



Creating urban forest canopy time series

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Current Urban Monitor Dates

- 2009, 2014, 2016,
- What can we do with the time-series data?
- This talk will present 2 concepts on how the time series can be used
 - Concept #1: Is the change in canopy cover estimates between 2 dates for each lot significant, especially where the changes are small?
 - Concept #2 : Reducing variance in estimates using full time series data

Concept #1

Is the change significant?

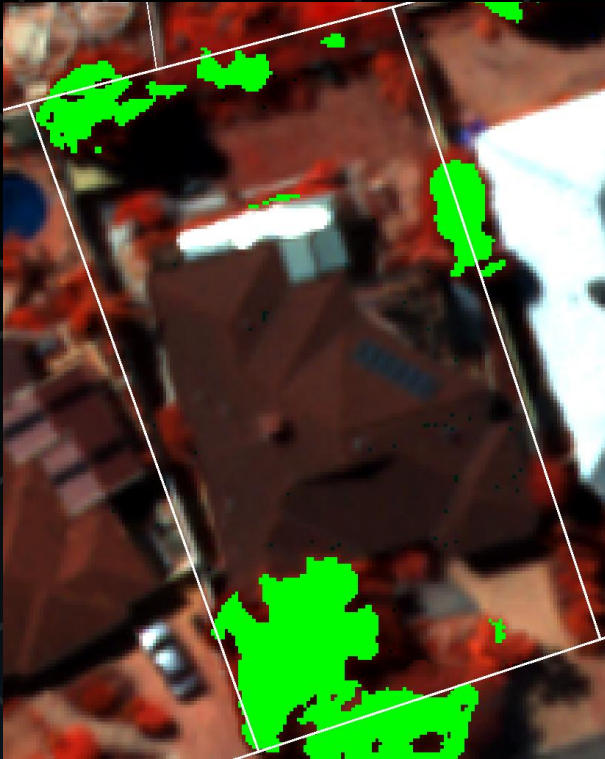
- Focus on changes in estimates that are small
- Factors contributing to change include:
 - climate (wet summer, dry summer)
 - photography (noise)

Concept #1

Idea: compute upper and lower bound of each estimate – 95% confidence interval

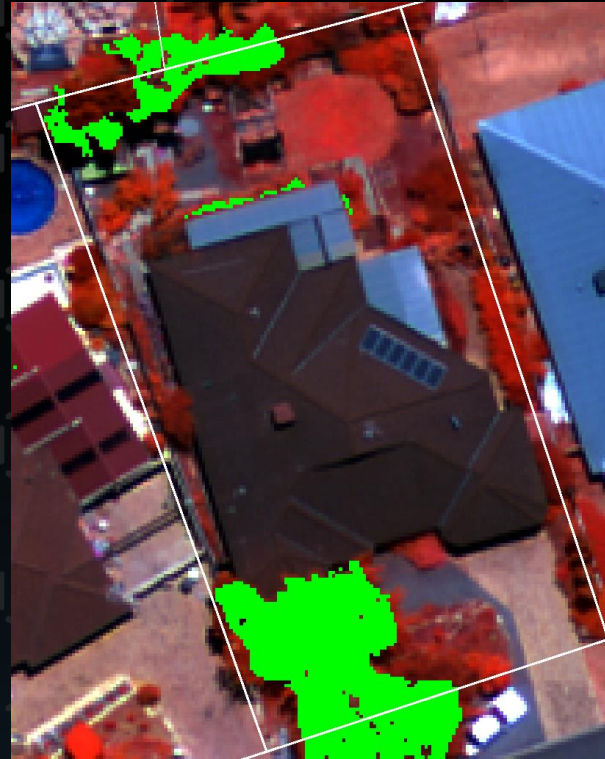
- A **95% confidence interval** is a range of values that you can be **95%** certain contains the true value.
- With large samples, you know the true value with much more precision than you **do** with a small sample, so the **confidence interval** is quite narrow when computed from a large sample.
- A narrow **confidence interval** implies that there is a smaller chance of obtaining an observation within that **interval**, therefore, our accuracy is higher.

