

# Satellite Imagery Semantic Segmentation on Intel® FPGA

## Example Design

### DESCRIPTION

Semantic segmentation is a computer vision problem, where each pixel of an input image is assigned a label corresponding to the class or type of object it belongs to. This technique can be applied in many applications where understanding the type, shape, occlusion, orientation, or position of an object of interest is important.

Determining information from satellite imagery in an automated way presents a unique challenge. Overhead images have less detailed features with lower spatial resolution. The environment can introduce occlusions by clouds and variation from seasons or weather. To overcome these challenges, satellites capture additional image channels through a wider band of the electromagnetic spectrum. In contrast, a conventional camera captures three image channels: red, green, and blue.

In this example, a deep convolutional neural network based on the U-net topology (Ronneberger, O. et al., 2015) was trained on satellite imagery for semantic segmentation. U-net begins with an encoder phase, where convolution and pooling layers reduce the input image to an encoded representation that is spatially smaller, but greater in depth. This encoded representation is then used by a decoder phase, where convolution and deconvolution layers

expand the encoded representation into a multidimensional array of segmentation probabilities. A segmentation mask output, with the same size as the input image, gives an identifier of the class of highest probability per pixel.

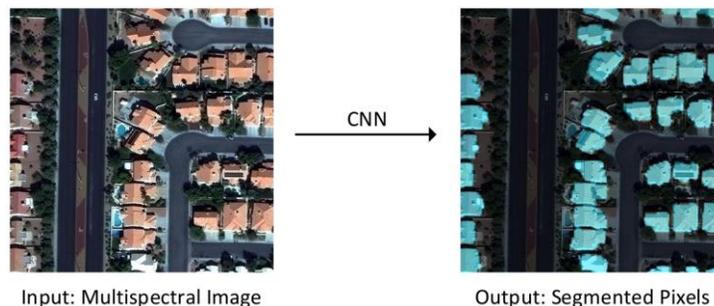
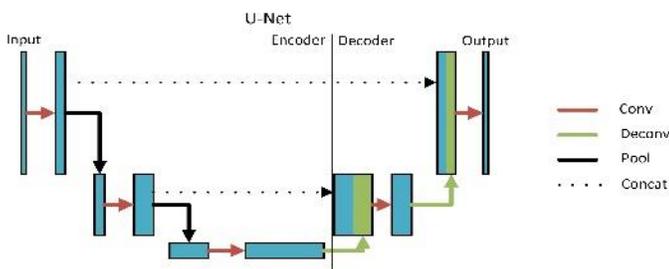
Deep learning inference was implemented and accelerated using the Intel® Distribution of OpenVINO™ toolkit. First the Model Optimizer software is used to optimize and convert a deep learning model from popular training frameworks to an intermediate representation. This intermediate representation can be used by Inference Engine to deploy the model across various Intel® hardware options for deep learning inference. This example deploys the model for acceleration by the Intel® Arria® 10 GX FPGA.

### FEATURES

- Deep learning Inference using the Intel® Distribution of OpenVINO™ toolkit
- Acceleration with Intel® Arria® 10 GX FPGA

### APPLICATIONS

- Mapping and Land Use Characterization
- Automated Map Updates
- Drone Delivery
- UAV Monitoring



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