University of Anbar
College of Science – Applied Geology Department
Dr. Omar AL-Jarrah
Assis. Professor

2nd Stage

Remote Sensing

Lecture 8 : Classification

Classification

Digital Image has been processed to put each pixel into a category (Class) .

The *Recognition* Of reflecting spectral Signatures for any number of classes: Vegetation, Soil, Water. The relative spectral shows in terms of some intensity units or as a percent. The Results are vegetation maps, land use maps, or other maps grouping of related features

Categories (classes) are defined by the final use of the map , Can be few or many categories, depending on the purpose of the map and available resources of the classification .

1- the nature of data to be analyzed : This process depend on : (Reflectance – thermal – visible – field measurements)

2- The computational resources available (the software – and other calculations equations)

3- The applications of the final classified data

In satellite digital recording the DNs or Digital Numbers commonly subdivided into numbers from 0 to 255 .

there is separation of the resulting values points in this two-dimensional diagram (2 spectral bands)

This result of separation points (known as a *scatter diagram)*,. For any two classes this scattering of value points may or may not overlap. In the lower case shown, three types of vegetation (crops), The collection of plotted values (points) associated with each class is known as a *cluster*

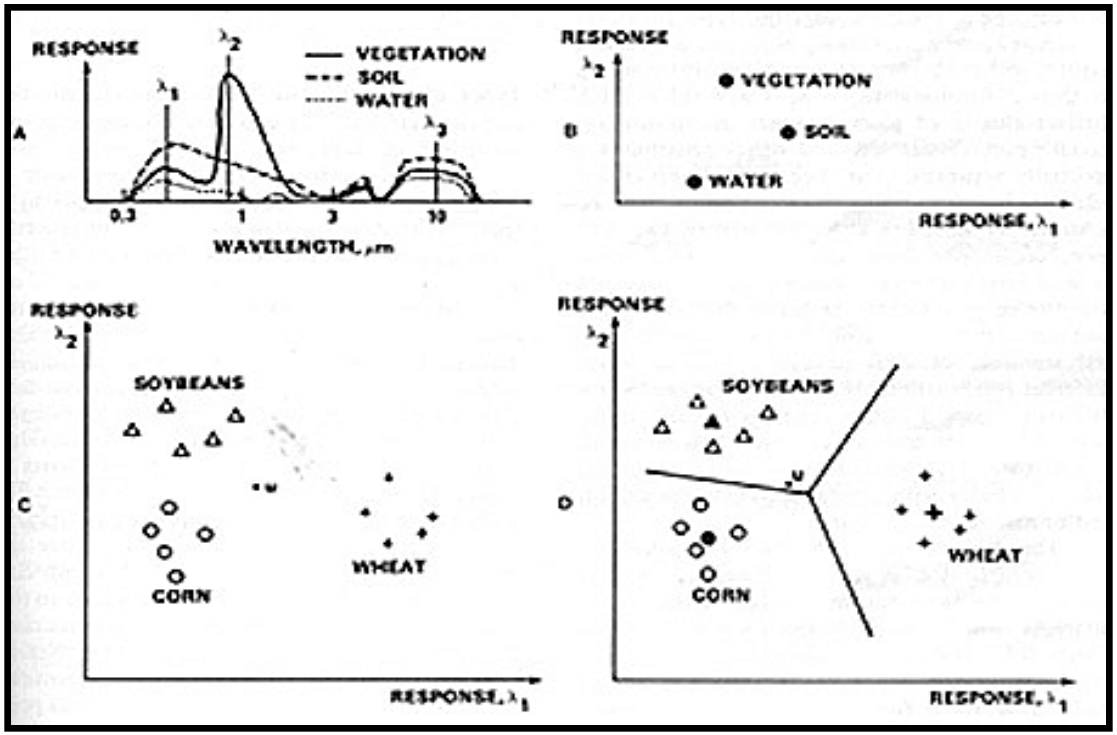


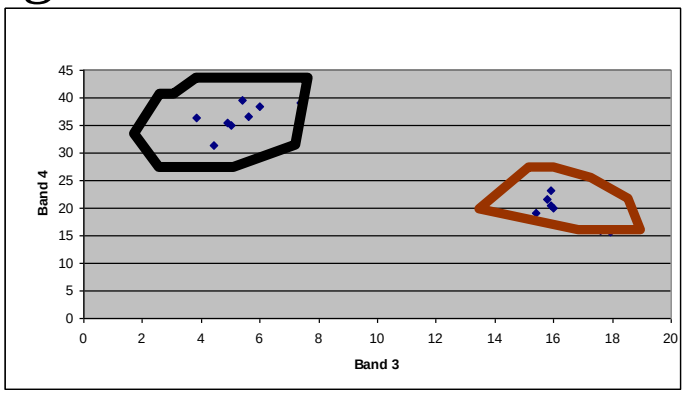
Image has been processed to put each pixel into Class or a category

Classes are defined by the intended use of the map Can be few or many categories, depending on the purpose of the map and available resources

- In an other world, all “Vegetation” pixels would have exactly the same spectral signature , so we could just say that any pixel in an image with that signature was vegetation
- We do the same for soil, and all other classes to get the end with a map of all classes we want to calculate them .

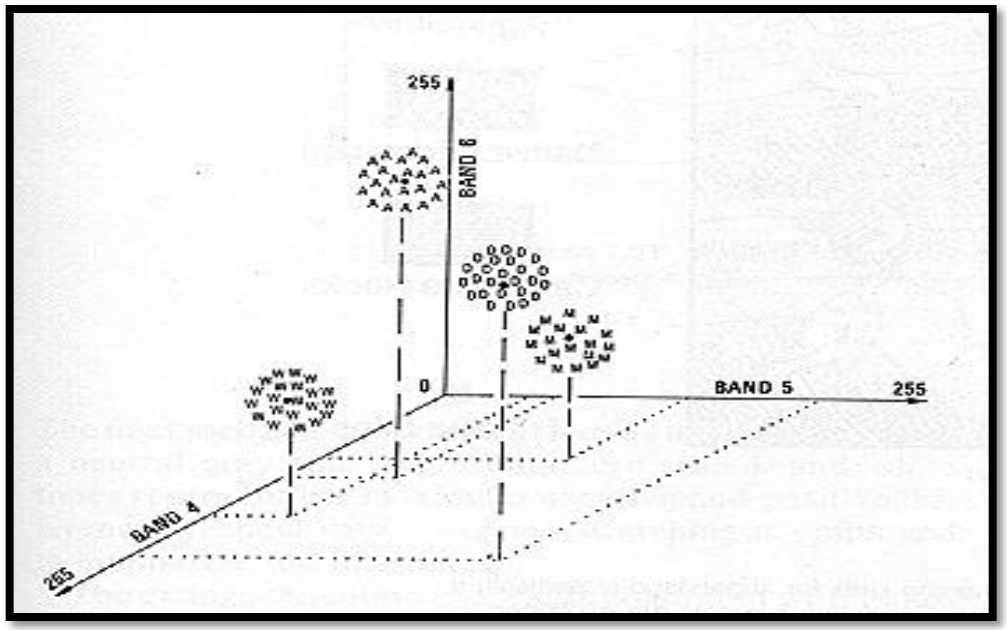
because different classes seldom have similar reflectance over a wide range of wavelengths. Any pixels in the image lying outside the training sites will be rejected, and other pixels assigned to the class it is closest to , this give a final map of classes (with a few pixels usually remaining unknown) that pixels are misclassified.

The general work of classification must done with 3 bands not only 2 bands , that change give us wide range of new classes separate totally each other because the ability of matching between 3 bands is not possible almost . For that any pixel with 3 reflectance value will be in range of one of the classes in Image reflectance range .



