Automated Identification of Oil Field Features using CNNs

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Motivation

- Oil and gas production sites are a major source of anthropogenic methane emissions.
- Emissions studies utilize counts of equipment to estimate emissions from production facilities.
- These counts are poorly documented, including both information about well pad locations and major equipment on each well pad.
- We adapted a computer vision model for detecting well pads and equipment from satellite imagery.

Dataset

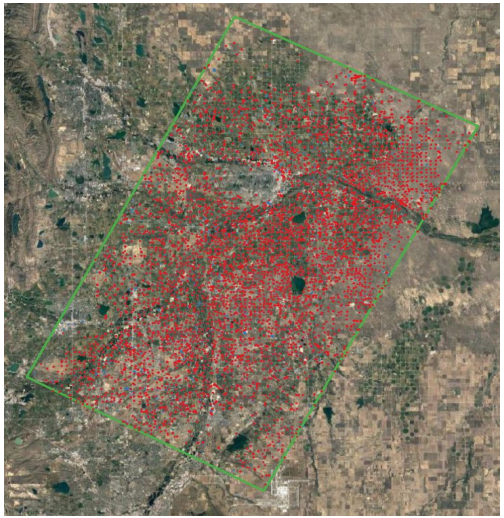
- Images are collected using google earth imagery
- RGB images of 600 x 600 pixels are used for training the model
- We collected and annotated 1650 well pad and 500 equipment images.

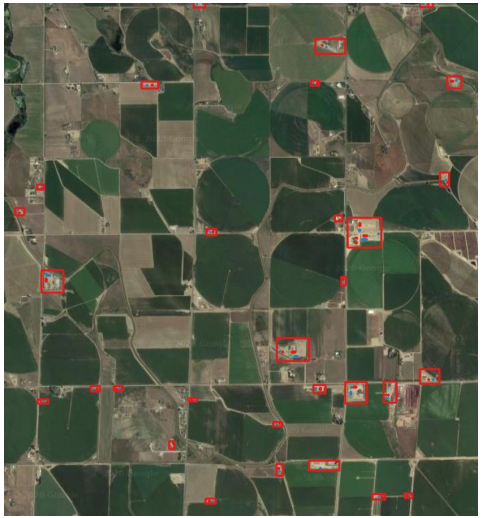
Model and Training

- A Yolo-V4 architecture is used for object detection task
- For training, we used a 5-fold cross validation strategy
- Data Augmentation techniques applied are Scaling, Rotation, Blur and Cut-mix
- CIoU-loss function is used for training
- F1 Scores for performance evaluation

Results

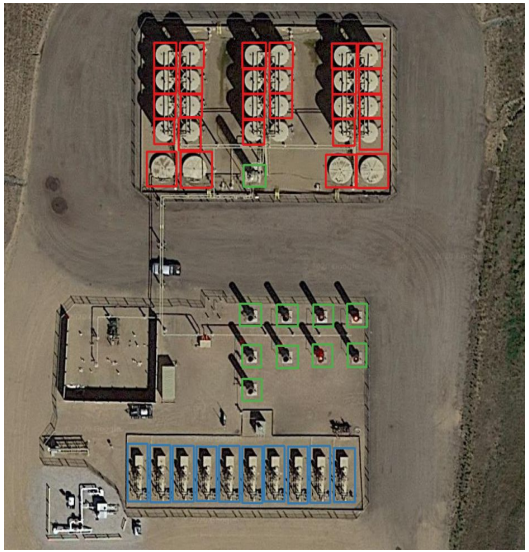
	True Positive Rate	False Positive Rate	False Negative Rate	F1 Score
Well Pad	99.2%	5.1%	0.7%	0.9696
Storage Tank	99.1%	2.4%	0.7%	0.9885





Results

- Model achieved an average wellpad detection accuracy of 95% in DJ Basin, Colorado



Conclusion

- We adapted a deep learning approach to detect well site and their major equipment to support a study of methane emissions in the DJ basin, Colorado.
- We hope our model can provide a starting point for Automated well site identification.
- The modeling technique utilized here could also be used for other applications, such as the detection of agricultural facilities or other emissions sources.

Thank you