Deep learning based Based Electrical Substation extraction from Images

Proposed Methodology:

In the proposed solution, very high-resolution remotely sensed images have been used to recognize electrical substations using a pre-trained deep convolutional neural network (DCNN). The experimentation has been carried out into two phases: pre-processing of the images (P) and training of a U-NET architecture to obtain the segmented mask of the electrical substation. A detailed explanation of the proposed methodology can be found in the following subsections.

Pre-processing of the images:

In the proposed experiment prior to model training, the processing of the data plays a vital role in the performance. In view of this, the images are resized from 750x750x3 to 224x224x3 dimension for further investigation.

Training of U-net architecture:

In the current investigation, a U-net architecture has been trained using the VGG16 pre-trained DCNN model as a backend. Here, the images obtained from the previous stage are segmented using a U-net DCNN, as shown in Fig. 1, to get segmented objects (electrical substation) present in the image. A U-net is a DCNN-based neural network consisting of two paths: an encoder and a decoder [1]. The encoder path, similar to a traditional stack of convolution operations, is a contraction path which means that every layer downsampled the original image to capture the contents of the major object in the image. On the other hand, the decoder path symmetrically expands the image to store the localization information from the image. As shown in the figure, the final segmented image is extracted from the final layer of this end-to-end deep network. After executing encoding and decoding operations, a sigmoid activation function is added at the end of the network to obtain the segmented image. Here, the back-propagation training algorithm is used to learn the weights of the U-NET. It is worth mentioning that the image is compressed in the encoder layer to get its symmetric down-scaled activation maps; the same kernel filters and activation maps of the same sizes are used during decompression (expansion) of the image. Finally, the trained U-NET model has been utilized to generate the segmented mono-chromatic maps for each of the images, which can now be used for evaluation.

Sample Results

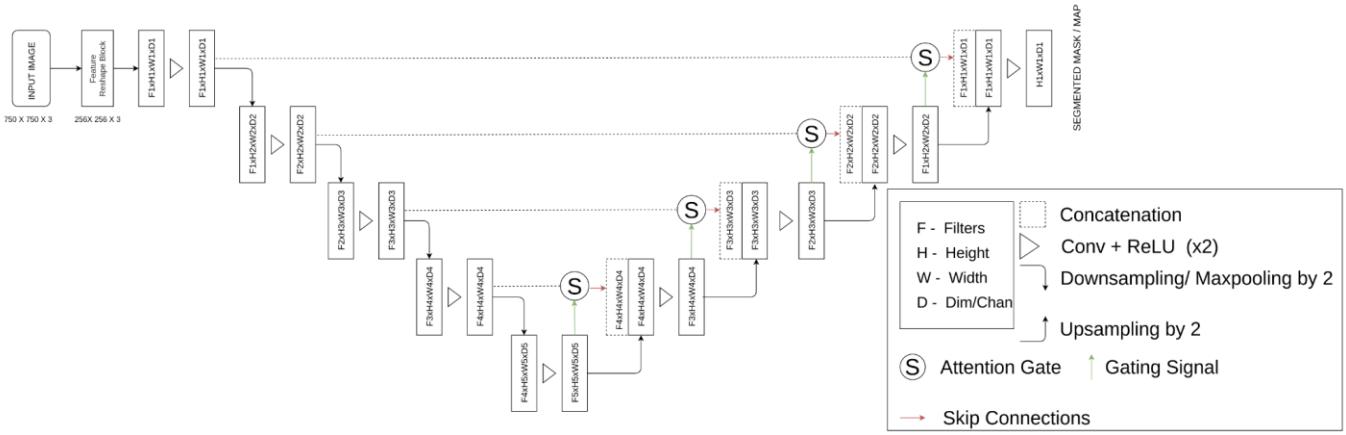
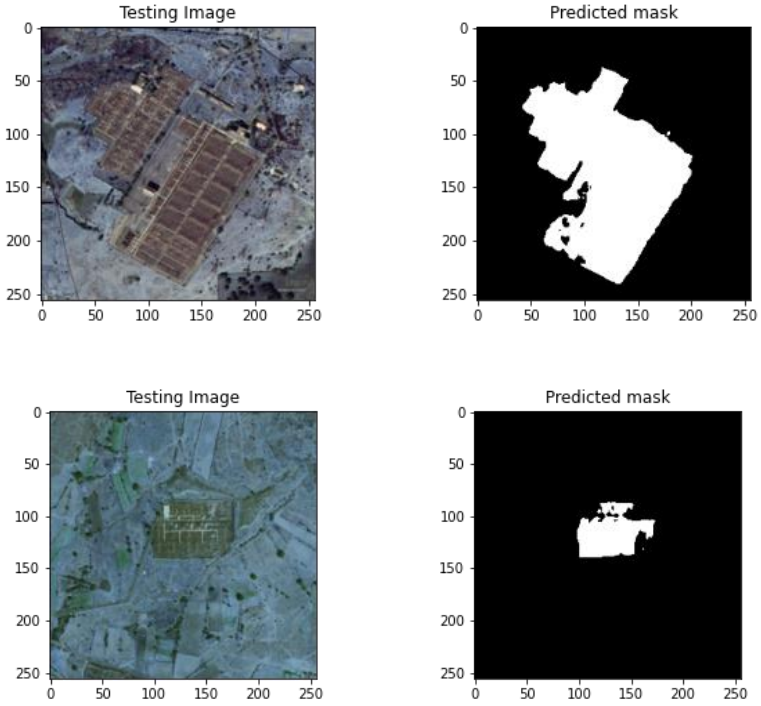


Figure1: Block diagram of the proposed U-net architecture



Reference of U-net segmentation model

[1] Ronneberger, Olaf, Philipp Fischer, and Thomas Brox. "U-net: Convolutional networks for biomedical image segmentation." International Conference on Medical image computing and computer-assisted intervention. Springer, Cham, 2015.