Deep Learning Project Proposal

GLOBAL WHEAT DETECTION

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OBJECTIVE

Predict bounding boxes around each wheat head in images that have them

MOTIVATION

- Wheat breeding progress has been the key for the food security in emerging countries
- **Wheat head number per unit ground area** is a major yield component
- Manual evaluation is labor-intensive and leads to measurement errors of around 10%
- Automatic sensing methods can improve the accuracy and reduce the human effort

DATA

- Training data consists of 3422 image files, totaling 613 Mb.

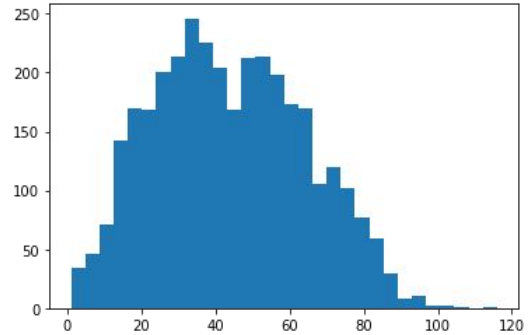
- Train.csv has columns such as image_id, width and height of the image, and bounding box dimension [xmin, ymin, width, height]

image_id	width	height	bbox
3373 unique values	1024 1024	1024 1024	147761 unique values
b6ab77fd7	1024	1024	[834.0, 222.0, 56.0, 36.0]

Exploration & Augmentation

Data Observations:

- There are plenty of overlapping bounding boxes
- All images have been taken vertically
- The wheat heads have different colors based on the source



Distribution of wheat heads per image

Data Augmentation techniques applied:

- Randomly changing the hue
- Vertical and horizontal flipping
- Random crop
- Converting image to grayscale
- Randomly changing brightness and contrast of the image

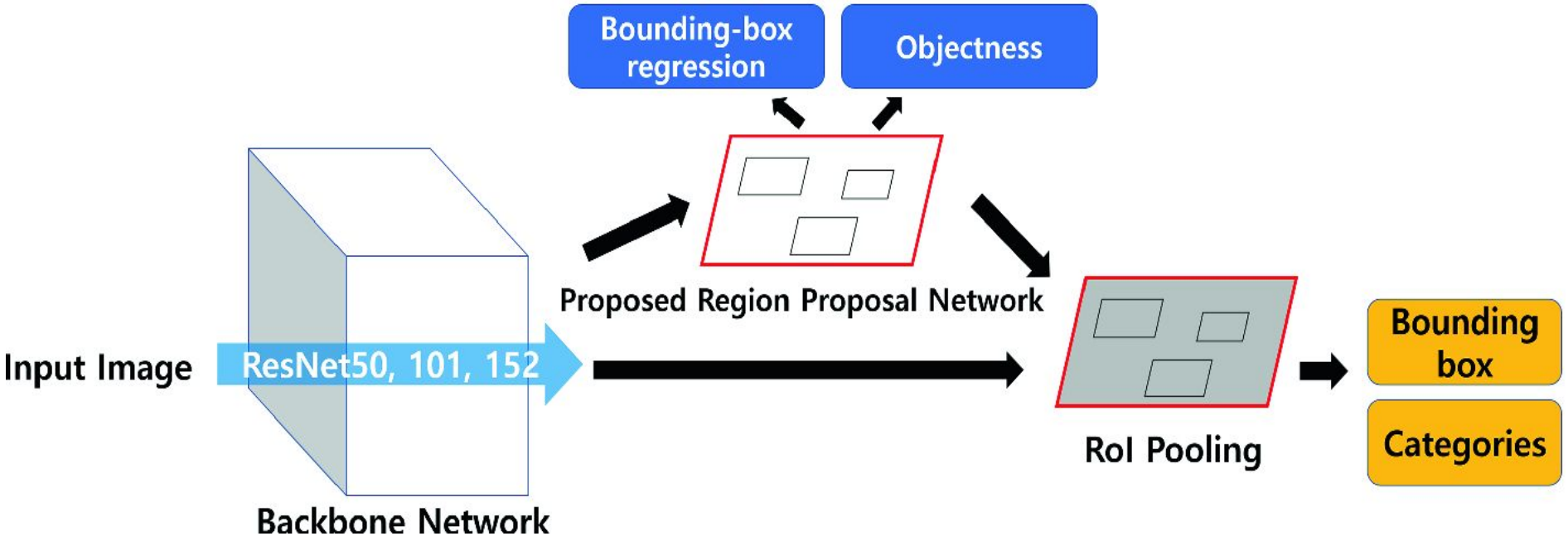
TECHNIQUES OVERVIEW

- Faster R-CNN to predict the bounding boxes for the wheat heads.

- Faster R-CNN is the state-of-the-art object detection method that depends on region proposal algorithms to hypothesize object locations.

- Region proposal generation and objection detection tasks are done by the same convolution network.

Faster-RCNN Architecture

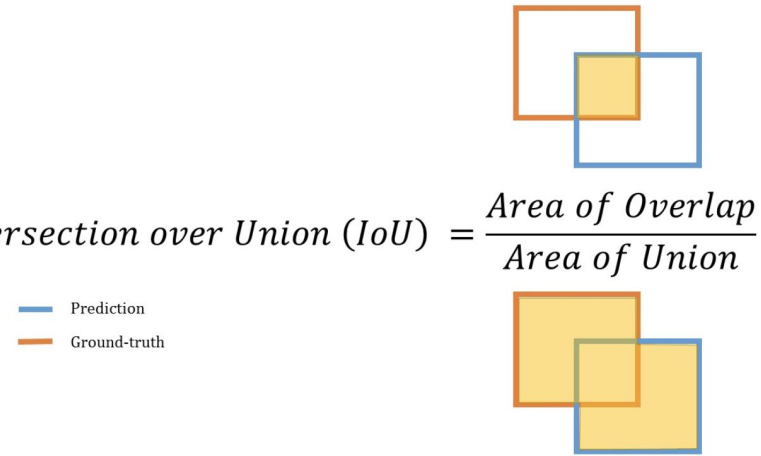


EVALUATION

- **Mean average precision** at different intersection over union (IoU) thresholds.

$$IoU(A, B) = \frac{A \cap B}{A \cup B}.$$

$$Intersection\ over\ Union\ (IoU) = \frac{Area\ of\ Overlap}{Area\ of\ Union}$$



Train Results

Backbone	Mean Average Precision at IoU
ResNet-34	0.680
ResNet-50	0.701
ResNet-152	0.711

Test Results

Backbone	Mean Average Precision at IoU
ResNet-34	0.515
ResNet-50	0.587
ResNet-152	0.672 (Top 53%)

Conclusions & Lessons Learnt

- Learnt about various data augmentation techniques, and experimented with augmentation libraries (eg. albumentations)

- Tricky to work with images with multiple overlapping bounding boxes

- Learnt how to submit to a kaggle competition using kaggle notebook

Thanks!

ANY QUESTIONS?