Background

There are already some previous studies applied to machine learning methods to identify solar panels from satellite images. For example, “The DeepSolar Project” conducted by Stanford University, “constructed a comprehensive high-fidelity solar deployment database for the contiguous U.S.”[1] The purpose of the project is to create a database for people who interested in how the solar panels are installed in the different area in the U.S. to conduct further analysis or research. The team applied the classification method based on Google Inception V3 to identify whether there is any solar panel in the piece of the image. [1] If an image is classified as there exist any solar panel, segmentation would be conducted to estimate the size of the solar panels. Though the purpose of the project is slightly different from our project, the goal is the same- detect solar panels from satellite images.

To identify solar panels from satellite images, image processing and image classification are the important methods in this project. Image processing is a subfield of signal processing, which uses computers to process digital images. This has been studied for decades since the 1950s according to Azriel Rosenfeld. [2] Since the digital images are represented using matrices, we can do scaling, color conversion, image enhancement, etc. to the image by adjusting the value in the matrices. Moreover, image processing can be used to filter out the information from the high dimension features of the images. According to D. Lu, “implementing feature extraction, and selecting suitable variables for input into a classification procedure are all important” [3] since we can make full use of the features and also reduce the dimension of the data. Some image processing methods such as Histogram of Oriented Gradients (HOG), Scale-Invariant Feature Transform (SIFT) [4] are famous as tools to extract informative features from the original image. With these filtered features, we can apply supervised machine learning methods to conduct image classification with high accuracy compared to use original images.

[1] Jiafan Yu, Zhecheng Wang, Arun Majumdar, Ram Rajagopal. Stanford Magic Lab. Retrived from: “<http://web.stanford.edu/group/deepsolar/home.html>”

[2] Azriel Rosenfeld 1969. Picture Processing by Computer, New York: Academic Press. Retrived from: “<https://dl.acm.org/doi/abs/10.1145/356551.356554>”

[3] D. Lu 2005. A survey of image classification methods and techniques for improving classification performance Retrived from: “<https://www.tandfonline.com/doi/full/10.1080/01431160600746456>”

[4] David G. Lowe 2004. Distinctive Image Features

from Scale-Invariant Keypoints. Retrived from: “<https://www.cs.ubc.ca/~lowe/papers/ijcv04.pdf>”