2 bands cluster

3 bands cluster



using statistics that calculate means of each class, to draw boundaries between clusters, such every point plotted in the spectral space on each side of a boundary will automatically belong the that class or type within that space. If any single point "w" which is an unknown object or pixel (at some specific location) whose identity is being reject. In this example, 'w' plots .

Thus, the principle of classification (by computer image-processing) : Any (most of) individual pixel or spatially grouped sets of pixels must representing some feature, class, or material in the real world .

There are two types of classification

1- *unsupervised classification*

2 – *supervised classification*

In *unsupervised classification* any individual pixel is compared to each cluster to see which one it is closest to. A map of all pixels in the image, classified as to which cluster for each pixel is most likely to belong, is produced (in black and white or more commonly in colors images). This then must be interpreted by the user to what the color mean in classes, that are actually present in the real world scene, this requires some knowledge of the scenes

In a *supervised classification* the interpreter must know the classes and what it represent in real , and where each in one or perhaps many locations within the digital scene., areas containing examples of the class are needed (making them training sites), the statistical analysis is done on the multiband data for each such class, then the classes groupings with statically functions that know each (it is possible that more than one class will have similar spectral values but that is unlikely when more than 3 bands are used .

Steps Supervised classification

1- Training stage : region of interest (ROI)

2- Classification statistical stage

3- Output stage

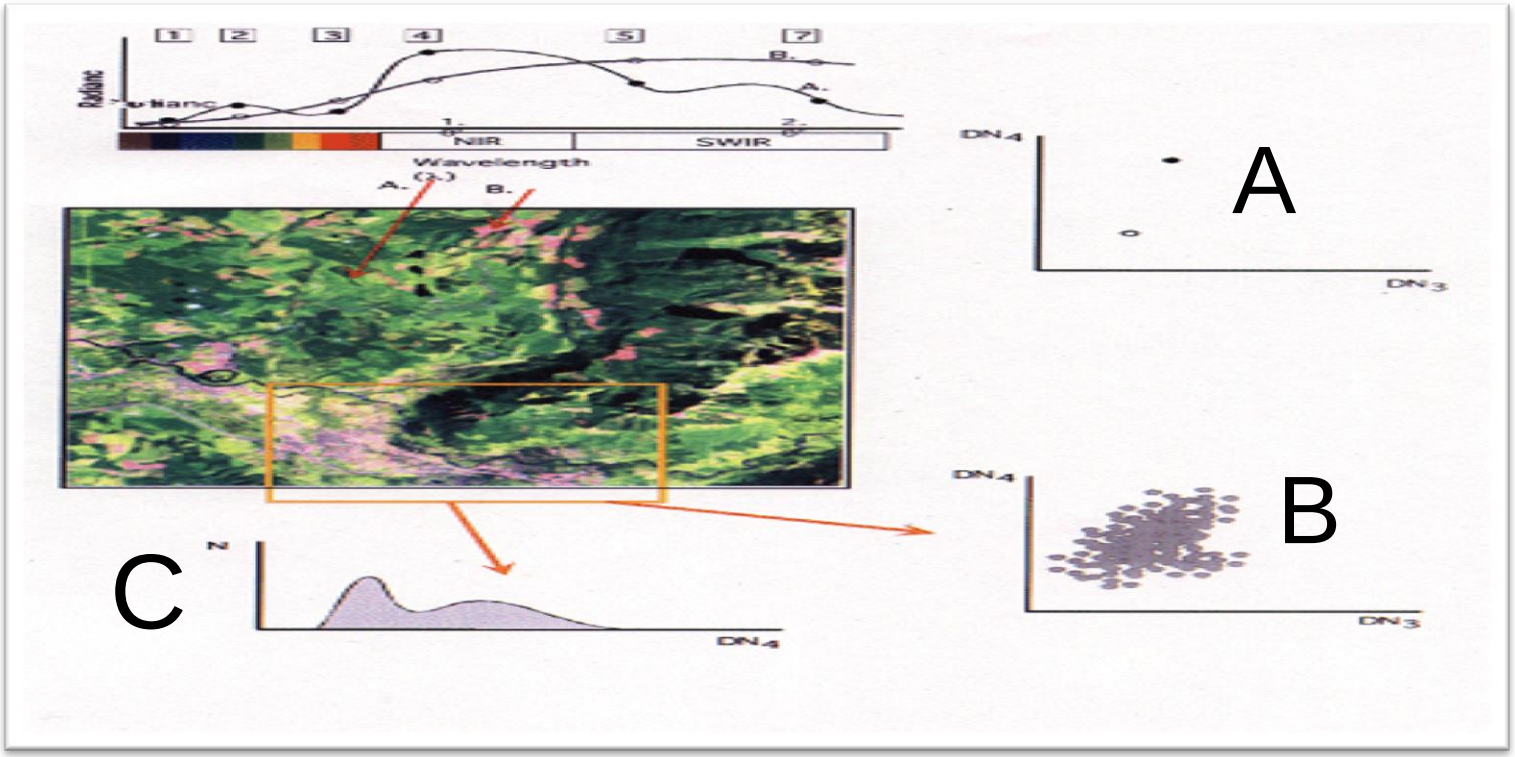
1- training stage : its some ideal areas define in satellite digital images as a training areas with all statically calculation to the class we want to apply to all the image .

