LAND USE PATTERN USING SEMI-AUTOMATIC CLASSIFICATION PLUGIN (SCP) WITH OPEN SOURCE DATA

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Abstract- **Since the early 1970s, NASA (National Aeronautics and Space Administration of the United States) has been developing a series of multispectral satellites known as Landsat. Landsat photos are frequently used in environmental studies. Image classification is one of the most important tasks in image processing and analysis. It's used to look at different forms of land use and cover. Satellite photos, like high resolution satellite images, are obtained using remote sensing. However, just examining these photos isn't enough; we also need to process them. Thus, to analyze these images, we need to classify them. For this paper the Landsat classification has been performed on the Sungai Petani a major city in Malaysia. Using Landsat 8-OLI data, this paper propose a wavelet transform-based Landsat classification. This classification analysis has been performed using the plugin tool Semi-Automatic Classification tool in QGIS software.**

Keywords—**Lands at Classification, Semi-Automatic Classification, NASA, QGIS, LANDSAT-8**

I. INTRODUCTION

A new era of Earth observation is upon us, where multiple, freely available remote sensing systems offer data at unprecedented spatial, temporal, and spectral resolutions. Landsat plays a prominent role in this development: The Landsat archive was made available in 2008, resulting in a massive exploitation of Earth observation data with exponential access statistics. The Sentinel-2 constellation is currently amending this long-term data record with even higher spatial, temporal, and spectral resolution. The European Space Agency (ESA) and the U.S. Geological Survey (USGS) publish 4 TB Sentinel-2 and 1.5 TB Landsat data on a daily basis, accumulating petabyte-scale archives quickly. We may be able to attain sustainable development goals by closely monitoring environmental status and change on relevant scales and at a global scale through this regular data flow. Although the first point is merely a technical issue that can be overcome

with enough processing power and storage, Earth observation data still need to be processed to an extent before being adequate for most analyses. Remote sensing, or perhaps the monitoring of objects without directly engaging with them, involves a wide range of fields. This usually refers to the examination of remotely sensed images, such as RADAR or multispectral satellite photos, in the context of remote sensing. Despite this, much commercially available remote sensing software is prohibitively expensive for the average user outside of major corporate or public institutions. We'll walk through a technique with Landsat imagery to distinguish icings. Icings can threaten distant villages or sensitive infrastructure as a result of several overflows. The workflow was created utilising high-end proprietary tools such as ENVI and ArcGIS. The goal of this work is to show how QGIS can be used in a real-world scientific situation by reproducing the results with free software.

II. OBJECTIVE

The overall objective of this study is to investigate the LANDSAT classification of the major city Sungai Petani in Malaysia using open source data products and software.
To view the various ground covers like rivers, Agriculture, Forests, buildings, bare soil.

III. LITERATURE REVIEW

I have reviewed many literatures related to my research work. Some literatures which were very useful for my research work are as under.
Meriame Mohajane, et. al., described that the goal of the study was to establish the LCLU status of the Azrou forest in Morocco's Middle Atlas from 1987 to 2017. In the Azrou forest, up-to-date reference information was developed using remotely sensed data, MLC, GIS geospatial techniques, and the usage of NDVI and auxiliary data (field data). The goal of this study was to have a recent viewpoint on LULC changes that occurred in Azrou forest during the previous 30 years.

The following is a summary of the work's findings: There has been a significant increase in vegetation in the research region; the amount of bare soil has significantly decreased over the study period; This research shows that using a free archive of Landsat data and processing it with open source software results in a reliable method of mapping and assessing changes in land cover over time, which can be used to inform land management and policy decisions. We intend to compare the outcomes of employing Landsat data with other forms of remote sensing data (e.g., Sentinel 2) to monitor LULC in the study area in future research. However, data from Sentinel 2 has only been accessible since 2015. The proposed methodology will also be extended to forestlands in other locations, allowing for a more thorough monitoring and mapping of forest change across Morocco's Middle Atlas.

Rui Correia 1 ID , Lia Duarte, ID , Ana Cláudia Teodoro and António Monteiro: This study proposes PI2GIS, a new open source plugin, as an integrated and user-friendly solution for processing satellite images in the QGIS open source environment. PI2GIS was developed as a new tool to support remote sensing courses at the university level, and it can be a useful contribution to easy and modern education, as it was developed under the open source concept and is expected to be simpler to use than other remote sensing software, based on the positive feedback provided by master's degree students who have already tested it. PI2GIS has emerged as a new training method for enhancing EO data usage.

