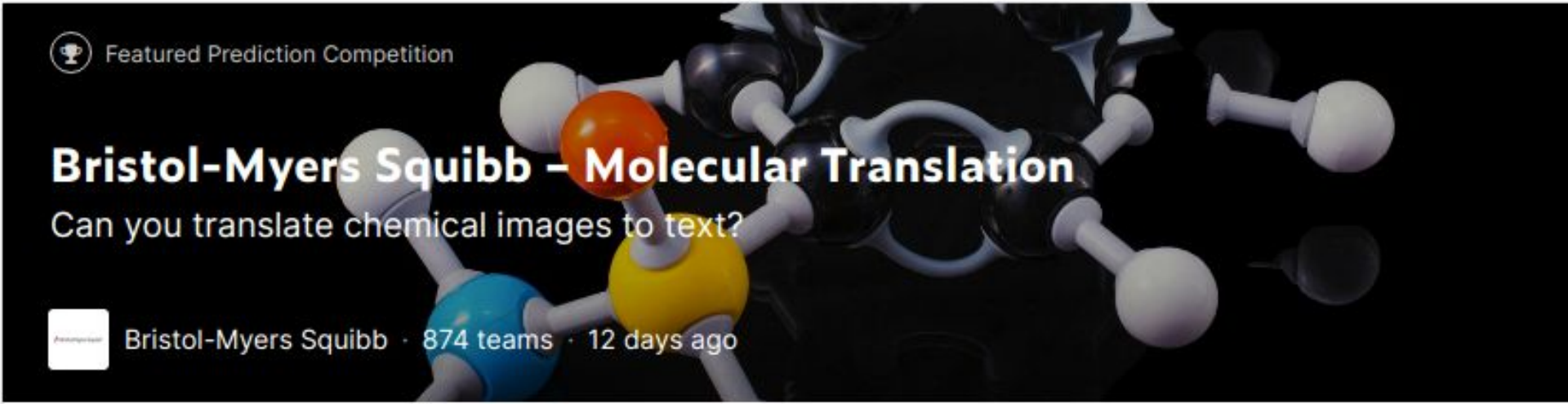
Taking part in competition! Become a part of society!

First concept of the project - failed

Topic: interpret old chemical images. With access to a large set of synthetic image data generated by Bristol-Myers Squibb, convert images back to the underlying chemical structure annotated as InChI text.



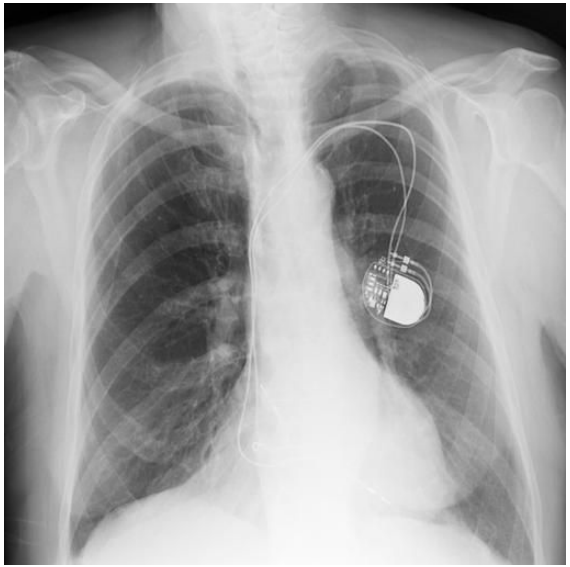
kaggle

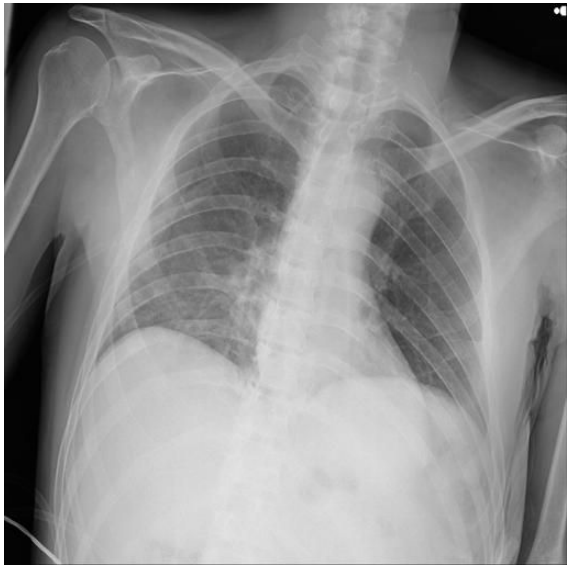
Society for Imaging Informatics in Medicine SIIM

Computer vision model for COVID pneumonia detection

Input Data

Chest radiographs annotated by a group of radiologists (a total of 7597 images divided into train and test datasets).





