

A horizontal banner with a blue background. On the left, there is a stylized graphic of a globe with white arrows pointing in different directions. On the right, the text 'GeoChange 2010' is written in a bold, yellow font.

GeoChange 2010

Research Symposium GIScience for Environmental Change

Campos do Jordão, SP-Brazil

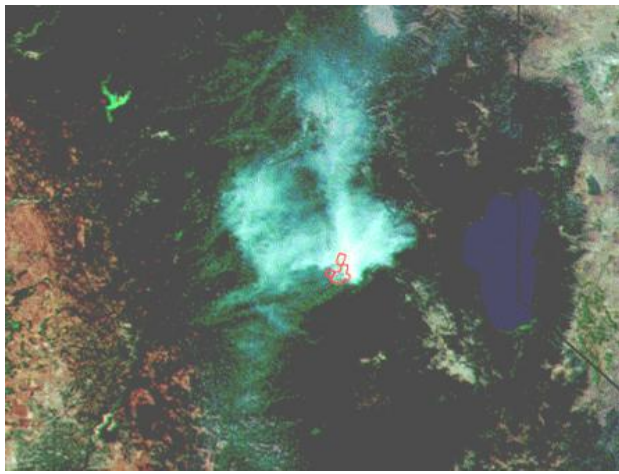
November 27, 2010

