SUMMARY

# Paper: Fast R-CNN

Ocean Monjur

June 21, 2022

# 1 Summary

## 1.1 Overview

The paper proposes an improved version of the R-CNN architecture called the Fast R-CNN. It tries to deal with some of the limitations of R-CNN and SPPNet, like multi-stage training, sharing of computation across layers, and warping of images to match the input resolution. The modifications and improvements make the Fast R-CNN faster and more accurate than the R-CNN architecture.

## 1.2 Fast R-CNN architecture and Training

Unlike R-CNN, Fast R-CNN inputs the entire image instead of 2000 proposed regions to the Convolution layer which creates a feature map. Whereas before warping was used to put the image into the expected shape which caused some information loss, Fast R-CNN uses a novel RoI pooling layer (a special version of the Spatial Pyramid Pooling) to make the shape stay in the expected input dimension. These inherent changes from the R-CNN architecture make the Fast R-CNN 9 times faster in training and 213 times faster in testing than the R-CNN.
Fast R-CNN dealt with the limitations of SPPNet which is highly inefficient in back-propagation when the images come from different distributions due to the massive receptive field of the RoI layer. Fast R-CNN fixes it by utilizing stochastic gradient descent. Fast R-CNN also only trains a softmax output layer and bounding box regressors instead of the SVM layer seen in the previous architectures.

## 1.3 Results

The Fast R-CNN architecture beat all contemporary architectures in the Pascal VOC 2007,2010,2012 datasets. The authors tested between the SVM and Softmax layer as the final output layer and the Softmax layer in the Fast R-CNN model was superior in terms of mAP.

## 1.4 Pros and Cons

Fast R-CNN was the State of the Art Object Detector at the time of release. It uses convolutions over the entire image which speeds up training. One of its major drawbacks is still using a region proposal algorithm like selective search which is inherently slower than modern implementations.