Three sources of ROI

A- Manually from an image using the mouse

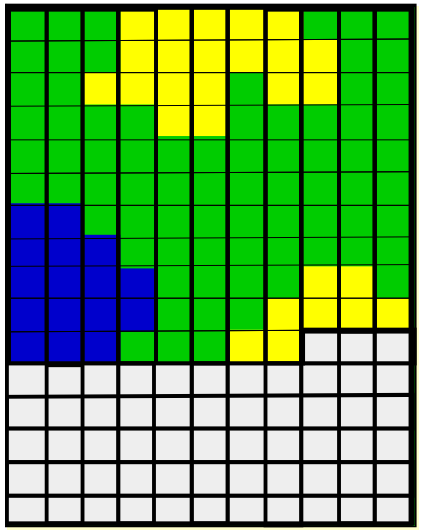
B- From pixel scatter plots

C - From vector layers



Steps of ROI

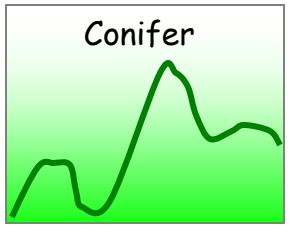
1- Selection of bands for 2D scatter plot
2- The least number of pixels required for each class
3- Dispersion of ROIs
4- Give each ROI a name
5- Output the ROIs into a file

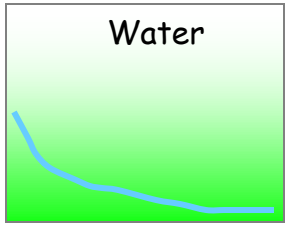


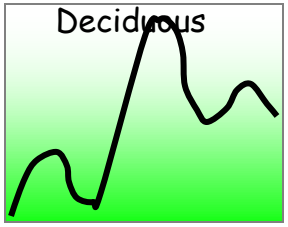
...

The computer then creates...