Annotations

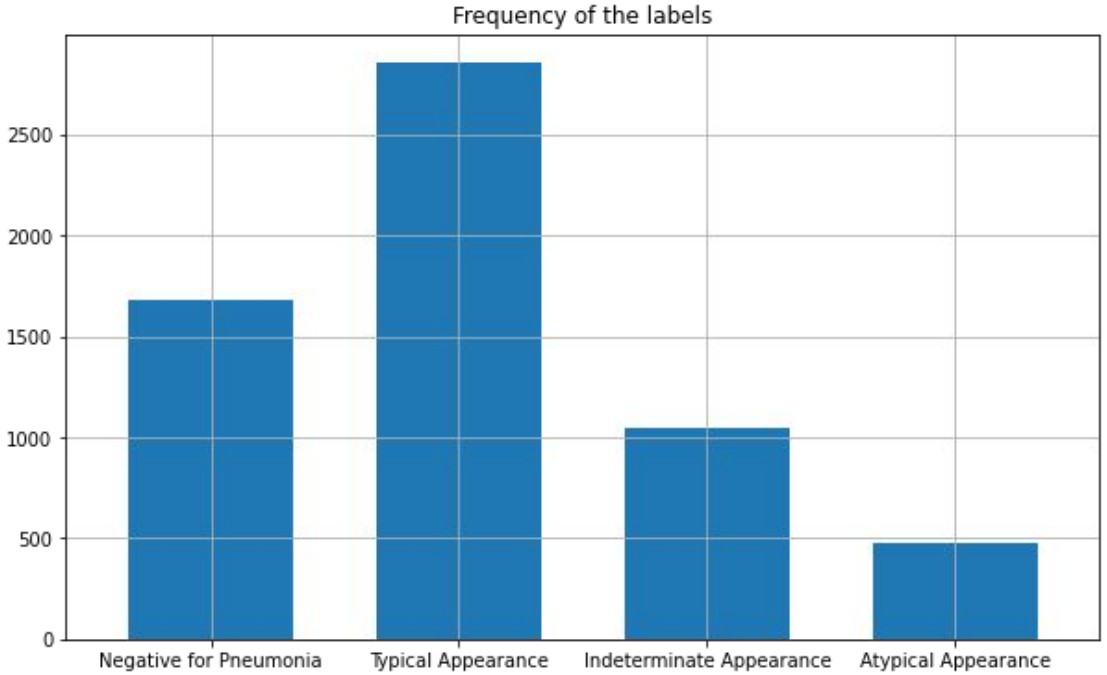
1) **Bounding boxes** for every image

	id	boxes	label	StudyInstanceUID
0	000a312787f2_image	[{'x': 789.28836, 'y': 582.43035, 'width': 102...	opacity 1 789.28836 582.43035 1815.94498 2499....	5776db0cec75
1	000c3a3f293f_image	NaN	none 1 0 0 1 1	ff0879eb20ed
2	0012ff7358bc_image	[{'x': 677.42216, 'y': 197.97662, 'width': 867...	opacity 1 677.42216 197.97662 1545.21983 1197....	9d514ce429a7
3	001398f4ff4f_image	[{'x': 2729, 'y': 2181.33331, 'width': 948.000...	opacity 1 2729 2181.33331 3677.00012 2785.33331	28dddc8559b2
4	001bd15d1891_image	[{'x': 623.23328, 'y': 1050, 'width': 714, 'he...	opacity 1 623.23328 1050 1337.23328 2156 opaci...	dfd9fdd85a3e

2) **Class** for every study

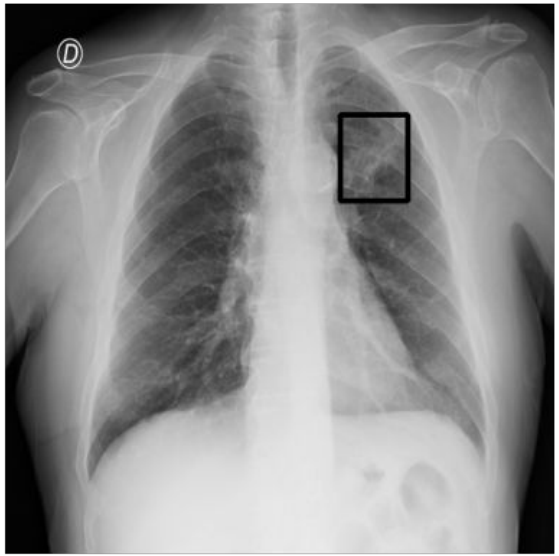
	id	Negative for Pneumonia	Typical Appearance	Indeterminate Appearance	Atypical Appearance
0	00086460a852_study	0	1	0	0
1	000c9c05fd14_study	0	0	0	1
2	00292f8c37bd_study	1	0	0	0
3	005057b3f880_study	1	0	0	0
4	0051d9b12e72_study	0	0	0	1

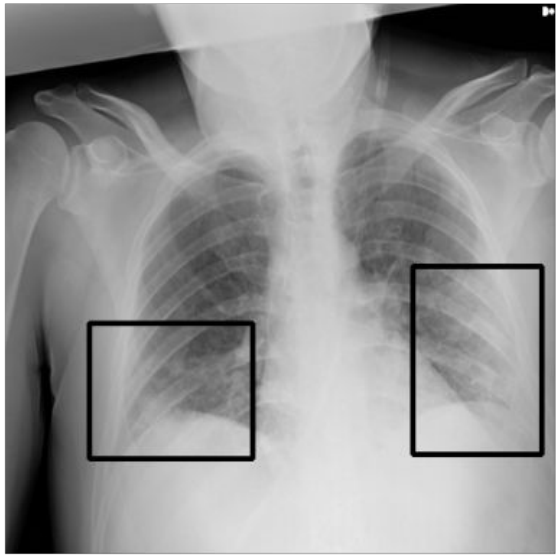
Classes


Frequency of the labels
2500
2000
1500
1000
500
0
Negative for Pneumonia
Typical Appearance
Indeterminate Appearance
Atypical Appearance

