

VinBigData

Chest X-ray Abnormalities Detection

김기영, 권형주, 손원용, 오상수, 이준호





01 개발 환경

02 진행 일정

03 자료 조사

04 Yolo, DB

05 향후 일정

개발 환경

kaggle



PyTorch



프로젝트



진행 일정

1주차 - 21년 2/8(月) ~ 12(金)

※ 2월 11일 ~ 2월 12일 설날

자료 조사

Y-Label 조사 및 설명
Kaggle Overview,
data 해석

yolov5 모델
탐색, 코딩, 테스트

데이터분석
DETR 모델 탐색

DICOM 파일 조사(Dicom viewer)
파일 변환(to PNG, JPEG)
MongoDB 업로드, 다운로드

설날 연휴

DB

MongoDB 파일 업로드 성능 측정(작업 시간)
MongoDB 데이터 업로드, 추가 다운로드

Featured Prediction Competition

VinBigData Chest X-ray Abnormalities Detection

Automatically localize and classify thoracic abnormalities from chest radiographs

\$50,000
Prize Money

Vingroup Big Data Institute · 604 teams · a month to go (a month to go until merger deadline)

Overview Data Notebooks Discussion Leaderboard Datasets ... My Submissions **Submit Predictions**

Overview

Description	When you have a broken arm, radiologists help save the day—and the bone. These doctors diagnose and treat medical conditions using imaging techniques like CT and PET scans, MRIs, and, of course, X-rays. Yet, as it happens when working with such a wide variety of medical tools, radiologists face many daily challenges, perhaps the most difficult being the chest radiograph. The interpretation of chest X-rays can lead to medical misdiagnosis, even for the best practicing doctor. Computer-aided detection and diagnosis systems (CADe/CADx) would help reduce the pressure on doctors at metropolitan hospitals and improve diagnostic quality in rural areas.
Evaluation	
Timeline	
Prizes	Existing methods of interpreting chest X-ray images classify them into a list of findings. There is currently no specification of their locations on the image which sometimes leads to inexplicable results. A solution for localizing findings on chest X-ray images is needed for providing doctors with more meaningful diagnostic assistance.

전문의도 해석하기 힘든 흉부 X-ray 진단의
품질 개선에 도움을 주기 위한 목적
Train : 15000 / Test : 3000
성능평가지표 : mAP at IOU > 0.4

자료 조사 - 캐글 요약



Submission File

Images in the test set may contain more than one object. For each object in a given test image, you must predict a class ID, confidence score, and bounding box in format `xmin ymin xmax ymax`. If you predict that there are NO objects in a given image, you should predict `14 1.0 0 0 1 1`, where `14` is the class ID for "No finding", `1.0` is the confidence, and `0 0 1 1` is a one-pixel bounding box.

The submission file should contain a header and have the following format:

```
ID, TARGET
004f33259ee4aef671c2b95d54e4be68 14 1 0 0 1 1
004f33259ee4aef671c2b95d54e4be69 11 0.5 100 100 200 200 13
0.7 10 10 20 20
etc.
```

환자 고유번호 (정보 보안)

□ : 예측(1개 이상, 없을 경우 0 0 1 1)

□ : Box 좌표 표시

총 15개의 Class

자료 조사 - 캐글 요약



자료 조사 - 클래스 분석

Cardiomegaly 심비대
Aortic enlargement 대동맥 확장
Pleural thickening 늑막 비후
ILD 간질성 폐질환
Nodule/Mass 종양
Pulmonary fibrosis 폐 섬유화
Lung Opacity 폐 불투명도

무기폐 Ateletasis
기타 병변 Other lesion
침투 Infiltration
흉막 삼출 Pleural effusion
석회화 Calcification
간경화 Consolidation
기흉 Pneumothorax