Decision Trees to Detect Changes in Remote Sensing Image Time Series

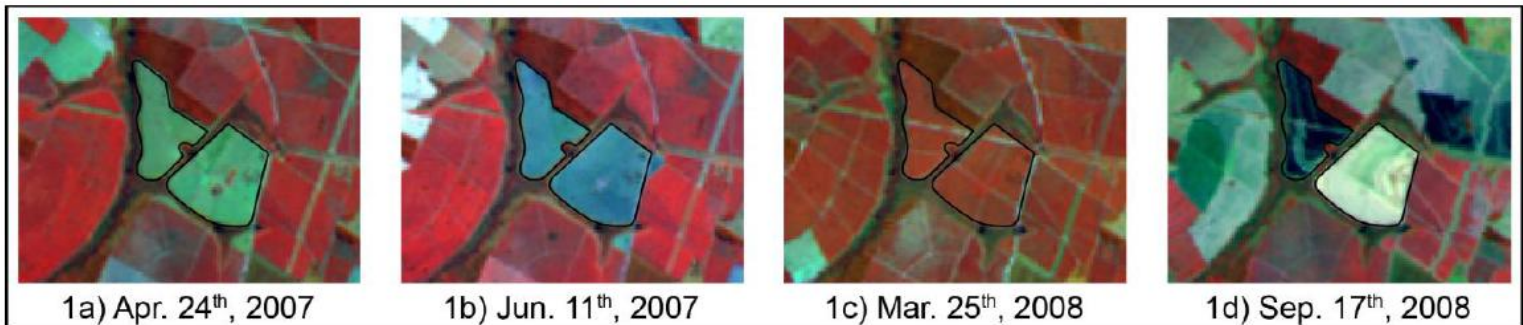
Thales Korting

Leila Fonseca

Gilberto Câmara



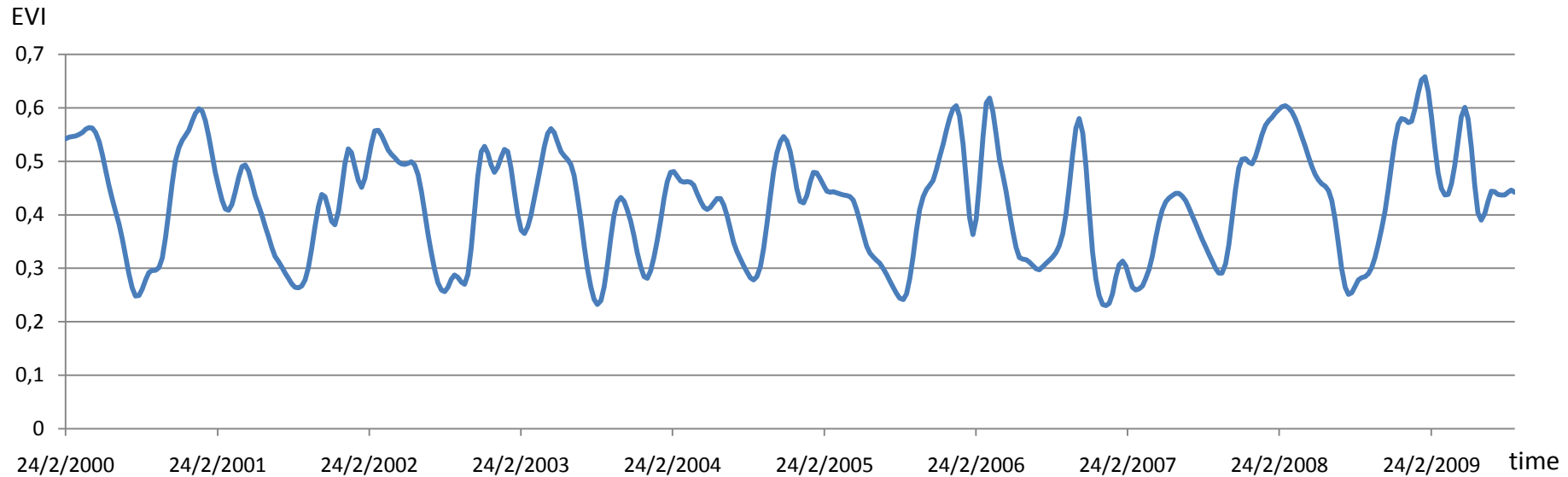
Satellite observations
offer new opportunities
for understanding how
the Earth is changing.



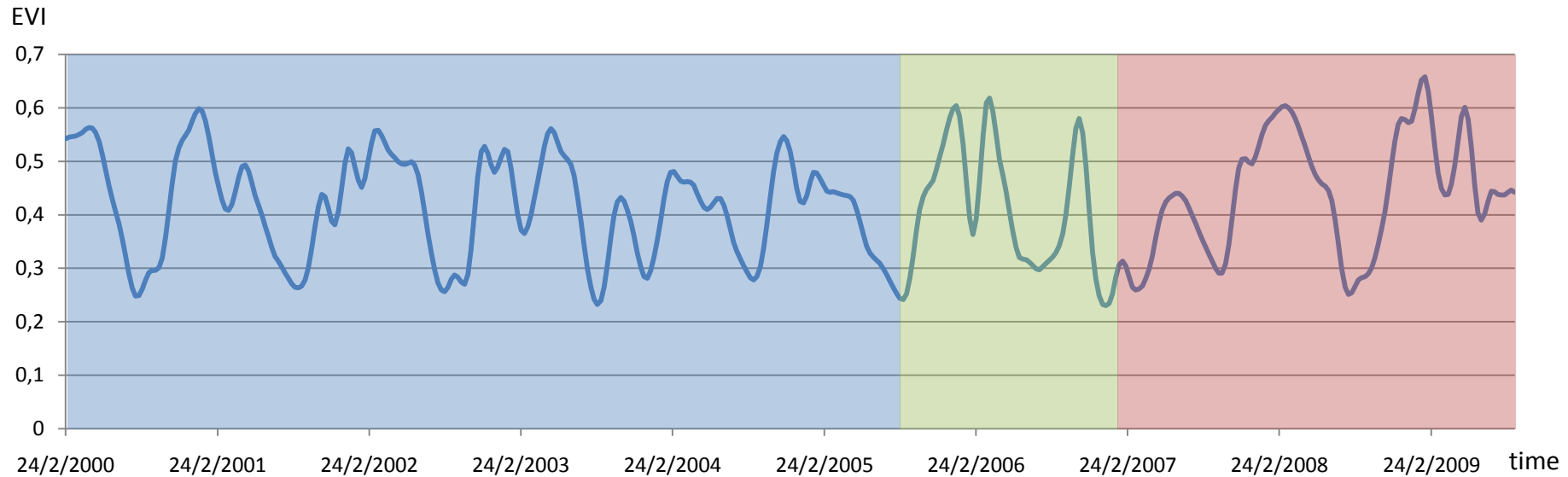


How the objects gain or lose their identity? How their properties change? What changes happen simultaneously?