Bounding boxes

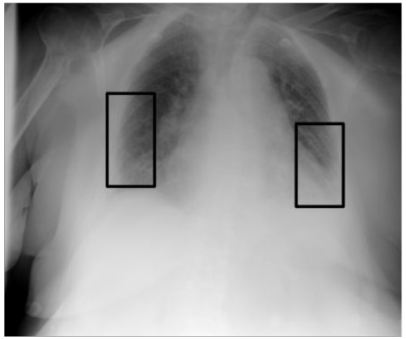
*"Opacity refers to any area that preferentially attenuates the x-ray beam and therefore **appears more opaque than the surrounding area**. It is a nonspecific term that does not indicate the size or pathologic nature of the abnormality" - from Felson's Principles of Chest Roentgenology (Fourth Edition).*



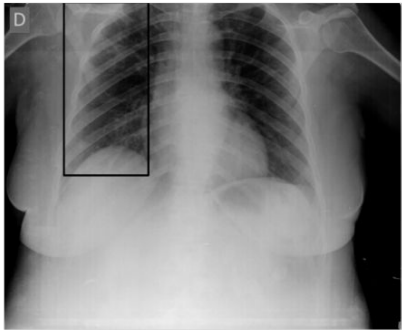


Negative for Pneumonia

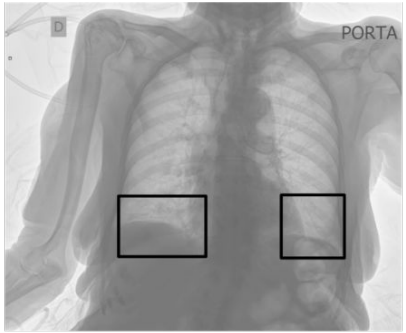
Typical Appearance

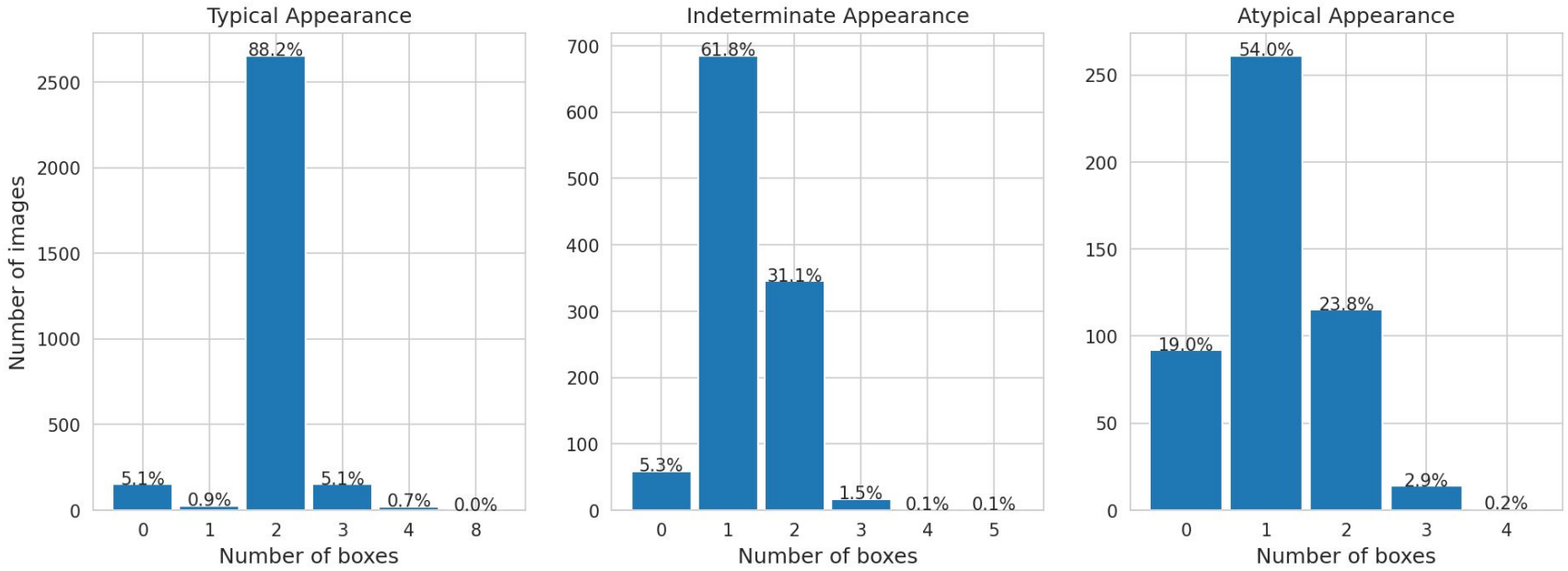


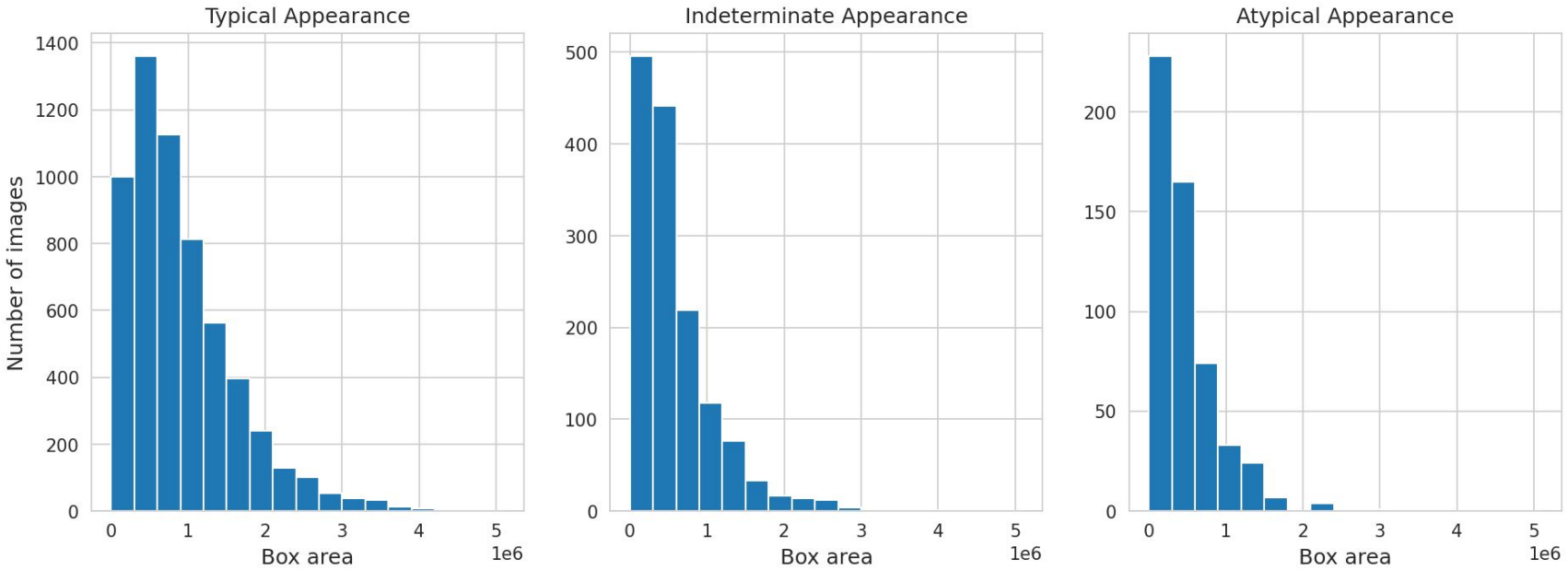
Indeterminate Appearance



Atypical Appearance




Number of boxes on images from each class
Typical Appearance
Indeterminate Appearance