Example: 3m – 8m canopy cover

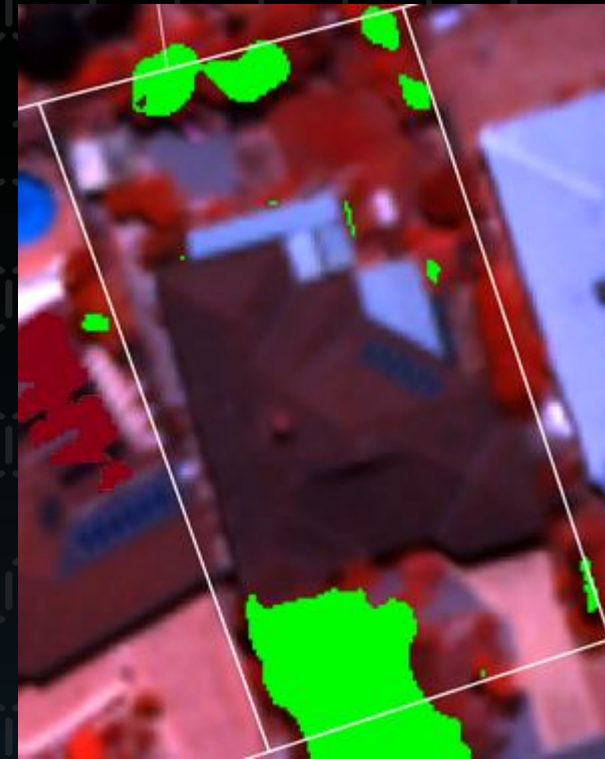


2009 – 11.65%

Area of lot: 848.76 m²

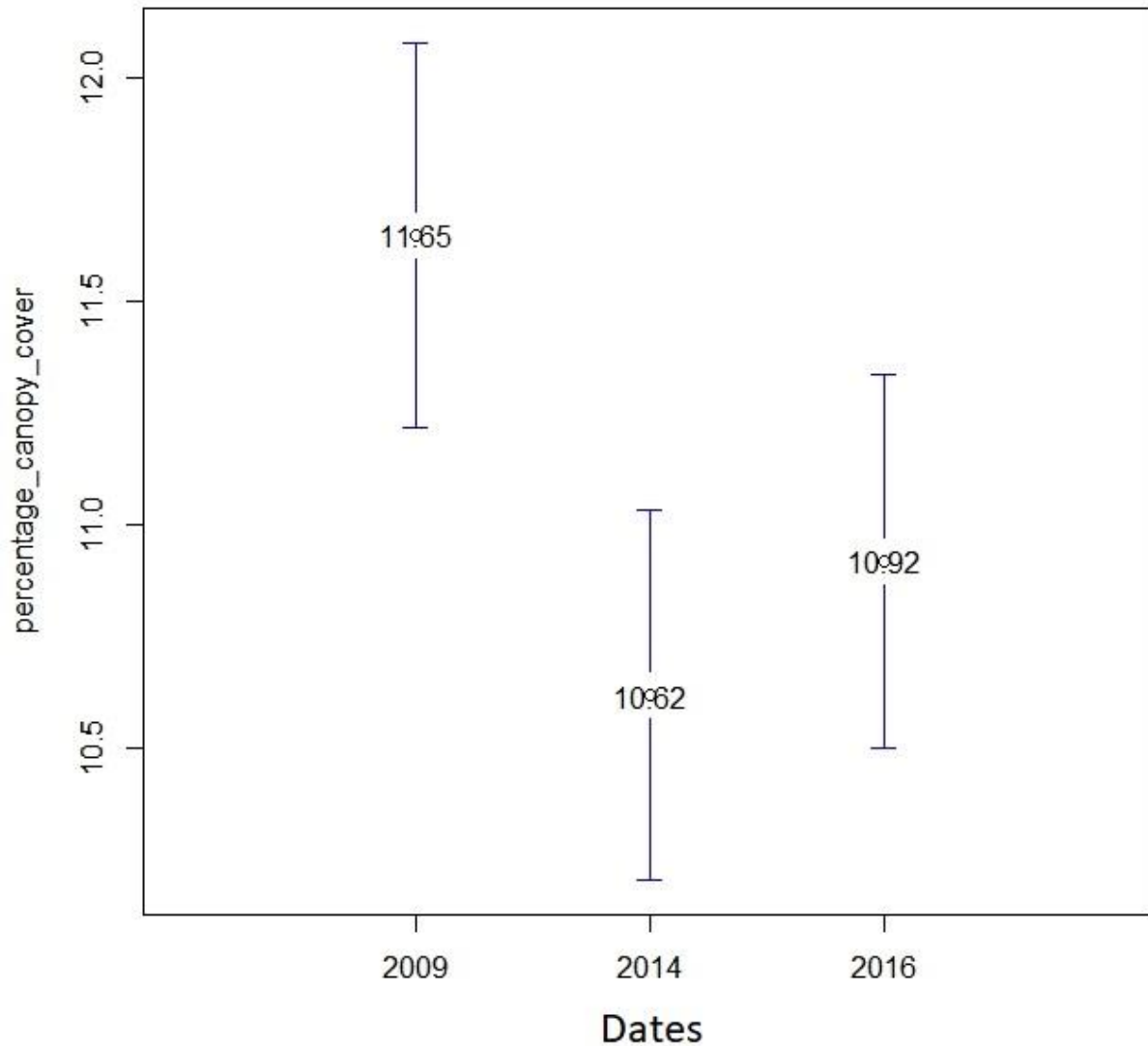


2014 – 10.62%



2016 – 10.92%

Plot of 95% confidence interval



- 2009 - 95% CI (11.22%, 12.08%)
- 2014 - 95% CI (10.20%, 11.03%)
- 2016 - 95% CI (10.50%, 11.34%)
- To determine if the change between 2014 and 2016 is significant, we can calculate the 95% CI of the difference in canopy estimates between the 2 dates.