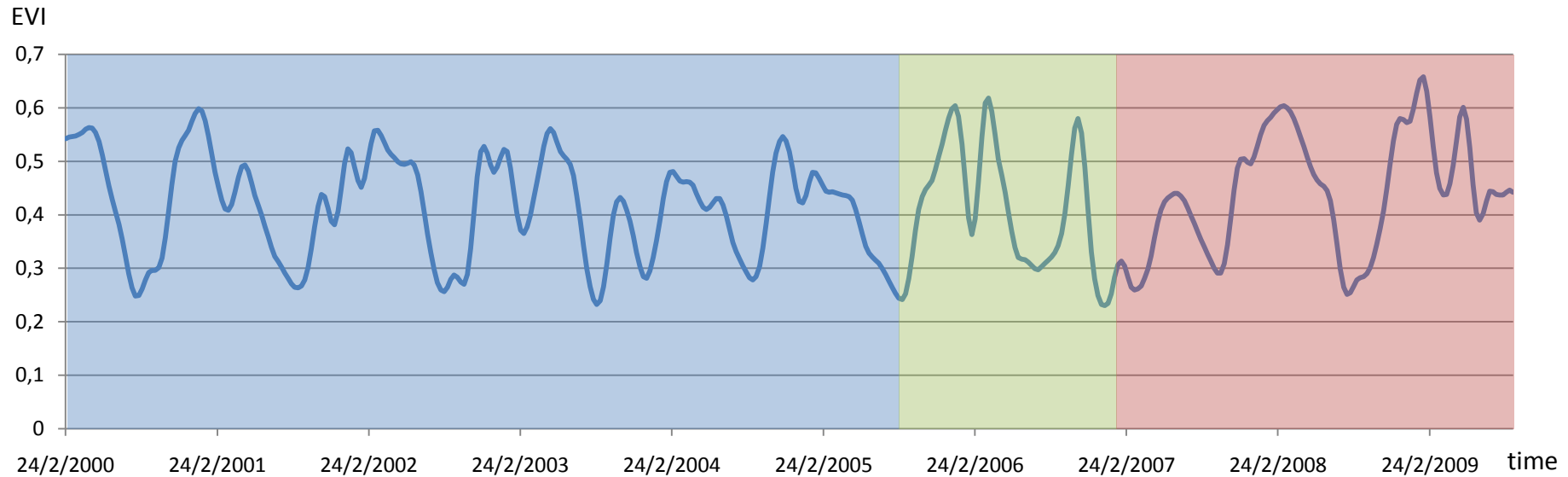
The variation of features from the images defines *trajectories*.



