

Deep Learning-Based Change Detection of Urban Forest, Water, Barren Land, and Human Activity

Keywords: deep learning; transfer learning; forest cover change detection; river change detection; barren land detection; very high resolution (VHR); DeepLabv3+; deeply supervised image fusion network (DSIFN); desertification

Expected output

- Grayscale segmented 2D map of an urban region, based VHR satellite image, classes include forest, water, barren land, and human activity (buildings, roads, agriculture).
- Colour coded map that shows region of change, based on pre- and post-VHR satellite image of region.

Potential use

- Forest conservation: Monitoring. Intervention impact analysis.
- Urban planning: City growth.
- Desertification identification: Monitoring. Intervention impact analysis.

Datasets

- LoveDA [GitHub - Junjue-Wang/LoveDA: \[NeurIPS 2021\] LoveDA: A Remote Sensing Land-Cover Dataset for Domain Adaptive Semantic Segmentation](#)
- Change Detection Dataset

Data Preparation

1. LoveDA

Category labels: background – 1, building – 2, road – 3, water – 4, barren – 5, forest – 6, agriculture – 7. And the no-data regions were assigned 0 which should be ignored. The provided data loader will help you construct your pipeline.

Original image and mask:



Merged labels:

- Forest: 6 -> 1 (Bright Green)
- Water: 4 -> 2 (Bright Blue)
- Barren land: 5 -> 3 (Bright Orange)
- Human activity: 2, 3, 7 -> 4 (Bright Magenta)
- Background: 1 -> 5 (Gray)
- No-data: 0 -> 0 (Black)

Image '1366' from train dataset:

