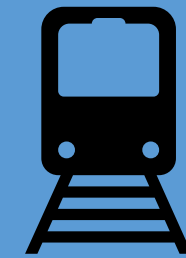# Improving VIA Rail Track maintenance using Computer Vision

Introduction

- Canadian Railway operates some of the longest rail lines in the world which passes through long stretches of sparsely populated lands which makes identifying defects, damage or simply maintaining these rail tracks a tough job.
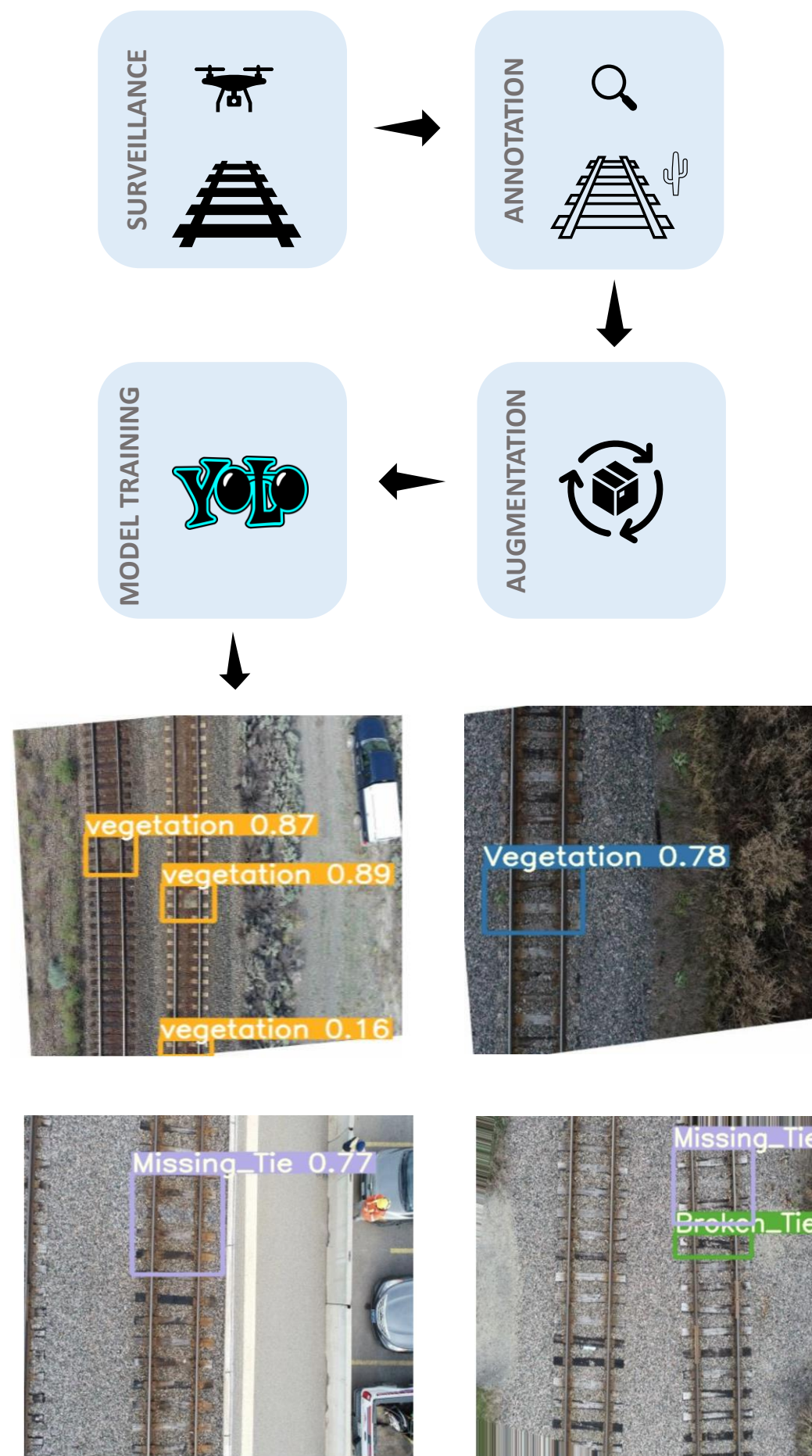- What if we can ease the process of identifying the sites which require maintenance using computer vision.