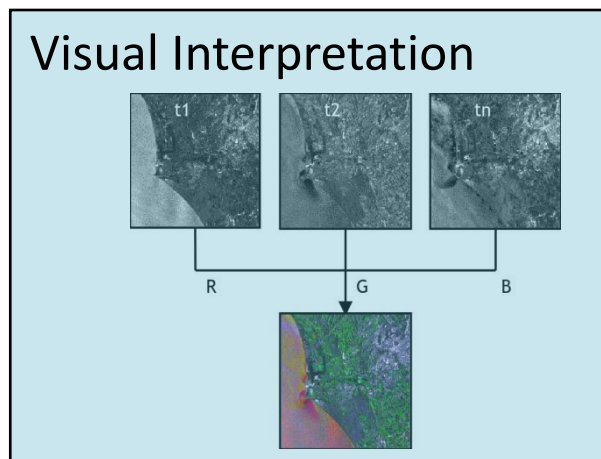
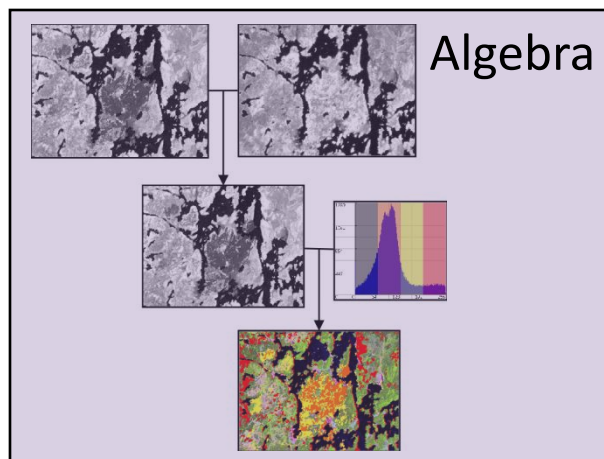
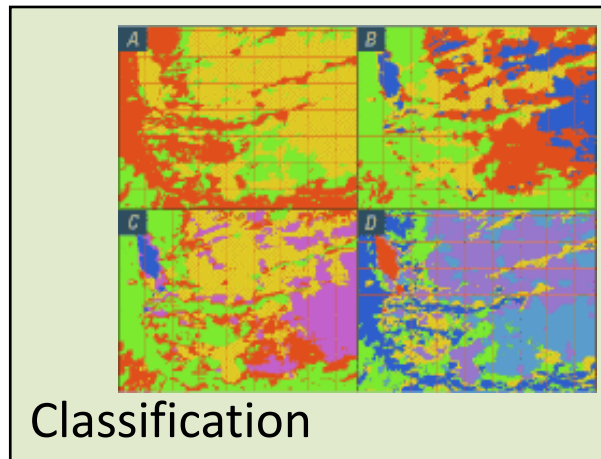
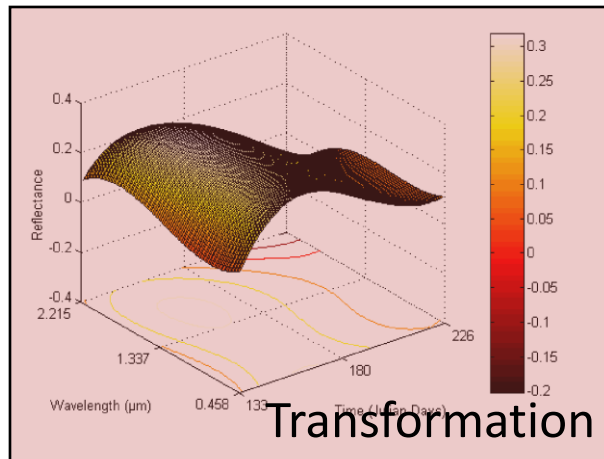
Trajectory portions that represent changes define *change signatures*.