- The resulting CI is (-0.289, 0.890) which means the change is not statistically significantly different.
- For change between 2009 and 2014, the 95% CI difference is (0.128, 1.33) which implies the change is significantly different.

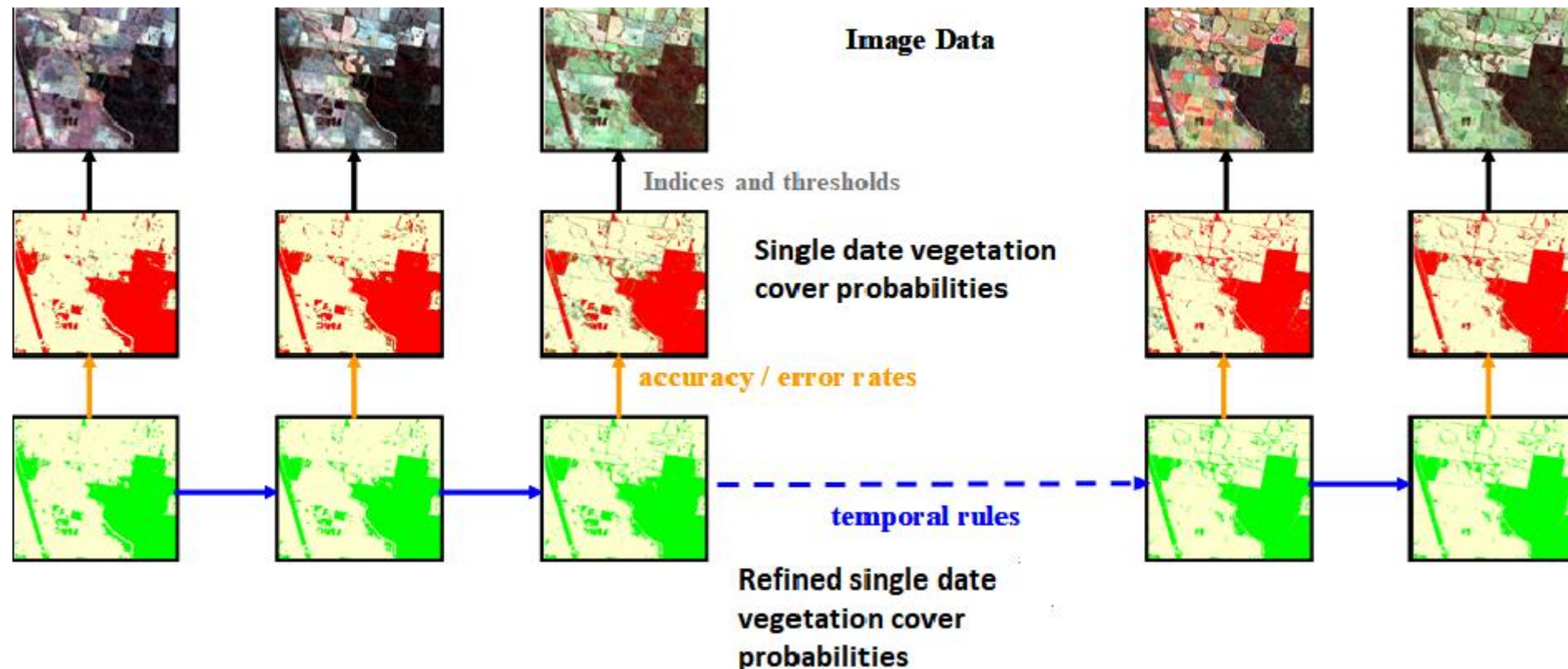
Going forward

- In future, the spreadsheets containing the statistics will have an extra feature (an extra column) to indicate if the change between the 2 dates is significant

