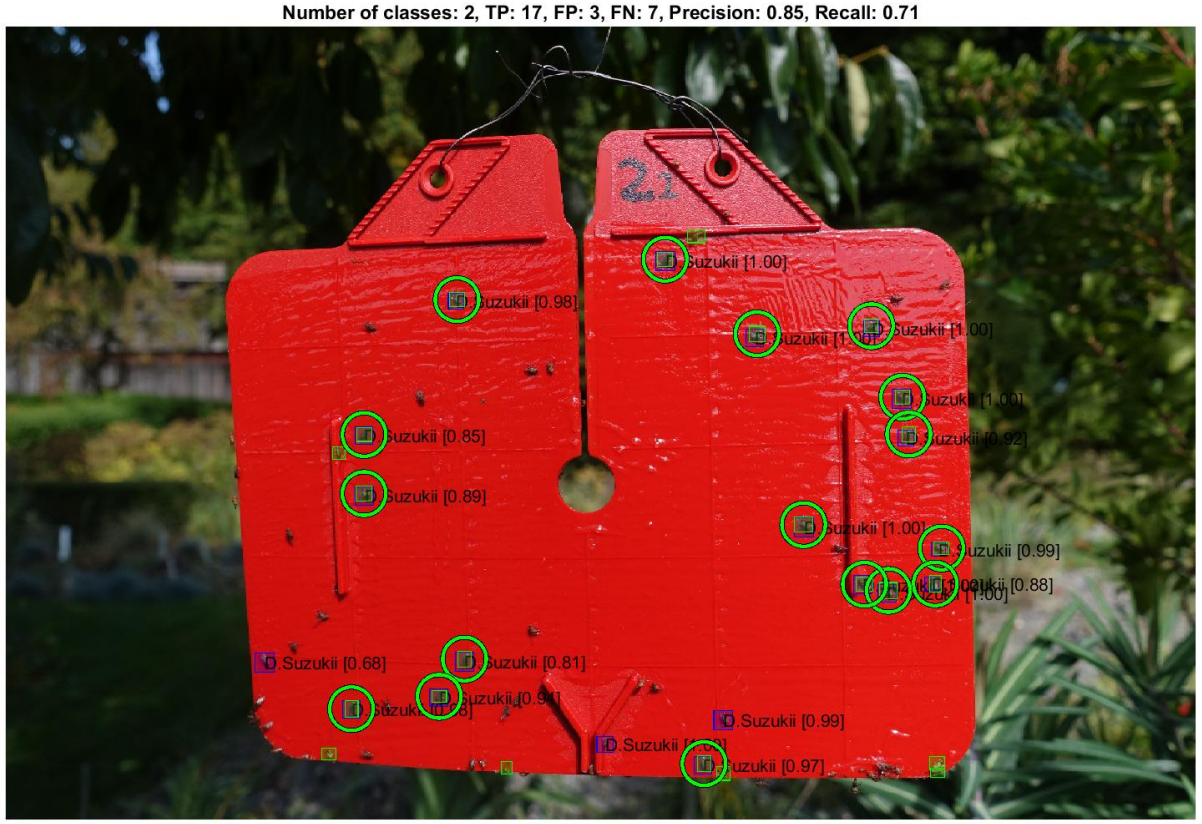
Recall = #correctly classified / #ground truth Suzukii

2 classes:



9 classes:

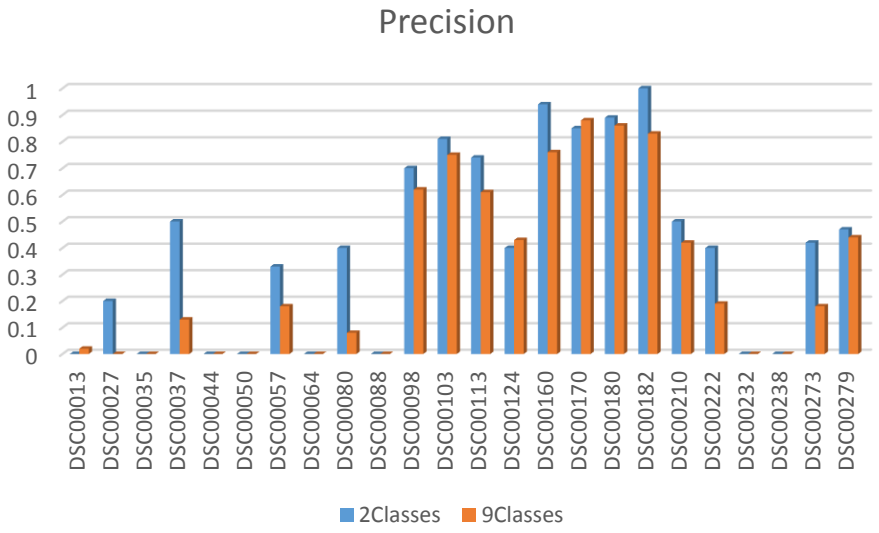


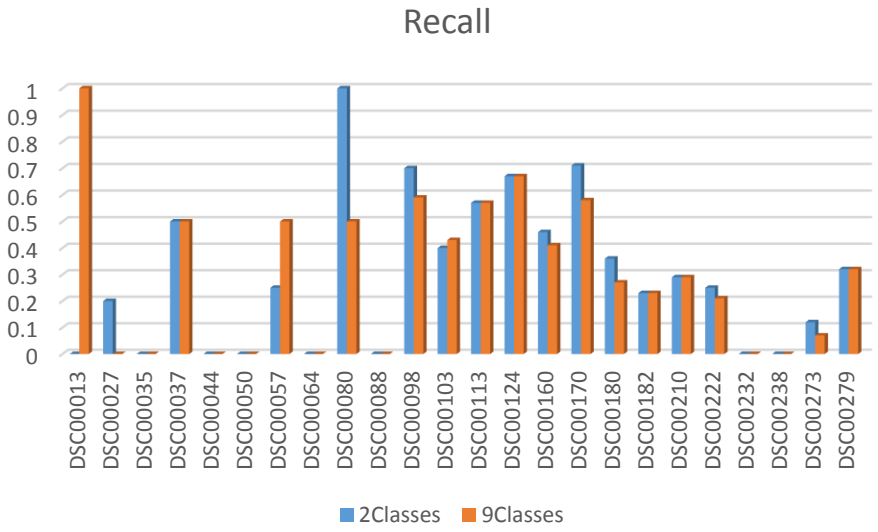


en box = Ground truth (location of Suzukii); Blue box = False predicted Suzukii; Green circle (green and blue overlapping box) = correctly predicted Suzukii

What's better?

- Almost always just 2 classes





Sometimes it works, sometimes it doesn’t

- Difficult lightning conditions
- Distance to trap
- Image at angle

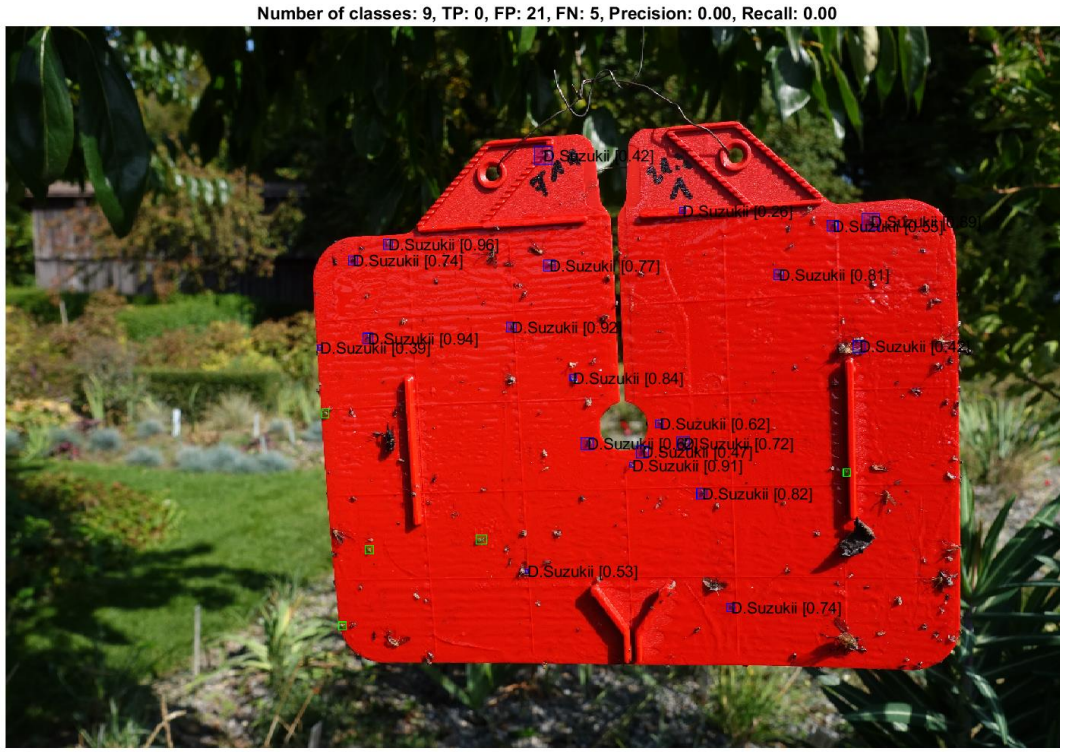


Photo requirements

- Resolution (Now: 5472 x 3648 px)
- Sensor target distance
- View angle
- Lightning conditions (shadows, sun glint)
- Sharpness
- Background (trap)
- ...

Data requirements

- Annotated images (Johannes, 2018)
  - Static images
  - Drone-based images
- Images by David
- Images by WUR
- ....

Planning

- Other cameras:
  - Mavic: 4000x3000 pix
  - DJI Zenmuse X4s: 5472×3648 pix
- Other than RGB: Hyperspectral / NIR / ...
- Publications
- DSS
- ...