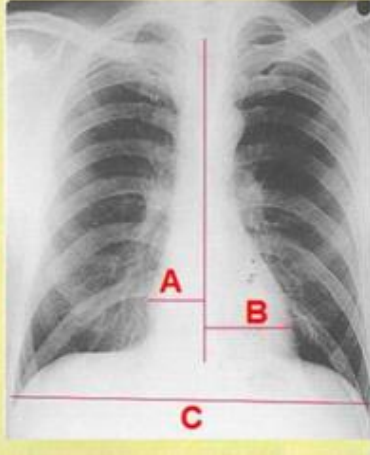


특징 분석

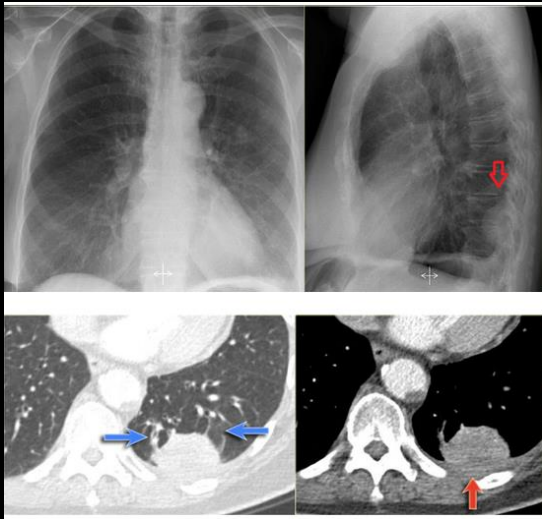
Chest X-ray anatomy - Heart size and contours

Cardiothoracic ratio:

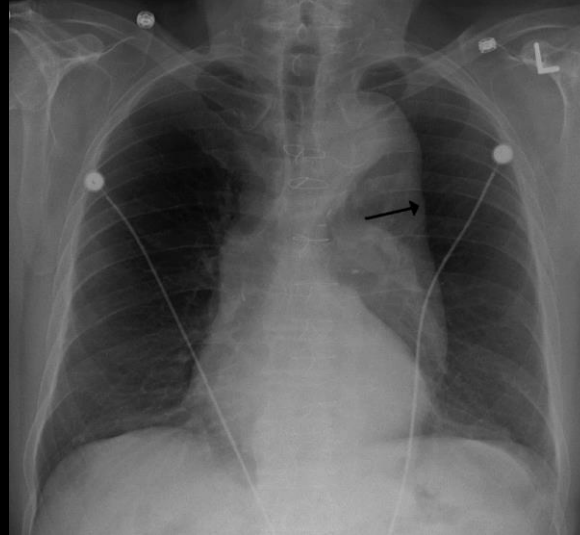
- ❑ The cardiothoracic ratio should be less than **0.5**. i.e. $A+B/C < 0.5$
- ❑ A cardiothoracic ratio > 0.5 suggests **cardiomegaly in adults**
- ❑ A cardiothoracic ratio > 0.6 suggests **cardiomegaly in newborn**.



