



# Object Detection for Species Recognition

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# Why Birds?

- Around 12% of current bird species are considered endangered, threatened, or vulnerable in some way.
- Many species play crucial roles in their respective ecosystems and are known as 'keystone species'
- Habitat loss and destruction is one of the leading causes of bird species extinction.



# Object Detection for Conservation



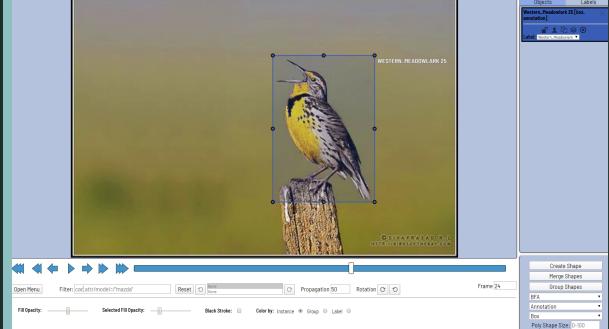
Teaming up with local governments and various conservation efforts.



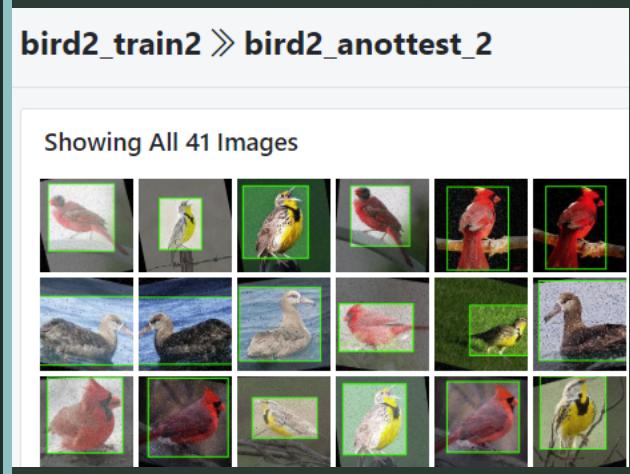
Train a model how to discern from background and foreground



Discretely place cameras in areas there may be endangered species with our software.



CVAT



Roboflow



# Data Collection, Annotation, and Augmentation

Combination of UCSD Bird Species (3, species, 45 images per species)

