Case 2 - COVID-19 Pneumonia Detection

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CT_01_B@seLine

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Outline

01. INTRODUCTION

- Background
- Dataset

02. METHODS

- Data preprocess
- Model structures

03. EXPERIMENT

- Experiment settings
- Experiment results

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- Our thoughts

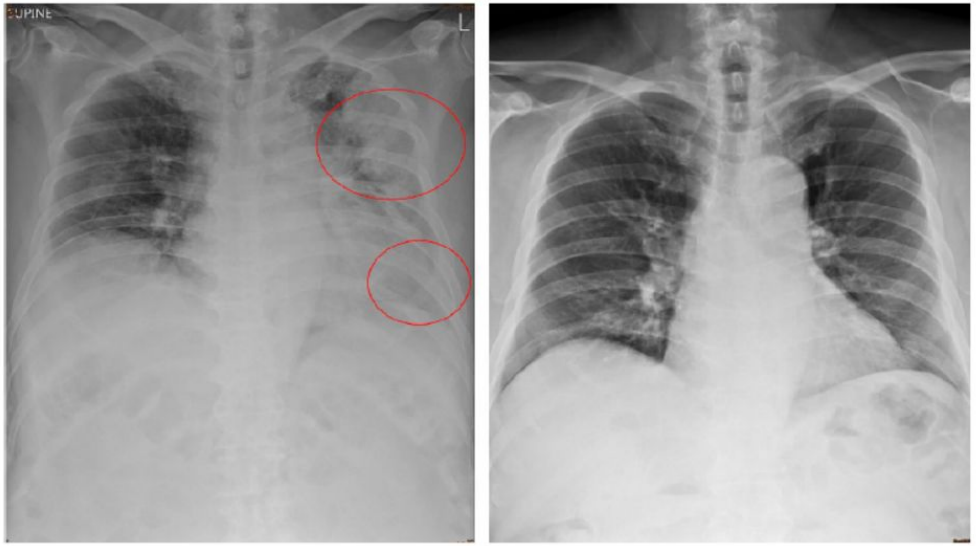
01.

Introduction

- Background
- Dataset

Background

- Typical pneumonia
  - respiratory symptoms
  - **lobar pneumonia**
- Atypical pneumonia
  - fever
  - headache
  - sweating
  - myalgia
  - **bronchopneumonia**