심비대



늑막 비후



대동맥 확장

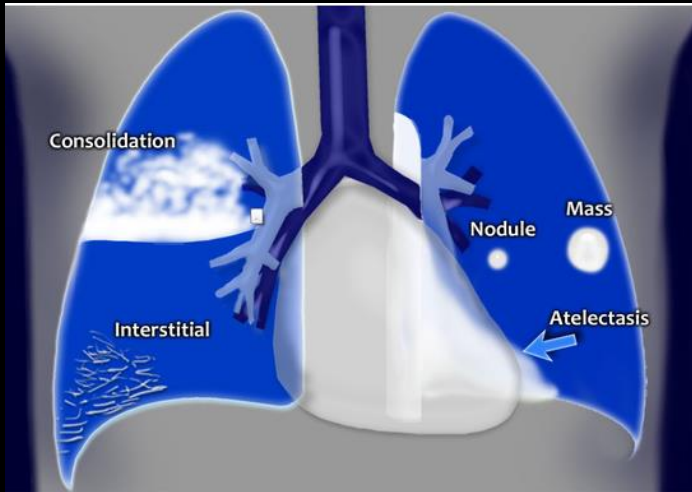


간질성 폐질환

자료 조사 - 클래스 분석



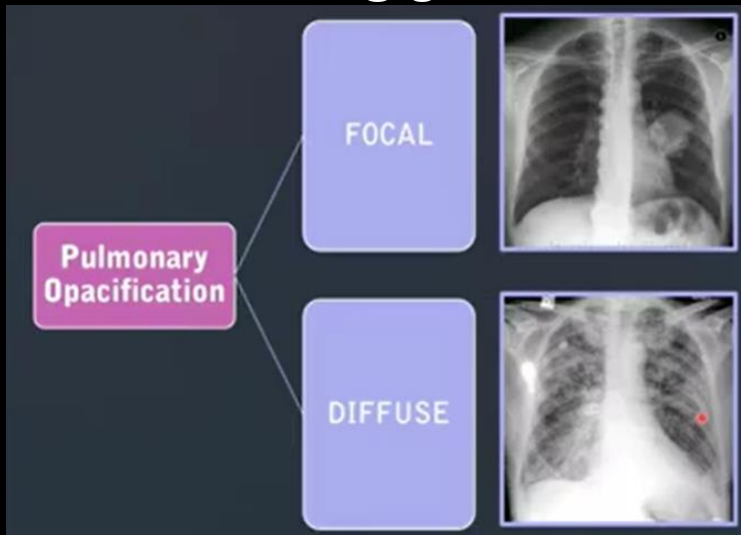
특징 분석



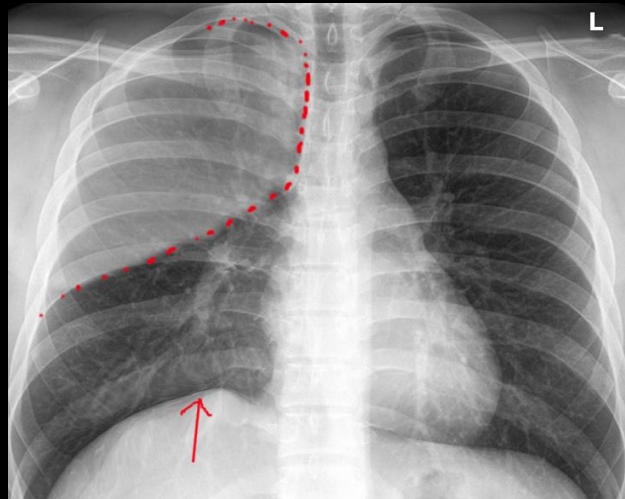
종양



섬유화



폐 불투명도



무기폐

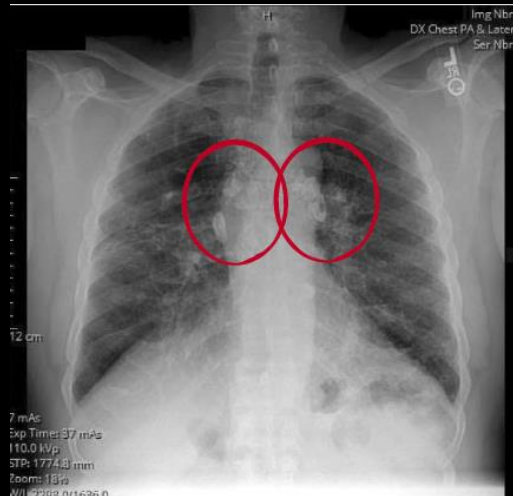
자료 조사 - 클래스 분석



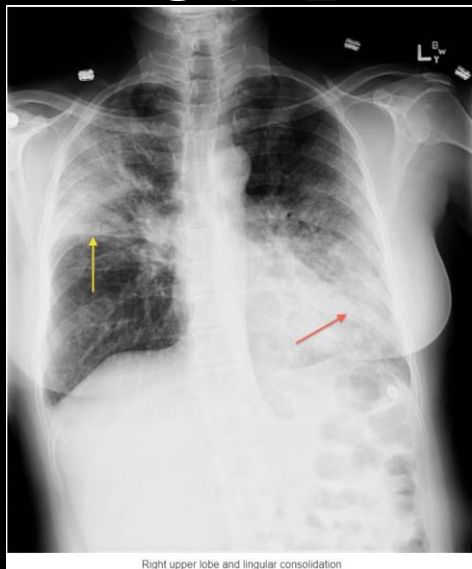
특징 분석



흉막 삼출

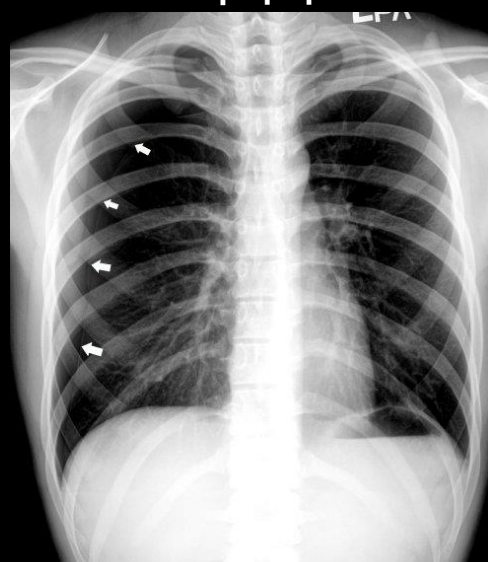


석회화



Right upper lobe and lingular consolidation

간경화



기흉

자료 조사 - 클래스 분석



문제점

기타 병변 Other lesion