Labeled and annotated with CVAT (Computer Vision Annotation Tool) and LabelImg

Augmentation with OpenCV and Roboflow.ai

# Augmentation

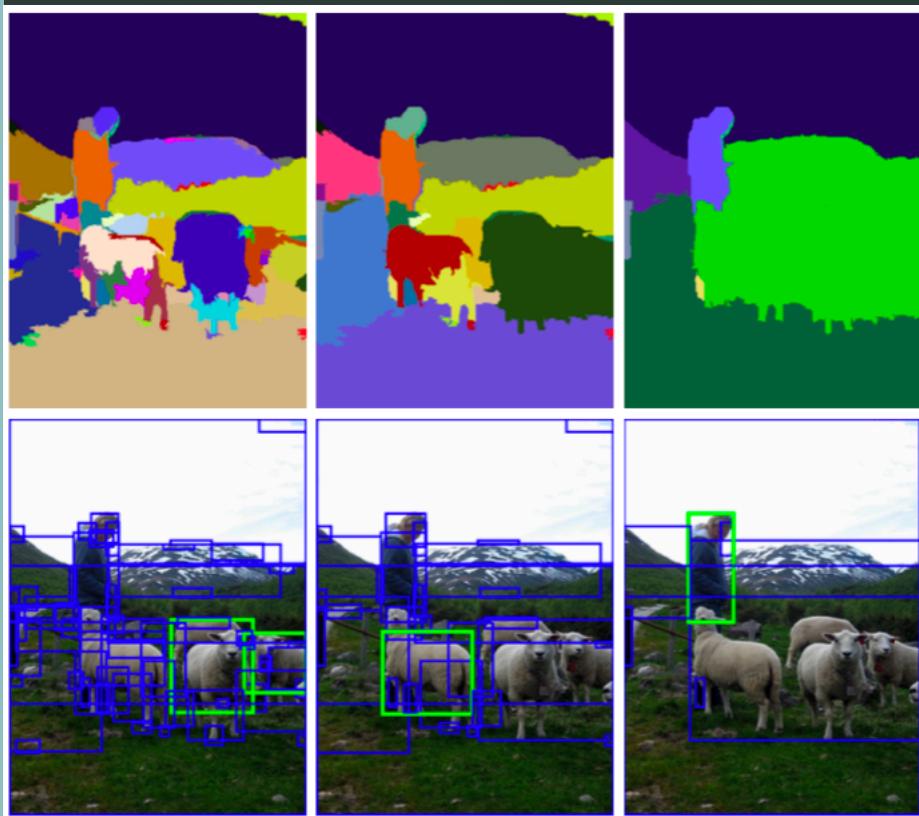


Noise Generation



Horizontal Flip

- Only performed on training set (as opposed to preprocessing)
- Think noise, perspective, time of day, season.
- Generate new data from initial set (no replacement)

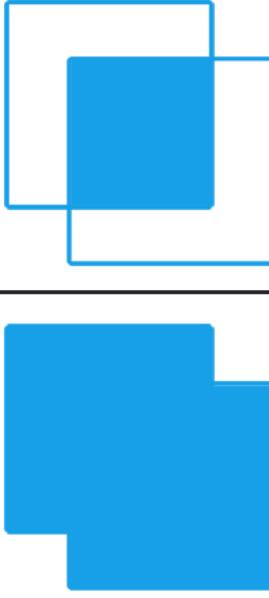


# Selective Segmentation

- Throws several diverse algorithms at image for partitioning
- Groups similar regions together based on texture, shape, color, saturation.