Reference: https://en.wikipedia.org/wiki/Atypical_pneumonia

Dataset - Label Distribution

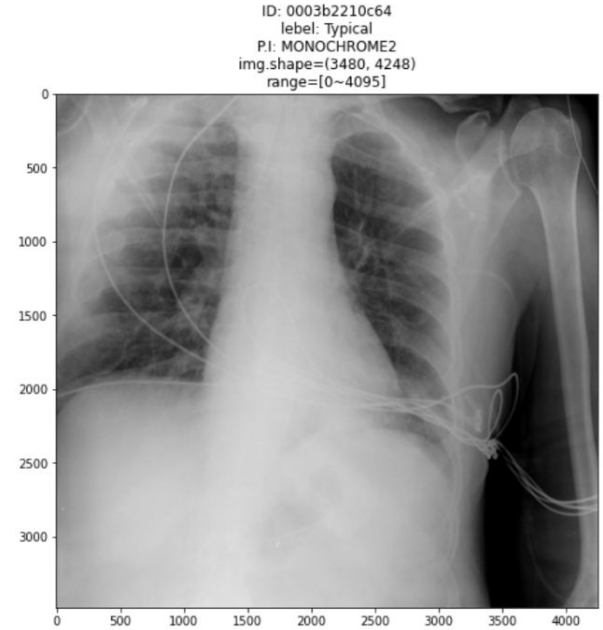
COVID-19 Pneumonia Detection

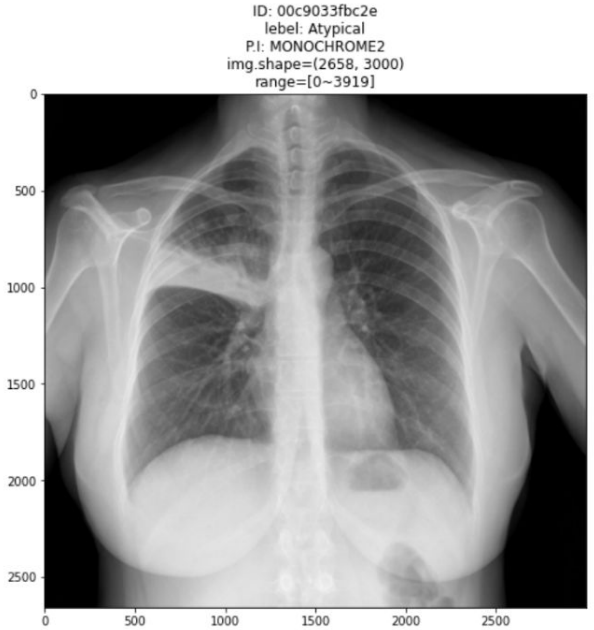
- Dataset for developing AI Models
  - 400 Non-Pneumonia
  - 400 Typical Pneumonia
  - 400 Atypical Pneumonia
- Dataset for validating AI Models
  - 50 Non-Pneumonia
  - 50 Typical Pneumonia
  - 50 Atypical Pneumonia

	A	B	C	D
1	FileID	Negative	Typical	Atypical
2	0003b2210c64	0	1	0
3	00af6f8c2a3d	1	0	0
4	00c9033fbc2e	0	0	1
5	00e0ce73dac8	0	0	1
6	00f0a591f18a	0	1	0
7	01113d3e0910	1	0	0
8	018861e85a54	0	0	1
9	01978984ac60	0	0	1
10	01a7576432b3	1	0	0
11	01ef587469f2	0	0	1
12	021f1372c819	0	0	1
13	026427c2156b	0	1	0
14	02a3e261c938	0	1	0
15	03379b1a9e12	0	0	1
16	034247332fec	1	0	0
17	038cd47a6ab8	0	0	1
18	039308b26a85	0	0	1
19	03bec103ef51	0	1	0
20	03f9dafeb772	1	0	0

Dataset - Samples

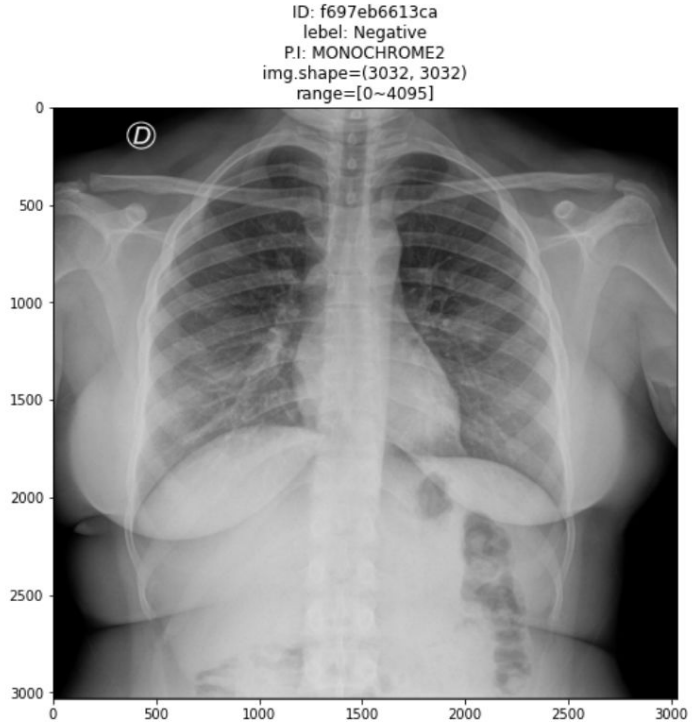
- Non-unified image sizes
- Slightly rotation





