UNIT IV

SENSING TECHNIQUES

1. CLASSIFICATION OF REMOTE SENSORS:

- A **Sensor** is a device that produces an output signal for the purpose of sensing a physical phenomenon.
- Sensors are used in everyday different objects, such as touch-sensitive elevator buttons and lamps.

1.1 Types of Sensors:

The two broadest classes of sensors are:

- ❖ Active Sensor
- ❖ Passive Sensor

➢ **Active Sensor:**

- Active Sensor is a source of light or illumination and its sensor measures reflected energy.
- The energy is generated and sent from the Remote Sensing platform towards the targets.
- **Radar** is an example of Active Sensor.
- Active Remote Sensing Instruments are,
  - ✓ Radar
  - ✓ Lidar
  - ✓ Sounder
  - ✓ Laser altimeter
  - ✓ Ranging instruments
  - ✓ Scatterometer

➢ **Passive Sensor:**

- **Passive Sensor** is a source of energy is that naturally available of the Sun.
- Most of the Remote Sensing systems work in passive mode, using solar energy as the source of EMR.
- **The Sun**, MSS**,** is an example of Passive Sensor.
- Passive Remote Sensing Instruments are,
  - ✓ Spectrometer
  - ✓ Radiometer
  - ✓ Spectroradiometer
  - ✓ Hyperspectral radiometer
  - ✓ Imaging radiometer
  - ✓ Accelerometer

Sensors also can be two different forms:

- ❖ Imaging
- ❖ Non-imaging

➢ **Imaging Sensor:**

- It is the electrons released are used to excite or ionize a substance, like silver in film or to drive an image producing device like a TV or computer monitor or a cathode ray tube or oscilloscope or a battery of electronic detectors.

➢ **Non-imaging Sensor:**

- It is the measuring of the radiation received from all points in the sensed target, integrates this, and reports the result as an electrical signal strength or some other quantitative attribute, such as radiance.

1.2 Sensor Resolution:

- Resolution is commonly used to describe the number of pixels display on a display device, or area on the ground that a pixel represents in an image file.
- The resolution of a sensor with a digital output is usually the numerical resolution of the digital output. A sensor's accuracy may be considerably worse than its resolution. Most sensors are influenced by the temperature of their environment.
- 4 distinct types of the Resolution must be considered:
  - ✓ **Spectral**—specific wavelength intervals that a sensor can record.
  - ✓ **Spatial**—area on the ground represented by each pixel.
  - ✓ **Radiometric**—number of possible data file values in each band.
  - ✓ **Temporal**—how often a sensor obtains imagery of a particular area.

2. RESOLUTION CONCEPT:

- Resolution is a broad term commonly used in Remote Sensing.
- The Resolution is several pixels display on a display device, or area on the ground that a pixel represents in an image file.
- 4 distinct types of resolution must be considered:

  - ✓ **Spectral**—specific wavelength intervals that a sensor can record.
  - ✓ **Spatial**—area on the ground represented by each pixel.
  - ✓ **Radiometric**—number of possible data file values in each band.
  - ✓ **Temporal**—how often a sensor obtains imagery of a particular area.

2.1 SPECTRAL RESOLUTION IN REMOTE SENSING:

- Spectral resolution refers to the specific wavelength intervals in the Electromagnetic spectrum that a sensor can record.
- For example, band 1 of the Landsat TM sensor records energy between 0.45 and 0.52 μm in the visible part of the spectrum.

- Wide intervals in the electromagnetic spectrum are referred to as coarse spectral resolution, and narrow intervals are referred to as fine spectral resolution.
- For example, the SPOT panchromatic sensor is considered to have coarse spectral resolution because it records EMR between 0.51 and 0.73 μm.
- On the other hand, band 3 of the Landsat TM sensor has a fine spectral resolution because it records EMR between 0.63 and 0.69 μm.
- There are three types of Imageries in Remote Sensing based on Spectral Resolution i.e. Mono-spectral, Multi-spectral and Hyper-spectral imageries.

2.2 SPATIAL RESOLUTION IN REMOTE SENSING:

- Spatial resolution is a measure of the smallest object that can be resolved by the sensor, or the area on the ground represented by each pixel.
- The finer the resolution, the lower the number.
- For instance, a spatial resolution of 79 meters is coarser than a spatial resolution of 10 meters.
- Spatial resolution refers to the clarity of features on the earth surface. Therefore, it is the ability of the sensor to differentiate between various objects and features of the earth surface.
- The clarity of features on earth's surface depends on the size of the pixel and the number of pixels in a given imagery.
- It is noted that one pixel can be attributed to only one colour. Therefore, if one pixel in an imagery represents a large area of the land, then the pixel will hide smaller details of that large area.

➢ Seale

- Large-scale in remote sensing refers to imagery in which each pixel represents a small area on the ground, such as SPOT data, with a spatial resolution of 10m or 20 m.
- Small scale refers to imagery in which each pixel represents a large area on the ground, such as Advanced Very High Resolution Radiometer (AVHRR) data, with a spatial resolution of 1.1 km.

➢ IFOV

- Spatial resolution is also described as the Instantaneous Field of View (IFOV) of the sensor, although the IFOV is not always the same as they are represented by each pixel.
- The IFOV is a measure of the area viewed by a single detector in each instant in time.

2.3 RADIOMETRIC RESOLUTION IN REMOTE SENSING:

- Radiometric resolution refers to the ability of a sensor to capture the minute differences in the radiated energy from the earth surface.
- Radiometric resolution also refers to the dynamic range, or number of possible data file values in each band. This is referred to by the number of bits into which the recorded energy is divided.
- In 8-bit data, the data file values range from 0 to 255 for each pixel, but in 7-bit data, the data file values for each pixel range from 0 to 128.