EXPT.NO:7
DATE: 16/04/2024

SEGMENTATION OF VEGETATION REGION FROM MULTISPECTRAL IMAGE USING MATLAB.

AIM:

To implement the Segmentation of vegetation region from multispectral image using MATLAB.

SOFTWARE USED:

MATLAB Version 2014a.

THEORY:

- **REMOTE SENSING:**

Remote sensing is the method of gathering data about objects or areas without direct contact. It uses sensors to capture electromagnetic radiation, which is then analyzed to obtain information about the Earth's surface, atmosphere, or other targets.This collected data is then analyzed and interpreted to extract valuable information about the Earth's surface, atmosphere, oceans, or other targets of interest. Remote sensing techniques are widely used in fields such as environmental monitoring, natural resource management, urban planning, agriculture, and disaster response, providing valuable insights for decision-making and scientific research.

- **MULTISPECTRAL IMAGE:**

A multispectral image is an image composed of multiple spectral bands, each capturing specific wavelengths of electromagnetic radiation, beyond the visible spectrum, to provide detailed information about objects or surfaces.Unlike a standard RGB (Red, Green, Blue) image, which only has three bands, multispectral images typically consist of four or more bands, allowing for the capture of additional information beyond what is visible to the human eye.

- **SEGMENTATION OF REGION OF INTREST FROM MULTI SPECTRAL IMAGE:**

Segmentation of regions of interest (ROI) from a multispectral image refers to the process of identifying and delineating specific areas within the image that are of particular interest for analysis or further processing. This involves partitioning the image into meaningful segments or regions based on characteristics such as color, texture, intensity, or spectral properties captured by the multiple bands of the multispectral image. The goal of segmentation is to accurately isolate and extract the regions that contain the objects or phenomena of interest, facilitating subsequent analysis or interpretation for various applications such as land cover classification, object detection, or environmental monitoring.

- **NORMALIZED DIFFERENCE VEGETATION INDEX (NDVI):**

The Normalized Difference Vegetation Index (NDVI) is a numerical measure used in remote sensing to assess and quantify the amount and health of vegetation in a particular area. It is calculated by comparing the reflectance of near-infrared (NIR) and red light wavelengths captured by sensors, indicating the density and vigor of vegetation. NDVI values range from -1 to 1, with higher values representing healthier vegetation, while lower values indicate less vegetation or non-vegetated surfaces.

- **SCATTER PLOT FOR REMOTE SENSING IMAGE:**

A scatter plot for remote sensing images is a graphical representation that visualizes the relationship between two or more variables extracted from the image data. In remote sensing, these variables could include spectral reflectance values, indices such as NDVI, or other derived parameters such as vegetation density or soil moisture content. The purpose of creating scatter plots is to identify patterns, trends, or correlations between these variables, which can provide valuable insights into the characteristics of the observed landscape or target area. By plotting data points corresponding to different image pixels or regions, scatter plots help analysts understand the relationships between various spectral bands or derived indices, aiding in tasks such as land cover classification, vegetation monitoring, or environmental assessment.

ALGORITHM:

1. Import Colour-Infrared Channels from a Multispectral Image File
2. Construct an NIR-Red Spectral Scatter Plot
3. Compute Vegetation Index via MATLABArray Arithmetic
4. Locate Vegetation -- Threshold the NDVI Image
5. Link Spectral and Spatial Content.

PROGRAM:

```
CIR = multibandread('paris.lan',[512, 512, 7],'uint8=>uint8',...
                128,'bil','ieee-le',{'Band','Direct',[4 3 2]});
imshow(CIR)
title('CIR Composite')
text(size(CIR,2),size(CIR,1) + 15,...
'Image courtesy of Space Imaging, LLC',...
'FontSize',7,'HorizontalAlignment','right')
NIR = im2single(CIR(:,:,1));
R = im2single(CIR(:,:,2));
imshow(R)
title('Visible Red Band')
imshow(NIR)
title('Near Infrared Band')
plot(R,NIR,'+b')
ax = gca;
ax.XLim  = [0 1];
ax.XTick = 0:0.2:1;
ax.YLim  =  [0 1];
ax.YTick = 0:0.2:1;
axis square
xlabel('red level')
```

```
ylabel('NIR level')
title('NIR vs. Red Scatter Plot')
ndvi = (NIR - R) ./ (NIR + R);
figure
imshow(ndvi,'DisplayRange',[-1 1])
title('Normalized Difference Vegetation Index')
threshold = 0.4;
q = (ndvi> threshold);
100 * numel(NIR(q(:))) / numel(NIR)
imshow(q)
title('NDVI with Threshold Applied')
figure
subplot(1,2,1)
plot(R,NIR,'+b')
hold on
plot(R(q(:)),NIR(q(:)),'g+')
axis square
xlabel('red level')
ylabel('NIR level')
title('NIR vs. Red Scatter Plot')
subplot(1,2,2)
imshow(q)
colormap([0 0 1; 0 1 0]);
title('NDVI with Threshold Applied')
```

