Automated Land Classification using AI/ML

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Abstract:- The wide unfold of mobiles as hand-held devices end up in varied innovative applications that create use of their ever-increasing presence in our existence. One such application is location chase and monitoring; chase exploitation Geographical Positioning System (GPS) and world System for Mobile Communication (GSM) technology. Land information systems (LIS) provide a technological foundation for decision-making in a wide range of natural resource applications, including scientific, environmental, engineering, and public policy. The LIS provides a 'framework to mix land surface models, relevant knowledge and computing tools and resources' (Kumar et al., 2006). Typically, LIS represents a processed info repository for holding geospatial elements, comprising 'mapping unit' pure mathematics, and connected geo-referenced materials like satellite imaging, earth science observations, and predictions, and scanned heritage mapping, that's wherever the thought of analysing the land via the assistance of satellite imaging enters. The system displays the item moving path on the monitor and also the same info may also be communicated to the user's cellular phone, thus we'd like an associate degree application to form one such mil model that offers North American nation automatic classification of land exploitation mil options. With a marker feature with draggable practicality on Google maps, survey officers will regulate coordinate positions additional exactly with real-world things on digital maps.

Keywords:- Machine Learning [ML], Artificial Intelligence [AI], GPS, LIS

I.   INTRODUCTION

Recent advances in computing technology, cloud computing, and superior computing area unit paralleled with those in advanced computer science (AI) algorithms and important investment within the European Copernicus Earth Observation program and its watch satellite missions. AI allows automatic detection of spatial patterns in environmental knowledge like satellite pictures supported coaching knowledge. The paradigm of searching for spatial patterns rather than the historic target spectral data in the satellite representational process permits the detection of the latest sorts of land cowl and land use. The free and open convenience of world coverage Earth observation knowledge consistently collected and archived by house agencies. Remotely perceived satellite pictures and knowledge embrace spectral, spatial, and temporal Resolutions. Spectral statistics involves components of remotely perceived image classification. The most facet that influences the accuracy of a ground object is spatial resolution. Land cowl maps for environmental designing, land use amendment detection, and transportation designing are often done mistreatment temporal resolution. knowledge integration and analysis of urban areas mistreatment mediums resolution remote sensing representational process chiefly focuses on the documentation of engineered up areas or is employed for differentiating between residential, business and industrial zones. to collect numerous geographic knowledge in numerous ways and techniques area unit obtainable. Geographic's mapping and earth resources inventory and mapping represent one of the most important activities in numerous geosciences and engineering disciplines. Combined analysis of map knowledge set at completely different scales is important in modelling and understanding processes associated with the Earth's physical setting, managing earth resources, etc. of these activities involving geographic knowledge sets area unit qualified because the four Ms: mensuration, mapping, monitoring, and modelling. The term Geographic data Systems (GIS) is sometimes utilized, particularly since the go's, to explain computerized systems dedicated to the analysis of varied geographic knowledge sets, hold on within the style of digital maps, and also the extraction and distribution of geographic data. Numerous tools are developed permitting localized searches in geographic databases and knowledge extraction, operations, map overlay, and combined knowledge sets analysis. Additional specialized GIS has conjointly been developed permitting full 3D illustration of the geographic house and new approaches area unit being explored for representing and analysing phenomena evolution in house and time. GIS area unit currently thought-about customary technology for geographic knowledge analysis and mapping. Pattern recognition and laptop vision were introduced in numerous geosciences and engineering disciplines within the early '70s as a method of mechanically extracting pertinent geographic data from remote sensing representational process.

II.   LITERATURE REVIEW

Over the previous couple of years, deep learning (DL) algorithms have exploded in quality for remote-sensing image process. the most decilitre ideas applicable to remote sensing area unit given during this report, and quite two hundred publications during this field area unit reviewed and examined, the bulk of that were revealed among the last 2 years. A meta-analysis was initial conducted to assess the state of remote sensing decilitre analysis in terms of study targets, decilitre model(s) used, image special resolution(s), study space sort, and classification accuracy achieved. Following that, a comprehensive study of however decilitre has been used for remote sensing image analysis tasks like

