Forest Fire Detection

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Introduction

- Wildfires are one of the deadliest and dangerous natural disasters in the world.
- Predicting fire behavior can help firefighters to have better fire management.
- Recent advance in aerial images shows that they can be beneficial in wildfire studies.
- FLAME (Fire Luminosity Airborne based Machine learning Evaluation) offers a dataset of aerial images of fires along with methods for fire detection and segmentation.

InceptionV3 Model

1. A deep learning model based on convolutional neural network
2. Assists in image analysis and object detection
3. The model is made up of symmetric and asymmetric building blocks, including convolutions, average pooling, max pooling, concats, dropouts, and fully connected layers.
4. It has a total of 42 layers and a lower error rate than its predecessors.

Data Collection

The model is trained using 41,378 images and tested using 10,608 images divided into two classes Fire and Non-Fire.

The Inception model is used to analyze the data and it gives an output of True if the image contains fire and False if not.

Architecture

Input Layer
Dim: (224, 224, 3)

Preprocessing

Initialise InceptionV3 model

Output Layer

Prediction

Rescaling
(1.0 / 255)

GlobalAveragePolling2D
Dense (units= 2048, RELU)
Dropout (0.5)

GlobalAveragePolling2D
Dense (units= 1024, RELU)
Dropout (0.5)

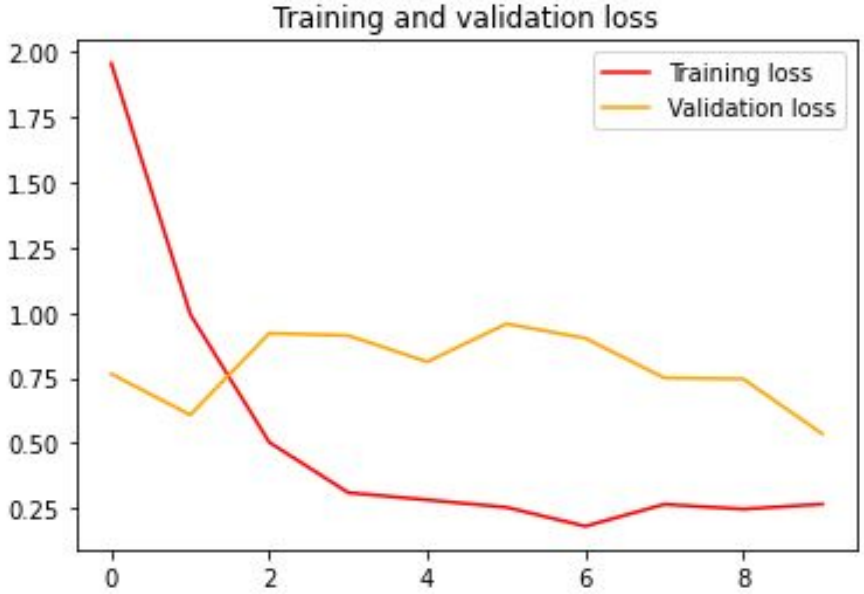
GlobalAveragePolling2D
Dense (units= 512, RELU)
Dropout (0.5)

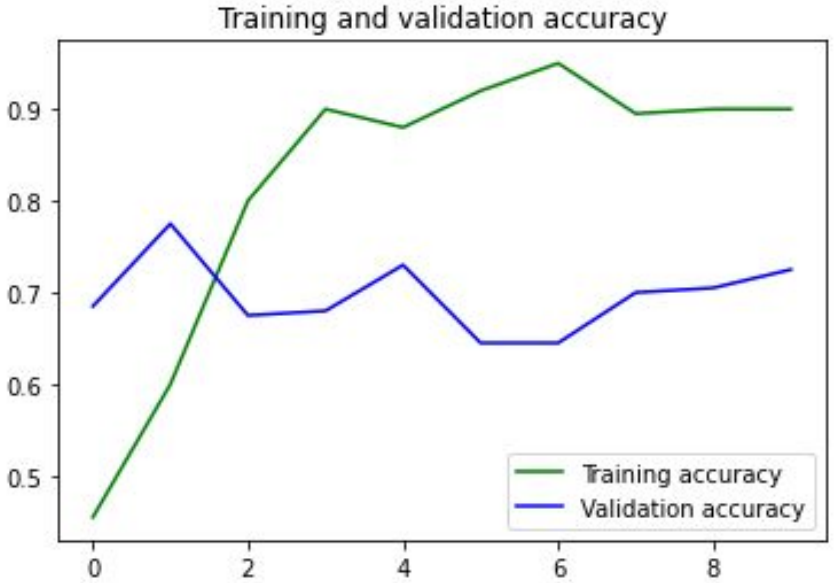
Dense (units= 2)
Softmax

True

False

Result


Training and validation loss
Training loss
Validation loss
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0
2
4
6
8


Training and validation accuracy
Training accuracy
Validation accuracy
0.9
0.8
0.7
0.6
0.5
0
2
4
6
8

Predictions

Input	Prediction	Accuracy	Correct / Incorrect
Fire Image	True	99.87%	✓
Non-Fire Image	False	99.47%	✓
Fire Image	True	99.49%	✓
Non-Fire Image	True	56.14%	✗
Non-Fire Image	True	87.7%	✗
Fire Image	True	87.52%	✓
Fire Image	True	96.17%	✓
Fire Image	True	89.37%	✓
Non-Fire Image	True	83.33%	✗
Fire Image	True	91.35%	✓

Conclusion

- Inspired by the great potential of InceptionV3 model, we can detect fire from images or videos at an early stage.
- The model gave us the accuracy of 72.5%, which in future can be improved.
- Considering the fair fire detection accuracy of the model, it can be of assistance to disaster management teams in managing fire disasters on time, thus preventing huge losses.