Mean Spectral Signatures



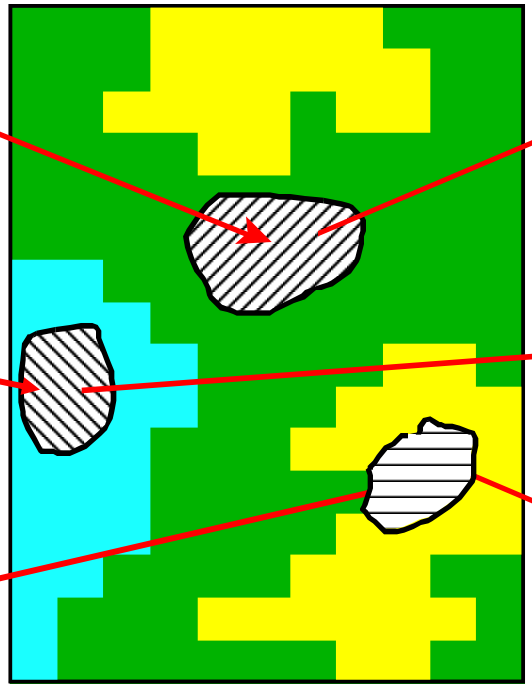




Known Conifer Area

Known Water Area

Known Deciduous Area



Digital Image

2- Classification statistical stage

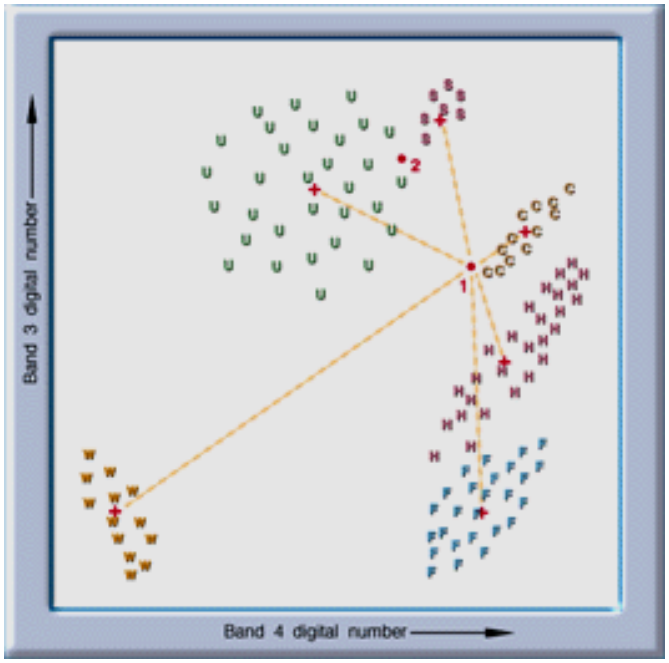
the application to select each pixel from the satellite digital image then apply the statical equations with the pixel values come from 3 bands and more to get the final state to that pixel .

There are 2 main application use for that propose :

A - Minimum Distance

each Uses the mean vectors of each ROI and calculates the distance from unknown pixel to the mean vector for each class

closest All pixels in image classified according to the class mean to which they are



