

Kaggle Competition

Chest X-ray Abnormalities Detection

경상대학교 수학과 오서영

1. Introduction

Chest radiograph is difficult task for radiologist. The interpretation of chest X-rays can lead to medical misdiagnosis, even for the best practicing doctor. Computer-aided detection and diagnosis systems would help reduce the pressure on doctors at metropolitan hospitals and improve diagnostic quality in rural areas.

2. Background

I use a dataset consisting of 18,000 scans in DICOM format that have been annotated by experienced radiologists. These annotations were collected via VinBigData's web-based platform, VinLab.

3. Project

1) Data Exploration

| | | |
|------------------------|------------------|-------------------------|
| 0 - Aortic enlargement | 5 - ILD | 10 - Pleural effusion |
| 1 - Atelectasis | 6 - Infiltration | 11 - Pleural thickening |
| 2 - Calcification | 7 - Lung Opacity | 12 - Pneumothorax |
| 3 - Cardiomegaly | 8 - Nodule/Mass | 13 - Pulmonary fibrosis |
| 4 - Consolidation | 9 - Other lesion | |

All images were labeled for the presence of 14 critical radiographic findings as listed above. And the "No finding" observation is (14).

| | image_id | class_name | class_id | rad_id | x_min | y_min | x_max | y_max |
|---|----------------------------------|--------------------|----------|--------|--------|--------|--------|--------|
| 0 | 50a418190bc3fb1ef1633bf9678929b3 | No finding | 14 | R11 | NaN | NaN | NaN | NaN |
| 1 | 21a10246a5ec7af151081d0cd6d65dc9 | No finding | 14 | R7 | NaN | NaN | NaN | NaN |
| 2 | 9a5094b2563a1ef3ff50dc5c7ff71345 | Cardiomegaly | 3 | R10 | 691.0 | 1375.0 | 1653.0 | 1831.0 |
| 3 | 051132a778e61a86eb147c7c6f564dfe | Aortic enlargement | 0 | R10 | 1264.0 | 743.0 | 1611.0 | 1019.0 |
| 4 | 063319de25ce7edb9b1c6b8881290140 | No finding | 14 | R10 | NaN | NaN | NaN | NaN |

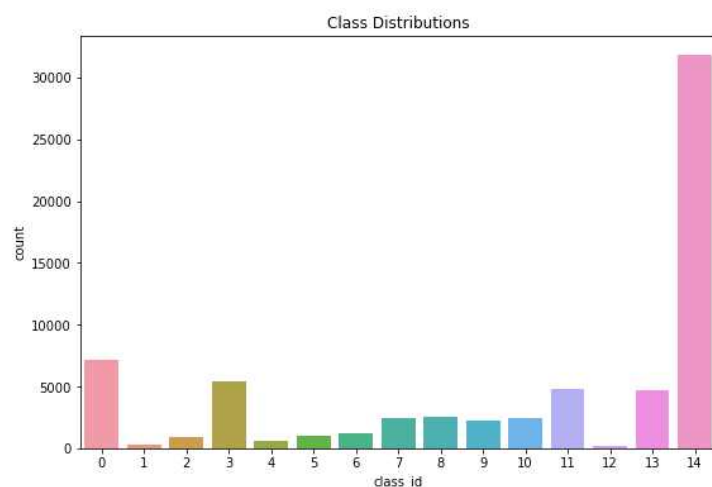
(x_min, y_min, x_max, y_max) is coordinate of the object's bounding box.

We have to predict (class, confidence, x_min, y_min, x_max, y_max).

```
print("Number of rows in train dataframe: {}".format(train.shape[0]))
print("Number of Unique images in train set: {}".format(train.image_id.nunique()))
print("Number of Classes: {}".format(train.class_name.nunique()))
print("Class Names: {}".format(list(train.class_name.unique())))
```

