FIGHTING BREAST CANCER: DOCTOR VS DETECTOR

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Context & Problem

When radiologists are provided with this technology-assisted information, their performance in mammographic detection could be :

- more accurate
- faster

In this study, we will investigate on Faster R-CNN model and its ability to detect object in a more efficient and accurate way than the previous ones (R-CNN and Fast R-CNN).

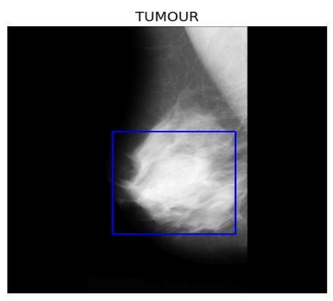
Methodology

- Understand and implement the Faster R-CNN model
- Compare loss with and without data augmentation (flip, contrast)
- Grid Search to optimize the parameters of our model

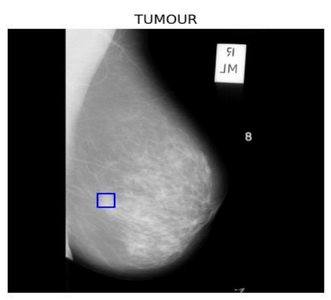
MIAS mammography database

322 left and right mammograms with he following annotations:

Mias db ref number	Character of background tissue	Class of abnormality	Severity	Coordinates of centre abnormality (x,y)	Radius of circle enclosing abnormality
mdb001	G (Fatty-Glandular)	CIRC: circumscribed masses	Benign	(535,425)	197 px
mdb058	D (Dense-Glandular)	MISC : other	Malignant	(318,359)	27 px

