Department of Computer Science and Engineering
Graphic Era deemed to be University, DEHRADUN

Project Requirement and Specification

On

Satellite Image Analysis using Deep Learning

(CSE V Semester Mini project)

2021-2022

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CSE-DS & AI-V-Sem

CONTEXT:

This project has been done as part of my course for B. Tech at GRAPHIC ERA UNIVERSITY, DEHRADUN.

MOTIVATIONS:

Nothing tells of the ubiquity of satellite imagery like Google Maps. A completely unpaid service provides anyone with internet access a entire planet's worth of satellite imagery. While Google Maps is free, other paid alternatives exist which take photos of the earth's surface on a more frequent basis for commercial use. World governments also utilize their satellites for many domestic uses.

As the availability of satellite imagery outpaces the ability of humans to look through them manually, an automated means to classify them must be developed. Classification of images is a fundamental problem in computer vision and neural networks provide an interesting solution.

OBJECTIVE:

The main objective of this project is to develop methods for detecting ships using satellite images.

Ship detection from remote sensing imagery is a crucial application for maritime security which includes among others traffic surveillance, protection against illegal fisheries, oil discharge control and sea pollution monitoring.

CHALLENGE:

Build an algorithm to automatically identify whether a remotely sensed target is ship or not.The algorithm had to be extremely accurate because lives and billions of dollars in energy infrastructure are at stake

REQUIREMENT OF PROJECT:

- Software Requirements :

  Any Python IDE (Jupyter Notebook ,Google Colab ,Spider)

- Environment and Tools :

  Numpy

  Pandas

  Tensorflow

  Keras

  Matplotlib

  Sklearn

- Dataset :

  Classifying Ships in Satellite Imagery

  https://www.kaggle.com/rhammell/ships-in-satellite-imagery?select=shipsnet

METHODOLOGY:

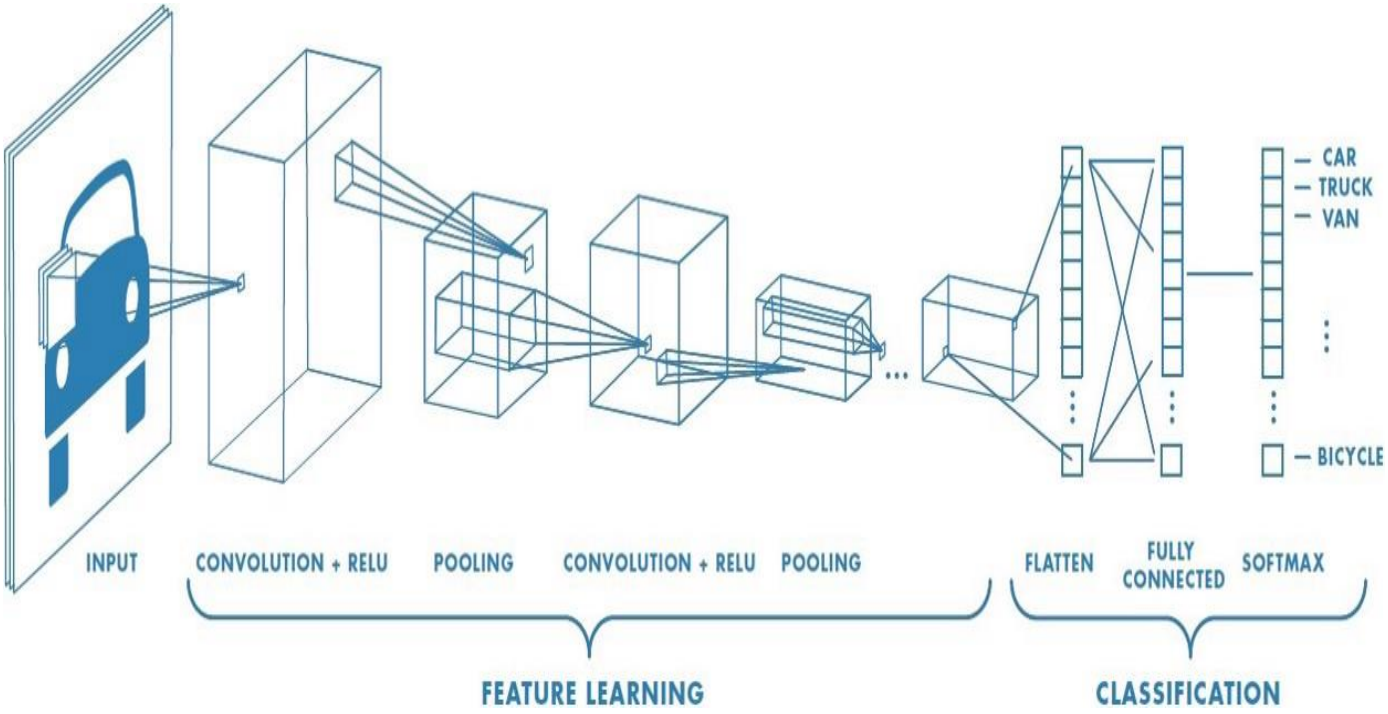
Deep learning is a subset of machine learning, which is essentially a neural network with three or more layers. These neural networks attempt to simulate the behavior of the human brain—albeit far from matching its ability—allowing it to "learn" from large amounts of data. While a neural network with a single layer can still make approximate predictions, additional hidden layers can help to optimize and refine for accuracy.

Deep learning drives many artificial intelligence (AI) applications and services that improve automation, performing analytical and physical tasks without human intervention.

Deep learning technology lies behind everyday products and services (such as digital assistants, voice-enabled TV remotes, and credit card fraud detection) as well as emerging technologies (such as self-driving cars).