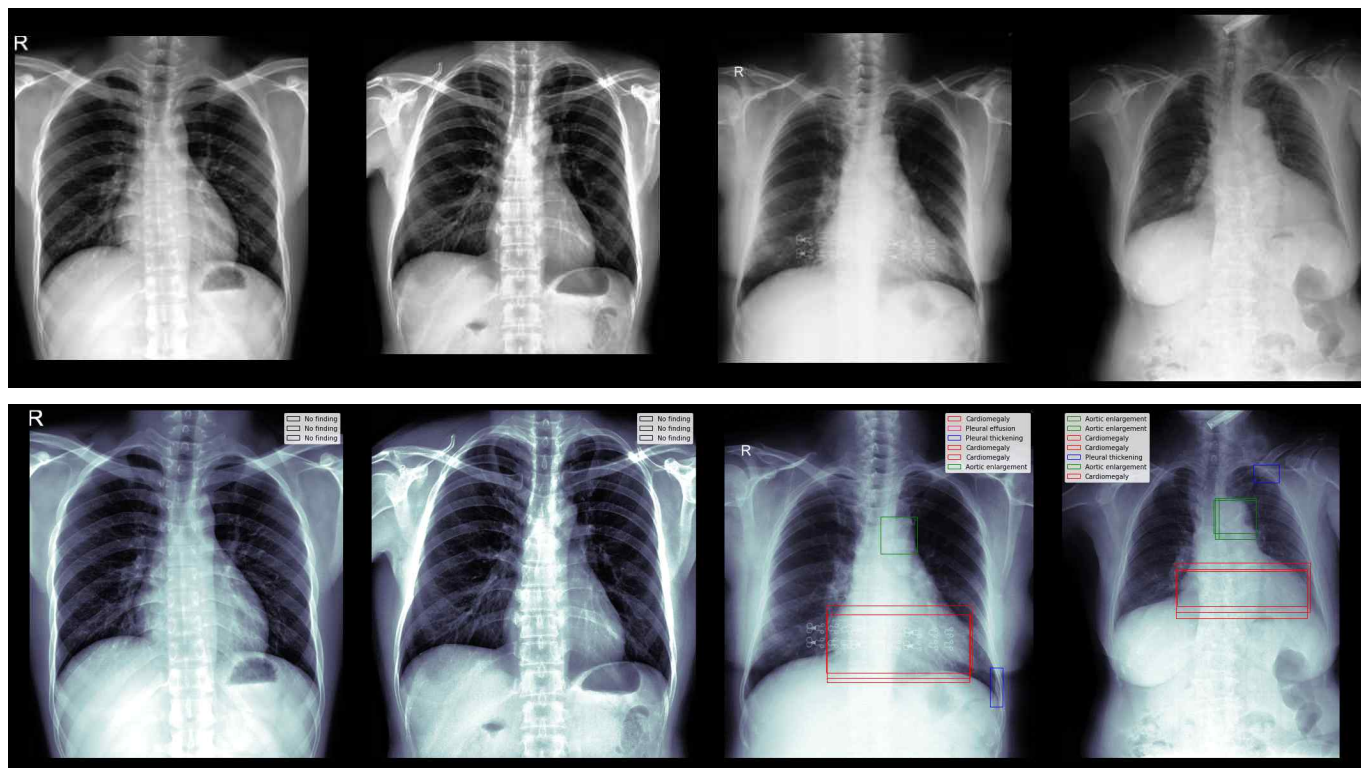
```
Number of rows in train dataframe: 67914
Number of Unique images in train set: 15000
Number of Classes: 15
```

```
Class Names: ['No finding', 'Cardiomegaly', 'Aortic enlargement', 'Pleural thickening', 'ILD', 'Nodule/Mass',
'Pulmonary fibrosis', 'Lung Opacity', 'Atelectasis', 'Other lesion', 'Infiltration', 'Pleural effusion',
'Calcification', 'Consolidation', 'Pneumothorax']
```



The number of "No finding" examples are very high. There is a huge class imbalance.

2) Data Visualization



There are many overlapping boxes from multiple radiologists.

3) Modeling

Since the purpose of this competition is to predict a class ID, confidence score, and bounding box. So the last layer of the model is divided into two, one predicting the class and one predicting the bounding box.

| Layer (type) | Output Shape | Param # | Connected to |
|--------------------------------|-----------------------|---------|-----------------------|
| input_2 (InputLayer) | [(None, 256, 256, 1)] | 0 | |
| conv2d_6 (Conv2D) | (None, 254, 254, 32) | 320 | input_2[0][0] |
| conv2d_7 (Conv2D) | (None, 252, 252, 32) | 9248 | conv2d_6[0][0] |
| max_pooling2d_3 (MaxPooling2D) | (None, 126, 126, 32) | 0 | conv2d_7[0][0] |
| conv2d_8 (Conv2D) | (None, 124, 124, 64) | 18496 | max_pooling2d_3[0][0] |
| conv2d_9 (Conv2D) | (None, 122, 122, 64) | 36928 | conv2d_8[0][0] |
| max_pooling2d_4 (MaxPooling2D) | (None, 61, 61, 64) | 0 | conv2d_9[0][0] |
| conv2d_10 (Conv2D) | (None, 59, 59, 128) | 73856 | max_pooling2d_4[0][0] |
| conv2d_11 (Conv2D) | (None, 57, 57, 128) | 147584 | conv2d_10[0][0] |
| max_pooling2d_5 (MaxPooling2D) | (None, 28, 28, 128) | 0 | conv2d_11[0][0] |
| flatten_1 (Flatten) | (None, 100352) | 0 | max_pooling2d_5[0][0] |
| dense_4 (Dense) | (None, 50) | 5017650 | flatten_1[0][0] |
| dense_6 (Dense) | (None, 50) | 5017650 | flatten_1[0][0] |
| dense_5 (Dense) | (None, 30) | 1530 | dense_4[0][0] |
| dense_7 (Dense) | (None, 30) | 1530 | dense_6[0][0] |
| class_out (Dense) | (None, 15) | 465 | dense_5[0][0] |
| box_out (Dense) | (None, 56) | 1736 | dense_7[0][0] |
| Total params: 10,326,993 | | | |
| Trainable params: 10,326,993 | | | |
| Non-trainable params: 0 | | | |

```
Epoch 1/10
468/468 [=====] - 3449s 7s/step - loss: nan - class_out_loss: nan - bb_out_loss: nan
- val_loss: nan - val_class_out_loss: nan - val_bb_out_loss: nan
```

NAN ☹☹

References

[1] Chest X-ray abnormalities: Baseline[TF.Keras],
<https://www.kaggle.com/bibhash123/chest-x-ray-abnormalities-baseline-tf-keras>