Domain Adaptable Deep Learning Models for Energy Infrastructure Detection using Synthetic Data Generation

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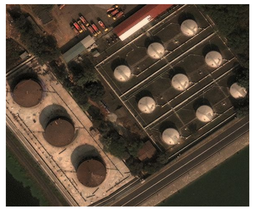
1 Energy Infrastructure Detection

Energy infrastructure mapping is vital for well-informed policy decisions in expanding energy access off of existing infrastructure. However, data on such infrastructure can be scarce. Our project aims to detect and map multiple energy infrastructures through publicly available satellite imagery globally.


Wind turbines

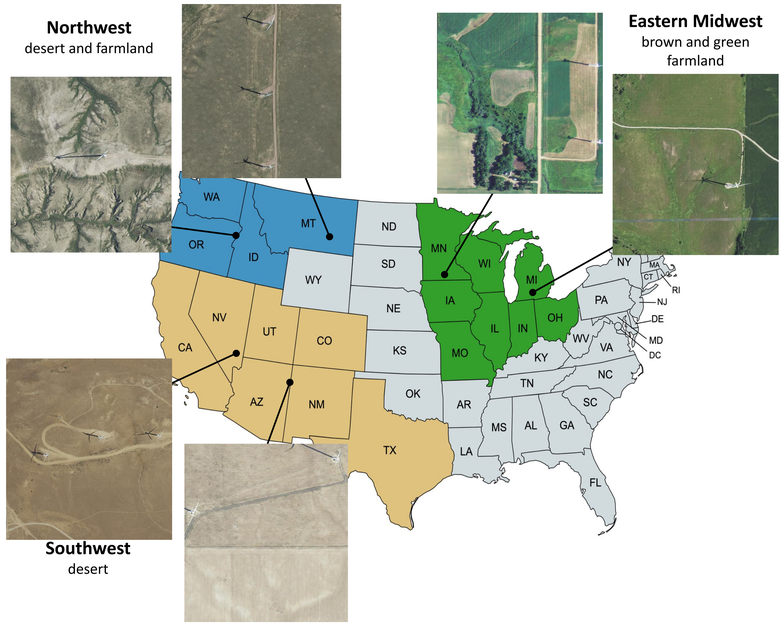

Transmission lines


Solar Panels


Storage Tanks

2 Domain Adaptation Problem

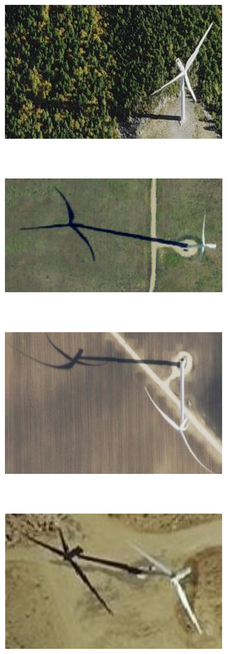
Computer vision techniques struggle when applied across satellite imagery from diverse geographies that vary in color, vegetation, terrain, etc..



3 Proposed Solution: Synthetic Data Generation

Synthetic data generation with synthetic image blender GP-GAN.

Sample Real Wind Turbines → **Randomize Placement & Size of Wind Turbines** → **Blend Image** → **Output Synthetic Image**




Sampled wind turbines from source domain are placed on a blank, white canvas at randomized locations and rotations


Corresponding mask is created that identifies the placement of the wind turbines


Selected destination image from target domain (contains no wind turbines)

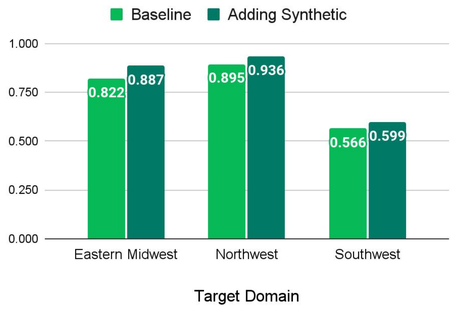
Synthetic Imagery Blender


Output image of wind turbines blended onto destination image

4 Selected Results from Wind Turbines Experiment

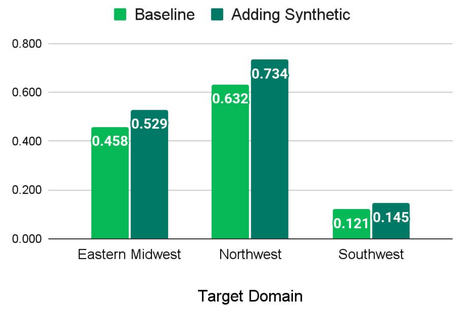
Synthetic data generation significantly improves energy infrastructure detection when it is cost-prohibitive to collect more real data.

Within-Domain Average Precision



↑ 6.64% Performance Gain over Baseline

Cross-Domain Average Precision



↑ 24.7% Performance Gain over Baseline

5 For more information, visit our website

bit.ly/aiforenergy2022