B - Maximum Likelihood

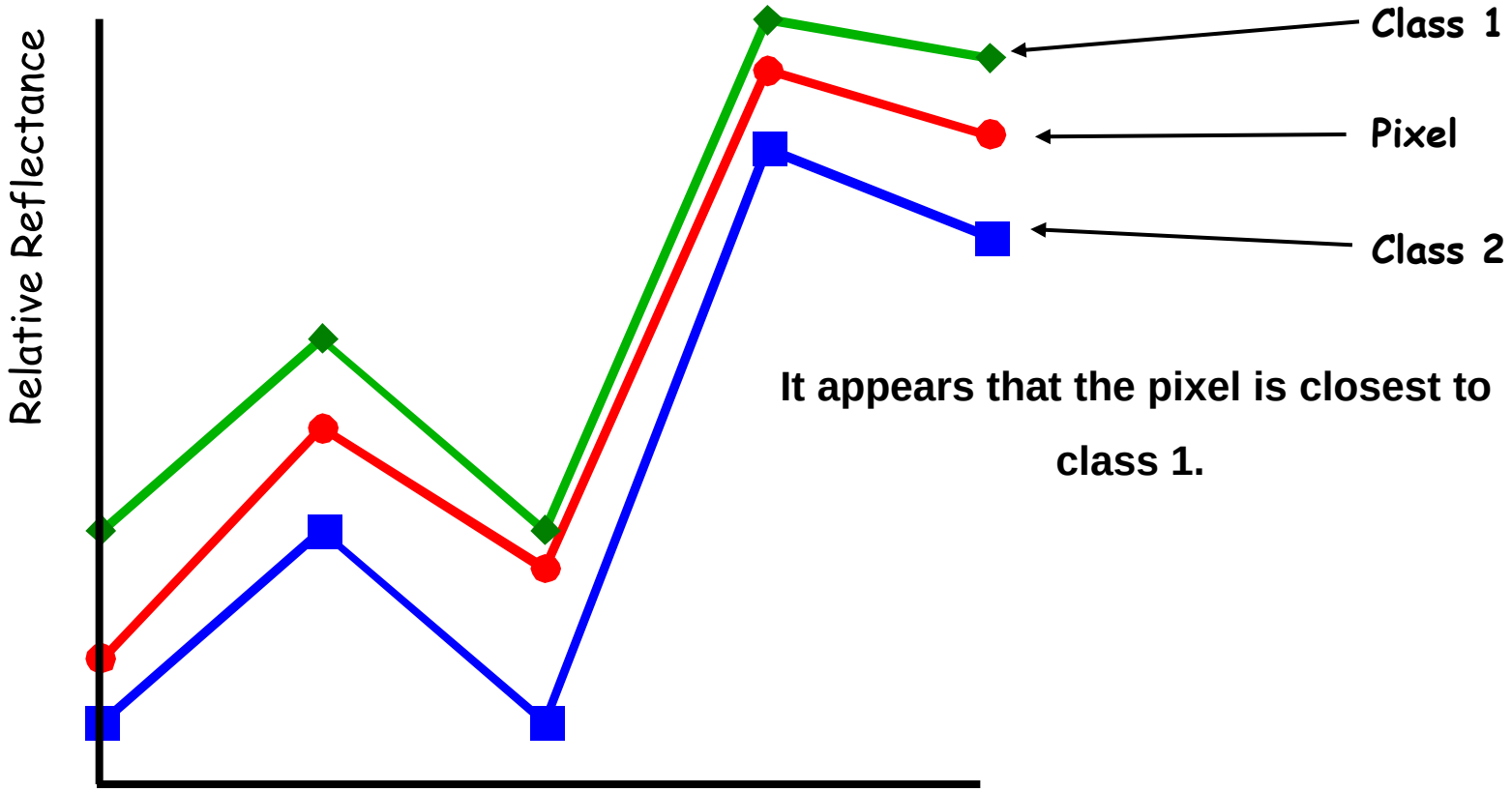
Assumes that the statistics for each class in each band are normally Defined

