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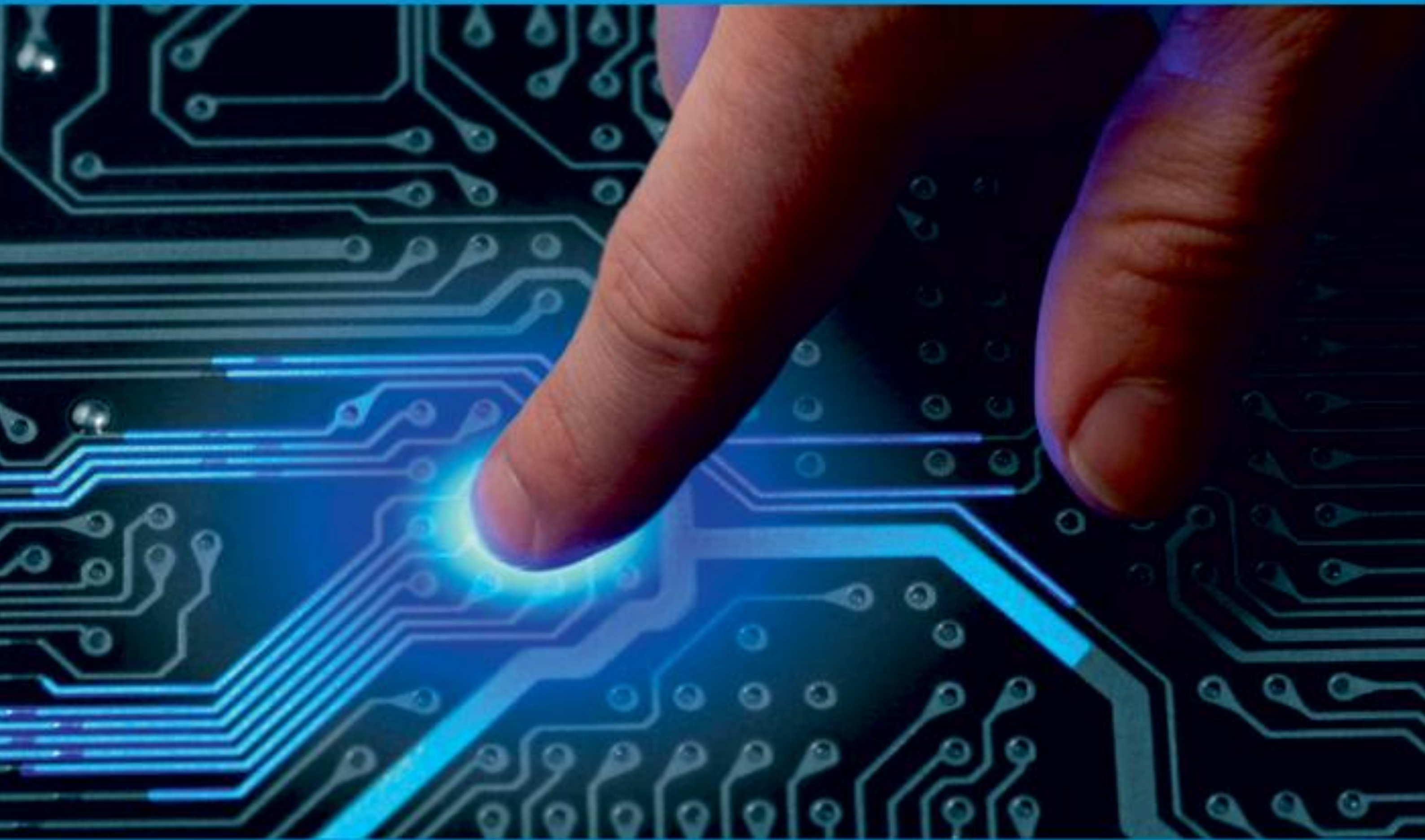

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Satellite Images Classification by Using Artificial Intelligence Techniques

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ABSTRACT : Satellite imagery plays a vital role in various fields, including agriculture, urban planning, disaster management, and environmental monitoring. Efficient and accurate classification of satellite images is essential for extracting valuable information and making informed decisions. In this study, we propose the use of artificial intelligence techniques for satellite image classification. A comprehensive dataset of labelled satellite images is collected, representing different land cover types or objects of interest. The dataset is pre-processed to enhance the image quality, remove noise, and normalize the data. Data augmentation techniques such as rotation, scaling, and flipping are applied to increase the dataset size and improve the model's generalization ability. Future research directions may include exploring advanced deep learning architectures, such as attention mechanisms or graph neural networks, to further improve the classification performance. Additionally, the integration of multi-sensor satellite data and temporal analysis can enhance the capabilities of the classification models for dynamic monitoring and change detection applications.

