UNIT II

RASTER METHOD OF TRANSFORMATIONS

In mathematics, computer graphics, and digital imaging, a raster is a rectangular grid of pixels, points, or lines. Raster images are also known as bitmaps or pixmaps. They are distinguished from vector images, which are composed of curves and polygons. Raster graphics are widely used to create patterns, textures, and shading in digital art. The process of rasterizing an image is sometimes called scanning or tracing. The raster method of transformation is a digital image processing technique that allows for the transformation of an image from one coordinate system to another. This technique is commonly used in applications such as computer-aided design (CAD) and geographic information systems (GIS).

There are many different ways to perform raster transformations, ranging from simple translation and rotation to more complex operations such as scaling, shearing, and reflection. In addition, there are numerous software packages available that can be used to perform raster transformations.

1. **Scaling:** There are three main types of scaling: point scaling, line scaling, and area scaling. Point scaling is when the scale factor is applied to individual points. Line scaling is when the scale factor is applied to lines. Area scaling is when the scale factor is applied to areas.
2. **Shearing:** Shearing is a raster image transformation that changes the orientation of an image. Shearing can be used to create an illusion of depth or to make an image appear larger or smaller. Shearing can also be used to correct geometric distortions in an image.
3. **Reflection:** There are several ways to mathematically transform raster images. The most common (and computationally simplest) are translation, rotation, and scaling. The translation is the movement of an image along the x- and y-axis. Rotation is the transformation of an image around a certain point, usually the origin (0,0). Scaling is the resizing of an image, which can be done isotropically (maintaining the same aspect ratio) or anisotropically (changing the aspect ratio).

All of these transformations can be done using interpolation, which is when new pixel values are estimated based on known values. The quality of the transformation depends on the interpolation

method used. The most common interpolation method is a bilinear interpolation, which gives each new pixel a value that is a weighted average of the known surrounding pixels.

The raster method of transformations is fast and easy to implement, but it can lead to some artifacts in the transformed image. These artifacts can be minimized by using higher-quality interpolation methods, such as bicubic interpolation.

Advantages:

There are many advantages to using the raster method of transformations as opposed to other methods. One advantage is that it is more accurate than other methods. This is because the raster method uses a grid system which makes it easy to determine the exact coordinates of each point on the image. This means that there is less chance of error when transforming an image.

Another advantage of the raster method is that it is less likely to cause distortion in an image. This is because the transformation is applied evenly across the entire image, rather than being applied selectively to certain areas. This makes it ideal for images that need to be transformed without changing their overall shape or appearance.

Finally, the raster method is also much faster than other methods. This is because all of the calculations are done by computer, rather than having to be done manually. This means that complex transformations can be carried out quickly and easily, without having to spend hours doing them by hand.

Disadvantages:

There are a few disadvantages to using the raster method of transformations. One is that it can be computationally expensive, especially if the raster data is large. Another is that it can be difficult to control the amount of distortion that occurs during the transformation process. Additionally, this method does not preserve all features of the original data, such as line work and text.

Applications:

There are many different ways to transform raster data, depending on the specific application. Some common applications include:

1. **Resampling to change the resolution of the raster:** The raster resolution is the number of pixels in a given area. Changing the raster resolution changes the number of pixels in an image, and therefore the size of the file. To change the resolution of a raster, you need to resample it. Resampling means changing the number of pixels in an image by adding or removing pixels. When you add or remove pixels, you change the pixel values so that they represent new values for the area being sampled. The most common way to

resample rasters is by using a bilinear interpolation. This means that new pixel values are calculated based on the surrounding four original pixel values.

2. **Reprojecting to change the coordinate system:** There are times when you need to change the coordinate system of your data. Maybe you're working with data from different sources that use different coordinate systems, or you need to use a specific coordinate system for analysis. In either case, you can reproject your data to a new coordinate system using QGIS. Reprojection is the process of transforming your data from one coordinate system to another. When you reproject your data, you specify the source and destination coordinate systems, and QGIS does the math to make sure your data is transformed correctly. This process can be done with vector or raster data, but we'll focus on raster data here. To reproject a raster layer in QGIS, go to Layer > Save As… and select the new coordinate system you want to use from the drop-down menu. You can also select multiple layers and reproject them all at once. Keep in mind that reprojection can sometimes introduce errors in your data. This is due to the fact that most map projections distort shape, area, distance, or direction in some way. So if accuracy is important to your work, make sure to check for errors after reprojecting your data.
3. **Reclassifying to change the values of cells in the raster:** There are two common ways to change the values of cells in a raster: reclassifying and rescaling. Reclassifying is when you assign new values to cells based on their original values. For example, you could reclassify all cells that have a value of 1 to have a value of 2. Or, you could reclassify all cells with values between 1 and 10 to have a value of 0. Rescaling is when you change the range of values in the raster. For example, you could rescale all cell values so that they range from 0 to 1. Or, you could rescale all cell values so that they are multiplied by 10. Both methods can be used to change the appearance of a raster dataset, but they are typically used for different purposes. Reclassifying is often used to group together similar values, while rescaling is often used to enhance contrast or make small changes in value easier to see.
4. **Calculating statistics such as mean, median, and mode:** There are a number of ways to calculate statistics such as mean, median, and mode from raster data. One common method is to use the "raster calculator" tool in a GIS software package. This tool allows you to input an expression that will be applied to all cells in the raster layer. For example, if you want to calculate the mean value of all cells in a raster layer, you would input the following expression into the raster calculator:"A" / count(). This expression tells the raster calculator to take the sum of all values in the raster layer ("A") and divide

it by the total number of cells. The result will be the mean value for the entire raster layer. You can use similar expressions to calculate the median and mode values as well.

5. **Creating histograms to visualize the distribution of values in the raster:** There are two ways to create histograms from raster data: by using the command line or by using a graphical user interface. To create a histogram using the command line, you need to use the GDALinfo tool. This tool will provide information about the raster dataset, including the number of bands, the data type, and the minimum and maximum values. You can then use this information to create a histogram using the GNUplot tool. To create a histogram using a graphical user interface, you can use the QGIS software. This software has a plugin called Raster Histogram that will allow you to visualize the distribution of values in the raster.