The Emerging technologies, such as open source software, would motivate learners to take on more responsibility in their career path, to work independently with new current tools, and to apply and adapt their knowledge to unexpected new scenarios, such as the need to develop a new application (e.g. PI2GIS). The prospect of developing GIS open source applications and the usage of these new tools in the classroom are presented in this work as two approaches to new learning methodologies. PI2GIS was tested by a few Master's degree students in remote sensing, who confirmed the tool's limitations and downsides and provided input. Furthermore, the application had previously been enhanced. In the future, PI2GIS will be used in the Master of Science in Remote Sensing.

This paper proposed PI2GIS as an open, integrated, and user-friendly remote sensing application for remote sensing imagery processing, which was implemented in QGIS software. Regarding the scant open solutions available to deal with imaging processing in a GIS context, the integration and release of remote sensing imagery operations through a user-friendly interface may constitute an added value of PI2GIS. The open nature of PI2GIS contributes to the millennium development goals, such as providing individuals with fair access to high-quality education and opportunities for lifelong learning. Simplify the use of remote sensing data in a GIS setting in environmental management and teaching, PI2GIS can help to improve educational quality.

IV. METHODOLOGY

A. QGIS

(QGIS) is a open source software that works with a broad range of geospatial vector and raster file types as well as database formats. The Programme provides conventional GIS functions such as mapping and data manipulation, as well as a diversity of mapping tools. QGIS also offers plugin support, which extends its capabilities by adding features such as Geolocation data connectivity, geo referencing, and extra mapping components. The QGIS project was founded by Gary Sherman in 2002. In June 2002, QGIS was officially registered as a project on the Source Forge webpage. The first CVS checking dates were from July 6th 2002. The QGIS project continuously attracted more software developers and users. In addition to Qt, required dependencies of QGIS include GEOS and SQLite. GDAL, GRASS GIS, Post GIS, and PostgreSQL are also recommended, as they provide access to additional data formats. It is a highly used spatial data analysis method. It can scale to meet user needs, from a simple data viewer to data collection, editing, and analysis, to web data serving – on as many machines as needed and without any licensing issues.

A GNU General Public user-friendly Open Source Geographic Information System (GIS). The Open Source Geospatial Function has approved QGIS as an official project. It covers a wide variety of vector, raster, and database formats and functions and runs on Linux, Unix, Mac OSX, Windows, and Android.

B. Semi-Automatic Classification Plugin

The SCP is a Python plugin for the software QGIS that was developed with the hope of creating land cover monitoring easier for persons whose primary field is not remote sensing but could benefit from it. The Semi-Automatic Classification Plugin is a set of intertwined tools and a user interface for easing and automating the phases of land cover classification, from the download of remote sensing images to pre processing (i.e. tools for preparing data for analysis or other calculations), processing (i.e. tools for trying to perform land cover classification or analysis), and post processing (i.e. tools for performing land cover classification or analysis) (i.e. tools for assessing the classification accuracy, refining the classification, or integrating additional data). Because remote sensing data processing can be computationally intensive, most developed tools employ Python multiprocessing to take advantage of the system's CPU and RAM by dividing the work across numerous sub processes. The built-in Python algorithms and third-party algorithms for particular function (e.g. Sentinel-1 pre processing through ESASNAP), the SCP Plugin aims to provide a complete collection of software tools for processing remote sensing data, relieving the phases related to the download, pre processing of images, and post processing of classification systems.

i.   USGS Earth Explorer
Earth Explorer is a Web application that allows users to search for, preview, and download or order digital data from the USGS. The site also has AVHRR, DOQ, aerial photography, and other data in addition to Landsat MSS, TM, and ETM+ data. The USGS Earth Explorer data site offers a one-stop shop for geospatial datasets from our vast collection. Landsat satellite imagery, Radar data, UAS data, digital line graphs, digital elevation model data, aerial photos, Sentinel satellite data, some commercial satellite imagery including IKONOS and OrbView3, land cover data, digital map data from the National Map, and many other datasets are available via interactive map or text search.

ii.   Procedure
Step 1: The first step is to download the image from this archive (data available from the USGS Earth Explorer) and unzip the downloaded file.
Step 2: Start using QGIS. In the SCP input, pick the file sample image.tif by clicking the Input image button. Sample image.tif is set as the Input image, the image is displayed in the map, and bands are loaded into the Band set after sample image.tif is selected**.**
Step 3: A Color Composite of Bands can be displayed: Near-infrared, red, and green: choose item 4-3-2 from the list RGB= in the Working toolbar (corresponding to the band numbers in Band set). The map's visual colours change depending on the bands selected, and vegetation is emphasised in red (if the item 3-2-1 was selected, natural colours would be displayed).