Dataset - Samples (cont'd)

- Inverted color scale



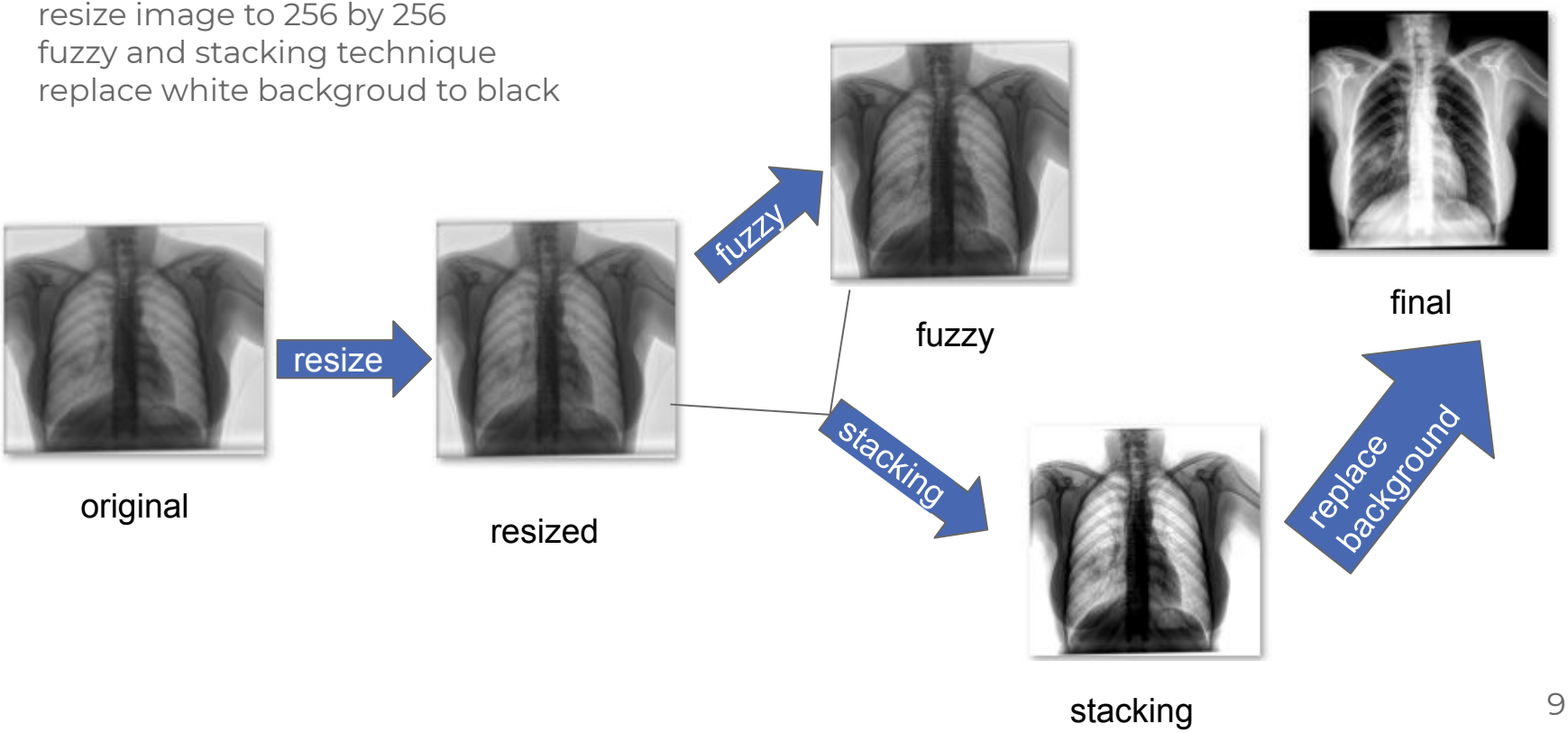
02.

