6th SEMESTER (MAJOR)

PAPER 604: PRINCIPLES AND APPLICATION OF REMOTE SENSING, GIS AND GPS

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VISUAL INTERPRETATION

The data products (aerial photographs and satellite imageries) acquired through remote sensing (RS) needs to be interpreted or analysed to extract information from it. The reasons why photo/image interpretation are powerful scientific tools:

- scale: aerial/regional perspective;
- three-dimensional depth perception;
- ability to obtain knowledge beyond our human visual perception;
- ability to obtain a historical image record to document change.

In general, information extraction methods from photographs or imageries can be subdivided into two categories:

- Information extraction based on visual analysis or interpretation (Visual image interpretation).
- Information based on semi-automatic processing by the computer (Image classification).

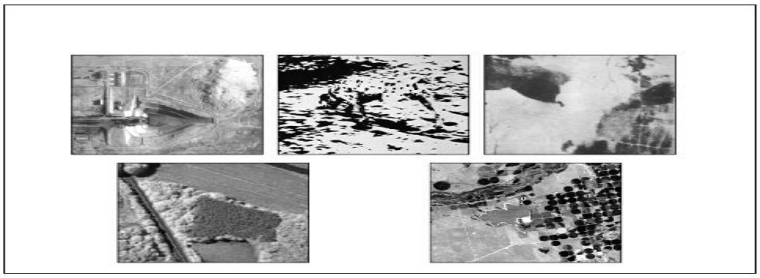
The most intuitive way to extract information from RS data is by visual image interpretation. Visual interpretation is important to GIS development and application. It is the interpretation of aerial photography by a photo interpreter. It is based on man's ability to relate colours and patterns in an image to real features. Visual image interpretation is used to produce spatial information is fields such as urban mapping, natural vegetation mapping, cadastral mapping, landuse mapping etc. Human vision goes a step beyond perception of colors which deals with the ability of a person to draw conclusion from visual observations. In analysing a picture two situations occurs i.e. spontaneous or direct recognition and logical inferences. Spontaneous recognition refers to the ability of an interpreter to identify objects or phenomenon at first glance. For example an agronomist would immediately recognize the pivot irrigation systems with their circular shape because of earlier (professional) experience. While logical inference means that the interpreter applies reasoning through his/her knowledge and experience. For example, concluding that a rectangular shape is swimming pool because of its location in a garden or near to a house.

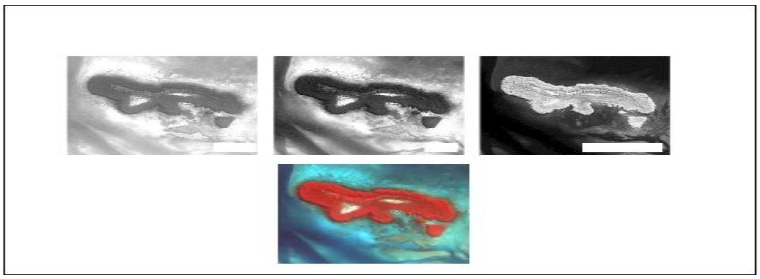
Elements of image interpretation:

When dealing with image data, visualized as pictures, a set of terms is required to express and define characteristics present in a pictures. These characteristics are called interpretation elements and are used, for example, to define interpretation keys, which provide guidelines on how to recognize certain objects. Following are the interpretation elements are distinguished: Tone/hue, texture, shape, size, pattern, shadow, site and association.

Tone/hue: Tone is defined as the relative brightness of a black/white image. Tonal variations are an important interpretation element in an image interpretation. The tonal expression of objects on the images is directly related to amount of light (energy) reflected from the surface. Different types of rocks, soil or vegetation most likely have different tones. Variations in moisture conditions are also

reflected as tonal differences in the image: increasing moisture content gives darker grey tones. Hue refers to the colour on the image. Variations in hue are primarily related to the spectral characteristics of the measured area and also to the bands selected for visualization. The advantage of hue over tone is that the human eye has a much larger sensitivity of variations in colour (approx 10,000 colours) as compared to tone (approx 200 grey levels).



