Solar Panel Detection in Satellite Images: A **Pixel-Wise** Approach

"Hot" Models To Detect Solar Panels

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Motivation

- Detect and determine the solar density within the Tshwane Municipality area
- Develop machine learning models
- Important as it is an indication of the adoption of renewable energy in South Africa
- Large satellite image dataset available
- Develop a working framework that can be upscaled in the future and further research

Modelling

- Developed shapefile to annotate satellite images for training / testing dataset
- Extracted RGB values and pixel class – stored as data frame for training / testing
- Three models employed – Random Forest (RF), Neural Network (NN) and Support Vector Machine (SVM)
- Models trained – trained model files stored for future predictions
- Predict satellite images using the three models. Output solar density and predicted image

Results & Conclusion

- Successfully implemented models that detect solar density
- Training and prediction time proportionate to number of pixels
- RF run time ~ x
- NN run time ~ 94 x
- SVM run time ~ 3.5 x
- Performs well on a dissimilar pixel value to solar panels pixel value
- *Conclusion:* RF most satisfactory detection (best accuracy, fastest run time)
- *Limitations:* Overfitting evident due to pixel value overlapping. Exhaustive Computing Power

Metrics	Accuracy (%)	Specificity (%)	Sensitivity (%)
Random Forest	94.3	94.6	94.1
Neural Network	93.4	94.3	92.5
Support Vector Machine	91.3	92.4	90.1

Table 1: Model accuracy metrics and veridicality

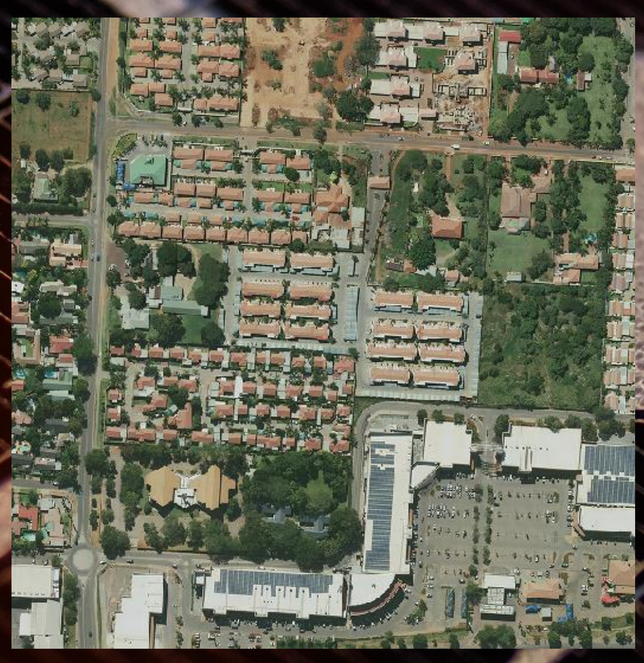

Figure 1: The original Satellite image of an area

Figure 2: Pixel prediction overlaid on the original image

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