기타 발견 가능성 있는 질환

침투 Infiltration

ILD 간질성 폐질환

Consolidation 간경화

Lung Opacity 폐 불투명도

- 질병 구분의 기준 모호
- 한 질병이 다른 질병의 상위 범주에 포함

- X-ray 에서 형태 흡사

Pleural thickening 늑막 비후

Pleural effusion 흉막 삼출

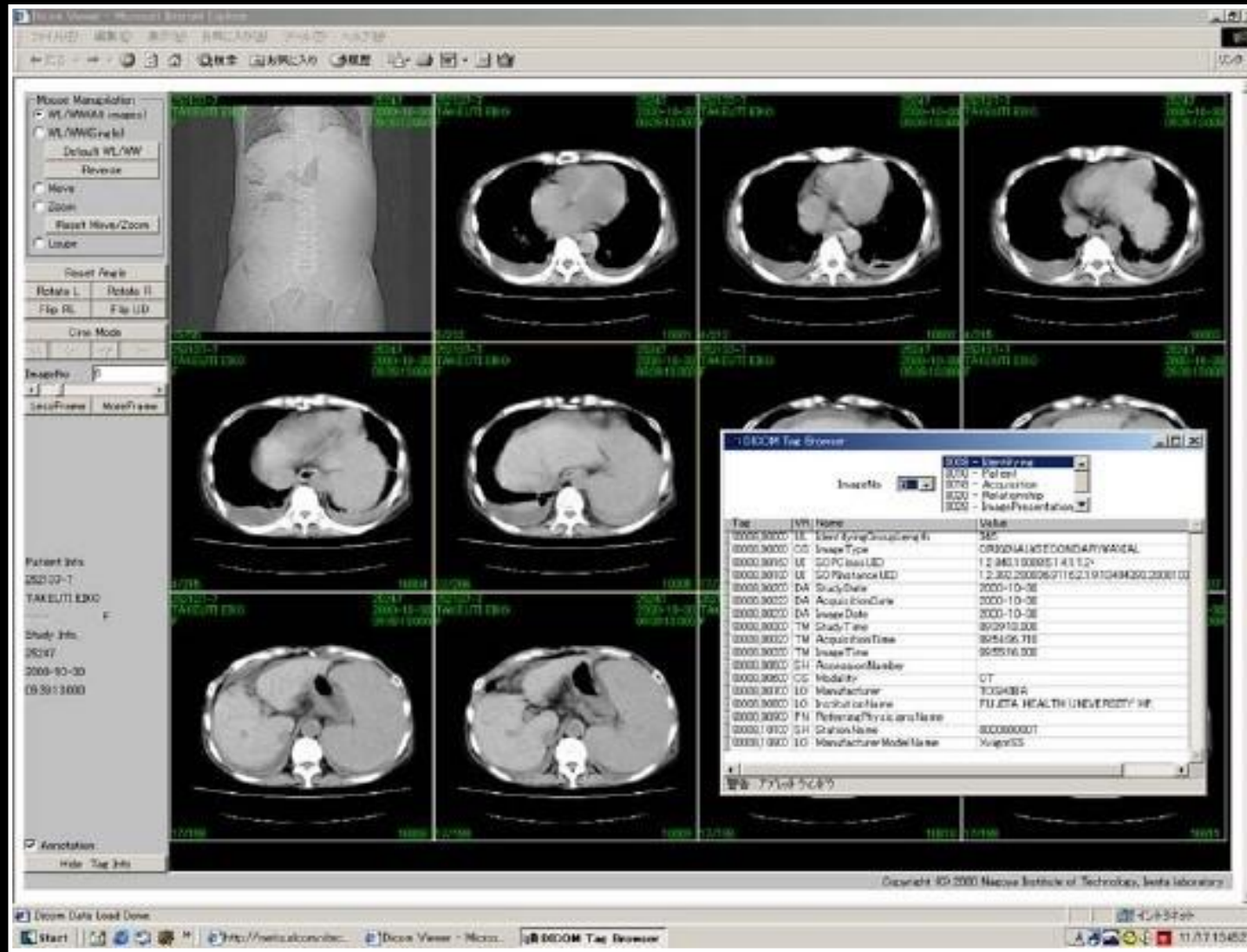
Ateletasis 무기폐

자료 조사

- 클래스 분석



MongoDB



파일명	개수	용량 (MB)	업로드 / 다운로드 시간(초)
-----	----	------------	------------------

DICOM	30	333	Done Upload time : 111.02231812477112 Done Download time : 86.94876837730408
-------	----	-----	---