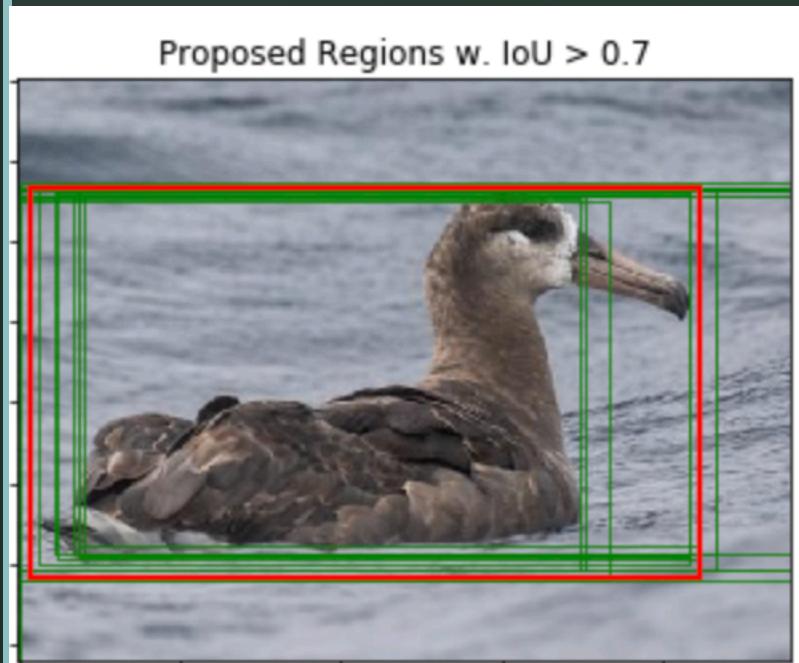


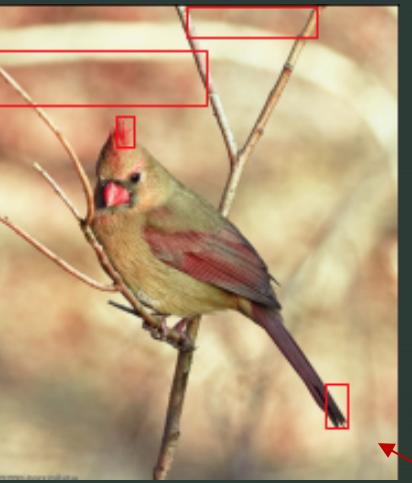
$k=200$

$$\text{IoU} = \frac{\text{Area of Overlap}}{\text{Area of Union}}$$


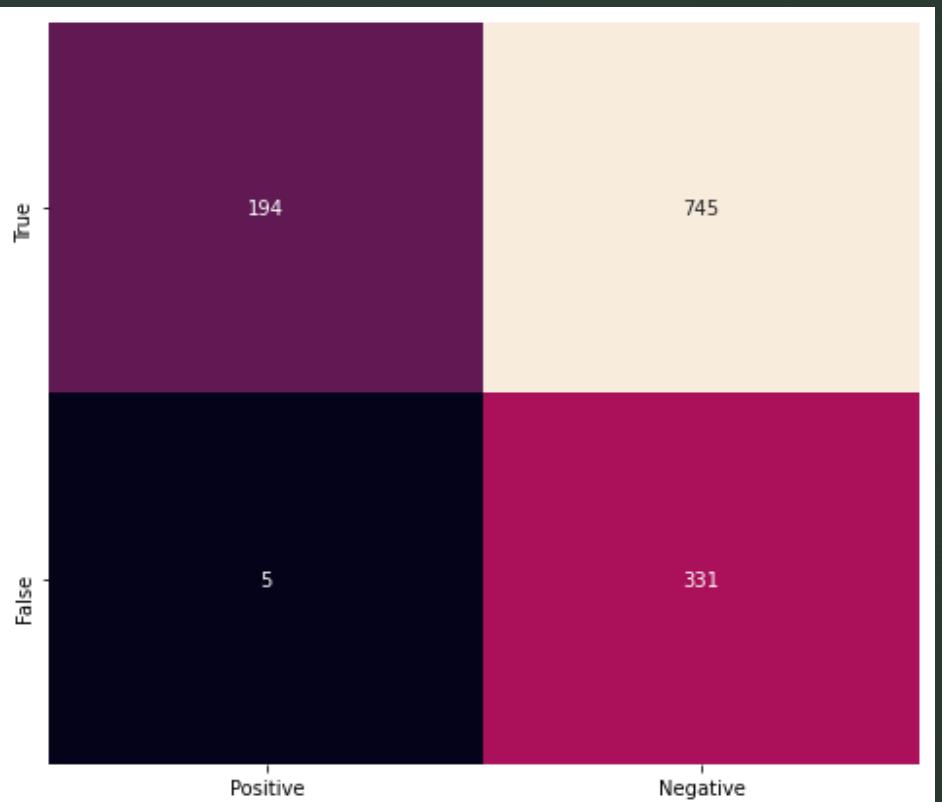
## Intersection over Union (IoU)

- Setup for binary classification
- Set IoU threshold.
- Filter out bad suggestions



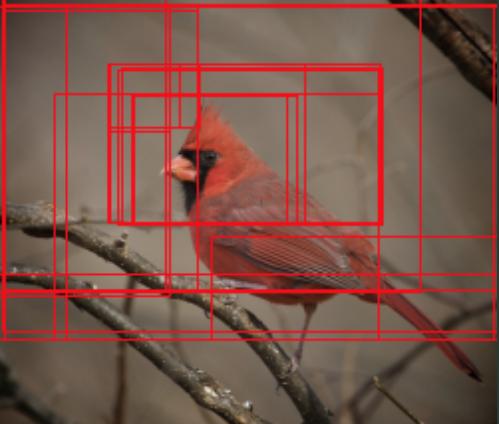
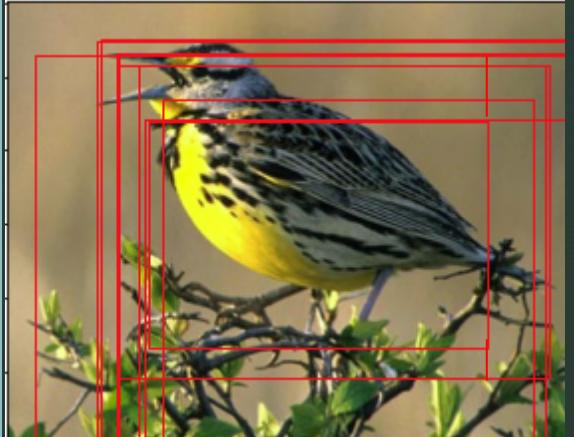


False positives.  $P(\text{isbird}) > 0.5$ ,  $y=0$ .

