Automated Texture Classification and Landform Taxonomy for Populating a GIS

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NATURAL ENVIRONMENT RESEARCH COUNCIL

Todays talk

- An introduction to my PhD project
- Preceding work by Gibbens, M (2008)
- Limitations of this work
- How one might go about improving it
- What's been done so far – past six months
- Future work – next two and a half years
- Questions

Introduction

- Increasing amounts of data to analyse
- Lots of work on feature extraction
- Less work on textural extraction

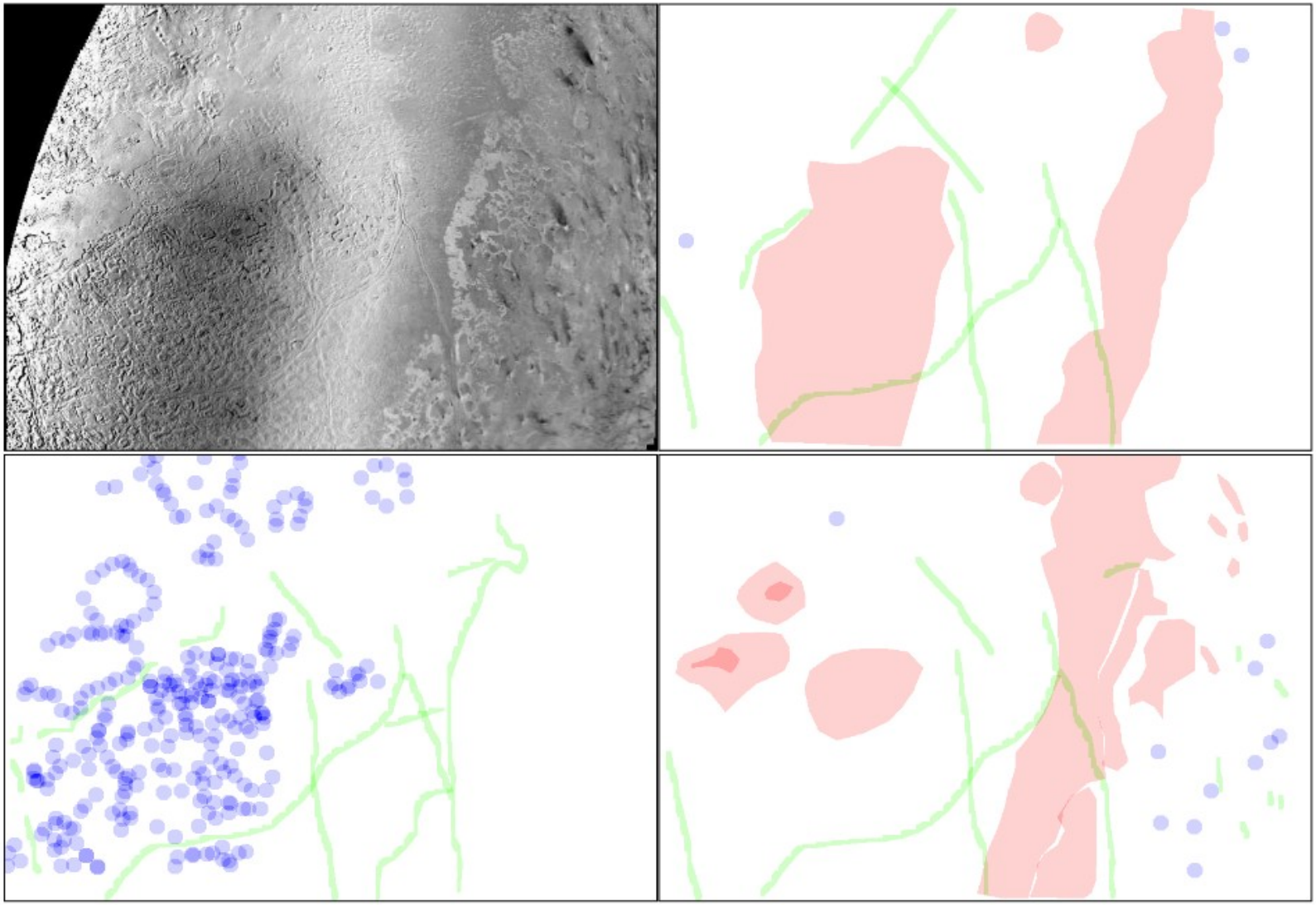
Taxonomies for Image Set Analysis Gibbens, M (2008)

- Image Segmentation
- Image Region modelling
  - Description
- Taxonomy construction
- Case Study: Clementine Lunar spacecraft data

