DEEP CONVOLUTION NEURAL NETWORK FOR DETECTION OF FAULTY SOLAR PANELS

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1. Introduction

Due to the fossil fuel is exhausted and causing problem, such as air pollution, acid rain, soil pollution, and so on. Now, many countries are interested in the new and reusable energy and want to minimize the damage caused by the use of fossil fuels. It results in interesting of the new and renewable energy. Therefore, solar photovoltaic energy production as a new and reusable energy, which becomes more and more important in this world. As the use of solar photovoltaic energy grows, more efficient ways are needed to build, operate, and maintain the solar industry.

The solar panel is greatly affected by the outdoor environment, such as the dust attached to the panel, sun hiding in the clouds, and etc. This requires some maintenance work for the user. **However, there are a lot of problems that the user cannot just judge by their eyes. Such as fault of solar panel, disconnection of the panel itself and hard to see what is attached to the solar panel.** Therefore, the automatic detecting faulty solar panel system is essential.

In this project, **I propose a detecting system of faulty solar panel using drones, and thermal cameras.** However, I focus on the processing of the image, which means that I do not need to know how to let drones take pictures of solar panels.

In order to detect the image faulty more easily, I need to get thermal image. Hence, the error of the photovoltaic panel is determined using the thermal imaging camera by drones. Once I get the picture, I will start to analyze the problem of solar panels, and then I report the problem to help for maintenance of solar panels.

2. System framework

This section talks about what I'm going to do in the experiment. First, I get the thermal image of solar panels from drones, and then I convert the RGB image to grayscale. Second, I find boundary of image by "Canny edge detection algorithm". If the boundary of image is rectangle, I go to next step, else I start over to get a new thermal image from drones. Third, in order to decide how many times I need to detect the solar panels, I count the number of solar panels in the image. Fourth, I draw rectangle boundary and find solar panel array. Fifth, I start to detect the problem for each solar panel. Sixth, I get information of solar panel. If there is faulty, I go to next step(because I detect the problem, then I can go to detect next solar panel), else I start over to get next solar panel. And keep doing this until the number of solar panel is zero.

2.1. Flow chart

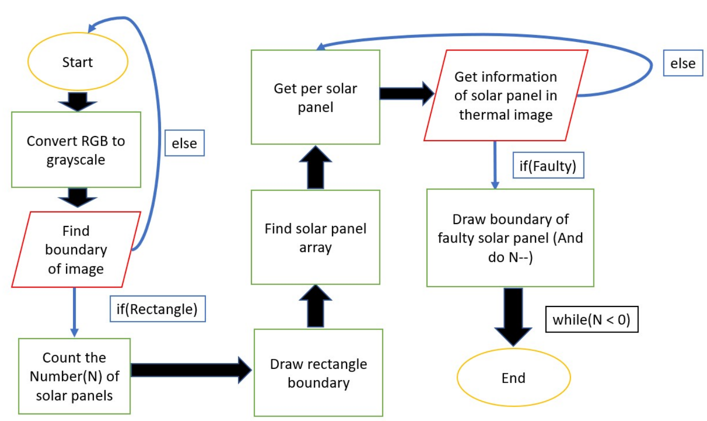

Figure 1. Experimental design

2.2. Tools and environments

Canny Edge Detection Algorithm: To get the edge of the thermal image so that I can find boundary of the solar panel.

OpenCV Blob Detection: To get the blob of solar panel so that I can detect the problem.

3. Expected results

I can successfully detect the problem of the solar panel. Also, I can classify and analyze the problem of the solar panel, such as “Cell”, “Cracking”, “Shadowing”, “Soiling” and etc. “Cell” means that hot spot occurring with square geometry in single cell. “Cracking” means that module anomaly is caused by cracking on module surface. “Shadowing” means that sunlight is obstructed by vegetation, man-made structures, or adjacent rows. “Soiling” means that dirt, dust, or other debris are on surface of module.

3.1. Dataset description

The dataset consists of 200 infrared images that are 750 by 840 pixels each. There are 12 defined classes of solar modules presented in this project with 11 classes of different anomalies and the remaining class being No-Anomaly (i.e. the null case).

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