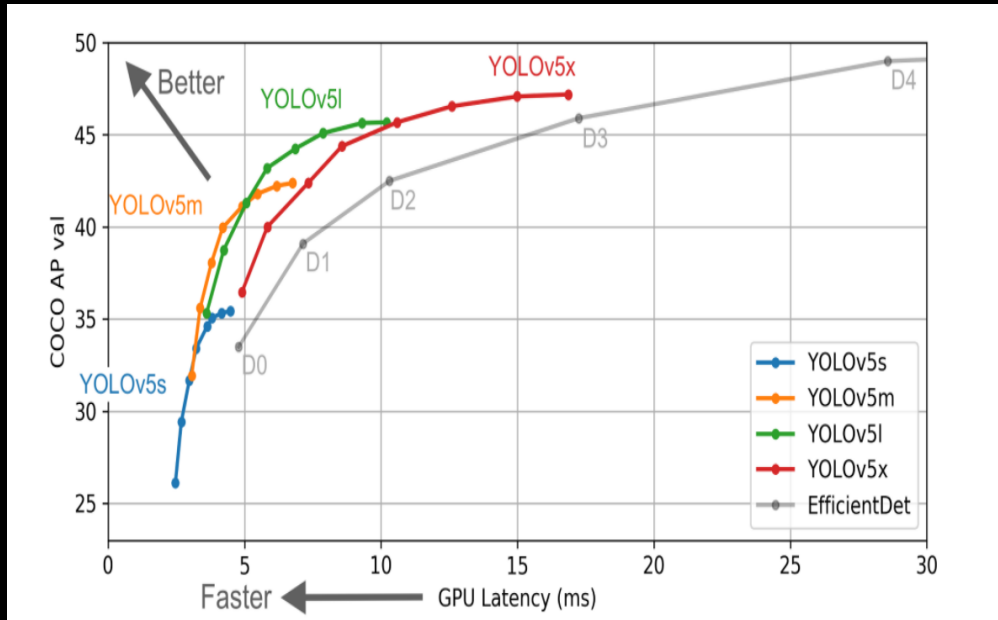
PNG	30	76.6	Done Uplode time : 41.680994272232056 Done DownLode time : 40.191808462142944
-----	----	------	--

JPG	30	13.9	Done Uplode time : 11.518765211105347 Done DownLode time : 2.778932809829712
-----	----	------	---

MongoDB



선택 이유



빠른 속도로 좋은 성능에 도달

Yolov5



선택 이유



다양한 Object Detection에 적합함

Yolov5



Modeling













Train Data : 3515
Validation Data : 879
Epochs : 30
mAP/IoU = .5 : 0.31

1차 테스트 검증 (설정 내용)