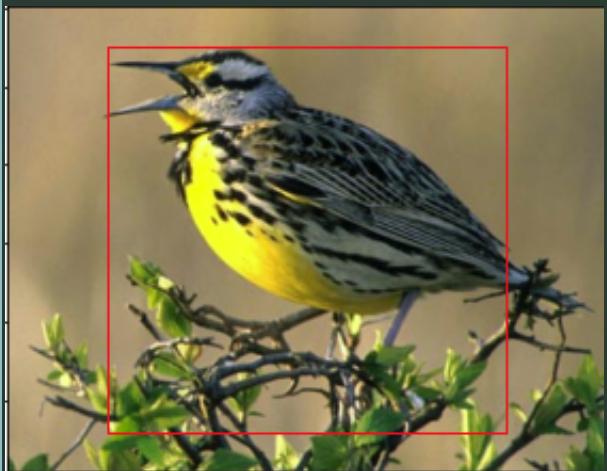


## Binary Classification(CNN)

- $(2 \times \text{Conv} + 1 \times \text{Pool}) \times 3 \rightarrow \text{FC}$
- 93% Training Accuracy
- 79% Testing accuracy
- Overfit, how can we remedy?



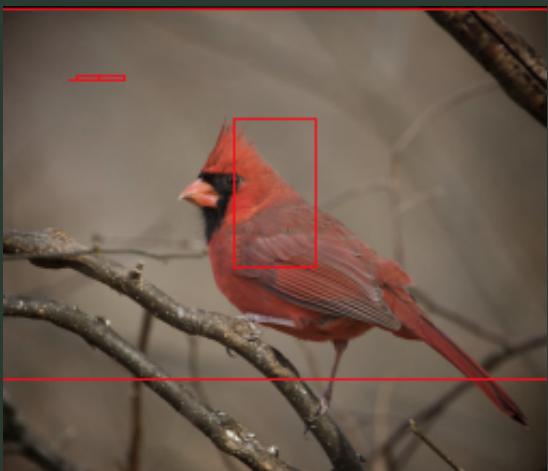
Non-Max Suppression



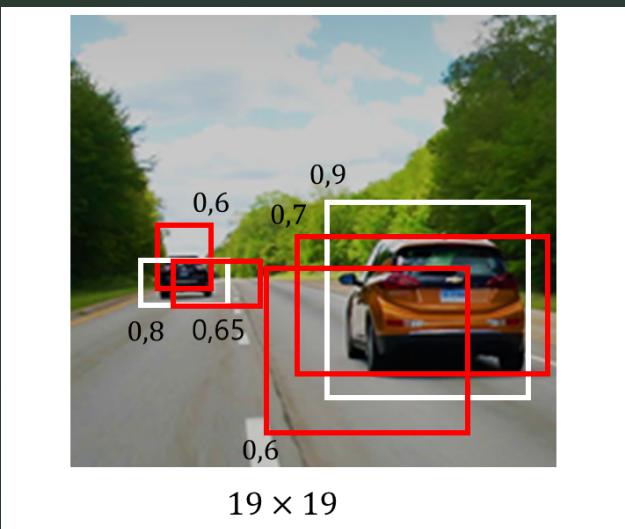
[1.000000e+00, 3.4251785e-11, 6.1666743e-09]

Classifies as Western Meadowlark!

# Non-Max Suppression & Classification



- Similar CNN framework
- 95% training accuracy
- 88% testing accuracy
- NMS uses  $p(\text{'isbird'})$  and IoU score to suppress other proposals



# Conclusion

- More data augmentation (more data in total)
- Object detector weak, classifier strong
- Outsource work
- Fine Grained Recognition