I have used CNN in my project which is a Deep Learning Algorithm.

ALGORITHM USED : Convolutional Neural Networks (CNN)



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.

Convolutional neural networks are distinguished from other neural networks by their superior performance with image, speech, or audio signal inputs. They have three main types of layers, which are:

- Convolutional layer
- Pooling layer
- Fully-connected (FC) layer

Convolutional Layer:

The convolutional layer is the core building block of a CNN, and it is where the majority of computation occurs. It requires a few components, which are input data, a filter, and a feature map

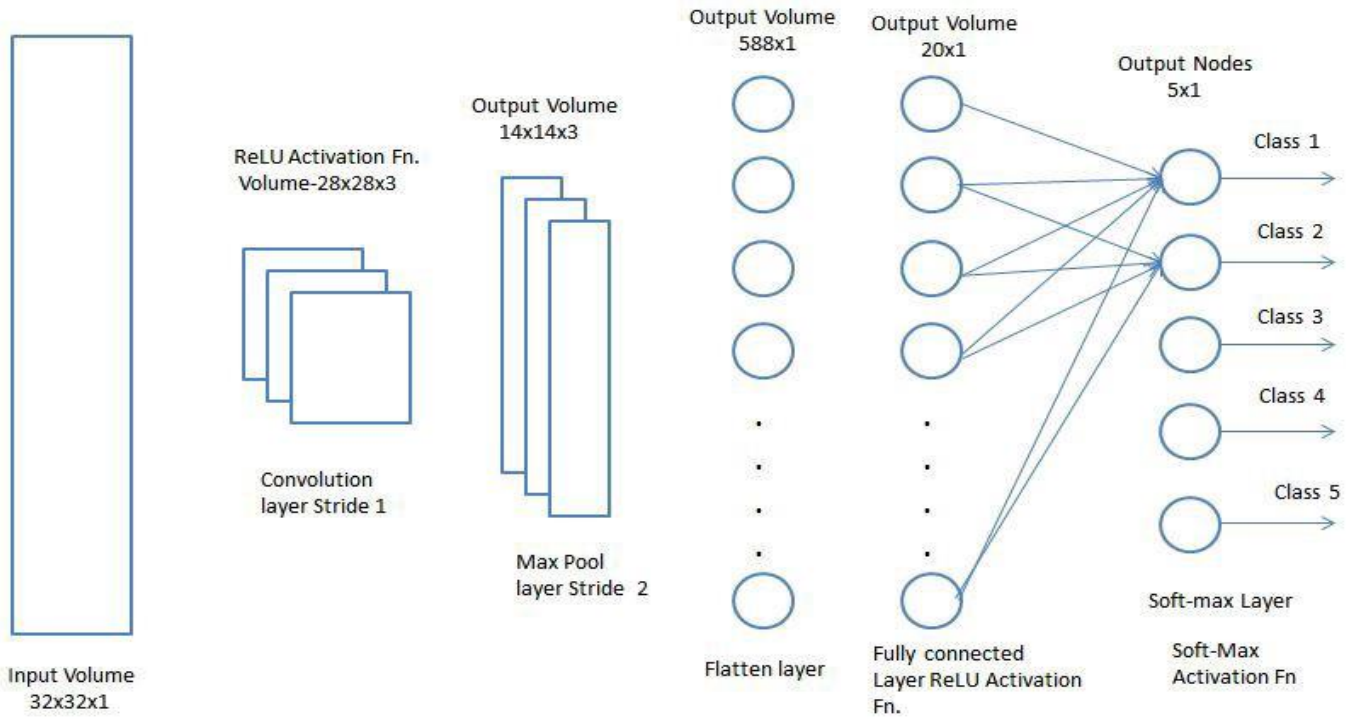
Pooling Layer:

Pooling layers, also known as downsampling, conducts dimensionality reduction, reducing the number of parameters in the input. Similar to the convolutional layer, the pooling operation sweeps a filter across the entire input, but the difference is that this filter does not have any weights. Instead, the kernel applies an aggregation function to the values within the receptive field, populating the output array. There are two main types of pooling:

- ***Max pooling:*** *As the filter moves across the input, it selects the pixel with the maximum value to send to the output array. As an aside, this approach tends to be used more often compared to average pooling.*
- ***Average pooling:*** *As the filter moves across the input, it calculates the average value within the receptive field to send to the output array.*

Fully-Connected Layer:

The name of the full-connected layer aptly describes itself. As mentioned earlier, the pixel values of the input image are not directly connected to the output layer in partially connected layers. However, in the fully-connected layer, each node in the output layer connects directly to a node in the previous layer.



SOURCE CODE:

https://github.com/KapishPandoh/Mini-Project/tree/main/Sem_05

RESULTS:

The model is able to achieve the accuracy of 98.00 %.

CONCLUSION:

Using satellite imagery to train a CNN provided the perfect dataset. All images were of the same size, taken at essentially the same angle and distance, and every ship retained a top-down view. While changing any of these parameters would make the problem of classification more difficult, the ship images demonstrated the power of neural networks applied to computer vision problems.

It is remarkable to see the success of deep learning in such varied real world problems. If we are able to detect and segment ships in an image, it would be of great help to the logistics and transportation team in northern countries like Sweden, Norway and Canada. It could bring a whole new dimension of transport for container ships and vessels by tracking ships from satellite images in real time

REFERENCE:

- For dataset: *https://www.kaggle.com/rhammell/ships-in-satellite-imagery?select=shipsnet*
- For resolving errors: *https://stackoverflow.com/*
- For Understanding the topics : *www.google.com* , *www.youtube.com* , *www.medium.com* , *https://docs.python.org*