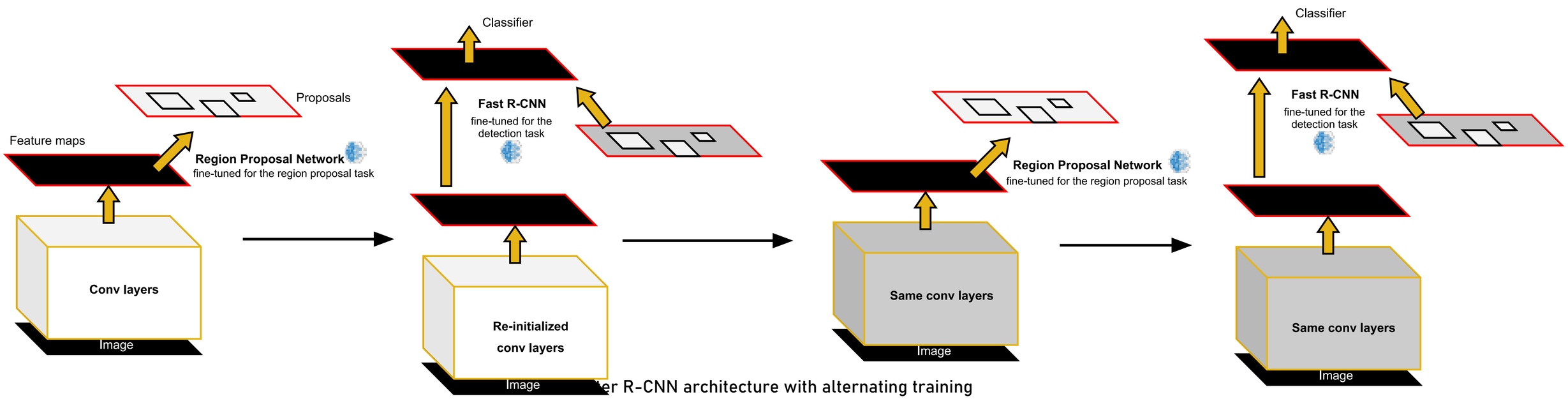


mdb001 scan



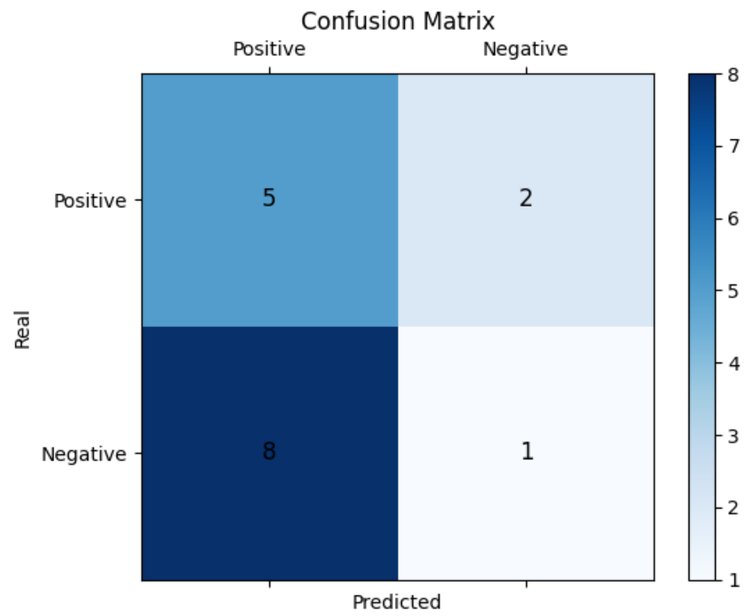
mdb058 scan

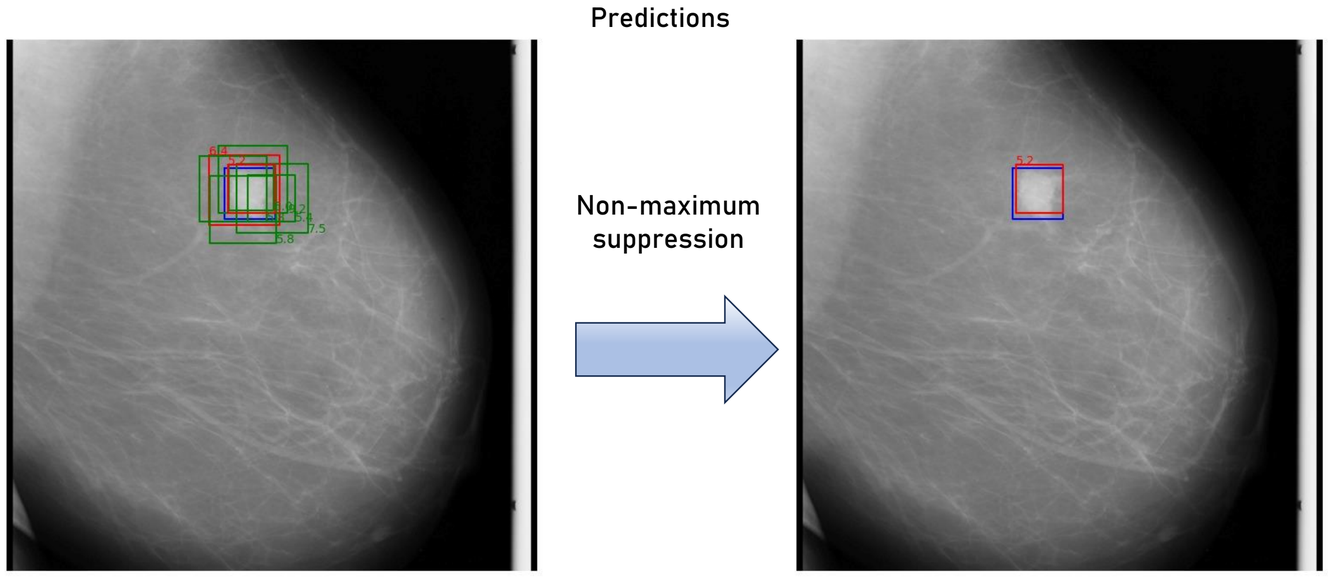
Faster R-CNN model description



Faster R-CNN architecture with alternating training

Results





	Precision	Recall	F1-score
Not augmented dataset	0.15	1.0	0.26
Augmented dataset (flip)	0.18	1.0	0.30
Augmented dataset (contrast)	0.36	0.80	0.50
Augmented dataset (flip and contrast)	0.39	0.83	0.53

With optimised parameters :

Precision	Recall	F1-Score
0,39	0,83	0,52

Take-home box

DeepLearning algorithms are a promising method for object Detection and medical image analysis. Currently no algorithm can compete with a Doctor, but it could assist him.

Two main hurdles are to solve before the solution can be deployed in the hospitals :
- Lack of label data for training the models
- Lack of computation power to train great model

References

1. S. Ren, K. He, R. Girshick, and J. Sun , "Faster R-CNN: Towards Real-Time Object Detection with Region Proposal Networks ", arXiv:1506.01497, 2016.

2. J Suckling *et al* (1994): *The Mammographic Image Analysis Society Digital Mammogram Database* Exerpta Medica. International Congress Series 1069 pp375-378.