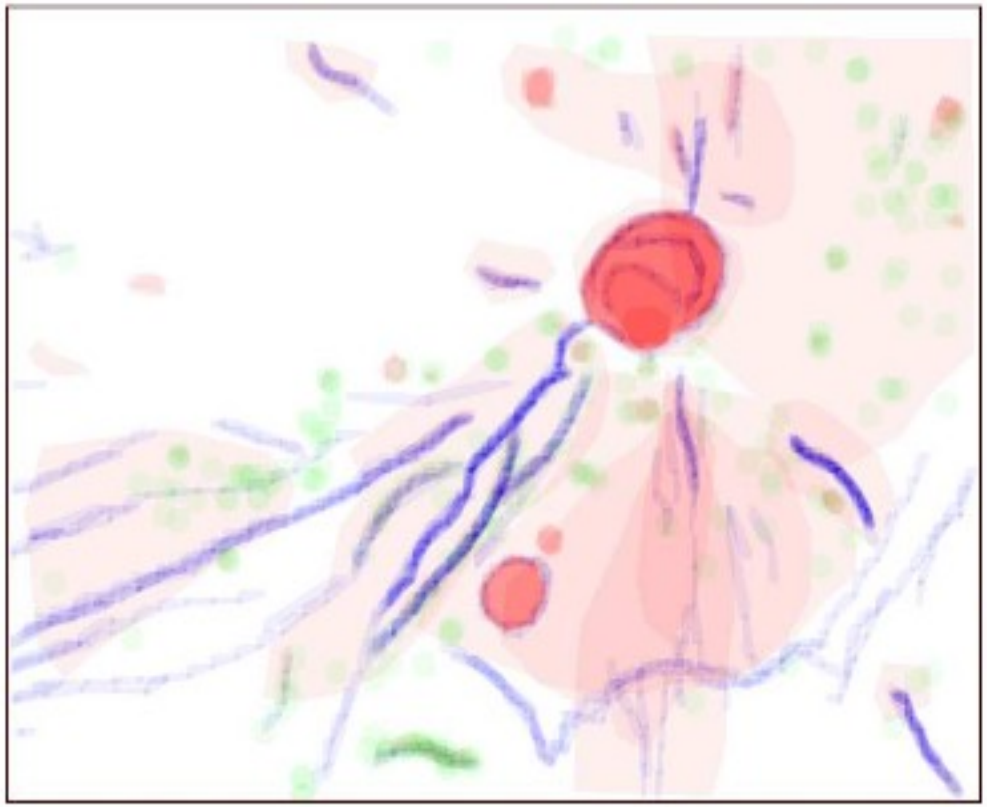
Image segmentation

- Consensus Regions
- Blob detection followed by watershed

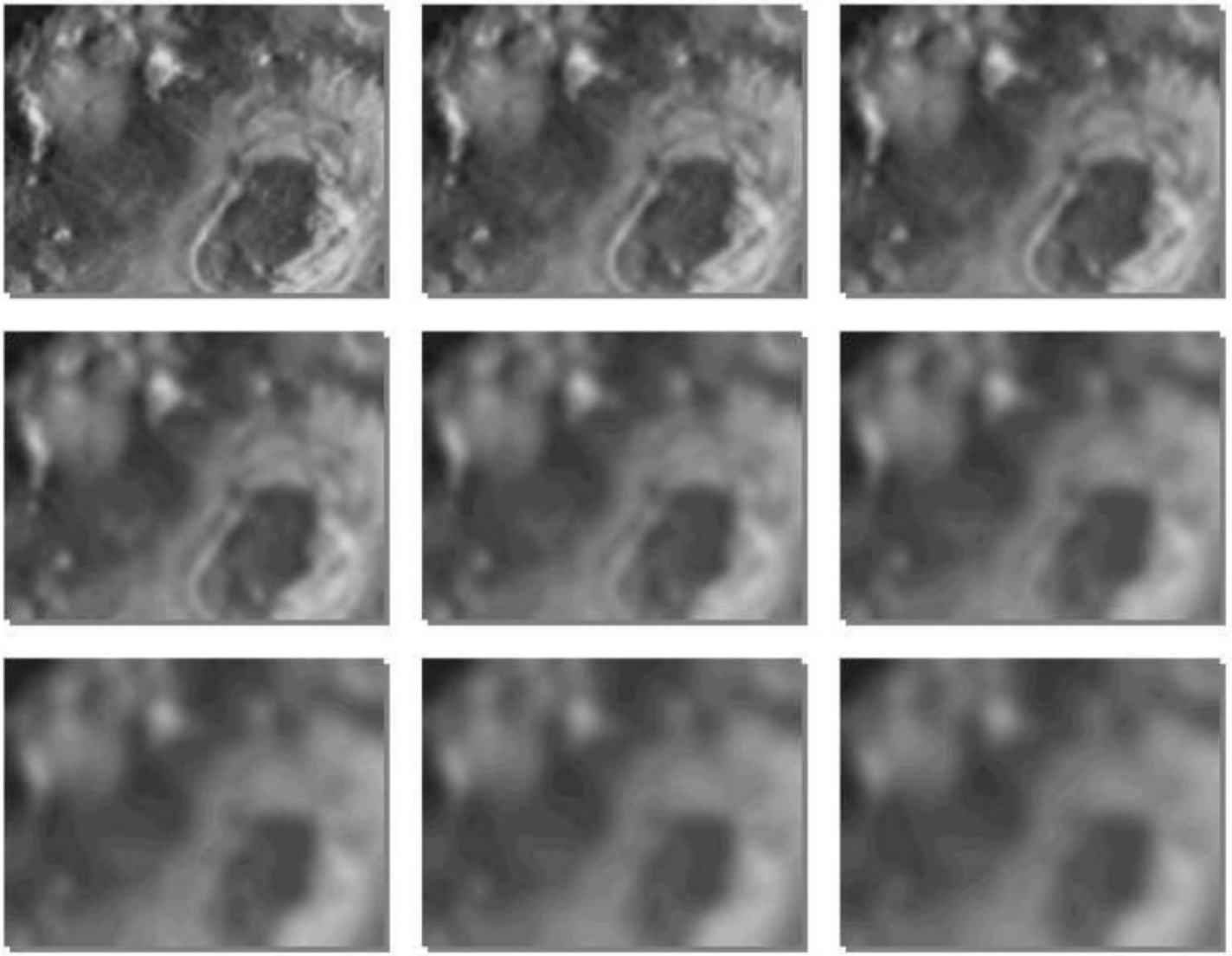
Consensus Regions



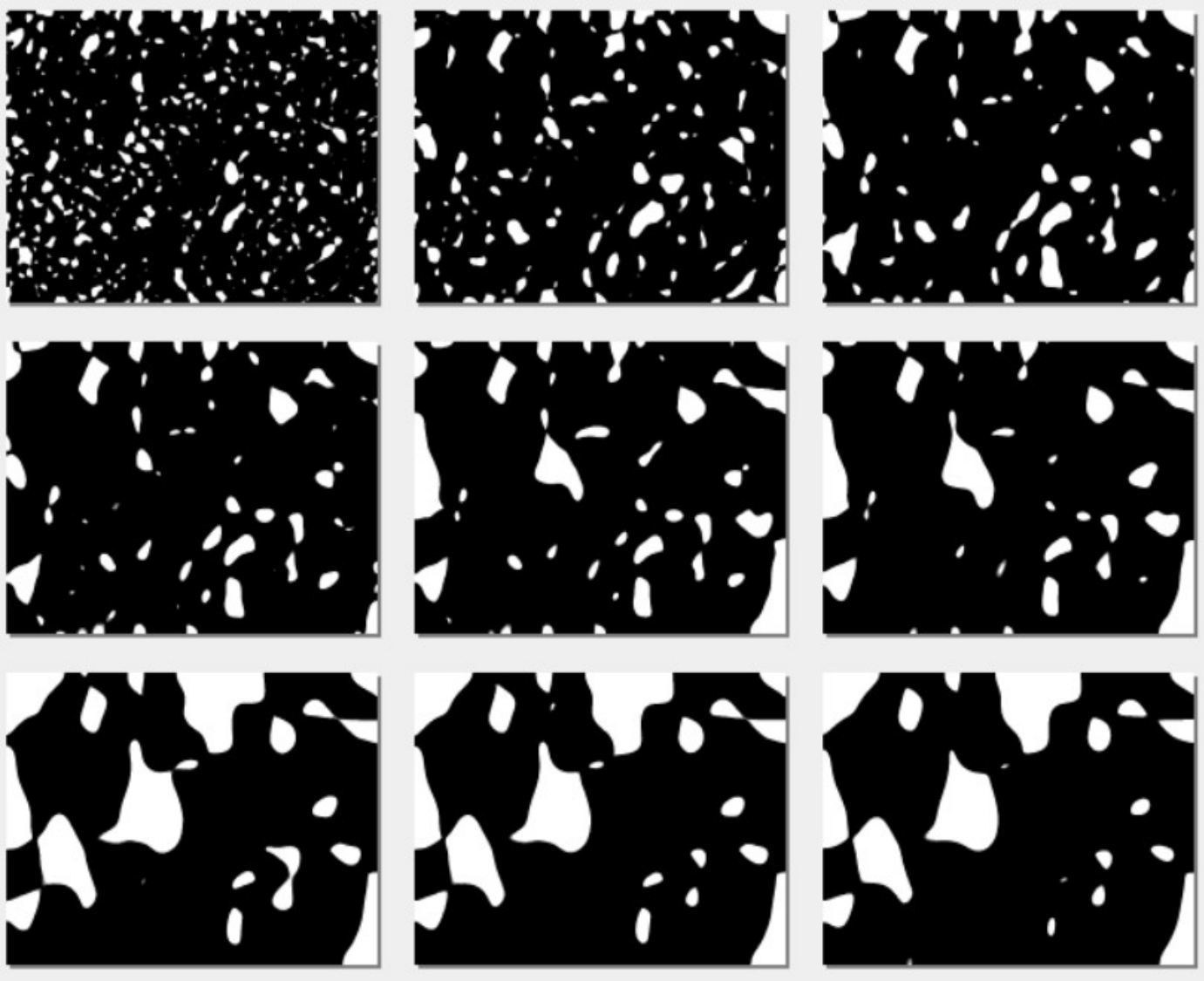
Consensus Regions



Blob Detection (1)