Research Questions

- How can we leverage **Image manipulation** to enhance the annotation process?
- How can we leverage different **augmentation techniques** to signify the points of interest?
- How can we leverage different versions of the **Yolo object detection algorithm** to achieve higher accuracy in detecting the points of interest.
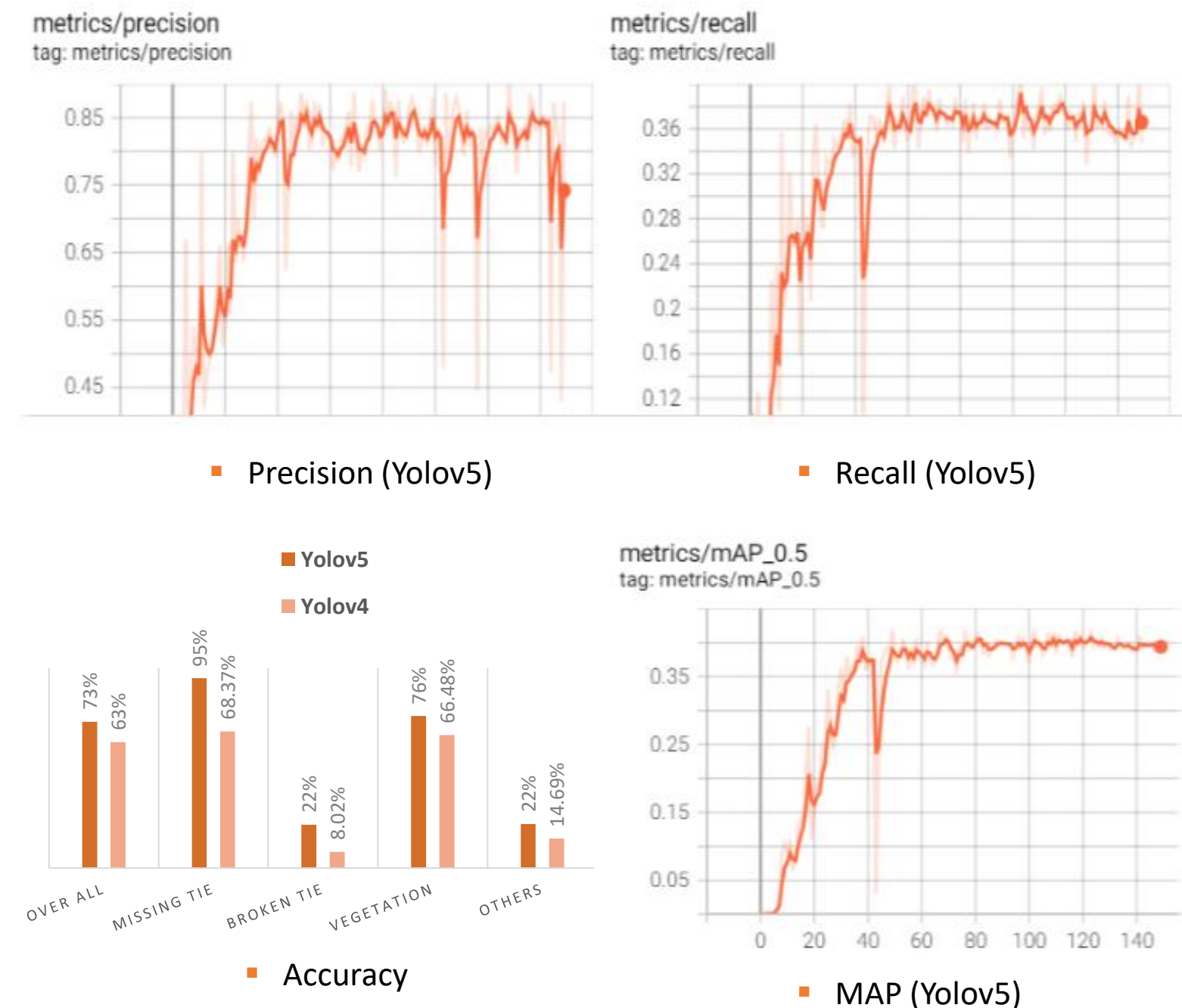
Evaluation

- **Dataset Size:** 1.6K Images
- **Annotations:** 1798
- **Data Split:** Training (70%), Validation(20%), Test(10%)
- **Augmentations:** Mosaic, Saturation

How does it work?

SURVEILLANCE → ANNOTATION → AUGMENTATION → MODEL TRAINING

vegetation 0.87
vegetation 0.89
vegetation 0.16
Vegetation 0.78

Missing_Tie 0.77
Missing_Tie
Broken_Tie

Result Analysis

metrics/precision
tag: metrics/precision

■ Precision (Yolov5)

metrics/recall
tag: metrics/recall

■ Recall (Yolov5)

■ Yolov5
■ Yolov4

	OVER ALL	MISSING TIE	BROKEN TIE	VEGETATION	OTHERS
Yolov5	73%	95%	22%	76%	22%
Yolov4	63%	68.37%	8.02%	66.48%	14.69%

■ Accuracy

metrics/mAP_0.5
tag: metrics/mAP_0.5

■ MAP (Yolov5)

Conclusion

- **Image manipulation** techniques such as orientation correction and artificial points of interest make annotation efficient and accurate.
- **Image Augmentations** have a drastic impact on the model performance where colour enhancing augmentations such as saturation and contrast lead to higher precision.
- **Robust training (epoch > 1000) of the Yolov5 model** leads to remarkable accuracy among some points of interest such as vegetation and missing tie.

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Learn more
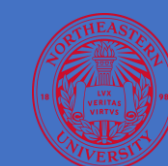
Northeastern University

VIA Rail Canada