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

CS6811 Project Work

Team 18

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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. | | | C:\Users\Admin\Desktop\airs-minisample\rooftype-dataset-mod\Flat-jpg\christchurch_196_40.jpg  christchurch\_196\_40 | Flat |
| 2. | | | C:\Users\Admin\Desktop\airs-minisample\rooftype-dataset-mod\Flat-jpg\christchurch_36_61.jpg  christchurch\_36\_61 | Flat |
| 3. | | | C:\Users\Admin\Desktop\airs-minisample\rooftype-dataset-mod\Flat-jpg\christchurch_173_42.jpg  christchurch\_173\_42 | Flat |
| **S. No.** | | | **Image** | **Roof type** |
| 4. | | C:\Users\Admin\Desktop\airs-minisample\rooftype-dataset-mod\Flat-jpg\christchurch_173_259.jpg  christchurch\_173\_259 | | Flat |
| 5. | | C:\Users\Admin\Desktop\airs-minisample\rooftype-dataset-mod\Flat-jpg\christchurch_174_12.jpg  christchurch\_173\_259 | | Flat |
| 6. | | C:\Users\Admin\Desktop\airs-minisample\rooftype-dataset-mod\Flat-jpg\christchurch_174_13.jpg  christchurch\_174\_13 | | Flat |
| **S. No.** | | **Image** | | **Roof type** |
| 7. | | C:\Users\Admin\Desktop\airs-minisample\rooftype-dataset-mod\Flat-jpg\christchurch_174_45.jpg  christchurch\_174\_45 | | Flat |
| 8. | | C:\Users\Admin\Desktop\airs-minisample\rooftype-dataset-mod\Flat-jpg\christchurch_196_20.jpg  christchurch\_196\_20 | | Flat |
| 9. | | C:\Users\Admin\Desktop\airs-minisample\rooftype-dataset-mod\Flat-jpg\christchurch_196_33.jpg  christchurch\_196\_33 | | Flat |
| **S. No.** | | **Image** | | **Roof type** |
| 10. | | C:\Users\Admin\Desktop\airs-minisample\rooftype-dataset-mod\Flat-jpg\christchurch_215_549.jpg  christchurch\_215\_549 | | Flat |
| 11. | | C:\Users\Admin\Desktop\airs-minisample\rooftype-dataset-mod\Gable-jpg\christchurch_36_31.jpg  christchurch\_36\_31 | | Gable |
| 12. | | C:\Users\Admin\Desktop\airs-minisample\rooftype-dataset-mod\Gable-jpg\christchurch_36_54.jpg  christchurch\_36\_54 | | Gable |
| **S. No.** | | **Image** | | **Roof type** |
| 13. | | C:\Users\Admin\Desktop\airs-minisample\rooftype-dataset-mod\Gable-jpg\christchurch_97_126.jpg  christchurch\_97\_126 | | Gable |
| 14. | | C:\Users\Admin\Desktop\airs-minisample\rooftype-dataset-mod\Gable-jpg\christchurch_97_161.jpg  christchurch\_97\_161 | | Gable |
| 15. | | C:\Users\Admin\Desktop\airs-minisample\rooftype-dataset-mod\Gable-jpg\christchurch_173_10.jpg  christchurch\_173\_10 | | Gable |
| **S. No.** | | **Image** | | **Roof type** |
| 16. | | C:\Users\Admin\Desktop\airs-minisample\rooftype-dataset-mod\Gable-jpg\christchurch_196_42.jpg  christchurch\_196\_42 | | Gable |
| 17. | | C:\Users\Admin\Desktop\airs-minisample\rooftype-dataset-mod\Gable-jpg\christchurch_215_21.jpg  christchurch\_215\_21 | | Gable |
| 18. | | C:\Users\Admin\Desktop\airs-minisample\rooftype-dataset-mod\Gable-jpg\christchurch_215_227.jpg  christchurch\_215\_227 | | Gable |
| **S. No.** | | **Image** | | **Roof type** |
| 19. | | C:\Users\Admin\Desktop\airs-minisample\rooftype-dataset-mod\Gable-jpg\christchurch_215_274.jpg  christchurch\_215\_274 | | Gable |
| 20. | | C:\Users\Admin\Desktop\airs-minisample\rooftype-dataset-mod\Gable-jpg\christchurch_215_440.jpg  christchurch\_215\_440 | | Gable |
| 21. | C:\Users\Admin\Desktop\airs-minisample\rooftype-dataset-mod\Hip-jpg\christchurch_36_33.jpg  christchurch\_36\_33 | | | Hip |
| **S. No.** | **Image** | | | **Roof type** |
| 22. | C:\Users\Admin\Desktop\airs-minisample\rooftype-dataset-mod\Hip-jpg\christchurch_97_31.jpg  christchurch\_97\_31 | | | Hip |
| 23. | C:\Users\Admin\Desktop\airs-minisample\rooftype-dataset-mod\Hip-jpg\christchurch_97_143.jpg  christchurch\_97\_143 | | | Hip |
| 24. | C:\Users\Admin\Desktop\airs-minisample\rooftype-dataset-mod\Hip-jpg\christchurch_97_270.jpg  chrischurch\_97\_270 | | | Hip |
| **S. No.** | **Image** | | | **Roof type** |
| 25. | C:\Users\Admin\Desktop\airs-minisample\rooftype-dataset-mod\Hip-jpg\christchurch_173_125.jpg  christchurch\_173\_125 | | | Hip |
| 26. | C:\Users\Admin\Desktop\airs-minisample\rooftype-dataset-mod\Hip-jpg\christchurch_173_253.jpg  christchurch\_173\_253 | | | Hip |
| 27. | C:\Users\Admin\Desktop\airs-minisample\rooftype-dataset-mod\Hip-jpg\christchurch_173_321.jpg  christchurch\_173\_321 | | | Hip |
| **S. No.** | **Image** | | | **Roof type** |
| 28. | C:\Users\Admin\Desktop\airs-minisample\rooftype-dataset-mod\Hip-jpg\christchurch_215_142.jpg  christchurch\_215\_142 | | | Hip |
| 29. | C:\Users\Admin\Desktop\airs-minisample\rooftype-dataset-mod\Hip-jpg\christchurch_215_253.jpg  christchurch\_215\_253 | | | Hip |
| 30. | C:\Users\Admin\Desktop\airs-minisample\rooftype-dataset-mod\Hip-jpg\christchurch_215_590.jpg  christchurch\_215\_590 | | | Hip |