Fig 1: Band Compositions for LANDSAT 8

Step 4: Now we must establish the Training input so that we may collect Training Areas (ROIs) and determine their Spectral Signature (which are used in classification) To create the Training input, click the button on the SCP dock and give it a name (e.g. training.scp). The file path is presented in the Training input.
Step 5: We will create ROIs that define the Classes and Macro classes. A Class ID is assigned to each ROI to designate a land cover class. The Class ID codes used in this tutorial are shown in the table below.

CLASS NAME	CLASS ID
Water	1
Built up	2
Vegetation	3
Bare Soil	4

Step 6: A region of interest can be created manually by drawing a polygon or automatically by using an algorithm to grow the region. Look at the dark area (it's a lake) in the lower right corner of the image. Create a ROI manually by clicking the button in the working toolbar. Use the left-click to locate the ROI vertices on the map, and the right-click to pinpoint the vertex terminating the polygon. A semi-transparent orange polygon is shown over the image, however it is not saved in the Training input.
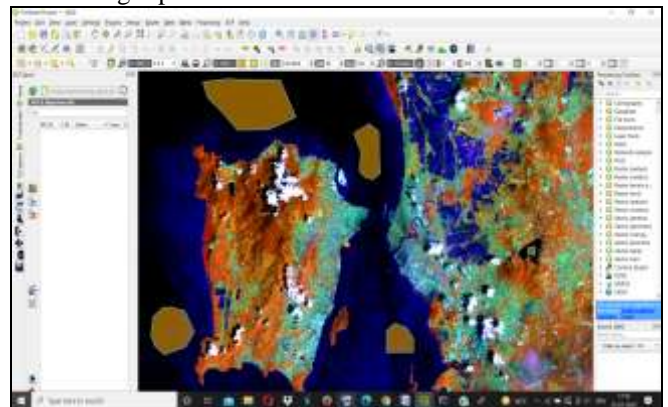

Fig 2: Polygons are displayed

Step 7: Manually created ROIs can be saved to training inputs if the shape is good. Go to the dock and define the Macro classes and Classes. In the ROI creation set MC ID = 1 and MC Info = Water; also set C ID = 1 and C Info = Lake. Now click to save the ROI in the Training input. The ROI is then listed in the ROI Signature list and the spectral signature is calculated.
Step 8: Upon saving the ROI in Training input, the CID is automatically increased by 1 when creating ROIs. In the map, the saved ROI is displayed as a dark polygon, and the temporary ROI is removed. Furthermore, in the ROI Signature list, you can see that the Type is B, meaning that the ROI spectral signature was calculated & saved in the Training input. The second ROI for the built-up class will be generated using the automatic region growing algorithm. Zoom in on the map to the upper left region with the blue area. In Working toolbar set the Dist value to 0.08. Click the button in the Working toolbar and click over the blue area of the map.

After a while the orange semi-transparent polygon is displayed over the image.

Step 9: A temporary ROI created with the automatic region growing algorithm. In the ROI creation set MC ID = 2and MC Info = Built-up; also set C ID = 2 (it should be already set) and C Info = Buildings.

Step 10: The classification process uses the ROIs (and spectral signatures of those ROIs) collected. A Classification preview is useful in order to evaluate the results (influenced by spectral signatures) before the final classification. To improve the classification of land cover, we can collect more ROIs if the results are not satisfactory. Set the color of land cover classes to be displayed in the classification raster before running the classification (or preview). Select a representative color (in the column Color) for each ROI in the ROI Signature list
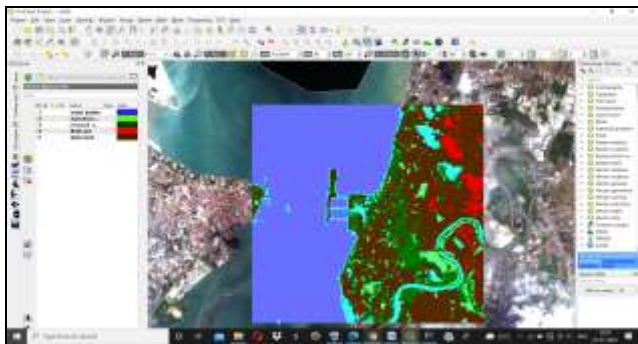
Fig 3: Classification

Step 11: click the button and then left click a point of the image in the map. The classification process should be rapid, and the result is a classified square centered in clicked point.

Step 12: Considering that the classification preview results were good. We can proceed to the real land cover classification of the entire image. In the Classification output, click the button and specify the path to the classification output, which is a raster file (.tif). If the Play sound when finished option is enabled in the Classification process settings, a sound is played when the process is completed.