Atypical Appearance
Number of images
Number of boxes
Number of boxes
Number of boxes
5.1%
0.9%
88.2%
5.1%
0.7%
0.0%
5.3%
61.8%
31.1%
1.5%
0.1%
0.1%
19.0%
54.0%
23.8%
2.9%
0.2%


Size of boxes for each class
Typical Appearance
Indeterminate Appearance
Atypical Appearance
Number of images
Box area
1e6
0
1
2
3
4
5
200
400
600
800
1000
1200
1400
100
300
500
50
150

Goal of the competition

This is an object detection and classification problem:

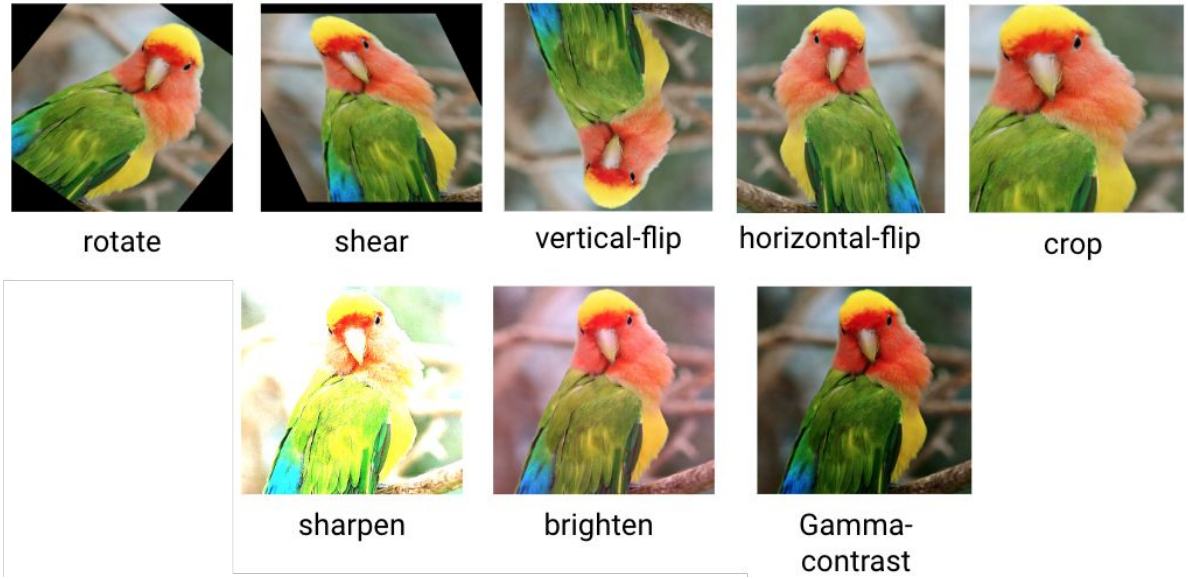
1) predict location of bounding boxes for each image (`xmin ymin xmax ymax`)
2) predict a class for each study (every study contains one or more images)
    - negative / typical / indeterminate / atypical