Blob Detection (2)



Blob Detection (3)

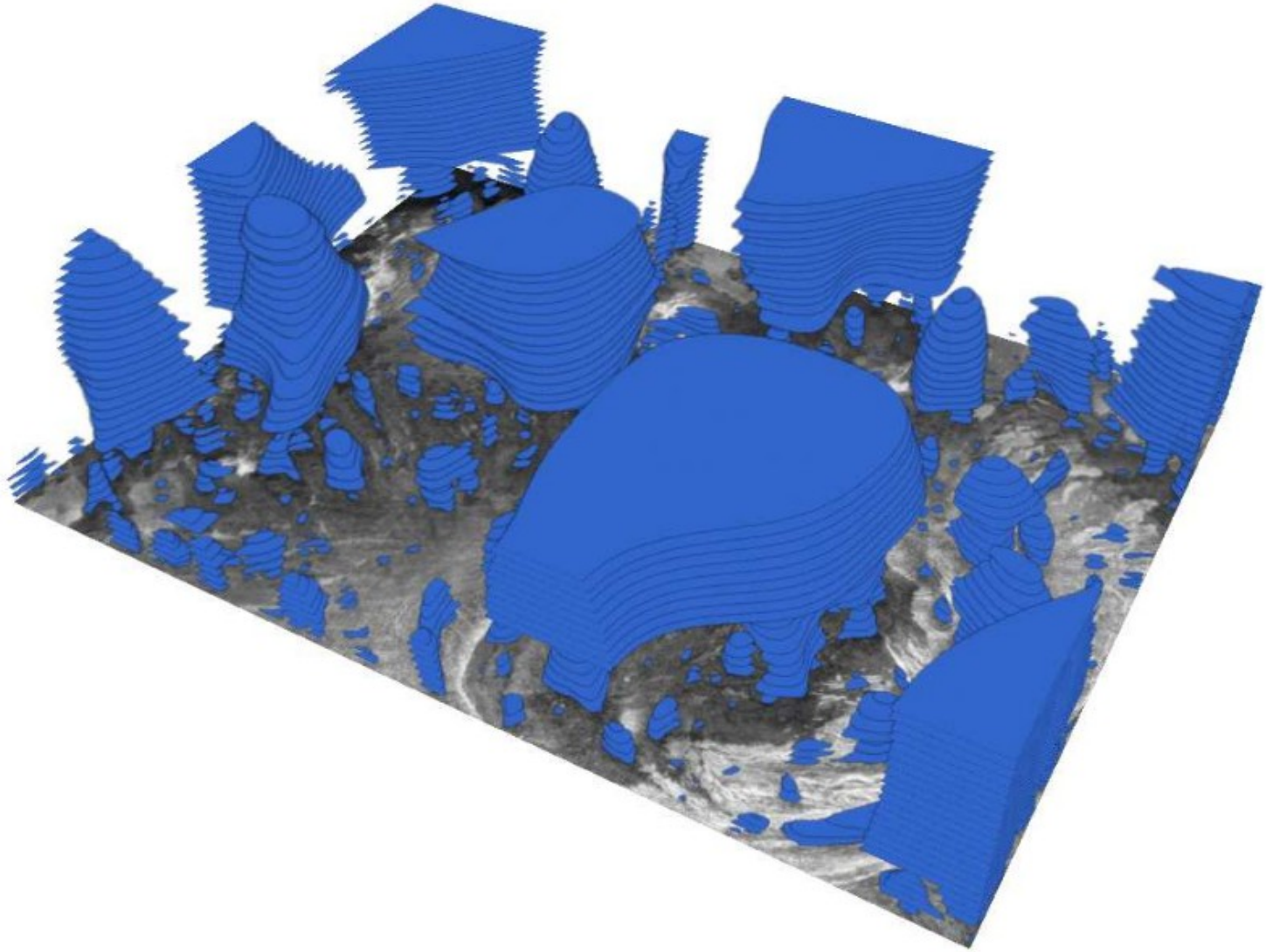
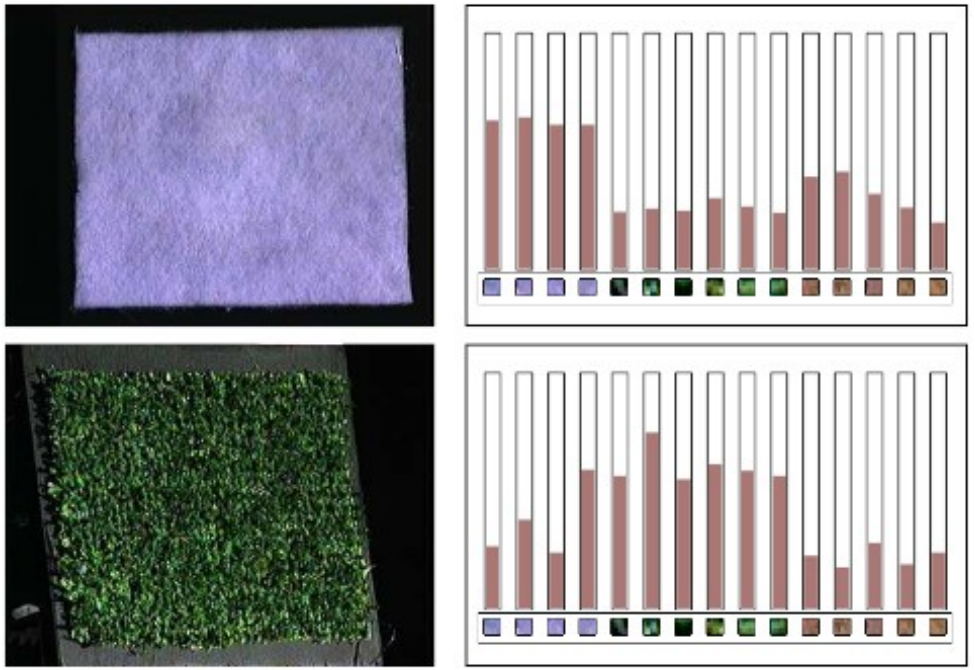
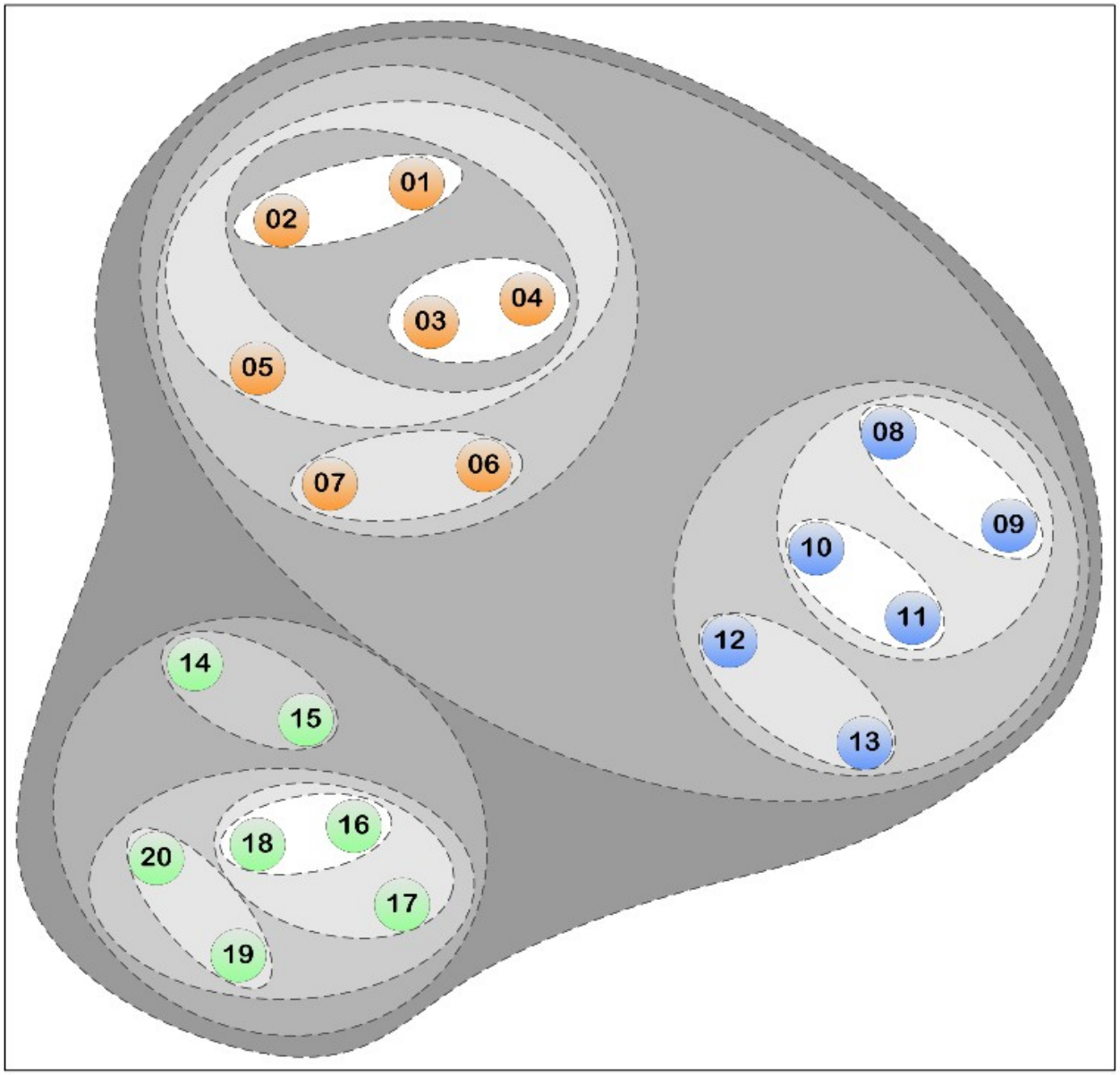