DESCRIPTION:

COMMANDS:

- **Im2single**

The `im2single` function in MATLAB converts an input image from its original data type to single-precision floating-point format. This means that each pixel value in the image is represented as a floating-point number ranging from 0 to 1, where 0 corresponds to black and 1 corresponds to white. This conversion is commonly used in image processing tasks to ensure numerical accuracy and consistency when performing calculations or applying algorithms that require floating-point data types.

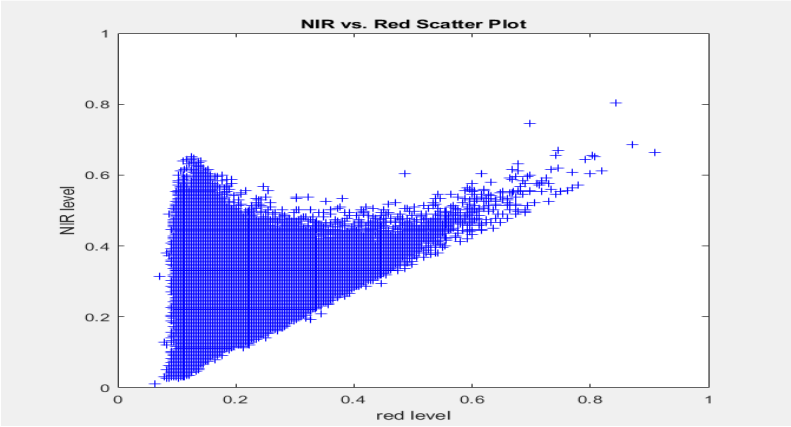
- **NDVI**

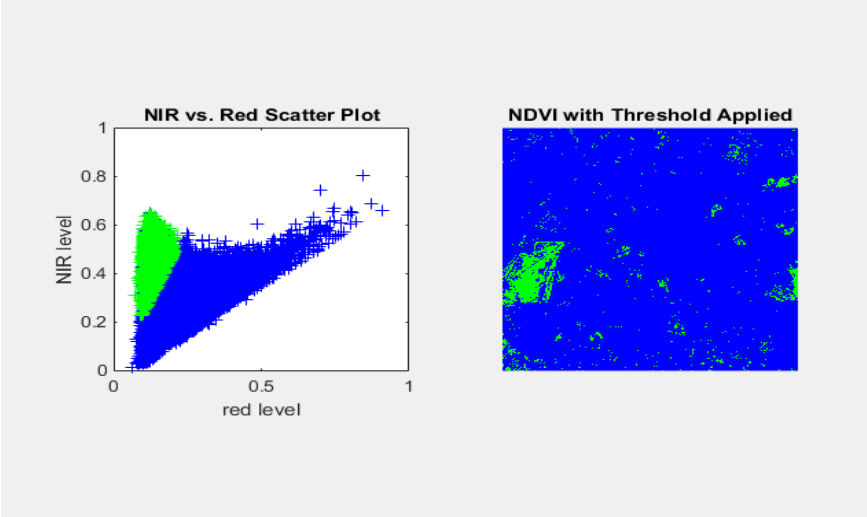
The NDVI is calculated by taking the difference between the Near-Infrared (NIR) and Red (R) bands, and then dividing this difference by the sum of the NIR and Red bands:

NDVI=NIR−RNIR+RNDVI=NIR+RNIR−R

This formula yields values ranging from -1 to 1. Higher NDVI values typically indicate healthier and more dense vegetation, while lower or negative values correspond to non-vegetated surfaces such as water or bare soil. NDVI is a valuable tool in assessing vegetation health, monitoring land cover changes, and evaluating ecosystem productivity.

OUTPUT:





Note: OUTPUT should be in LHS. & note the image size, row, column and channel size

RESULT:

Thus the implementation of segmentation of vegetation region from multispectral image is done through MATLAB software and the output is verified.