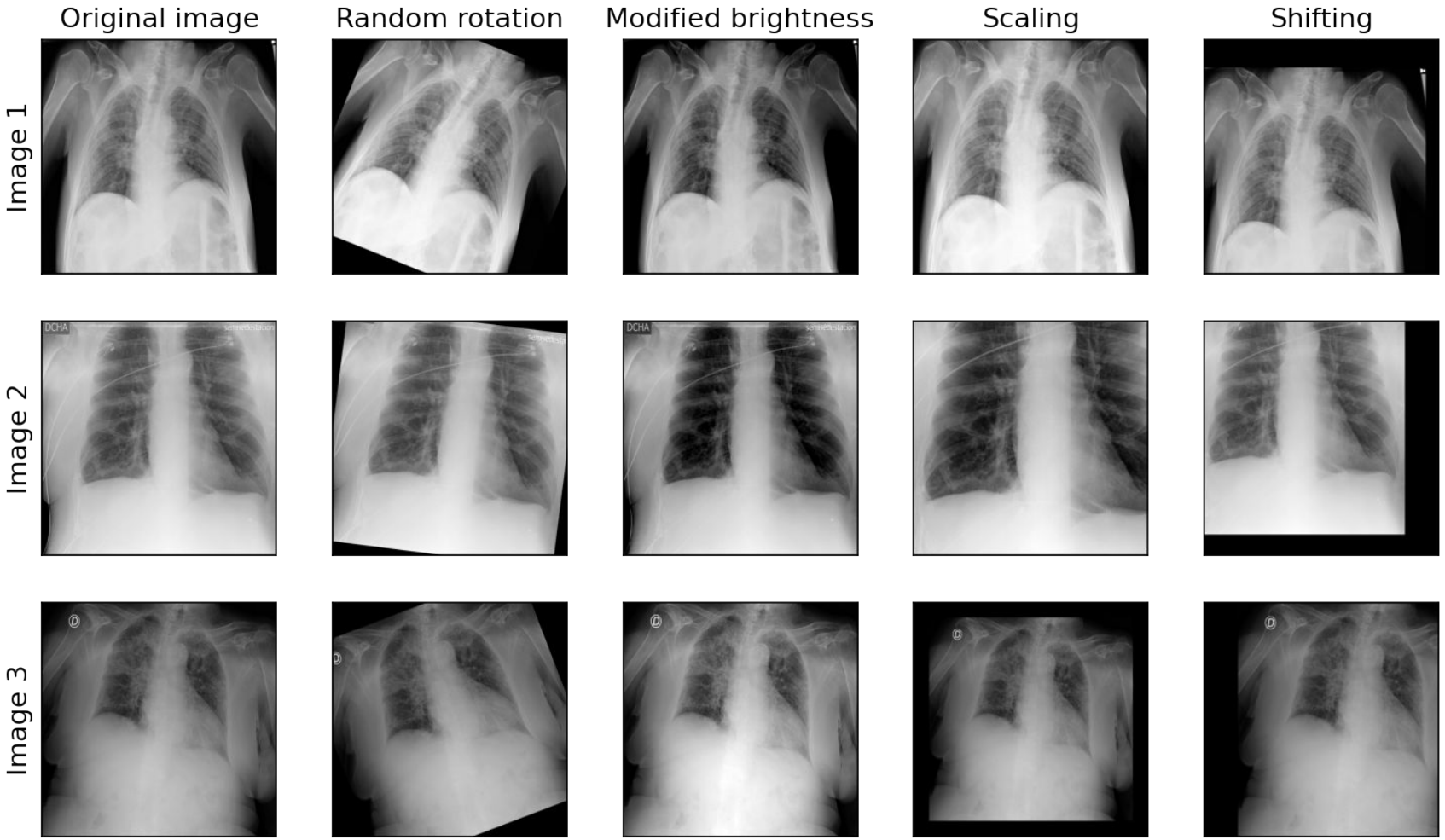
Evaluation of bounding boxes prediction:
to be considered a correct detection, the area of overlap a_o between the predicted bounding box B_p and ground truth bounding box B_{gt} must exceed 50% by the formula:

$$a_o = \frac{area(B_p \cap B_{gt})}{area(B_p \cup B_{gt})}$$

Data augmentation

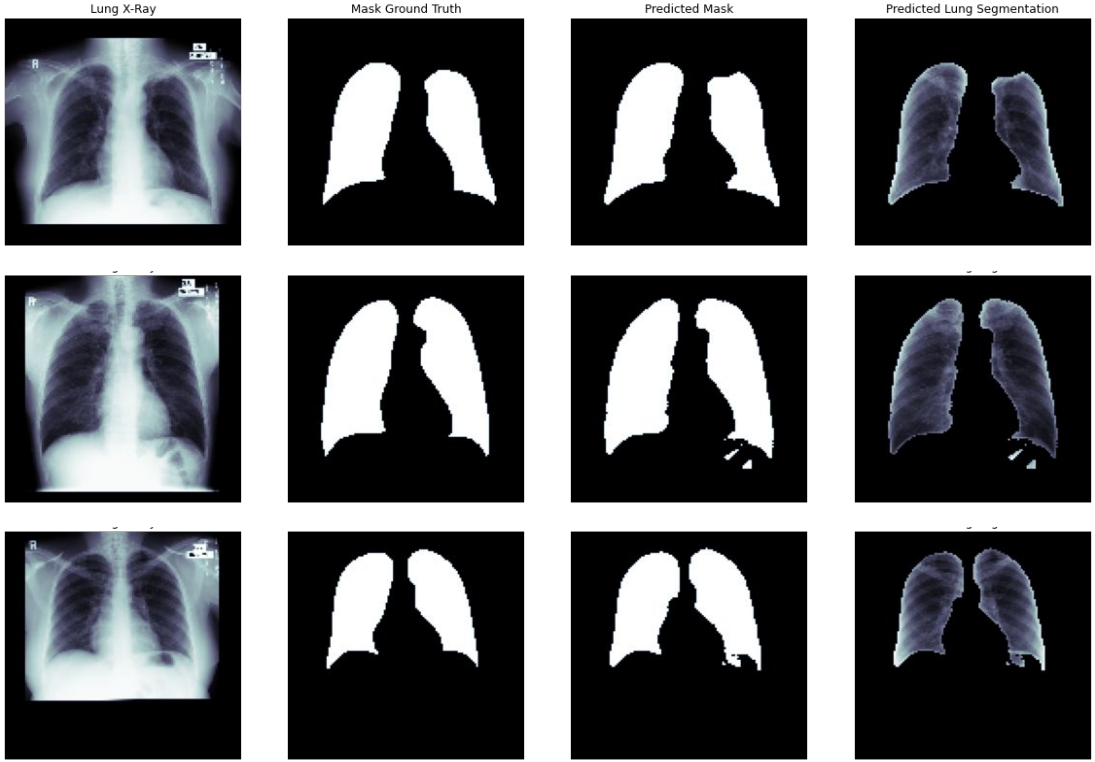
Applying random perturbations to the training dataset to increase generalizability of the model



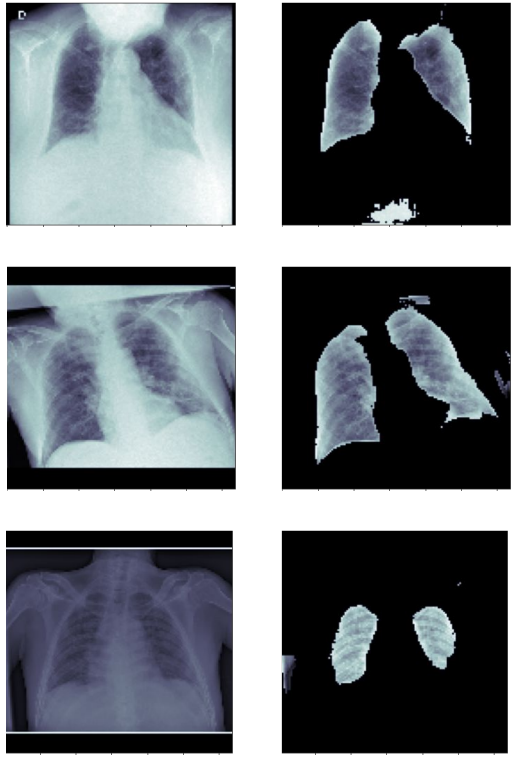

Original image
Random rotation
Modified brightness
Scaling
Shifting
Image 1
Image 2
Image 3

Attempt to cut lungs from X-rays - failed

External set



Our data



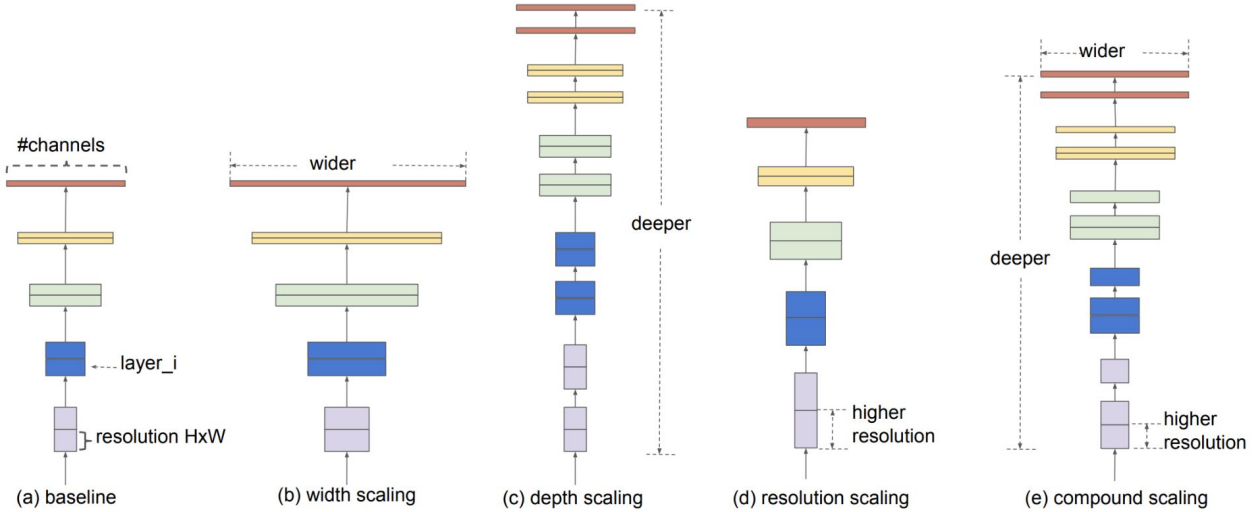
EfficientNet
(transfer learning CNN)

