EGM702 – Photogrammetry and Advanced Image Analysis

Week 5, Part 1: Image Classification

Week 5 Outline

1. Refresher on image classification
2. Image segmentation and OBIA
3. Intro to machine learning
4. Machine learning classification
5. Accuracy analysis

Image classification

- As we have seen, remotely sensed images can be difficult to interpret
- Often, we are interested in classifying (identifying) objects in an image:
  - Burn scars from wildfires
  - Water bodies
  - Different vegetation types
- Identifying each pixel by hand is time-consuming (and exhausting)

Classification

- The process of categorizing the data in an image into information that:
  - Can be used by non-specialists
  - Can also be used as input for further study
- Creates a thematic map of the image
- Here, we will be talking about automated classification routines

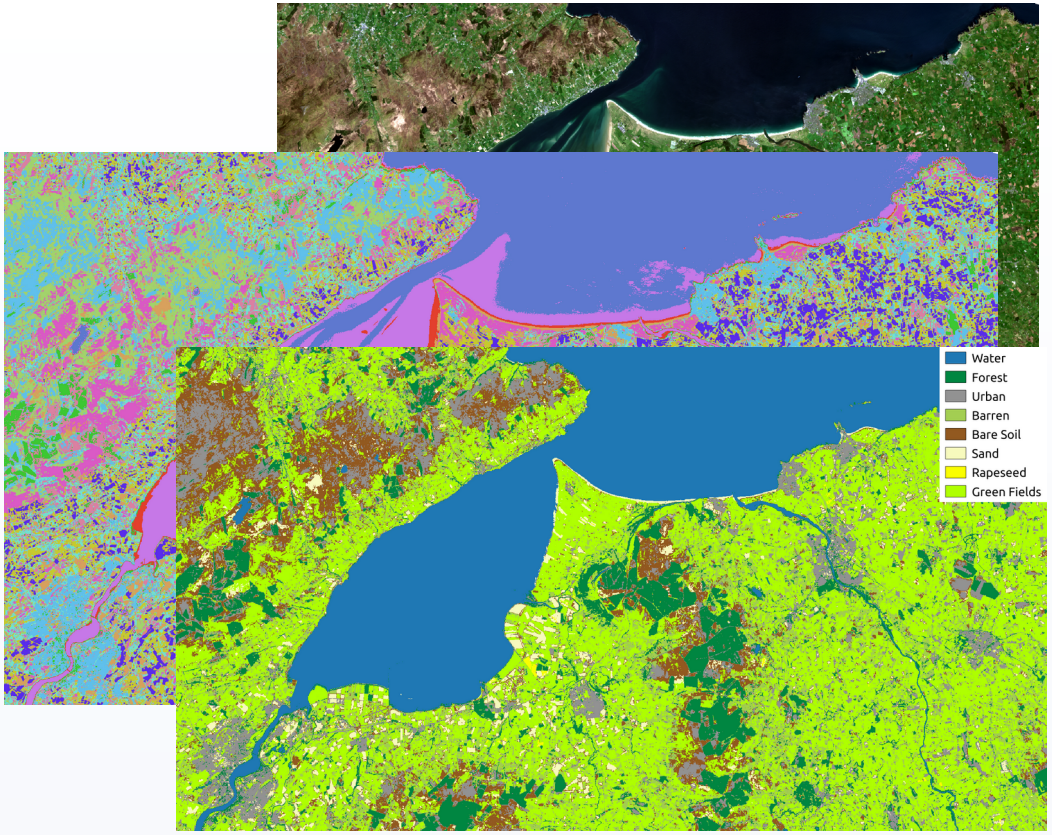
Kim and Yeom, 2012

Characterizing Classification Algorithms

- Manual ↔ Supervised ↔ Unsupervised
- Spatial ↔ spectral ↔ object-oriented
- Parametric ↔ Non-parametric
- Physical ↔ Empirical
- Pixel ↔ Subpixel
- Hard ↔ soft

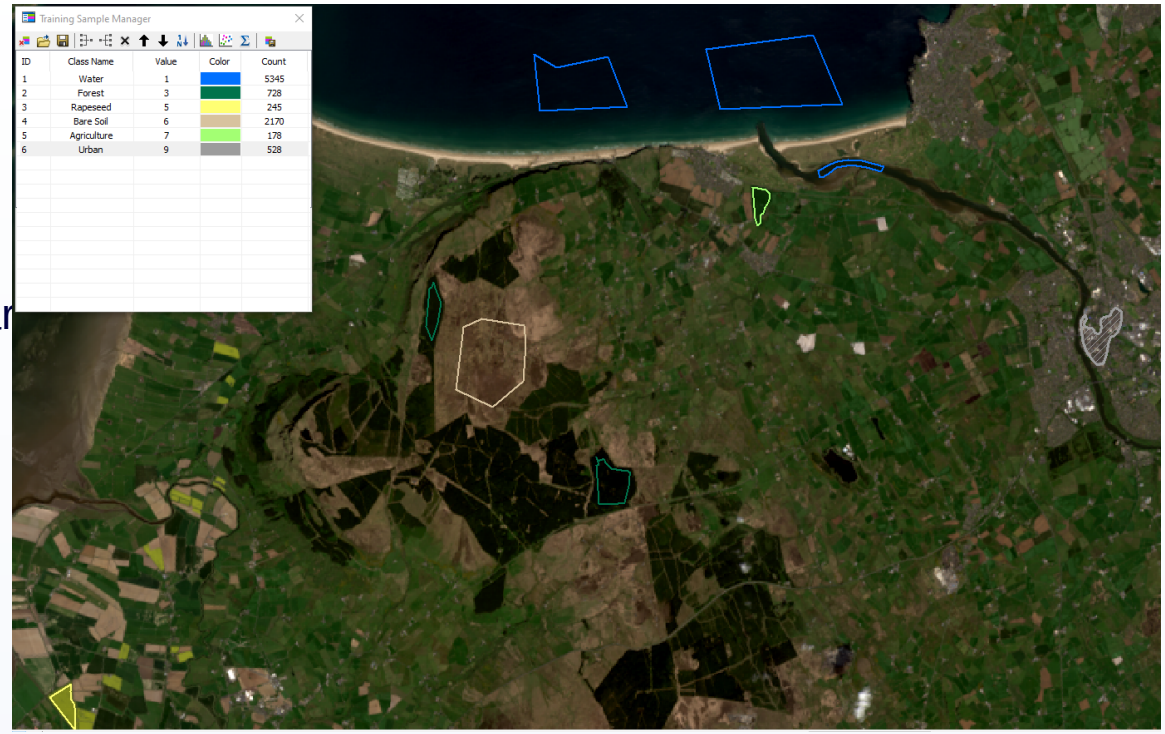
Unsupervised classification

- “Unsupervised” means little to no user input
- Algorithm determines how best to group pixels based on statistical properties
- Examples:
  - K-means clustering
  - ISODATA clustering
- User then identifies each spectral class



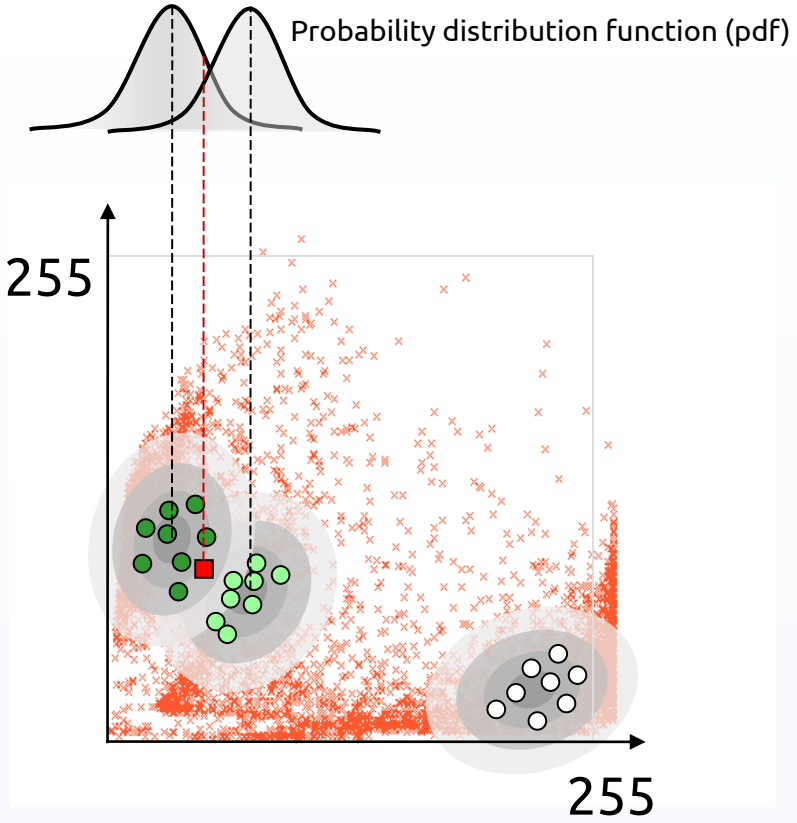
Supervised classification

- User trains the algorithm based on pre-identified areas
- Training areas:
  - Uniform characteristics
  - Spatially-distributed
- Algorithm uses statistics of the training ar to determine class
- Examples:
  - Maximum Likelihood
  - Minimum distance
  - K-nearest neighbours
  - Parallelepiped



Maximum Likelihood

- Algorithm uses training data to assign each pixel to a class
  - Calculates probability distribution function based on training data
  - Measure of how likely a value is to fall within the given class
- Example: given our three training classes, where should red square go?



Summary

- We want to extract meaningful information from raw image data
- Want to avoid classifying images by hand
- Automated classification schemes can be categorized in a number of ways
- Choice of algorithm depends on input data, application

Additional resources

- Lillesand, Kiefer & Chipman – Chapter 7
- Jensen – Chapter 9
- K-means & Image Segmentation [computerphile]
- What is image classification? [ESRI]
- Lu and Weng, 2007 [Int J Rem Sens]