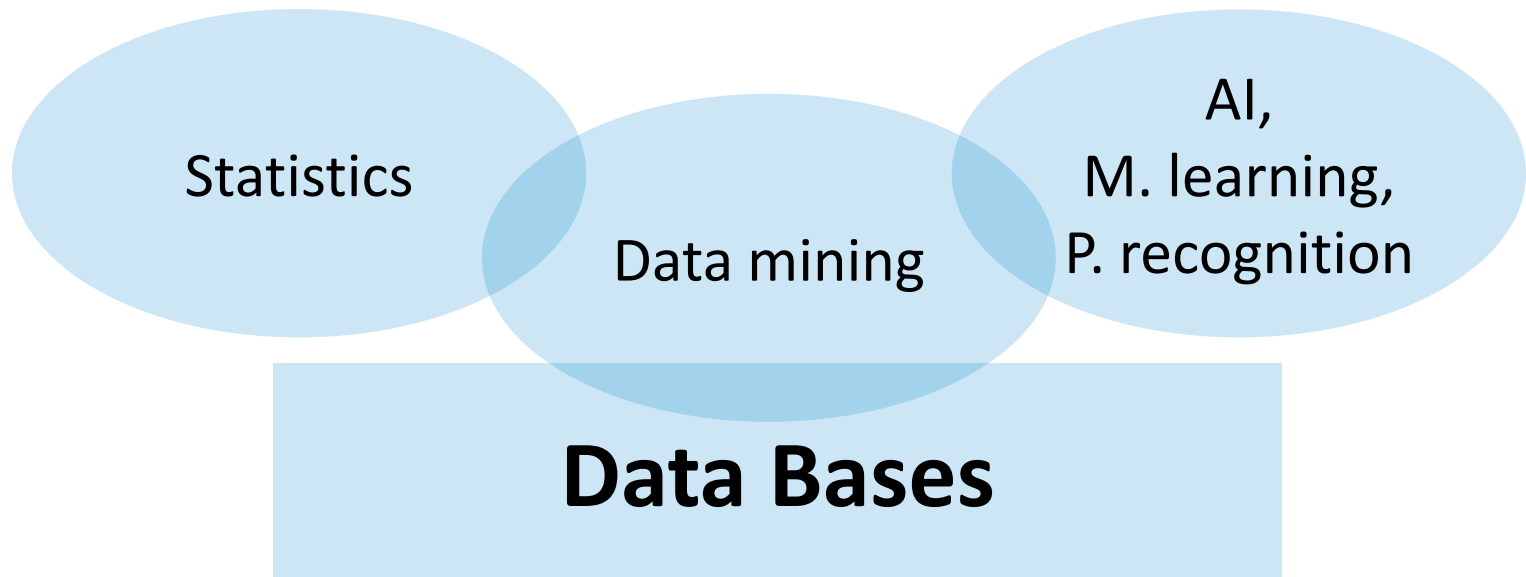
Recovering change signatures is useful to understand the land evolution.



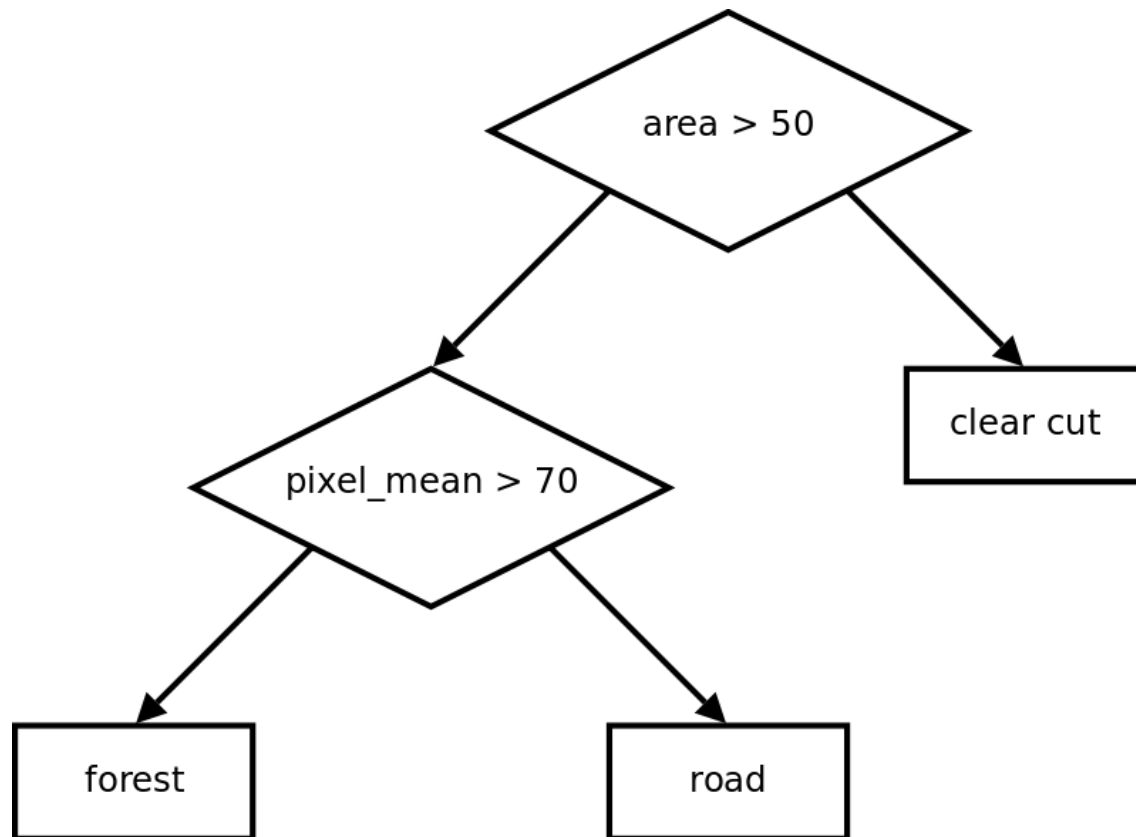
How to detect changes from remote sensing images automatically?