Image Region modelling

- Textural Analysis
  - Texton
  - LM vs. VZ
  - Dictionary construction

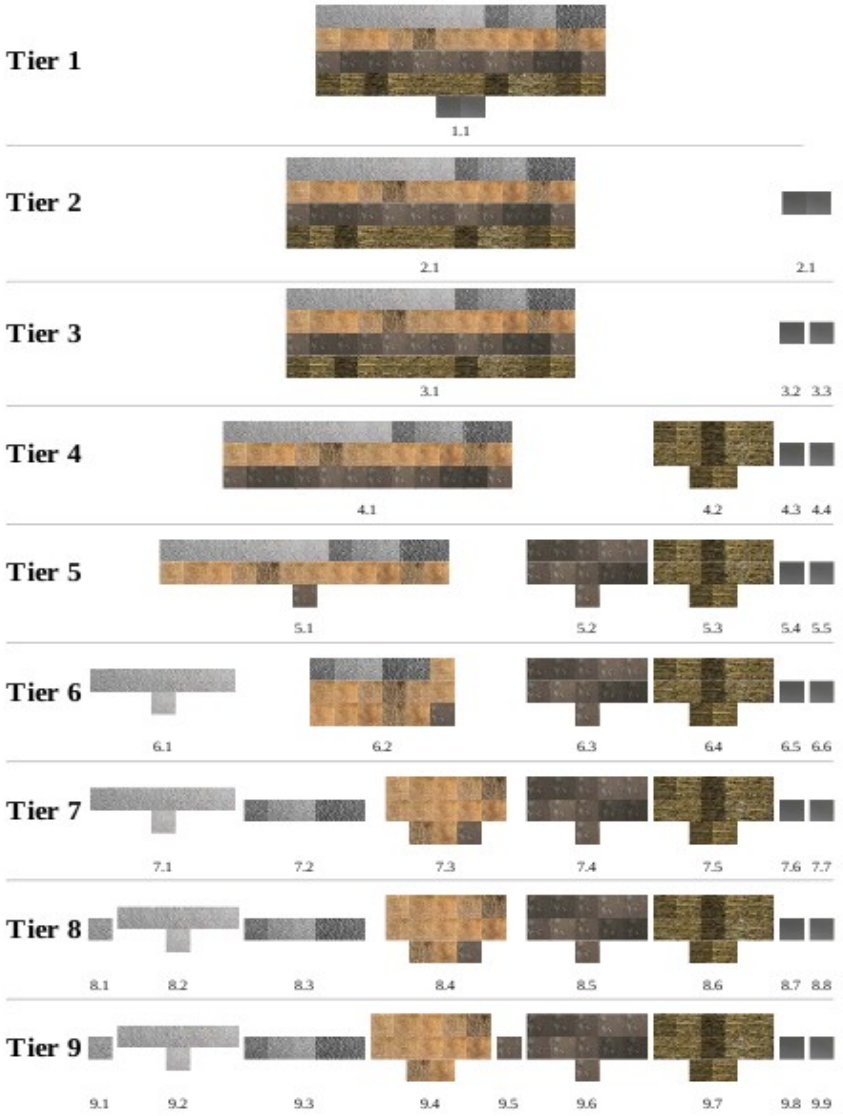


Taxonomy - Agglomerative Clustering

