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Deep Learning Based Machinery Threat Detection on Pipeline Right of Way

**INTRODUCTION**

In this research, we develop a new deep learning strategy for robust detection and classification of objects on the pipeline right of way from aerial images. Our method can detect machinery threat with multiple sizes, different orientation and complex background in aerial images. In the proposed framework, the skip connection is used in the CNN structure to enhance feature learning.

**FEATURE EXTRACTION**

We use Residual Network (ResNet) as the backbone to extract the feature from the input images. Based on the Feature Pyramid Network (FPN), we create a bottom-up, a top-down pathway and various lateral connections to combine low-resolution and high-resolution features. The feature maps from higher stages are up sampled and enhanced to the same size with the bottom-up features through lateral connections. This process is looped until the final resolution feature map is generated.

**REGION PROPOSAL**

Region Proposal Network (RPN) takes the feature maps of arbitrary size to generate a set of rectangular object proposals. It also can predict object bounds and scores at each position. ROI Align uses bilinear interpolation to compute the arbitrary feature maps to a fixed-length vector.

Each feature vector fed into a series of Fully Connected (FC) Layers that finally branch into two sub-layers: one that produces softmax probability estimates over object classes and another that outputs four values encodes refined bounding-box positions for each of the object classes.