Models

Mask R-CNN
(transfer learning)

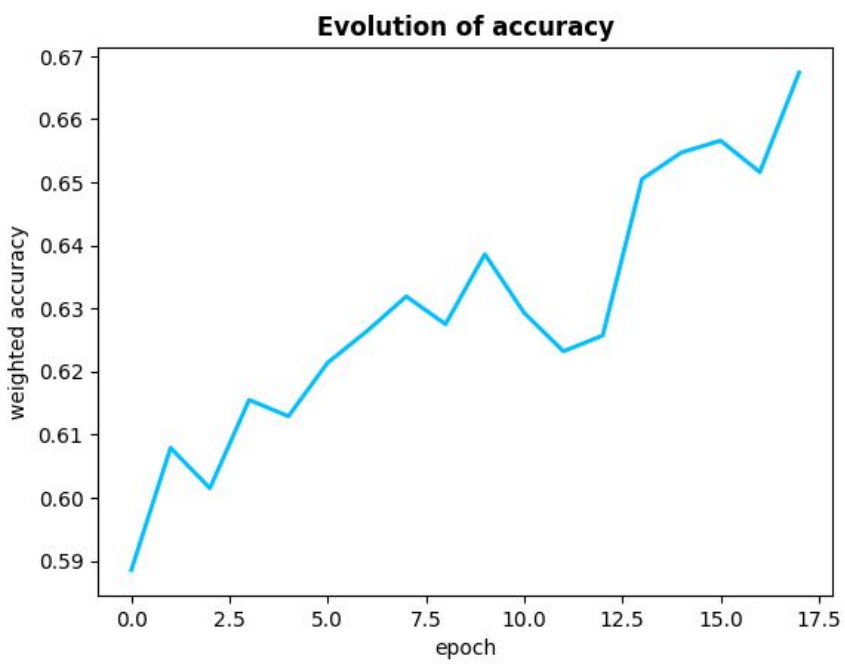
EfficientNet

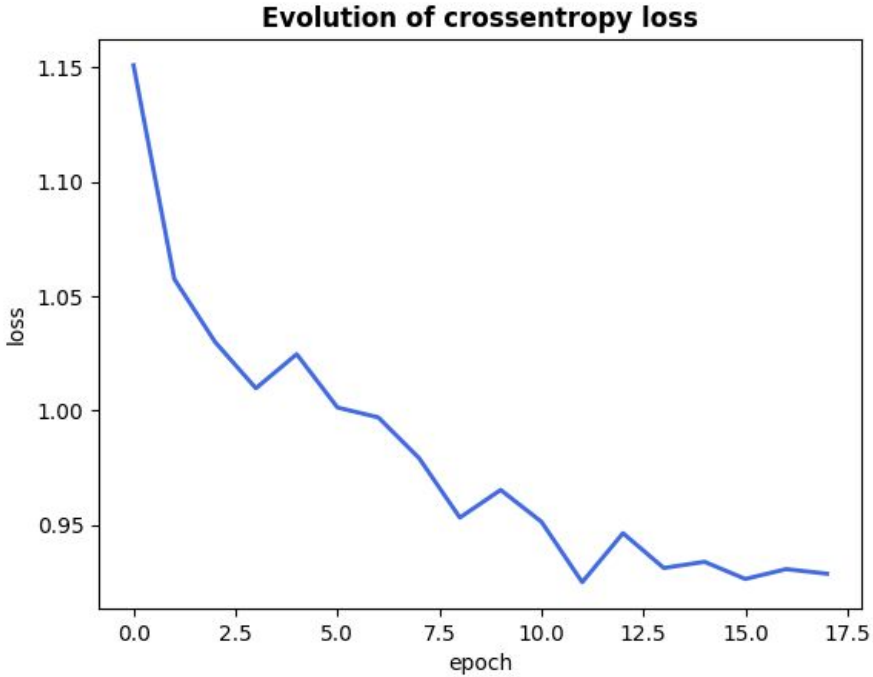
EfficientNet is a new family of convolutional networks that have faster training speed and better parameter efficiency than previous models. To develop this family of models, we use a combination of training-aware neural architecture search and scaling, to jointly optimize training speed and parameter efficiency.