Calculates the probability that a given pixel belongs to a specific class

Which have most smeller statical properties , all pixels are classified

Each is assigned to the class that has the highest probability

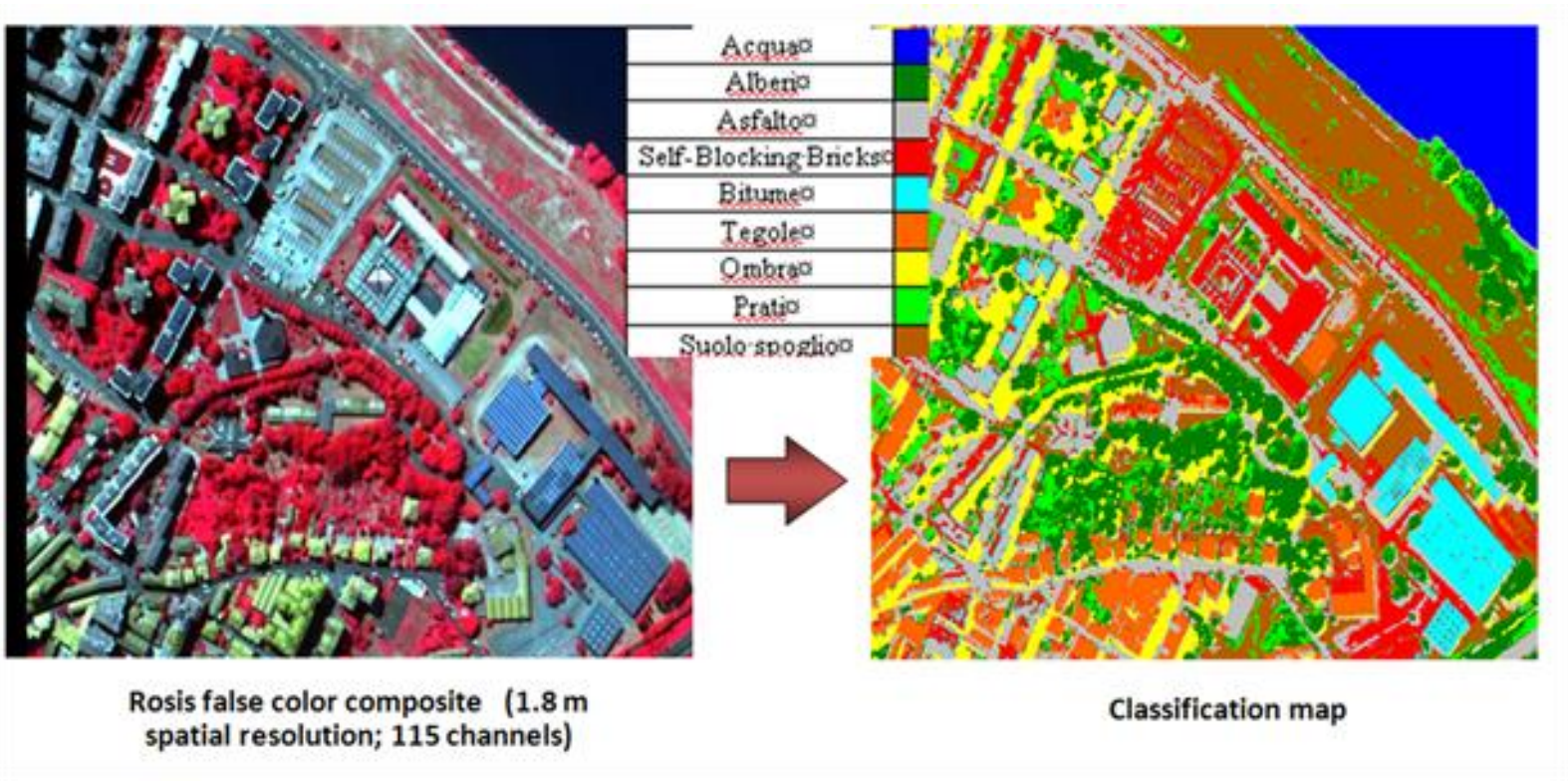
To that pixel



3- output stage

after all that work we must be familiar with the major classes appear in the scene, also by visiting the scene in real (ground truth) and visually correlating map patterns to their ground existing . And the classes are not classified in the seen what they present in ground to correct their characteristic later in calculations .

The acceptable rate for reject pixels in an Image or seen must not be more than 5 -10 % .



Rosis false color composite (1.8 m spatial resolution; 115 channels)

Classification map

References

IMAGE INTERPRETATION IMAGE INTERPRETATION , Seventh Edition, Lillesand T. M., Kiefer R. W., Chipman J. W., WILEY press , USA , 2015

Earth Science Satellite Remote Sensing Vol. 1: Science and Instruments , Qu J. J., Gao W. , Kafatos M. , Murphy R. E, Salomonson V. V., Tsinghua University Press, Beijing and Springer-Verlag GmbH Berlin Heidelberg . 2006

Internet Remote Sensing Lectures sites