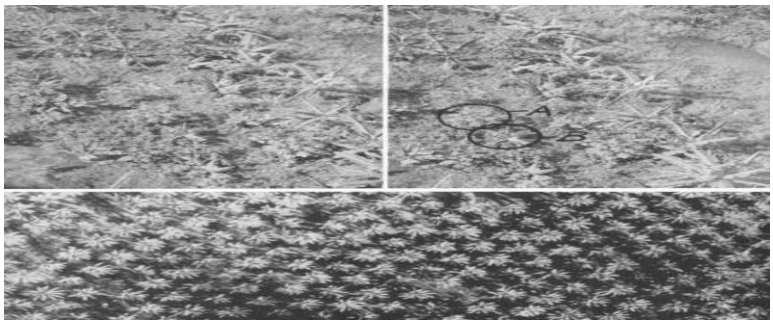


Shape: Shape or form characterizes many terrain objects visible in the image. It is the outline of a feature. Shape also relates to (relative) height when dealing with stereo-images. Height differences are important to distinguish between different vegetation types and also in geomorphological mapping. The shape of objects often helps to determine the character of object (built-up areas, roads and railroads, agricultural fields, etc).

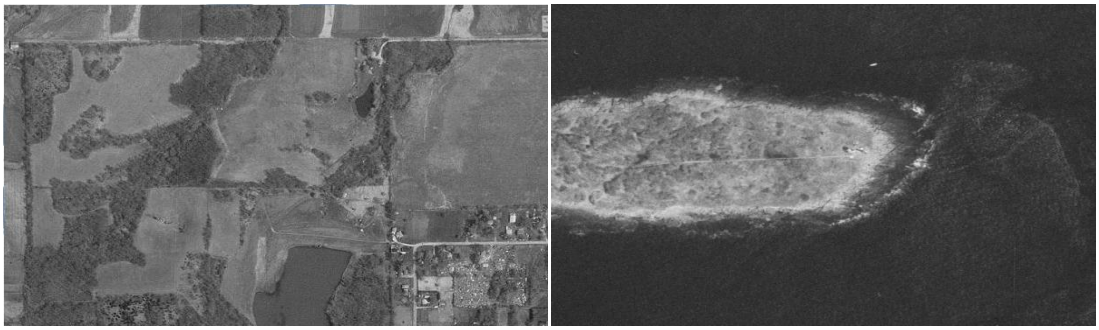
Size: Size of objects can be considered in relative or absolute senses. The width of road can be estimated, of example, by comparing it to the size of the cars, which is generally known. Subsequently this width determines the road types, e.g., primary road, secondary road, etc. **Size** of objects in an image is a function of scale. It is important to assess the size of a target relative to other objects in a scene, as well as the absolute size, to aid in the interpretation of that target. A quick approximation of target size can direct interpretation to an appropriate result more quickly. For example, if an interpreter had to distinguish zones of land use, and had identified an area with a number of buildings in it, large

buildings such as factories or warehouses would suggest commercial property, whereas small buildings would indicate residential use.

Pattern: It refers to spatial arrangements of objects and implies the characteristic repetition of certain forms or relationship. Pattern can be described by terms such as concentric, radial, checkerboard. Some land uses, however, have specific characteristics patterns when observed on aerospace data. You may think of different irrigation types but also different types housing in the urban fringe.



Texture: Texture relates to the frequency of tonal change. Texture may be described by terms as coarse or fine, smooth or rough, even or uneven, mottled, speckled, granular, linear, woolly etc. Texture can often relate to terrain roughness. Texture is strongly related to the spatial resolution of sensor applied. A pattern on a large scale image may show as texture on a small scale image o the scene.



Shadow: It refers to large distinctive shadows that revealed the outline of a future as projected onto a flat surface. It also depends on the nature of the object, angle of illumination, perspective, and slope of the ground surface. Shadow is also helpful in interpretation as it may provide an idea of the profile and relative height of a target or targets which may make identification easier. However, shadows can also reduce or eliminate interpretation in their area of influence, since targets within

shadows are much less (or not at all) discernible from their surroundings. Shadow is also useful for enhancing or identifying topography and landforms, particularly in radar imagery.

Site: It relates to the topographic or geographic location. A typical example of this interpretation element is that backswamps can be found in a flood plain but not in the centre of the city. Similarly, a large building at the end of a number of converging railroads is likely to be the railway station- we do not expect a hospital at this site.

Association: It refers to the fact that a combination of objects makes it possible to infer about its meaning of function. An example of the use of 'association' is an interpretation of a thermal power plant based on combined recognition of high chimneys, large buildings, cooling towers, coal heaps and transportation belts. In the same way the land use pattern associated with small scale farming will be characteristically different to that large scale farming.