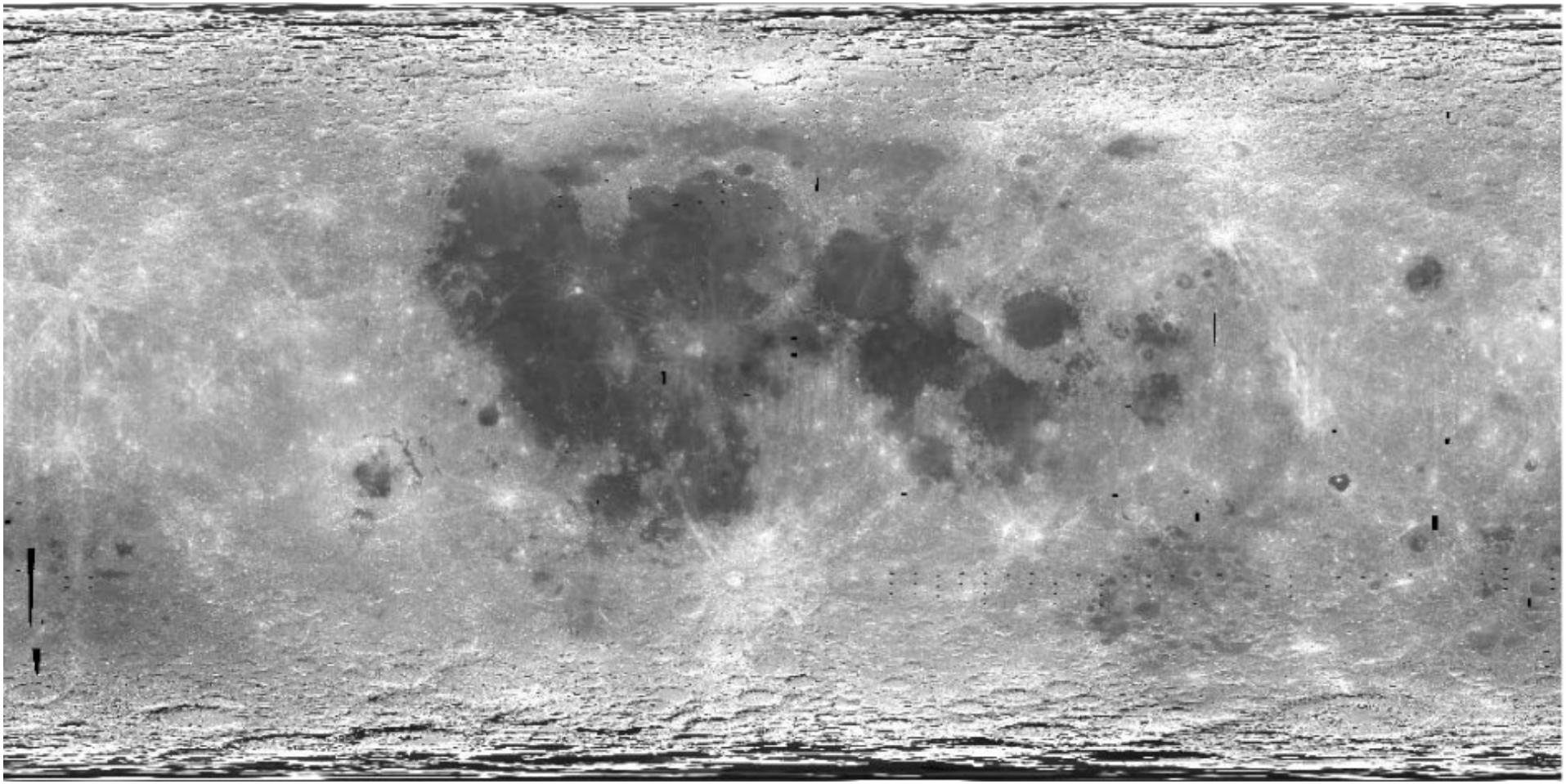


Taxonomy – PR measure

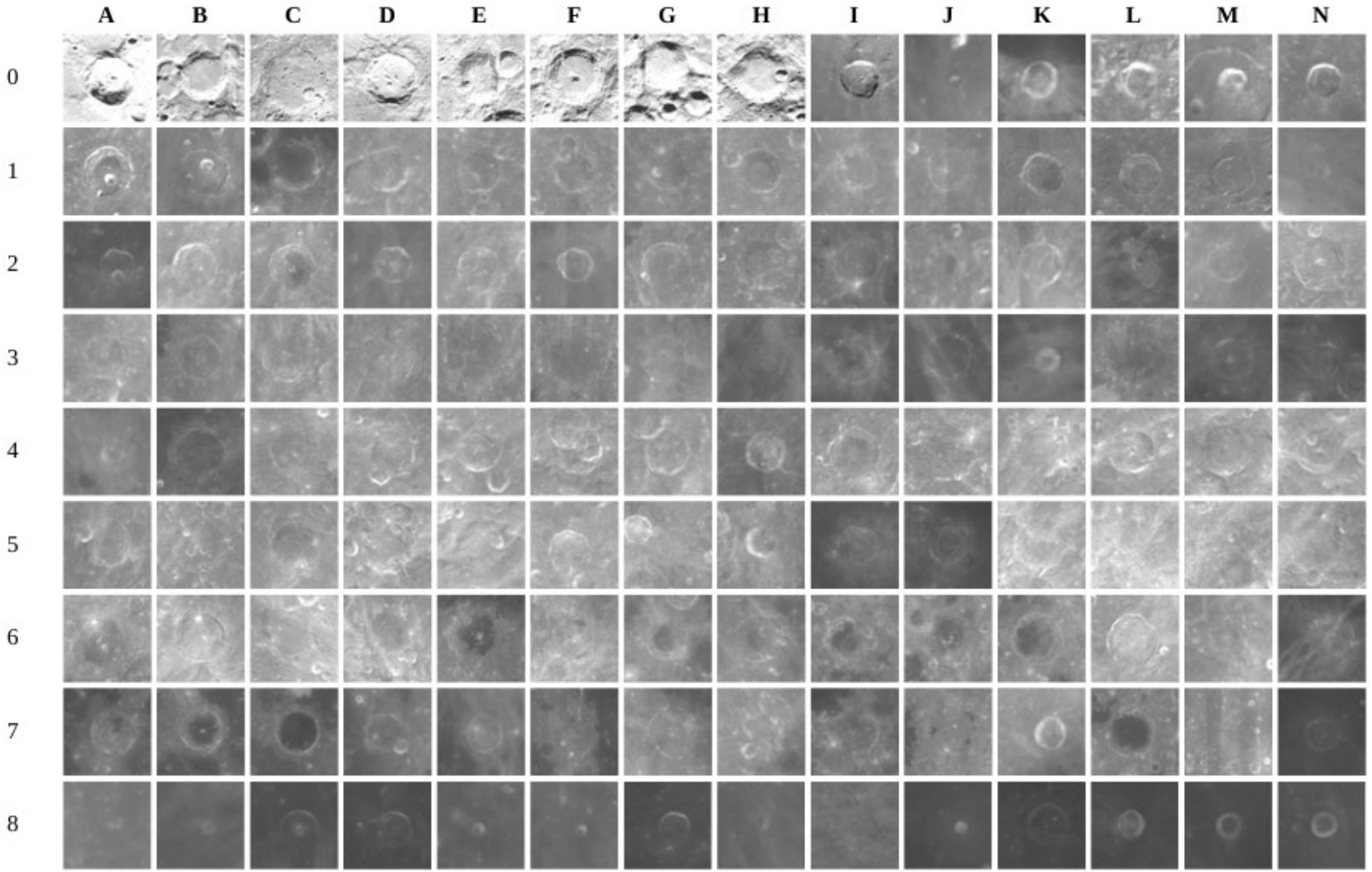
$$P(x) = \frac{\binom{a}{x_a}\binom{b}{x_b}}{\binom{a+b}{n}}$$