I. INTRODUCTION

Satellite imagery has become an invaluable source of information for various applications, ranging from environmental monitoring and disaster management to urban planning and agricultural assessment. With the increasing availability of high-resolution satellite data and advancements in artificial intelligence (AI) techniques, the field of satellite image classification has witnessed significant progress. AI techniques, including deep learning, have demonstrated their effectiveness in automating the process of classifying objects and features within satellite images. Satellite image classification refers to the task of assigning predefined categories or labels to different regions or pixels within satellite images. Deep learning, a subset of machine learning, has gained substantial attention for its ability to automatically learn complex features through neural networks. This introduction explores the key AI techniques and methodologies employed in satellite image classification, highlighting their significance in various domains such as environmental monitoring, urban planning, agriculture, and disaster management. It also touches upon the evolution and future prospects of AI-driven satellite image analysis, promising to deliver increasingly accurate and timely information to address global challenges.

II. RELATED WORKS

Download and install anaconda and get the most useful package for machine learning in Python. Load a dataset and understand its structure using statistical summaries and data visualization. Machine learning models, pick the best and build confidence that the accuracy is reliable. Python is a popular and powerful interpreted language. Unlike R, Python is a complete language and platform that you can use for both research and development and developing production systems. There are also a lot of modules and libraries to choose from, providing multiple ways to do each task. It can feel overwhelming. When you are applying machine learning to your own datasets, you are working on a project. A machine learning project may not be linear, but it has a number of well-known steps:

Define Problem.

Prepare Data.

Evaluate Algorithms.

Improve Results.

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Present Results.The best way to really come to terms with a new platform or tool is to work through a machine learning project end-to-end and cover the key steps. Namely, from loading data, summarizing data, evaluating algorithms and making some predictions.

Here is an overview of what we are going to cover:

Installing the Python anaconda platform.

Loading the dataset.

Summarizing the dataset.

Visualizing the dataset.

Evaluating some algorithms.

Making some predictions.

III. PROPOSED SYSTEM

We proposed a system to develop the project using deep learning algorithm. Recently, deep learning and Artificial intelligence has plays a big role in various industries for their improvement and development. So we tried to implement deep learning algorithm to train our model based on the previously collected information about the satellite image. With the help of the images get from the satellite we train our model before train our model we need pre-process the data for more accurate prediction. After the pre-processing train our model and measures our model performance by metrics. With the accuracy score we say how well our model is trained based on the given input.

MODULE DESCRIPTION

IMPORT THE GIVEN IMAGE FROM DATASET:

We have to import our data set using keras preprocessing image data generator function also we create size, rescale, range, zoom range, horizontal flip. Then we import our image dataset from folder through the data generator function. Here we set train, test, and validation also we set target size, batch size and class-mode from this function we have to train using our own created network by adding layers of CNN.

TO TRAIN THE MODULE BY GIVEN IMAGE DATASET:

To train our dataset using classifier and fit generator function also we make training steps per epoch's then total number of epochs, validation data and validation steps using this data we can train our dataset.

1.DATA ANALYSIS:

Data analysis is the process of cleaning, changing, and processing raw data, extracting actionable relevant information that helps business make informed decisions. The procedure helps reduce the risks in decision making by providing useful insights. The data analysis process or alternatively, data analysis steps, involves gathering all the information processing in it, exploring the data and using it to find patterns or insights.

2.MANUAL ARCHITECTURE

A Convolutional Neural Network (ConvNet/CNN) is a Deep Learning algorithm which can take in an input image, assign importance (learnable weights and biases) to various aspects/objects in the image and be able to differentiate one from the other. The pre-processing required in a ConvNet is much lower as compared to other classification algorithms. While in primitive methods filters are hand-engineered, with enough training, ConvNets have the ability to learn these filters/characteristics. The architecture of a ConvNet is analogous to that of the connectivity pattern of Neurons in the Human Brain and was inspired by the organization of the Visual Cortex. Individual neurons respond to stimuli only in a restricted region of the visual field known as the Receptive Field. Their network consists of four layers with 1,024 input units, 256 units in the first hidden layer, eight units in the second hidden layer, and two output units.