Methods

- Data preprocess
- Model structures

Preprocessing

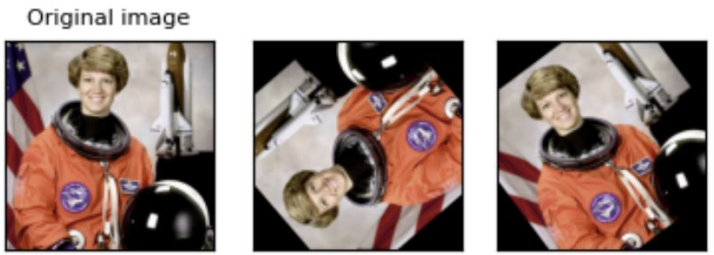
- resize image to 256 by 256
- fuzzy and stacking technique
- replace white backgroud to black



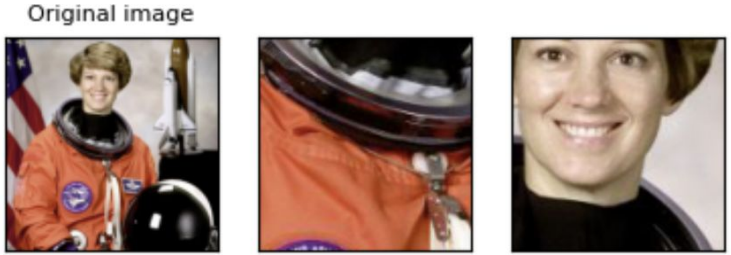
Methods: Data Augumentation

- Resize

- Random Rotation



- Random Crop

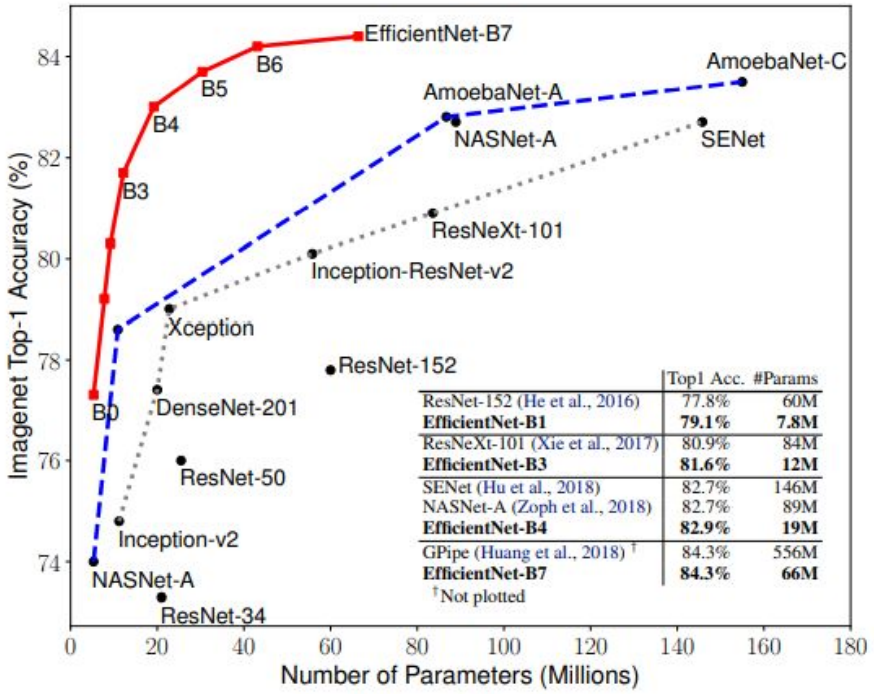


- Random Invert

Source: https://pytorch.org/vision/stable/transforms.html

Methods : CNN Models

- ResNet101
- DenseNet121
- EfficientNet B0~B4



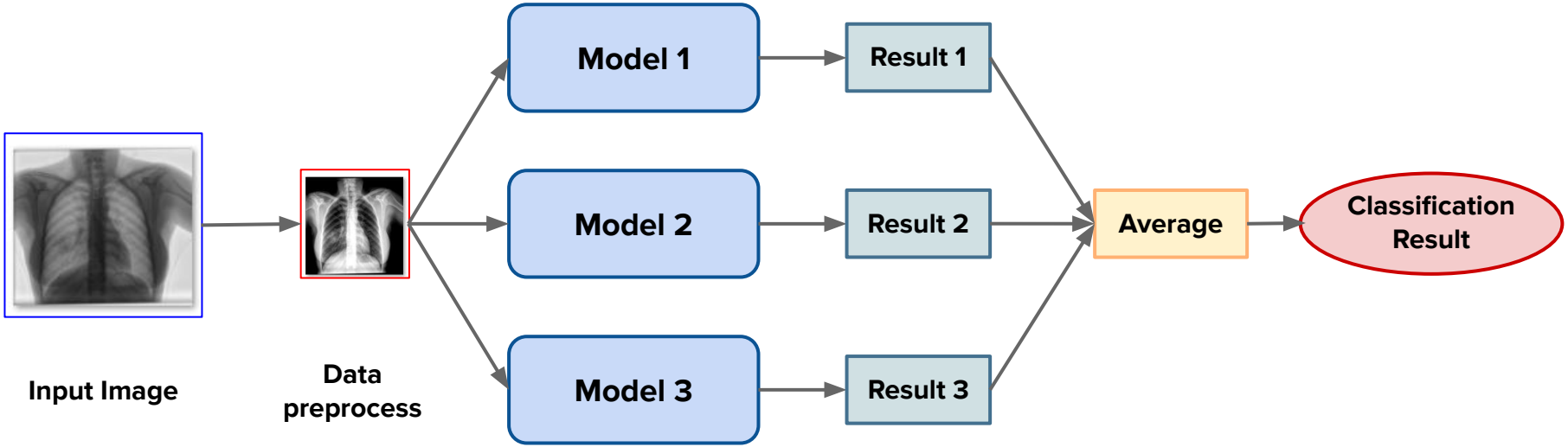
Source : Tan, M., & Le, Q.V. (2019). EfficientNet: Rethinking Model Scaling for Convolutional Neural Networks. *ArXiv, abs/1905.11946*.