Concept #2

Time Series -- reducing variance of estimates by using full time series

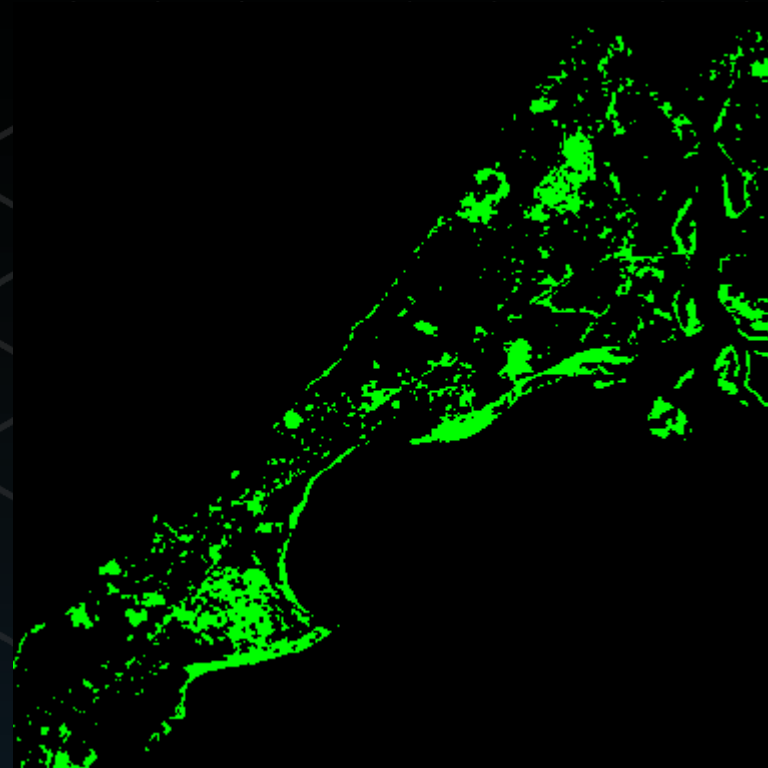
- Conditional probability models are used to combine probabilities from a number of years to give an overall assessment of the likelihood of land cover change.