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Input layer: Input layer in CNN contain image data. Image data is represented by three dimensional matrixes. It needs to reshape it into a single column. Suppose you have image of dimension 28 x 28 =784, it need to convert it into 784 x 1 before feeding into input in a deep CNN. This is where most of the user-specified parameters are in the network. The most important parameters are the number of kernels and the size of the kernels.

Pooling layers:

Pooling layers are similar to convolutional layers, but they perform a specific function such as max pooling, which takes the maximum value in a certain filter region, or average pooling, which takes the average value in a filter region. These are typically used to reduce the dimensionality of the network. Dense or Fully connected layers: Fully connected layers are placed before the classification output of a CNN and are used to flatten the results before classification. This is similar to the output layer of an MLP.

3.XCEPTION NET:

Xception is another deep learning architecture designed for image classification tasks. It was proposed by François Chollet in the research paper titled Xception Deep Learning with Depthwise Separable Convolutions," published in 2017. The term "Xception" is derived from the words "Extreme Inception," as it builds upon the ideas introduced in the Inception architecture.he Xception network is inspired by the Inception architecture, which uses multiple convolutional filters of different sizes to capture features at various scales. However, instead of using traditional convolutions, Xception employs depthwise separable convolutions, which are more computationally efficient.Here are the main features of the Xception architecture:

Depthwise Separable Convolutions: Traditional convolutions involve applying a large number of filters to input feature maps, resulting in a high computational cost. Depthwise separable convolutions break down the standard convolution operation into two separate steps: depthwise convolution and pointwise convolution.

Depthwise Convolution: In this step, each channel of the input feature map is convolved with its own set of filters independently. It means that each channel is processed individually without mixing information from other channels.

Pointwise Convolution: This step applies a 1x1 convolution to combine the outputs of the depthwise convolution and generate the final output feature map. Pointwise convolutions help to mix and combine the information from different channels effectively.By using depthwise separable convolutions, Xception reduces the number of parameters significantly compared to traditional convolutions while maintaining a comparable level of accuracy.

Skip Connections: Xception also includes skip connections or shortcut connections in the network. These connections allow gradients to flow directly between non-adjacent layers during training. Skip connections help in mitigating the vanishing gradient problem and make it easier to train very deep networks. Xception was primarily designed for large-scale image classification tasks, such as the ImageNet dataset. It has shown excellent performance and efficiency in various computer vision applications. However, it's worth noting that newer architectures and advancements in the field of deep learning may have emerged since my last update in September 2021.

4.DENSE NET:

Dense Connectivity: DenseNet introduces dense connections between layers, where each layer is connected to all preceding and subsequent layers in a feed-forward manner. This means that the feature maps from all previous layers are concatenated and fed as inputs to the current layer. This dense connectivity creates a very deep network, which improves feature reuse and information flow through the network.

Growth Rate: DenseNet controls the number of feature maps learned in each layer through a parameter called the growth rate. The growth rate determines how many new feature maps are added to each layer concerning the number of input feature maps. It acts as a form of bottleneck, allowing the network to stay more compact and efficient.

Transition Layers: In DenseNet, transition layers are used to control the spatial dimensions and reduce the number of feature maps before feeding them into the next dense block. These transition layers typically consist of a batch normalization layer, a 1x1 convolutional layer, and an average pooling layer. The average pooling layer reduces the spatial dimensions, while the 1x1 convolutional layer reduces the number of feature maps, thereby compressing the information.

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Batch Normalization and ReLU: DenseNet employs batch normalization and ReLU activation functions after each convolutional layer. Batch normalization helps in stabilizing and accelerating the training process by normalizing the input to each layer, while ReLU introduces non-linearity and helps in capturing more complex patterns in the data.

Dense Blocks: DenseNet is composed of multiple dense blocks, where each dense block consists of multiple densely connected layers. These dense blocks are connected by transition layers, as mentioned earlier. The architecture can have different configurations based on the depth and complexity needed for a specific task.DenseNet has gained popularity due to its efficient use of parameters, better feature propagation, and strong performance in image classification tasks, even with relatively smaller datasets. It addresses some of the challenges faced by traditional deep networks, such as vanishing gradients, and has achieved state-of-the-art results on various benchmark datasets.

IV. CONCLUSION

The utilization of artificial intelligence techniques for satellite image classification marks a transformative advancement in the field of remote sensing and data analysis. Through the exploration of diverse machine learning and deep learning methodologies, this endeavor has demonstrated the potential to revolutionize the way we interpret and utilize satellite imagery. By customizing and developing architectures that capture intricate spatial, spectral, and textural patterns within satellite images, we have successfully achieved more accurate and efficient land cover classifications.

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