Transfer Learning approach for Smoke Image Detection

Simone Fisicaro
MSc in Big Data

UNIVERSITY of STIRLING

Introduction

Wildfires are rare events that can cause huge losses of lives, wildlife and money. **Smoke Detection Algorithms** may help reduce response times and contribute to a better understanding of wildfire patterns.

Convolutional Neural Networks (CNN) are an extremely powerful tool, able to control actions and perform tasks on a human competitive level.

The approach of **Transfer Learning** allows the construction of **Deep CNNs** through the usage of architectures and weights already existing [1]. It is a particularly effective technique when working with small datasets and easily generalizable problem.

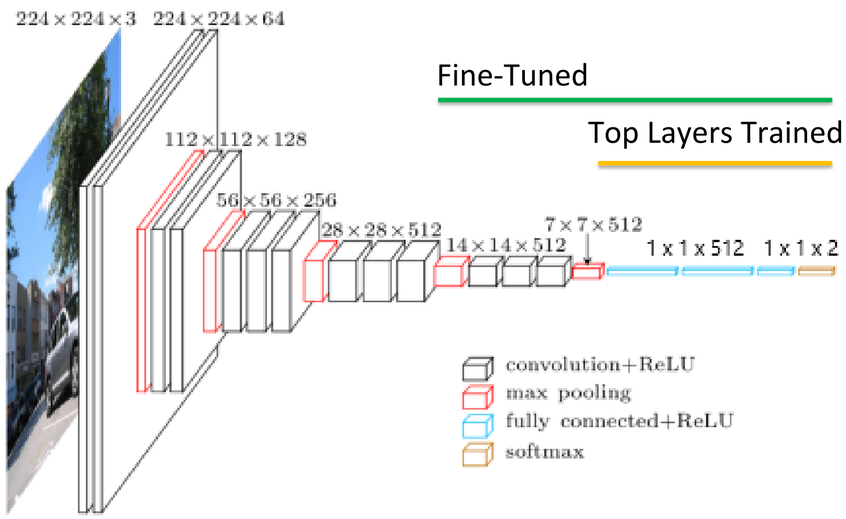

Fig. 1 – VGG16 architecture and layers to train.

Objective

This work aims to study and understand **how Transfer Learning techniques perform in the task of Detecting Smoke in Images**.

Fig. 2 – Original image (left) and heatmap of the last convolution (right).

Methodology

Data: 300 labelled images from open source datasets and internet image search. A balanced set, split into training, validation, and testing (70, 15, 15).

Pre-processing: Cropping, labeling, normalising to standard size, scaling and flipping.

Modelling: Transfer Learning process (Fig. 1 & 3).

Evaluation: Loss and accuracy curves for epochs, confusion matrix and AUC-ROC curve, CNN heatmaps.

Partial Results

- Quality of the dataset and complexity of the task made the problem not trivial.
- The model is overfitting.
- The network learns what's surrounding the smoke's shape (Fig. 2).
- Next steps:
  - Improve the quality of the dataset.
  - Define a better data preparation strategy.

Fig. 3 – Transfer Learning process.

[1] Chuanqi Tan, Fuchun Sun, Tao Kong, Wenchang Zhang, Chao Yang, Chunfang Liu "A Survey on Deep Transfer Learning" https://arxiv.org/abs/1808.01974

For further information contact: *Simone Fisicaro*

sif00012@students.stir.ac.uk