Ensemble Models

- *Model Backbone : EfficientNet B4 (pretrained on ImageNet)*

- Model 1:
  - Data: Negative:Typical:Atypical=2:3:3
- Model 2:
  - Data: Negative:Typical:Atypical=1:3:0
- Model 3:
  - Data: Negative:Typical:Atypical=1:0:3

Ensemble Model



03.

Experiment

- Experiment settings
- Experiment results

Experiment Settings

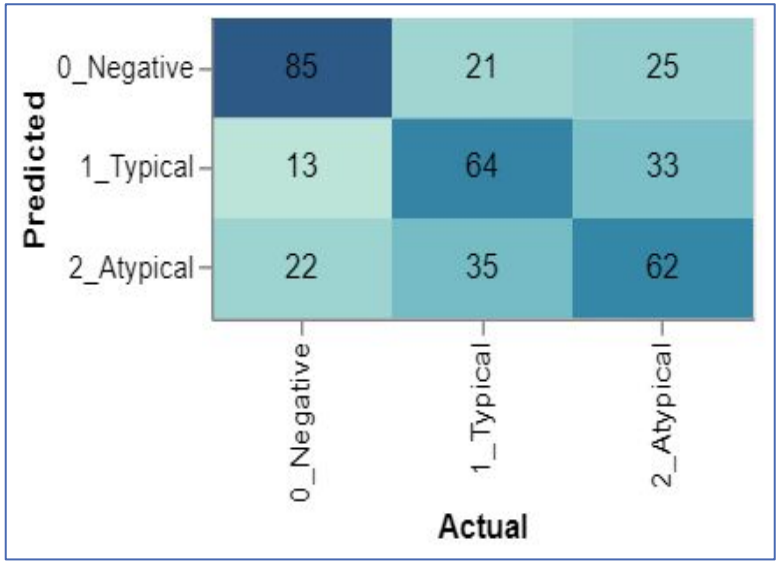
	Model Backbone	Dataset	Data Augmentation	# of models
Baseline	EfficientNet B4	256x256 Image	None	1
With data preprocess	EfficientNet B4	Fuzzy & Stacking	Negative : +1 Typical/Atypical : +2	1
Ensemble	EfficientNet B4	Fuzzy & Stacking	Refer to P.13	3