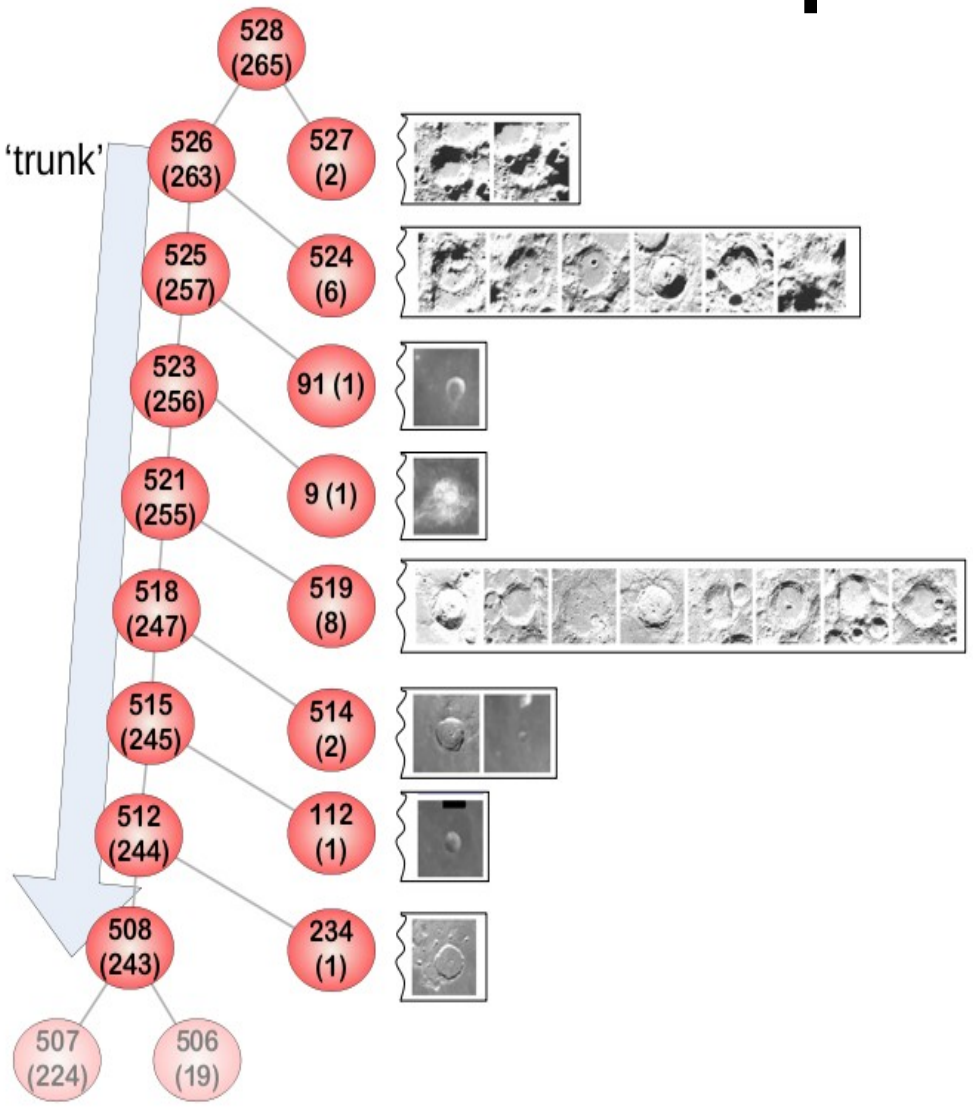
Case Study: Clementine Lunar spacecraft data