Data mining analyzes data to discover implicit but potentially useful information.



A decision tree is a set of conditions applied to intervals of features values.



Decision trees are independent on data standards, thus more flexible for classification.

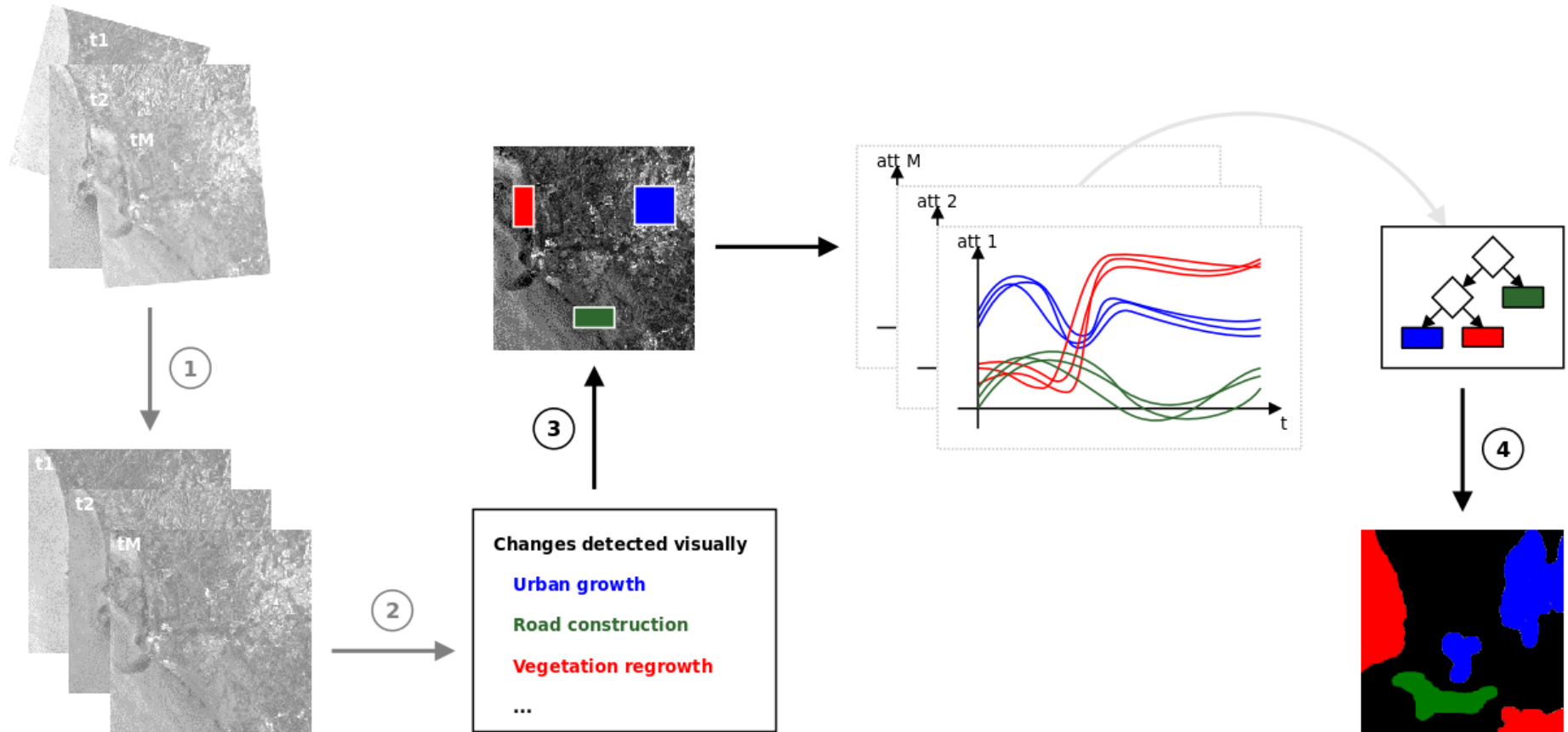
$$H(p_1, p_2, \dots, p_N) = -p_1 \log p_1 - p_2 \log p_2 \cdots - p_N \log p_N$$