Yolov5



1차 제출선정

589	ivanwang		0.044	1	19d
590	ilyes		0.040	2	1mo
591	Sylvain LEJAMBLE		0.035	1	14d
592	Rookie		0.030	1	1mo
593	Xuling		0.028	1	12d
594	JunHo Lee		0.023	1	3h
Your First Entry 					
Welcome to the leaderboard!					
595	AnhPham79		0.021	1	20d
596	Howie Wu		0.019	3	2d
597	gbdmms		0.019	10	1mo
598	Nadir Tariverdiyev		0.018	1	1mo
599	Michal Kucirka		0.000	1	20h





1차 SubMission : 0.023

Yolov5




1) ICCV2019 - "CutMix: Regularization Strategy to Train Strong Classifiers with Localizable Features"


- 서로 다른 클래스에 해당되는 이미지가 2개 이상 있을 때 이미지들을 랜덤하게 섞어서 새로운 이미지 생성 및 활용
- 기대효과 : Feature 비중이 낮은 부분으로 Object 탐지 및 분류

ResNet-50	Mixup[47]	Cutout[3]	CutMix
			
Dog 1.0	Dog 0.5 Cat 0.5	Dog 1.0	Dog 0.6 Cat 0.4
76.3 (+0.0)	77.4 (+1.1)	77.1 (+0.8)	78.6 (+2.3)
46.3 (+0.0)	45.8 (-0.5)	46.7 (+0.4)	47.3 (+1.0)
75.6 (+0.0)	73.9 (-1.7)	75.1 (-0.5)	76.7 (+1.1)

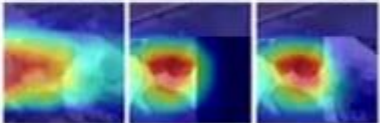
Original Samples



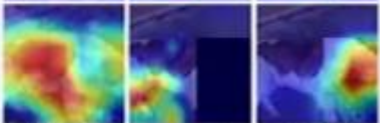
Input Image



CAM for 'St. Bernard'



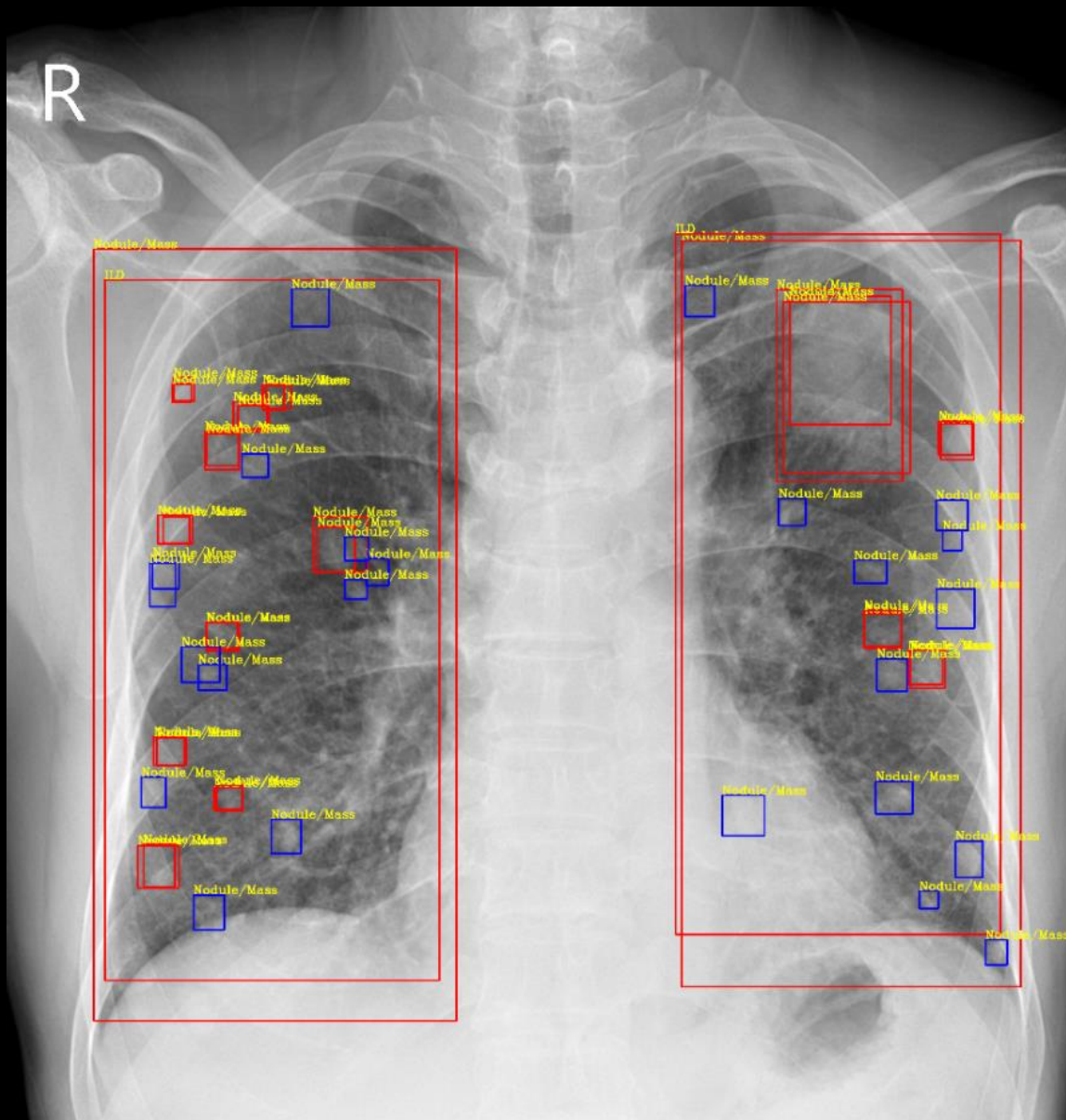
CAM for 'Poodle'