image fusion, image registration, scene classification, object detection, land use and land cowl (LULC) classification, segmentation, and object-based image analysis is performed (OBIA). From pre-processing to mapping, this study covers nearly each application and technology within the field of remote sensing. Land cowl classification is one in all the popular ways used for remote sensing because it lays the muse of the many world and environmental applications. Before the advancements of the technology, algorithms like most probability classifier, SVM, Random forest and object primarily based classification. With the assistance of ArcGIS API for Python, showcases associate degree finish to finish land cowl classification progress. There are 3 major steps within the workflow: (1) extract coaching knowledge, (2) train a deep learning image segmentation model, and (3) deploy the model for illation and map creation. We'll use World imagination and high-resolution tagged knowledge from the Chesapeake Conservancy land cowl project to assist justify this operation.

III. METHODOLOGY

ArcGIS professional provides information preparation tools for deep learning workflows, conjointly for improved support for deploying qualified models for feature extraction and classification. Similar capabilities are on the market in ArcGIS Image Server within the ArcGIS Enterprise ten.7 update that permits users to deploy deep learning models at scale mistreatment distributed computing. Learn modules within the ArcGIS API for Python to coach deep learning models employing a easy, intuitive API. ArcGIS Notebooks offers a ready-to-use atmosphere for deep learning model coaching. For object detection and classification workflows mistreatment CNTK, Keras, PyTorch, fast.ai, and TensorFlow, ArcGIS provides intrinsically Python formation functions. You'll be able to conjointly produce your own Python formation feature that employs your most popular deep learning library or a specific deep learning model/architecture.

3.1 ArcGIS PRO:

Every part of the information science progress may be motor-assisted by ArcGIS tools, as well as information preparation and preliminary information analysis; model training; special analysis; and at last, scattering results through internet layers and maps and driving field operation. ArcGIS professional additionally provides information preparation tools for deep learning workflows, additionally as improved support for deploying qualified models for feature extraction and classification.

3.2 ANDROID STUDIO

Linking of the deep learning trained modules from ArcGIS Pro to Android Studio to work as an front-end app giving the satellite imagery, data and also providing the user the benefit of choosing their specific location through the ArcGIS satellite map.

3.3 DEEP LEARNING MODULE

Deep learning rekindled the pursuit of artificial intelligence in the direction of a general-purpose computer capable of automating any human-related operation. This is primarily due to a burst of interest in deep machine learning, which uses hierarchical feature representations rather than human-designed features or rules to model high-level abstractions, demonstrating great promise in recognizing and characterizing LC and LU patterns from VFSR imagery.

IV. WORKING

At the very initial stages, we will be training the deep learning data sets using satellite imagery for ArcGIS pro. In which the further segmentation and Labelling of the images will take place. To export training data, there is a labelled imagery layer with the class label for each position, as well as a raster input with all the original pixels and band information. This land cover classification situation will use a subset of the one-meter resolution Kent County, Delaware dataset as the named imagery layer and World Imagery: Color Infrared as the raster input. With the feature class and raster layer in place, the module is ready to use the export training data() method in the ArcGIS. To export training data, use the Learn module. In addition to feature class, raster layer, and output folder, we must also specify tile size (image chip size), strid size (distance to transfer each time when creating the next image chip), chip format (TIFF, PNG, or JPEG), and metadata format (how we are going to store those training labels). Depending on the size of the data, tile and stride size, and computing resources, this operation took 15 minutes to 2 hours in our experiment. After the modules have been trained and published as a deep learning package, the deep learning package will export and connect the maps to Android Studio for user access.

Fig. 1: A subset of the labelled data for Kent County, Delaware.

V. CONCLUSION

Once the maps are exported and synced with the Android Studio, the users can easily drag the marker on the map to their selected locations. National Agriculture Imagery Program (NAIP) images are categorised into six major land cover classes by the qualified model: 1) structures, 2) roads or parking lots, 3) water, 4) cultivated, open land or bare land, 5) woodland, and 6) planted or dark cropland, among others. The use of ArcGIS Pro with the ArcGIS API for Python and combine it with deep learning tools (e.g., Keras) to make data planning and modelling easier and integrating it with Android studio for the user output .Using NAIP bands to identify NAIP, the U-Net model performs very well.

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