$$\text{info}([v_1, v_2, \dots, v_N]) = H\left(\frac{v_1}{D}, \frac{v_2}{D}, \dots, \frac{v_N}{D}\right)$$

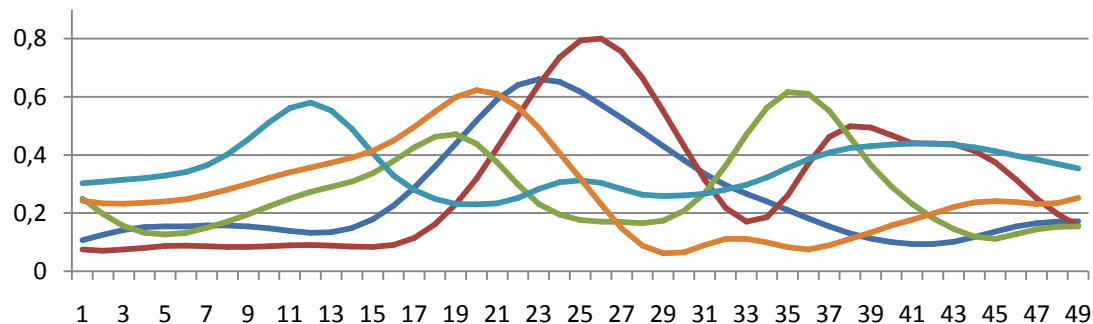
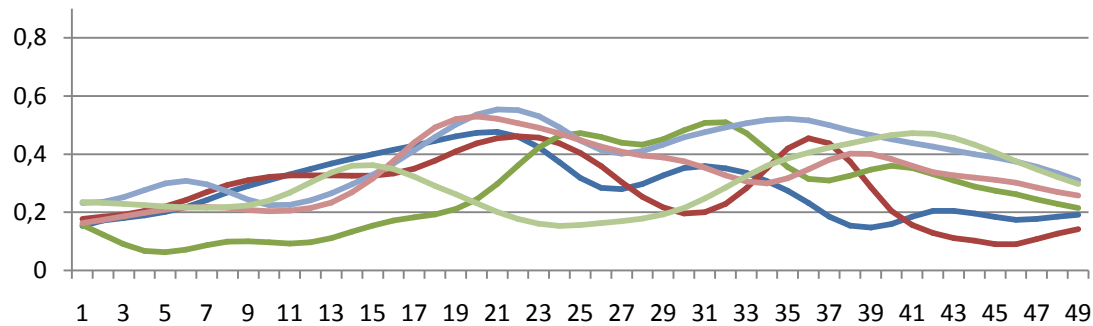
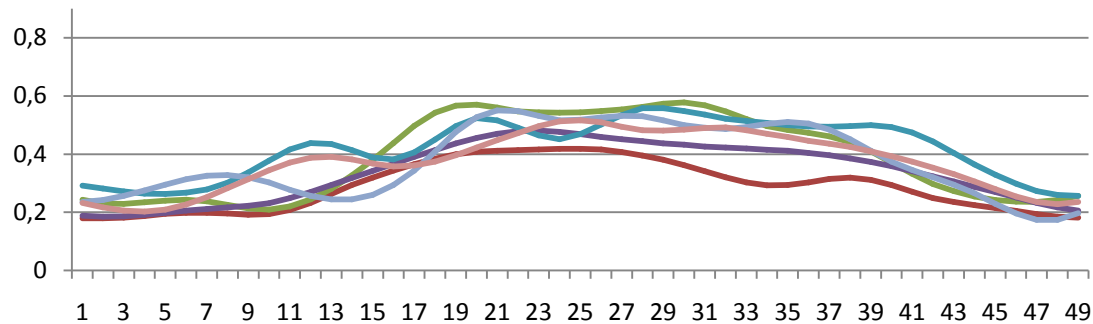
$$D = \sum_{i=1}^N v_i$$