An Example Using Landsat Data



2016 Landsat image – true colour display (Mandurah to Dawsville inlet)

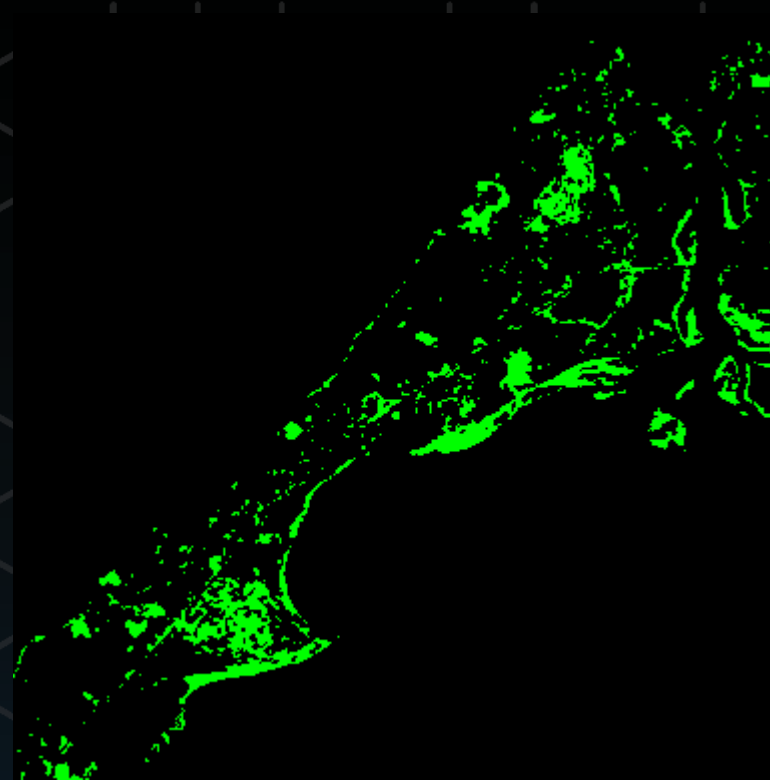


2016 Vegetation classification

An Example Using Landsat Data

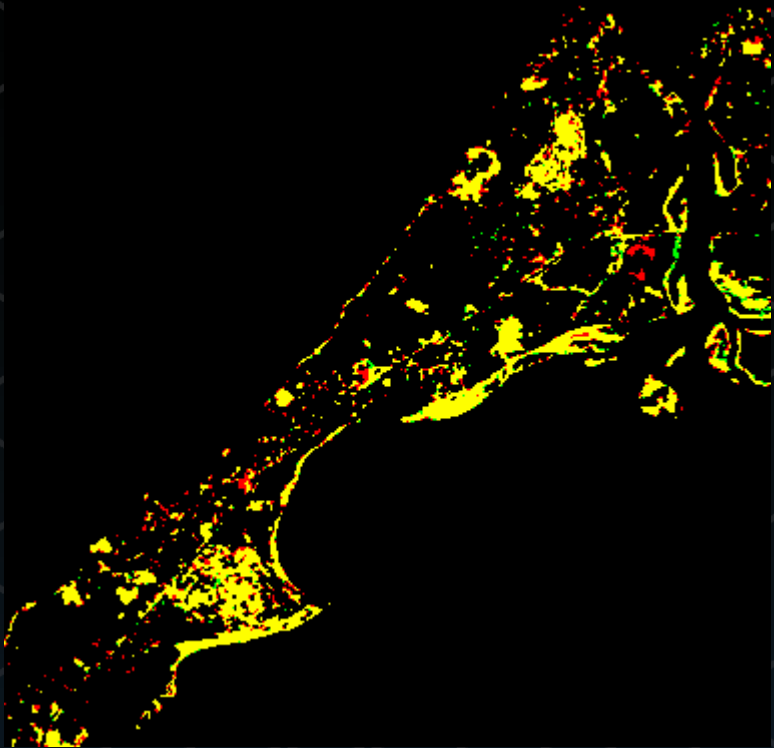


2017 Landsat image – true colour display (Mandurah to Dawsville inlet)

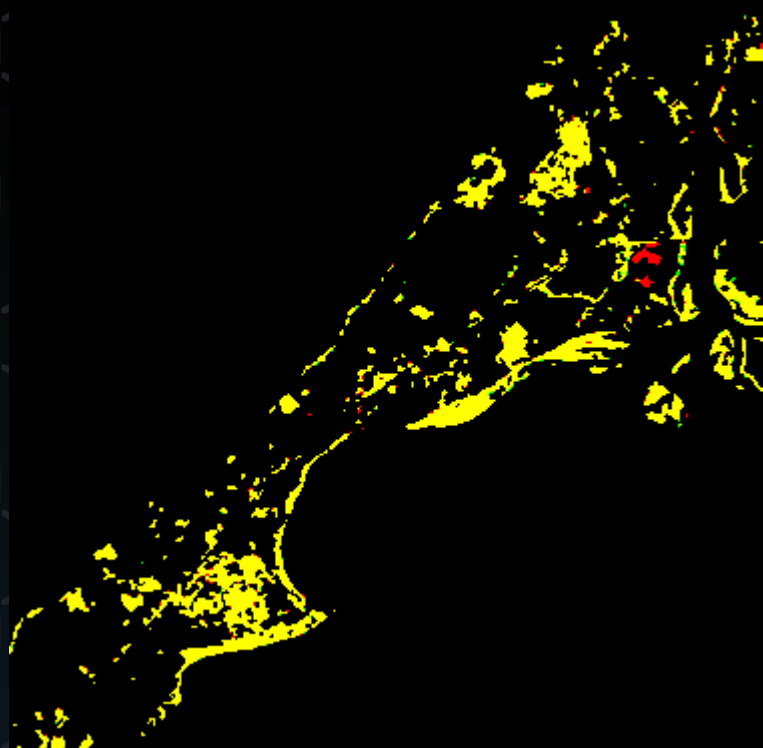


2017 vegetation classification

An Example Using Landsat Data -- Results



Comparison of single-date classification – 2016 in red, 2017 in green



Comparison of CPN outputs – 2016 in red, 2017 in green

How does it work for Urban Monitor?

- Our team has used the conditional probability modelling method using Landsat full time series data for long standing successful project such as the Land Monitor.
- The same method can be applied to Urban Monitor data.
 - requires regular time dates in the time series, for example, every year
- If we have full time series, the conditional probability modelling has potential to reduce the noise in the data and thereby reduce the variability in the estimates



THANK YOU

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