https://ai.googleblog.com/2019/05/efficientnet-improving-accuracy-and.html

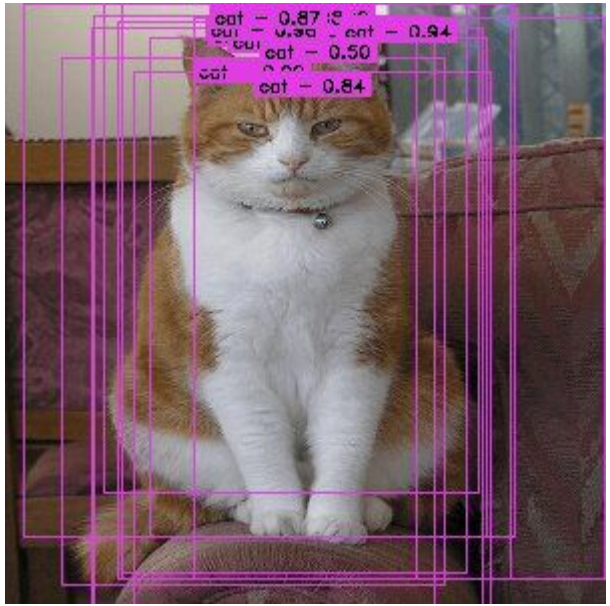
EfficientNet Results





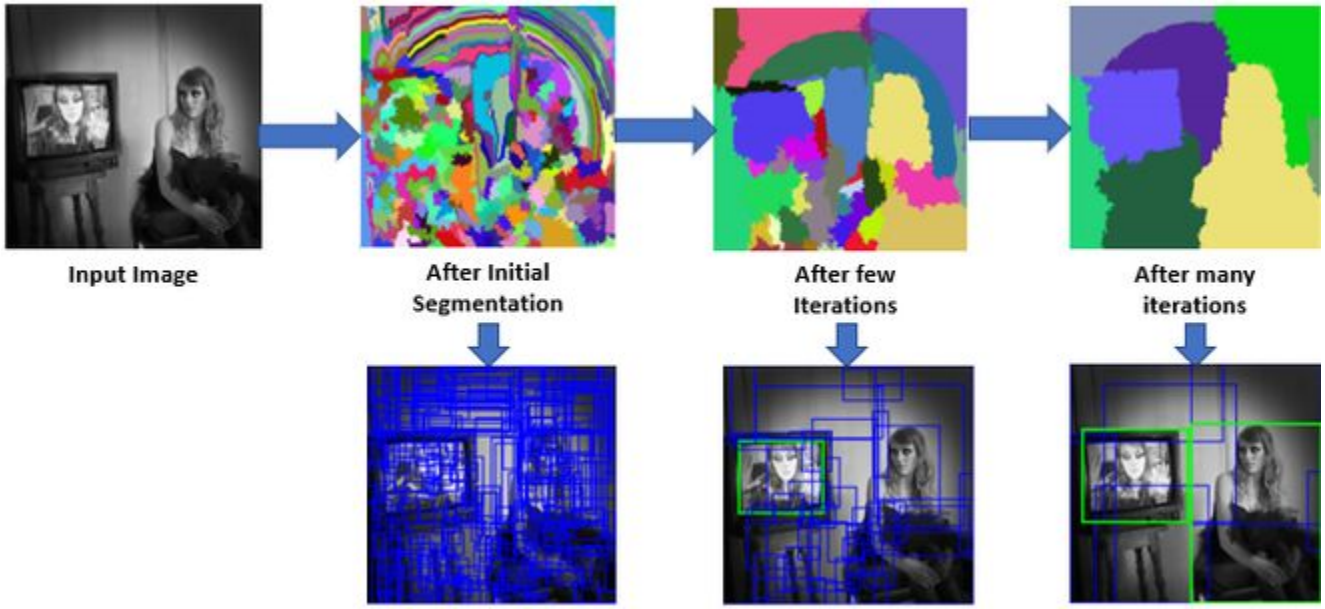
R-CNN (Regions Based CNN) using Faster R-CNN

Given an input image, R-CNN begins by applying a mechanism called Selective Search to extract regions of interest (ROI), where each ROI is a rectangle that may represent the boundary of an object in image. Depending on the scenario, there may be as many as two thousand ROIs. After that, each ROI is fed through a neural network to produce output features. For each ROI's output features, a collection of support-vector machine classifiers is used to determine what type of object (if any) is contained within the ROI.



https://en.wikipedia.org/wiki/Region_Based_Convolutional_Neural_Networks

Faster R-CNN



https://towardsdatascience.com/faster-r-cnn-for-object-detection-a-technical-summary-474c5b857b46

Notebooks

Getting started + simple EDA
Updated 7d ago
0 comments · SIIM-FISABIO-RSNA COVID-19 Detection

4 ▲ ···

PUBLISHED

[torch] Simple dataloader with data augmentation
Notebook copied with edits from Aleksandra Możwiłło · Updated 38m ago
0 comments · SIIM-FISABIO-RSNA COVID-19 Detection +1

1 ▲ ···

[torch] Classiffication with EfficientNet
Updated 3h ago
Private · 0 comments · SIIM-FISABIO-RSNA COVID-19 Detection +1

0 ▲ ···

IN PROGRESS

FasterRCNN Train
Notebook copied with edits from Heroseo · Updated 2h ago
Private · 0 comments · SIIM-FISABIO-RSNA COVID-19 Detection +2

0 ▲ ···

Bottlenecks

- GPU / TPU limits
- relatively small dataset
- hard classification problem : the classes are unrecognizable for person without medical knowledge
- competing with experts from machine learning fields

Summary

- We trained model using the transfer learning.
- We published first notebooks and received first upvotes :)
- We learnt a lot about Deep Learning
- Joined community of Kaggle
- We got almost two months to go to improve :)

Thank you for attention!

Me: *uses machine learning*

Machine: *learns*

Me: