

EGM310: GIS and Remote Sensing

Week 11, Part 5: 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)

- 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



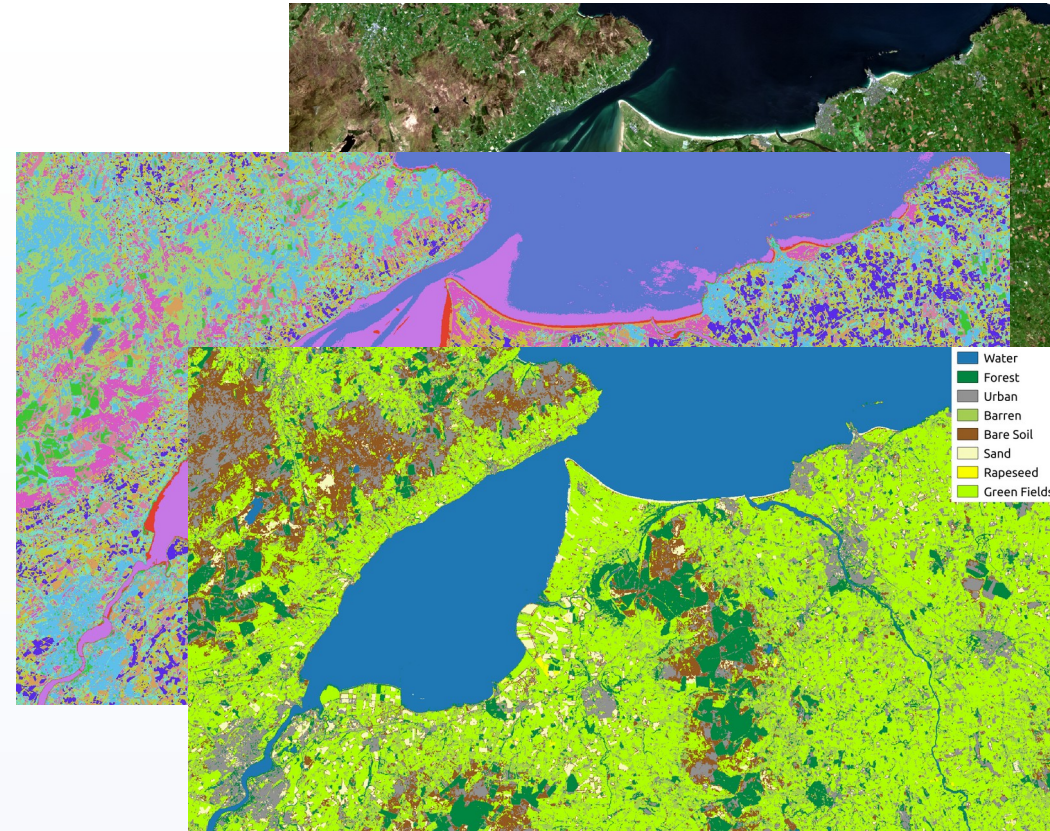
Kim and Yeom, 2012

Characterizing Classification Algorithms

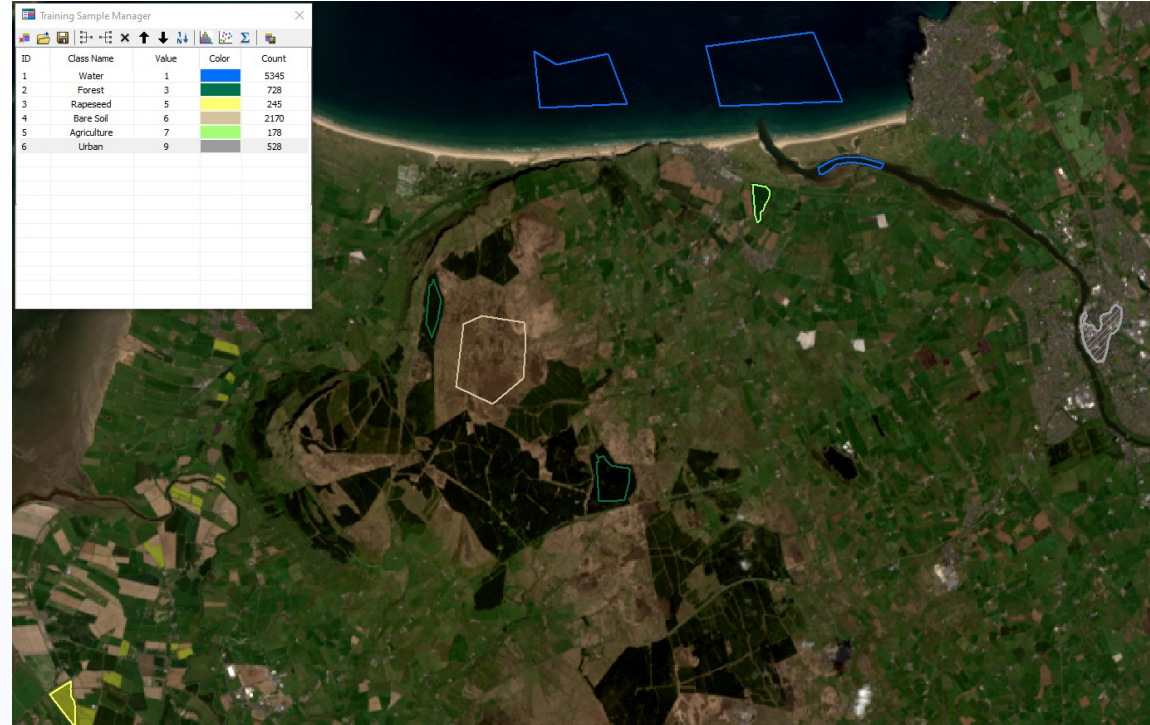
- Manual ↔ Supervised ↔ Unsupervised
- Spatial ↔ spectral ↔ object-oriented
- Parametric ↔ Non-parametric
- Physical ↔ Empirical
- Pixel ↔ Subpixel
- Hard ↔ soft

Unsupervised classification

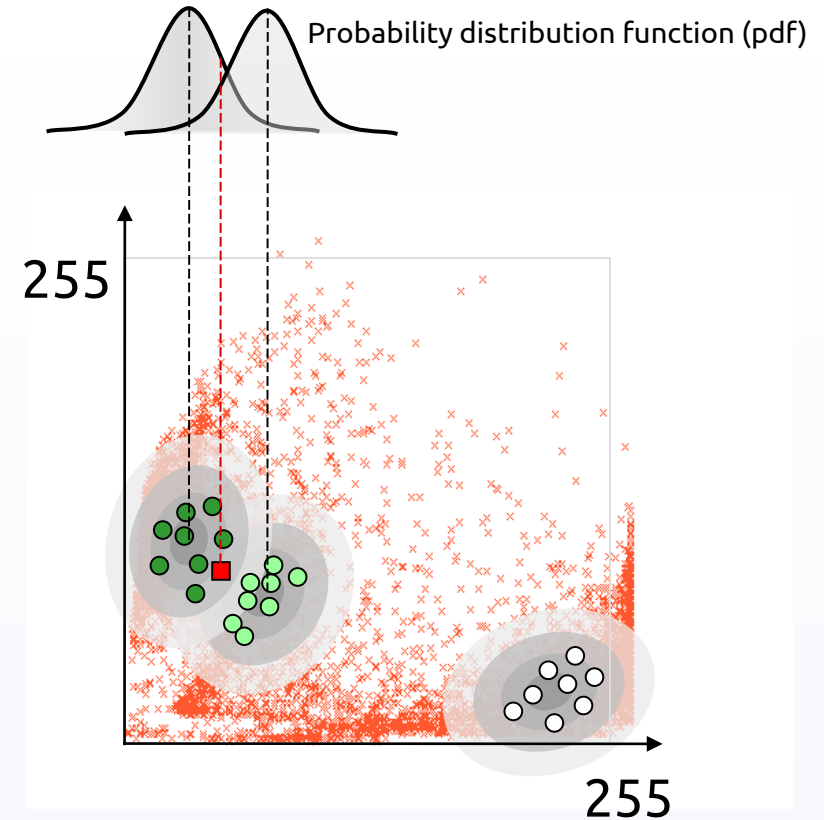
- “Unsupervised” means little to no user input
- Algorithm determines how best to group pixels based on statistical properties
- Examples:
 - K-means clustering
 - ISODATA clustering
- User then identifies each spectral class



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



- 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?



Object-based image analysis

- Classification based on image **objects**, not **individual pixels**
- Steps:
 - Segmentation (image → objects)
 - Classification (objects → meaningful objects)
- Can incorporate:
 - Spectral properties
 - Shape
 - Texture
 - Area
 - Context
 - Other layers/datasets



- 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

- Lillesand, Kiefer & Chipman – Chapter 7
- Campbell & Wynne – Chapter 12
- K-means & Image Segmentation [[computerphile](#)]
- What is Image classification? [[ESRI](#)]
- Lu and Weng (2007), Int. J. of Remote Sensing