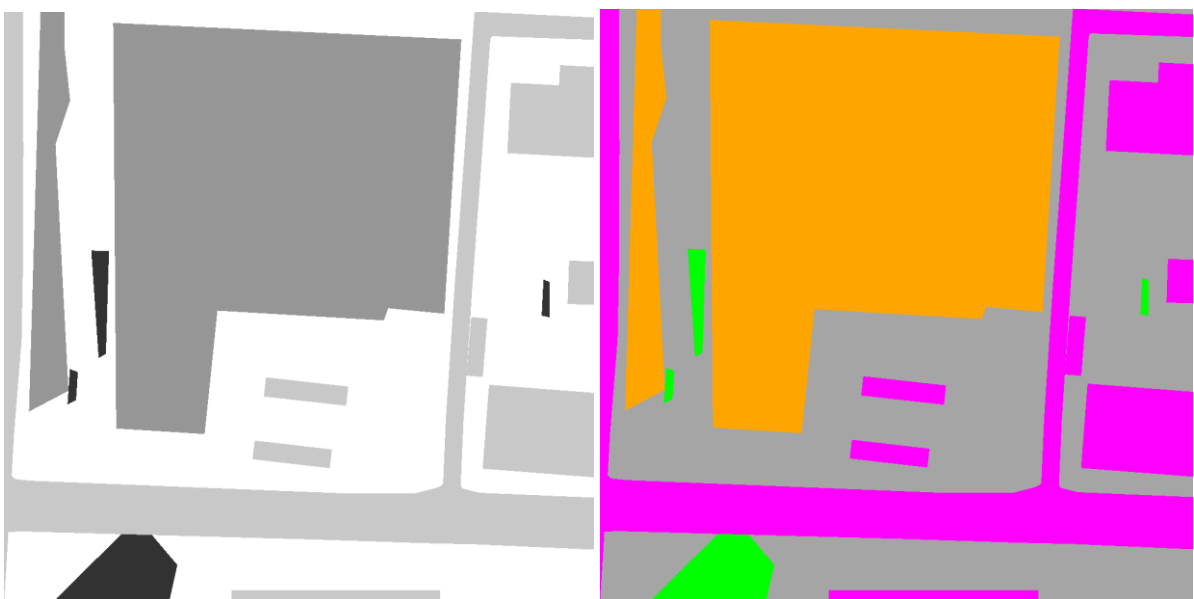
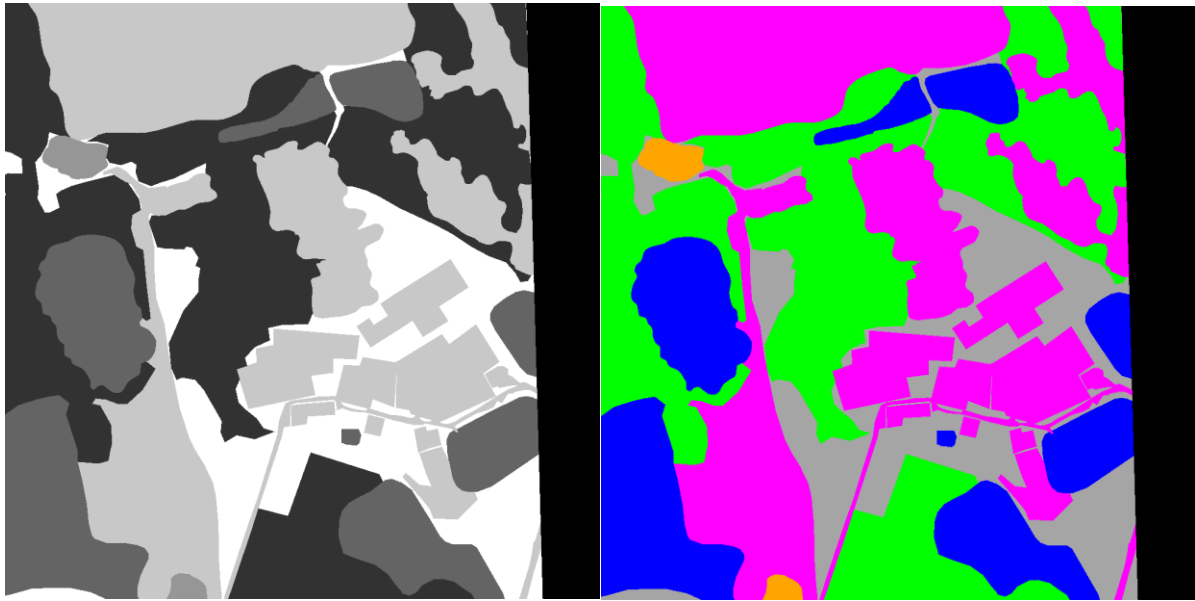
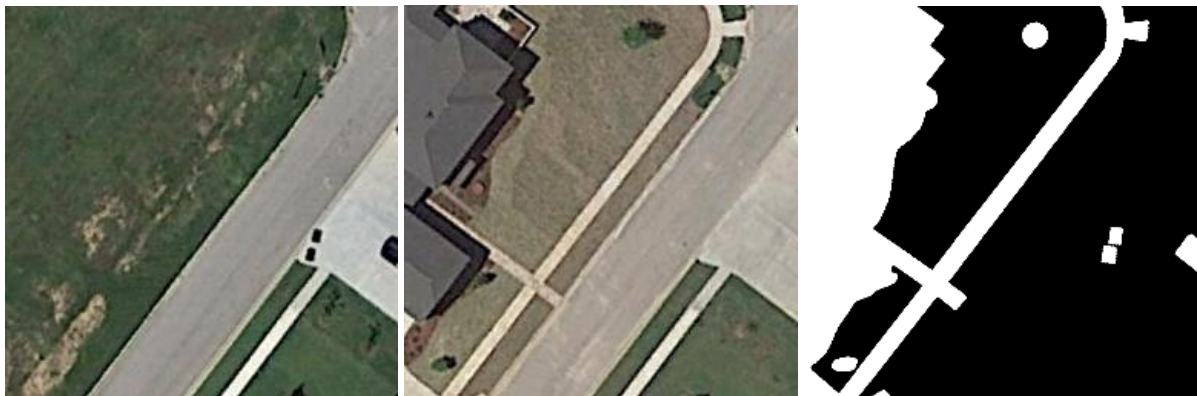


Image '3520' from validation dataset:



2. Change Detection Dataset

Image '19' from Real/subset/train. From left to right, B-A-OUT.



Transfer learning

1. DeepLabv3+

80/20 train/test split, 20 epochs, training time ..., Train loss graph, Test loss graph, Training time

M. S. Minhas, "Transfer Learning for Semantic Segmentation using PyTorch DeepLab v3," GitHub.com/msminhas93, 12-Sep-2019. [Online].

Available: <https://github.com/msminhas93/DeepLabv3FineTuning>.

2. VGG16

No additional fitting is done, as the model up to pool5 is used for feature extraction (Simonyan and Zisserman, 2014).

Deeply Supervised Image Fusion Network (DSIFN)

[A deeply supervised image fusion network for change detection in high resolution bi-temporal remote sensing images - ScienceDirect](#)

[Step by step VGG16 implementation in Keras for beginners | by Rohit Thakur | Towards Data Science](#)

Generated Change Maps

Generated Urban Activity Segmentation

Comparison to Directly Pixel-Wise Deduction