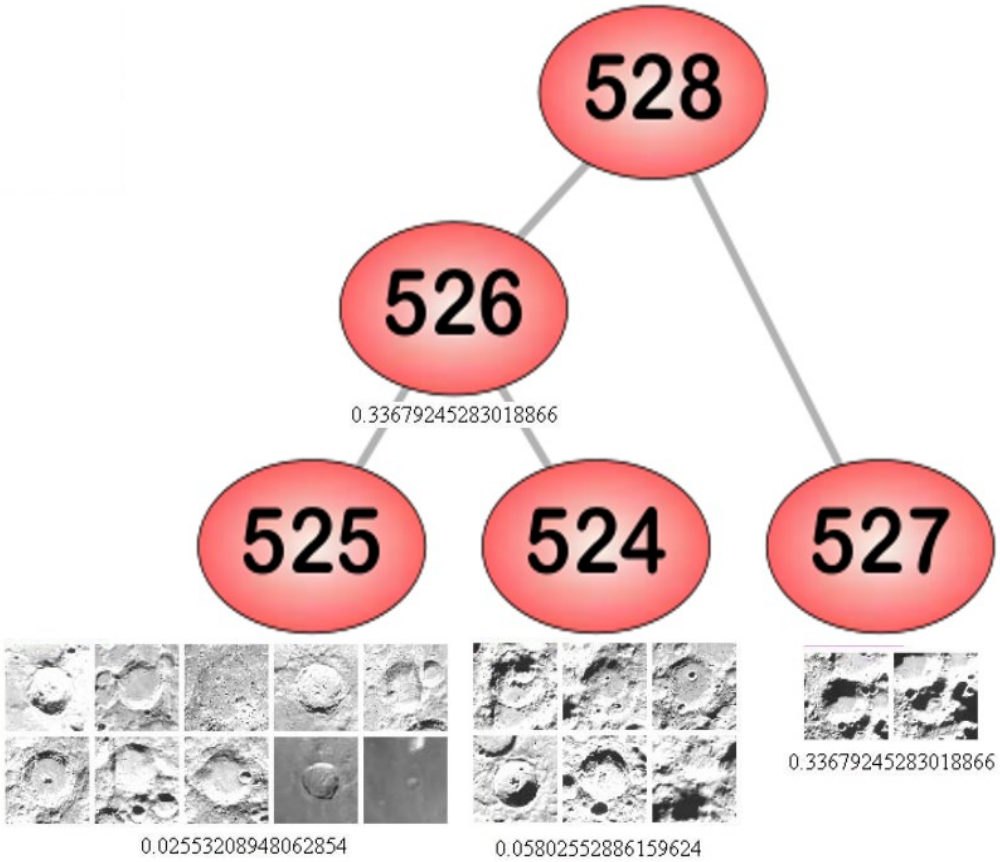


Case Study: Clementine Lunar spacecraft data

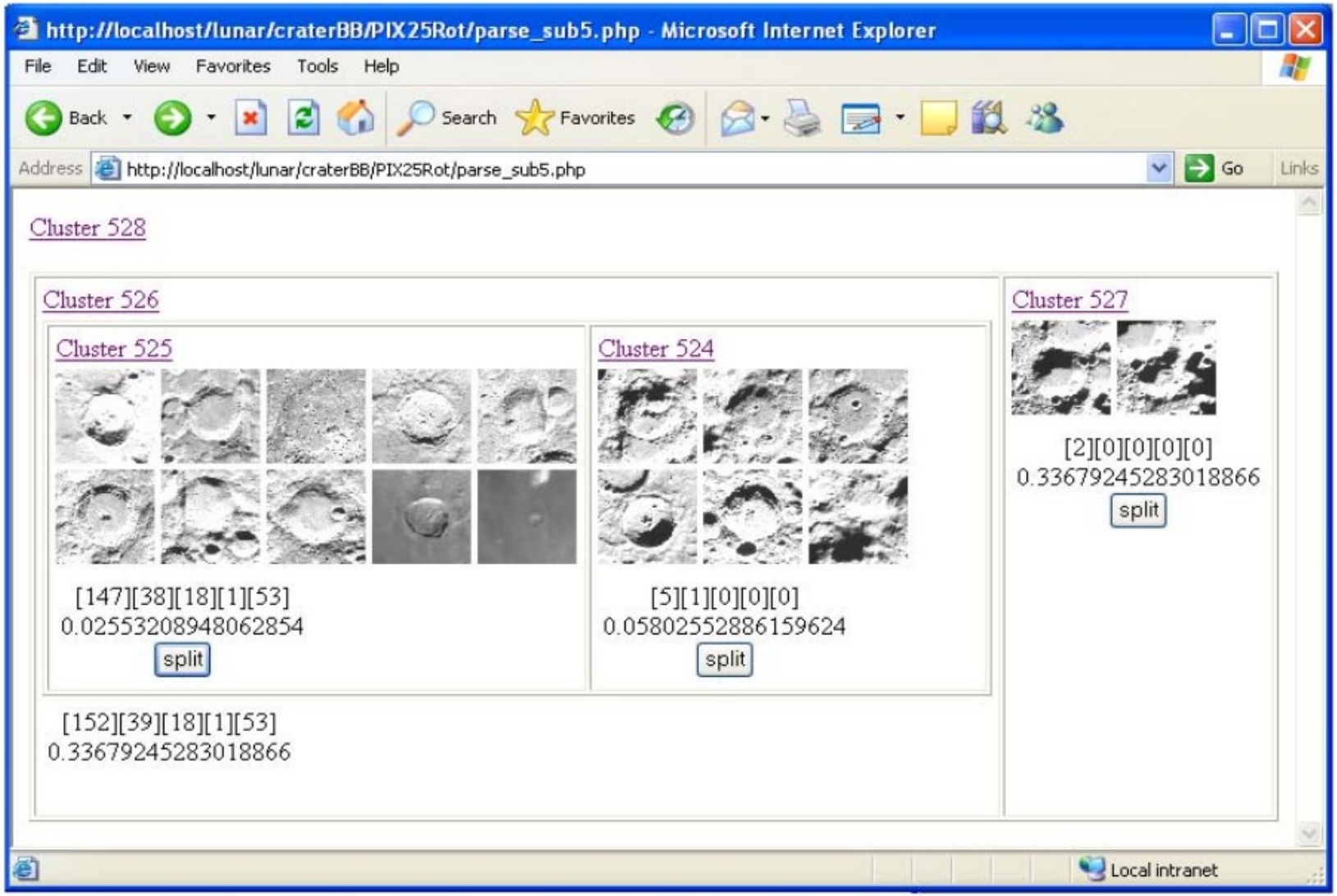


Case Study: Clementine Lunar spacecraft data





Case Study: Clementine Lunar spacecraft data



Limitations

- Processing time vs. ability to cope with unforeseen image data
- Image region modelling largely dependent upon segmentation
- No user-based query interface to the taxonomy

Improvements

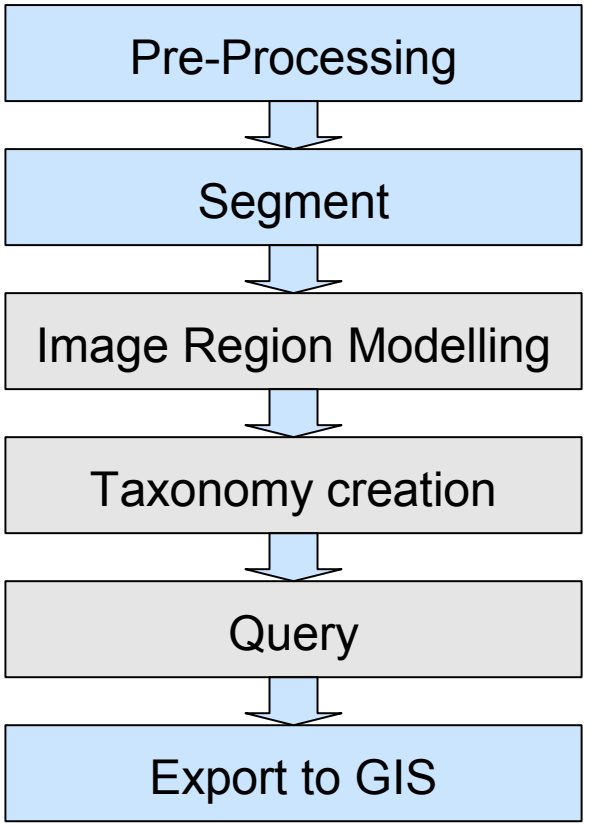
- Review and extend with more complicated case studies
- Improve image segmentation
- Query based taxonomy interface
- Ground Truth
- Integrate taxonomy with standard GIS formats

Work been done – past six months

- Image segmentation
  - Edge Detection
  - Morphology
- Simple Image region analysis
  - Perimeter / Area
  - Fractal Dimension
- Applying to new imagery
- Export to GeoTIFF

