 Road boundary detection in image is actually a segmentation problem in computer vision. The purpose of road boundary detection is to find the area of road, or in other word, find the area of specific class in images. We did some research on this topic during the last several weeks. The most common computer vision method in recent years is deep learning with convolution neural network. Deep learning neural network is the complicated and optimized version of traditional neural network with multiply hidden layers. In our final project, we decide to test the traditional neural network and the deep learning neural network. We will test, analysis, and compare the existing neural network layouts. Then, we will optimize the existing neural network, or design our own neural network.

The project has two important parts, data preprocess and deep learning neural network construction. The paragraphs above have introduced the method to preprocess the dataset. The preprocessed dataset will provide the labels and features for neural network to learn. The output will be significant different with different preprocess methods. We will test different preprocessed datasets with same neural network layout and find the method that provides the highest accuracy.

Deep learning neural network can work on supervised and unsupervised learning. For this project, we will use deep learning as supervised learning. We will preprocess the images, extract features, and label road area. The deep learning neural network will learn the rule from labels and predict the road based on the road labeled in input dataset. For multiple hidden layers in deep learning neural network, each hidden layer goes into the next layer with non-linear combination of the layers below it. In other word, each layer is an optimally weighted, non-linear combination of the layer below it. Therefore, deep learning has great ability to extract the intrinsic regularity from dataset and it is a good method to predict the road.

We have read several papers about segmentation with deep learning. In the paper about semantic segmentation [1], people adapt contemporary classification network, such as, AlexNet, VGGNet, and GoogleNet, into fully convolutional network transfer the learned representation to segmentation task. This neural network can make pixel-wise prediction for different classes based on the input with arbitrary size. We believe this neural network also work for road detection if we train this network with our road dataset. The layout will be shown below.