gain: advantage of using one attribute in despite to another
info for all classes minus *info* per branch

Classifying change signatures



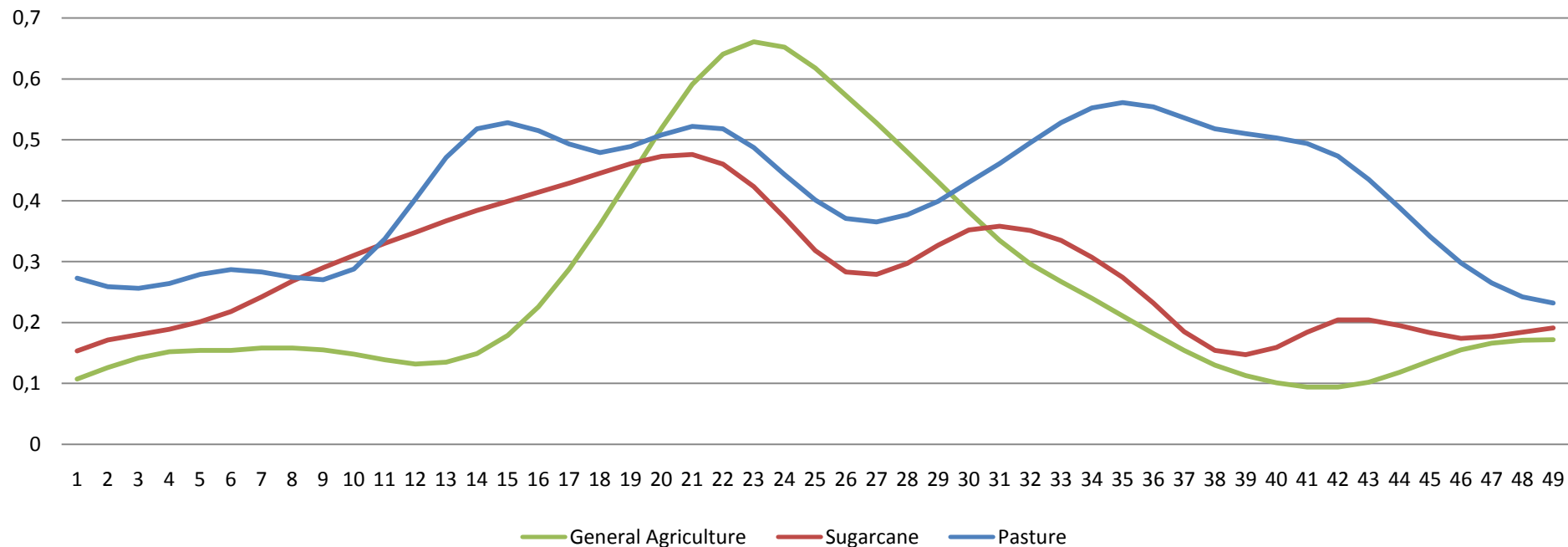
What features are good descriptors of change?



Decision trees can classify change signatures in remote sensing imagery.

```
amp_serie <= 0.461
| avg_1d <= 0.001188
| | min_1d <= -0.083: sugarcane
| | min_1d > -0.083: pasture
| avg_1d > 0.001188: sugarcane
amp_serie > 0.461: general agriculture
```

amp_serie = data amplitude
avg_1d = first derivative average value
min_1d = first derivative minimum value



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