Mixup Cutout CutMix

진행 상황
상세 공유
(추가)





진행 상황 상세 공유 (추가)

2) 증상별 상관관계 분석

- IOU 0.4 기준 4,352개의 이미지에 증상 중복

< 겹치는 증상 요약 (Top 3) >

1. 대동맥 확장 + 심비대 3,847
2. 흉막 삼출 + 늑막 비후 479
3. 늑막 비후 + 폐 섬유화 310

등 대략 60개 케이스에 대해 증상 중복

향후 일정

2주차 - 21년 2/15(月) ~ 19(金)

※ 2월 11 ~ 2월 12일 설날

3주차 - 21년 2/22(月) ~ 26(金)

※ 2월 11 ~ 2월 12일 설날

자료 조사

yolov5 Submission

CutMix 분석

DETR 모델 탐색

새로운 모델 탐색

기존 모델 튜닝

DB

DICOM 영상처리 방법 학습

MongoDB 대용량 파일

업로드, 다운로드

이미지 전처리

참고 자료



Y-Label

- 1) <https://m.blog.naver.com/PostView.nhn?blogId=cloveryou1&logNo=221457514606&referrerCode=0&searchKeyword=Cardiomegaly>
- 2) <https://radiopaedia.org/articles/pulmonary-infiltrates-1>
- 3) <https://twitter.com/radiologistpage>
- 4) <https://radiologyassistant.nl/>
- 5) Youtube - KIM'S CLINIC, hammadshams, Ayman Taji

yolov5

- 1) <https://github.com/ultralytics/yolov5>
- 2) <https://www.kaggle.com/awsaf49/vinbigdata-cxr-ad-yolov5-14-class-train>
- 3) <https://www.kaggle.com/xhlulu/vinbigdata-process-and-resize-to-png-1024x1024>

MongoDB

- 1) <https://dicom.innolitics.com/ciods>
- 2) <https://www.mongodb.com/blog/post/building-mongodb-applications-binary-files-using-gridfs-part-1>
- 3) <https://pymongo.readthedocs.io/en/stable/api/gridfs/>



THANK YOU

<https://trello.com/b/bUlob804/kaggle>

<https://github.com/orgs/X-Ray-Project/teams/x-ray>