Forest Fire Detection from Satellite Imagery

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Project Guide

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Project Introduction

- Forest fire is a major concern as it causes huge damage to environment. Forest fire detection and coming up with optimal solution is a challenge.

- The satellite imagery from Planet.com will help in monitoring the surface bed of earth.

- Imagery of the entire land surface of earth at 3-5 meter resolution are available and a coarse-resolution imagery from Landsat(30 meter pixels) or MODIS (250 meter pixels).

Literature Survey on Project

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Summary of Literature Survey

1. Satellite imagery finds many applications and some also evolve around object detection and removing noise from the images.

2. Algorithms that were proved to be the best were Resnet-50 ,Alexnet ,GoogleNet and Mask R-CNN for masking the objects found in the image.

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Objectives

1. Forest Fires are not a sudden incidents they occur in steps and the focus is to detect it in latest possible stage.

2. Detecting patches in field where heat-maps give high temperature readings.

3. Detecting nearby local areas to find the sensitivity of incident.

4. Providing an optimal solution recover the fire.

Seminar Topics

1. Pawan Phalak - GoogleNet(Smoke Detection with Noise Filteration)

2. Durgendra - Mask R-CNN(Masking over detected patches)

3. Vighnesh - Resnet-50(Train an eye in sky)

4. Veer Abhimanyu - CNN(Patches Detection Pseudo Color Image Processing for infrared forest fire detection)

The Challenges of Deep Network

- Adding layers increases the number of parameters and makes the network prone to over-tting
- Linear increase in lters results in quadratic increase in compute
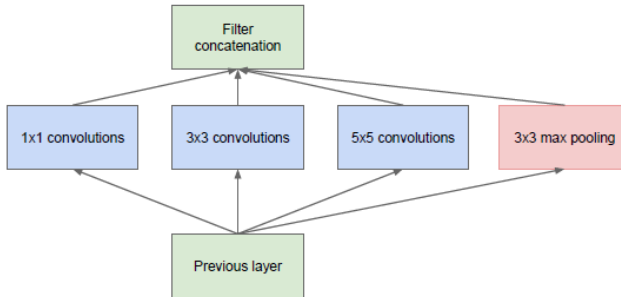- More data means more expense in their annotation

Benefit of GoogLeNet Architecture

- 12 times lesser parameters than AlexNet and signicantly more accurate than AlexNet
- Lower memory-use and lower power-use acutely important for mobile devices.
- Stays within the targeted 1.5 Billion multiply- add budget.Computational cost "less than 2X compared to AlexNet"

GoogLeNet Working

- Cluster neurons according to the correlation statistics in the dataset.An optimal layered network topology can be constructed by analyzing the correlation statistics of the preceding layer activations and and clustering neurons with highly correlated outputs.
- The architecture is a combination of the of all the convolutions, the 1x1, 3x3, 5x5, as input to the next stage. Since max-pooling has been successful, it suggests adding a pooling layer in parallel
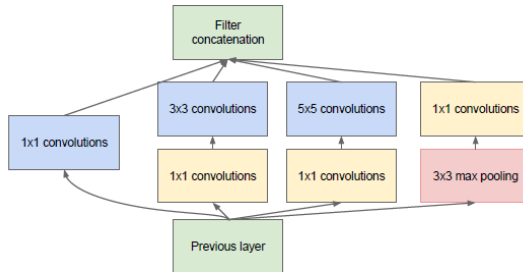
GoogLeNet Working

(a) Inception module, naïve version

[1]

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GoogLeNet Working

- In GoogLeNet, 1 x 1 convolution is used as a dimension reduction module to reduce the computation.

(b) Inception module with dimensionality reduction

[2]

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GoogLeNet Working

- In the lower layers, there exists high correlations in image patches that are local and near-local. These can be covered by 1x1 convolutions.

- Additionally, a smaller number of spatially spread-out clusters can be covered by convolution over larger patches; i.e., 3x3, and 5x5. And there will be decreasing number of patches over larger and larger regions.
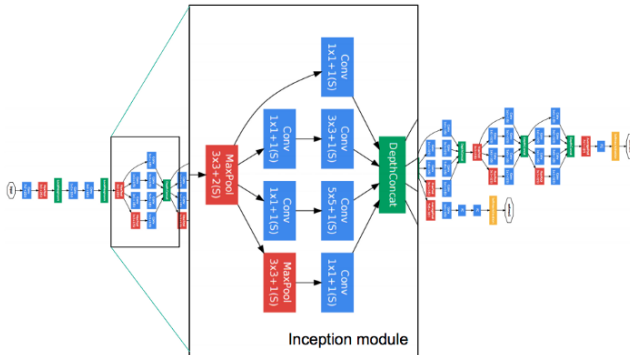
GoogLeNet Working
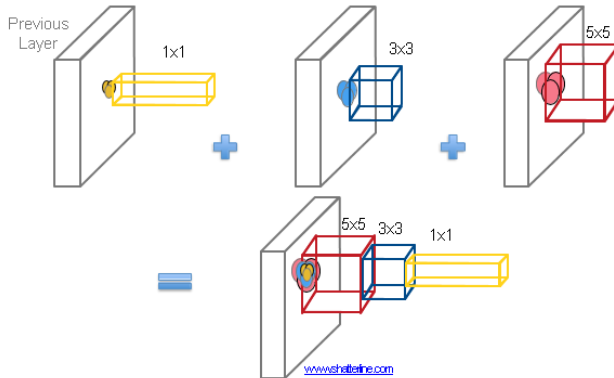
Inception Module Working [3]

GoogLeNet Architecture

- The winner of ILSVRC 2014 and the GoogLeNet architecture is also known as Inception Module. It goes deeper in parallel paths with different receptive field sizes and it achieved a top-5 error rate with of 6.67

- There are 22 layers in total. A very deep model compared with previous AlexNet, ZFNet and VGGNet. (But not as deep compared with ResNet invented afterwards.) There are numerous inception modules connected together to go deeper.

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GoogLeNet Architecture

GoogLeNet Architecture [4]

Dataset Details

1. Planet: Understanding the Amazon from Space.
2. Size : 34 GB
3. Type : .tif files
4. Provider : Planet and SCCON

Applications of GoogLeNet in Problem Statement

1. GoogLeNet Model is used in forest fire detection
2. Once the forest fire is detected by the model ,the fire-intensity map is used to predict the nearest region prone to catch fire.
3. GoogLeNet helps in increasing the efficiency and accuracy of the process to get the better predicted results.

References I

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[2]   Daniel Gardner , David Nichols, *Multi-label Classification of Satellite Images with Deep Learning , Stanford University*.

[3]   Anju Unnikrishnan , Sowmya V, Soman K P, *Deep AlexNet with Reduced Number of of Trainable Parameters for Satellite Image Classification*.

[4]   Grant J. Scott,Matthew R. England,William A. Starms, Richard A. Marcum (Member of IEEE), *Training Deep Convolutional Neural Networks for Land–Cover Classification of High-Resolution Imagery*

References II

[5] Pierre Guillou *medium.com/@pierre˙guillou/understand-how-works-resnet-without-talking-about-residual-64698f157e0c*

[6] Christian Szegedy, Google Inc *Going deeper with convolutions,17 Sep 2014*

[7] Moulay A. Akhloufi, Roger Booto Tokime, Hassan Elassady *Wildland fires detection and segmentation using deep learning,27 April 2018*

[8] Tingting wang,Jianmin Su,Yinglai Huang *Study of pseudo color processing for infrared forest fire detection*

Thank You !