

BUILDING EXTRACTION AND CLASSIFICATION OF AERIAL IMAGES OF ROOFTOP FOR ESTIMATING MAXIMAL PV PANEL INSTALLATION

CS6811 Project Work

Team 18

Submitted by

Shruthi M - 2018103592
Gayathri M - 2018103535
Jayapriya M – 2018103029

Under the guidance of
Prof Dr. P. Uma Maheswari

B. E. COMPUTER SCIENCE AND ENGINEERING



COLLEGE OF ENGINEERING, GUINDY

ANNA UNIVERSITY: CHENNAI 600 025

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PROBLEM DESCRIPTION




Sustainable environment is required for the advancement of economic development, to improve energy security, access to energy, and mitigate climate change. Energy production sources such as coal, oil, and natural gas are responsible for one-third of global greenhouse gas emissions, and there is a growing need for everyone to switch to solar power for electricity generation. Estimating a roof's solar potential, on the other hand, is a time-consuming process that requires manual labor and site inspection.




In this project, we use the AIRS dataset that provides a wide coverage of aerial imagery with 7.5 cm resolution and propose a mechanism to address the above problem: (i) Using state-of-the-art MultiRes U-Net architecture for building detection as a first step to segment and extract buildings from aerial image, (ii) Classifying rooftops from the extracted buildings with different deep learning and transfer learning algorithms and detecting the boundaries of rooftop, (iii) Use maximum fitting algorithm to find the maximal no of solar PV panels based on the type of roof.




The AIRS dataset do not have ground truth labels for the classification of different types of roofs. We have manually labelled 1115 roof type images into 3 categories: Flat, Gable, and Hip. In the following table, we have a subset of 14 images in each of the categories. They give a holistic representation of different ways in which each of the rooftops is present in the city of Christchurch, New Zealand.




ROOFTYPE CLASSIFICATION

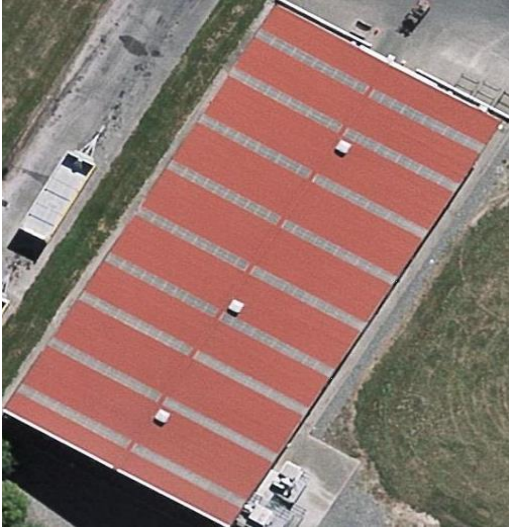


S. No.	Image	Roof type
1.	 christchurch_196_40	Flat
2.	 christchurch_36_61	Flat
3.	 christchurch_173_42	Flat

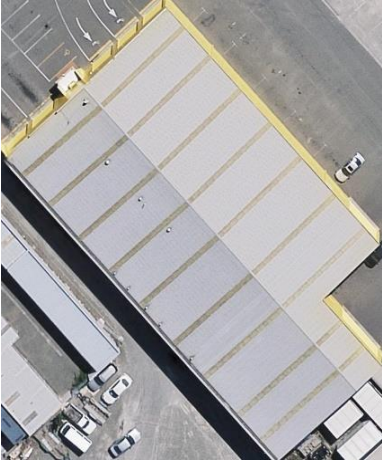


S. No.	Image	Roof type
4.	 <p>christchurch_173_259</p>	Flat
5.	 <p>christchurch_173_259</p>	Flat
6.	 <p>christchurch_174_13</p>	Flat




S. No.	Image	Roof type
7.	 <p>christchurch_174_45</p>	Flat
8.	 <p>christchurch_196_20</p>	Flat
9.	 <p>christchurch_196_33</p>	Flat




S. No.	Image	Roof type
10.	 <p>christchurch_215_549</p>	Flat
11.	 <p>christchurch_36_31</p>	Gable
12.	 <p>christchurch_36_54</p>	Gable




S. No.	Image	Roof type
13.	 <p>christchurch_97_126</p>	Gable
14.	 <p>christchurch_97_161</p>	Gable
15.	 <p>christchurch_173_10</p>	Gable

S. No.	Image	Roof type
16.	 <p>christchurch_196_42</p>	Gable
17.	 <p>christchurch_215_21</p>	Gable
18.	 <p>christchurch_215_227</p>	Gable

S. No.	Image	Roof type
19.	 <p>christchurch_215_274</p>	Gable
20.	 <p>christchurch_215_440</p>	Gable
21.	 <p>christchurch_36_33</p>	Hip

S. No.	Image	Roof type
22.	 <p>christchurch_97_31</p>	Hip
23.	 <p>christchurch_97_143</p>	Hip
24.	 <p>chrishchurch_97_270</p>	Hip

S. No.	Image	Roof type
25.	 <p>christchurch_173_125</p>	Hip
26.	 <p>christchurch_173_253</p>	Hip
27.	 <p>christchurch_173_321</p>	Hip

S. No.	Image	Roof type
28.	 <p>christchurch_215_142</p>	Hip
29.	 <p>christchurch_215_253</p>	Hip
30.	 <p>christchurch_215_590</p>	Hip