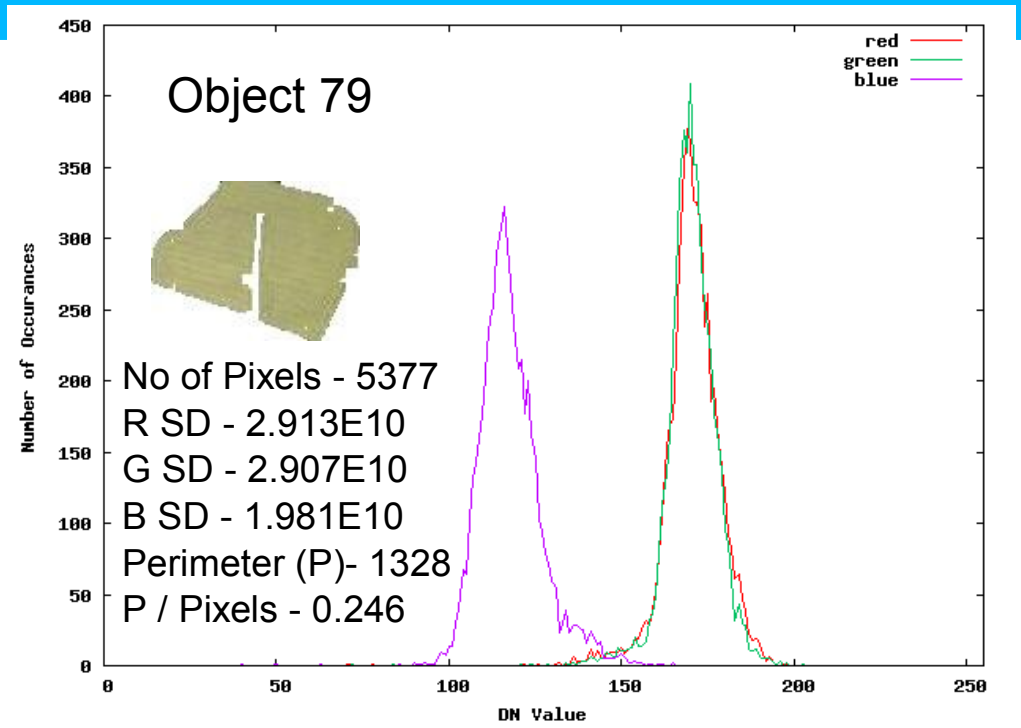
Frame work

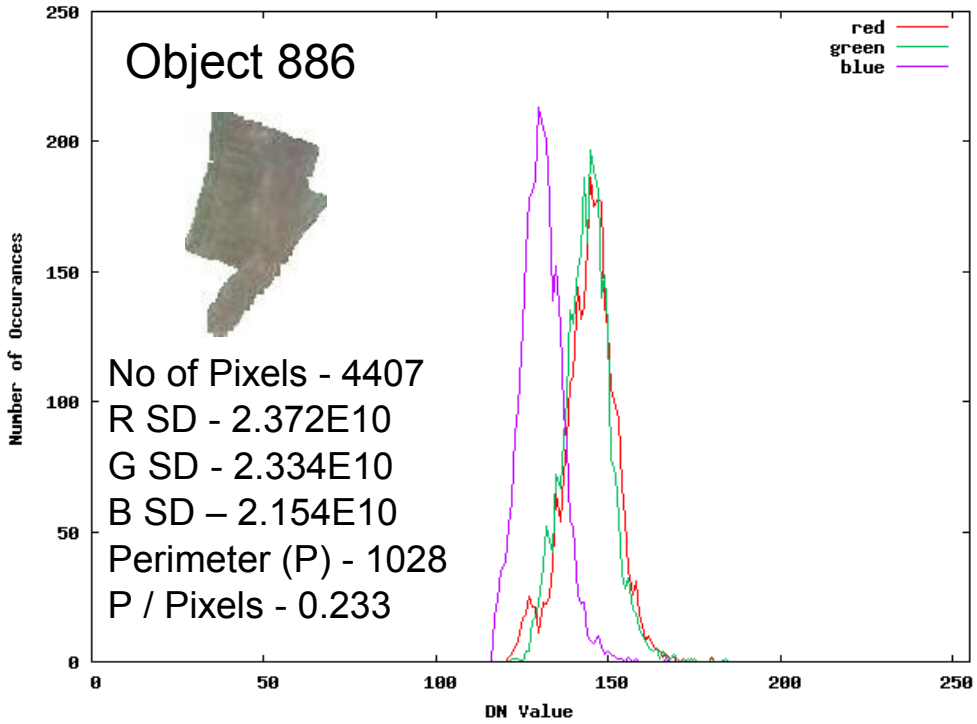
- Toolkit to perform tasks
- Written in Java using JAI
- Modular
- Produces Statistics
- Visualise output

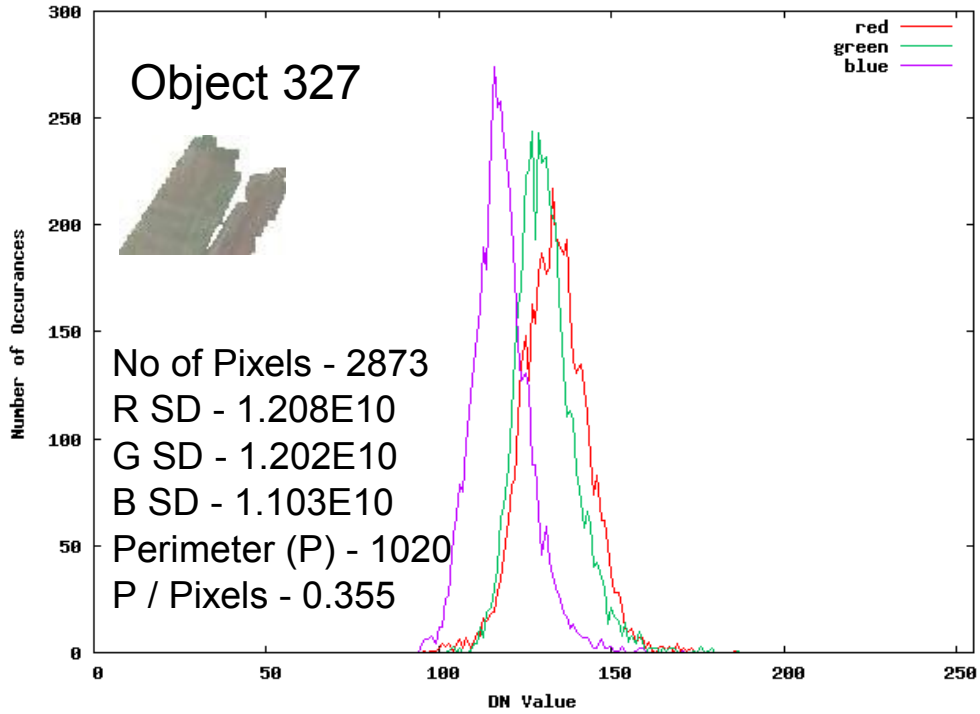


Segmentation

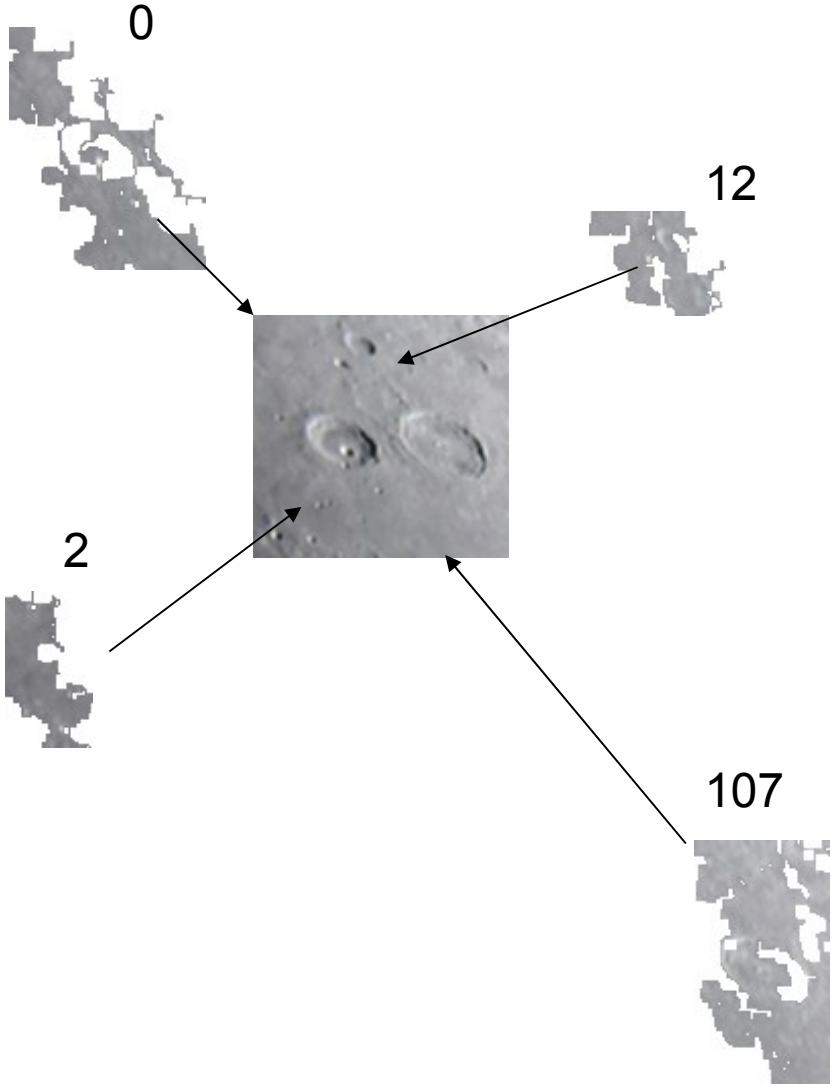
Watershed


Object 79
No of Pixels - 5377
R SD - 2.913E10
G SD - 2.907E10
B SD - 1.981E10
Perimeter (P)- 1328
P / Pixels - 0.246
red
green
blue
Number of Occurances
DN Value


Object 886
No of Pixels - 4407
R SD - 2.372E10
G SD - 2.334E10
B SD – 2.154E10
Perimeter (P) - 1028
P / Pixels - 0.233
red
green
blue
Number of Occurances
DN Value


Object 327
No of Pixels - 2873
R SD - 1.208E10
G SD - 1.202E10
B SD - 1.103E10
Perimeter (P) - 1020
P / Pixels - 0.355
red
green
blue
Number of Occurances
DN Value

Segmentation Issues



Future work – Next two and a half years

- Image Segmentation
  - Combine segmentation techniques to
- Taxonomy Creation
- Apply to multispectral terrestrial datasets
- Query the taxonomy

Questions?