Step 13: Therefore the land cover classification is done.

V. CONCLUSION & DISCUSSION

THE FOLLOWING ARE THE LANDCOVER TYPES OF SUNAGI PETANI OF MALAYSIA
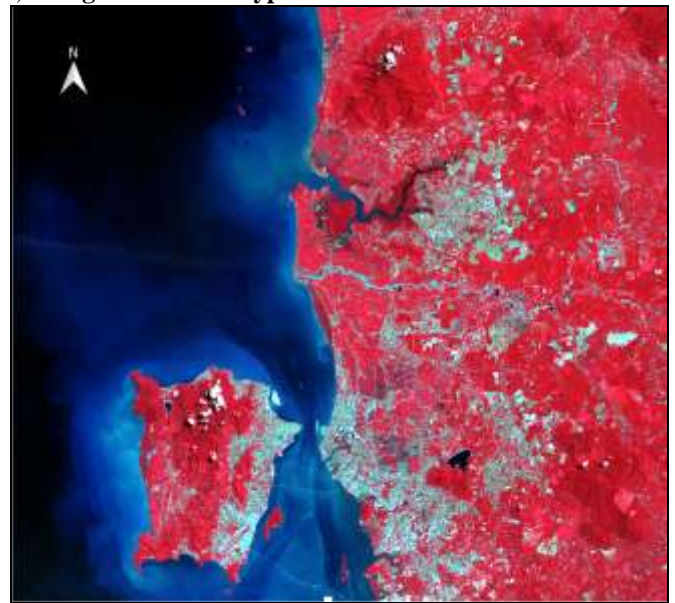
1) **Vegetation band type classification**

Fig 4: Vegetation

2) **Virtual view of Sungai Petani**

Fig 5: Virtual view
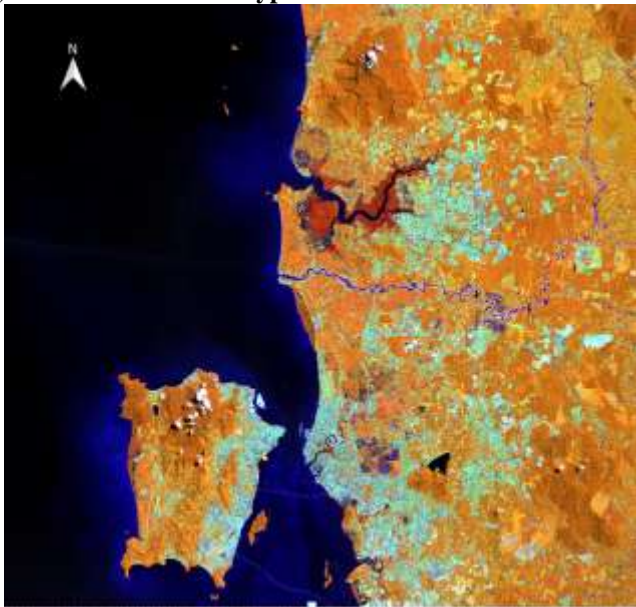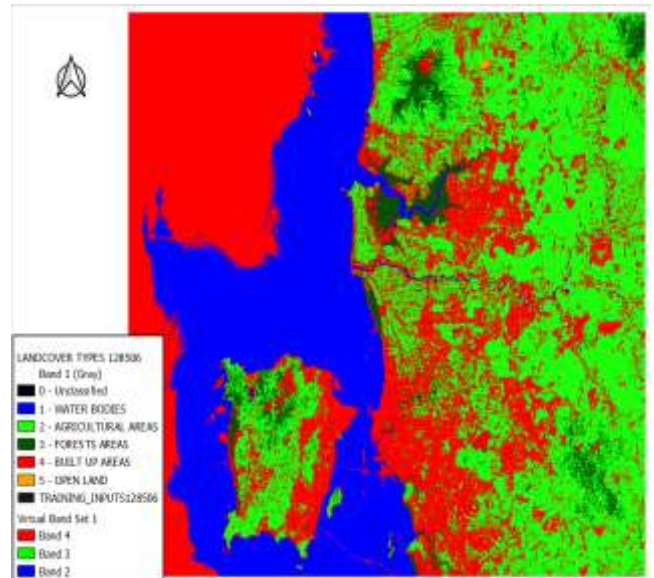
3) **Land cover band type**

Fig.6: Land cover

Fig.7: land Type Classification on first view

Fig.8: Land Type Classification on Second view

Fig 9: Overall Land classification of Sungai Petani

VII.   REFERENCES

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