Experiment Result

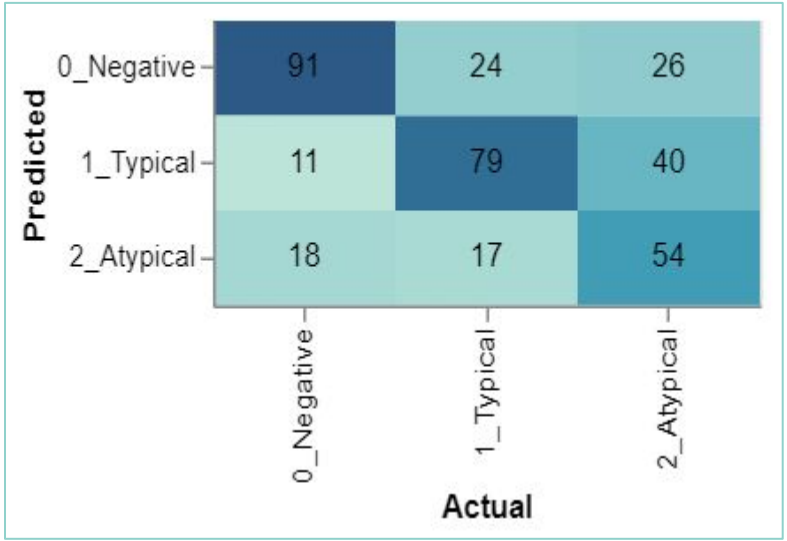
	Test F1-score	F1-score on public leaderboard
Baseline	58.4%	53.33%
With data preprocess	61.5%	57.14%
Ensemble	64.0%	54.85%

Experiment Result

Baseline

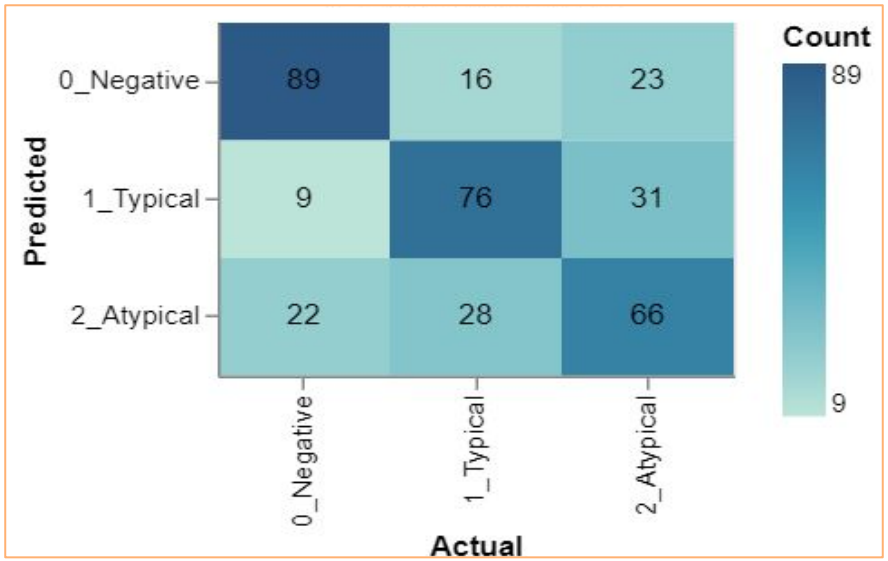


With data preprocess



Experiment Result

Ensemble



04.

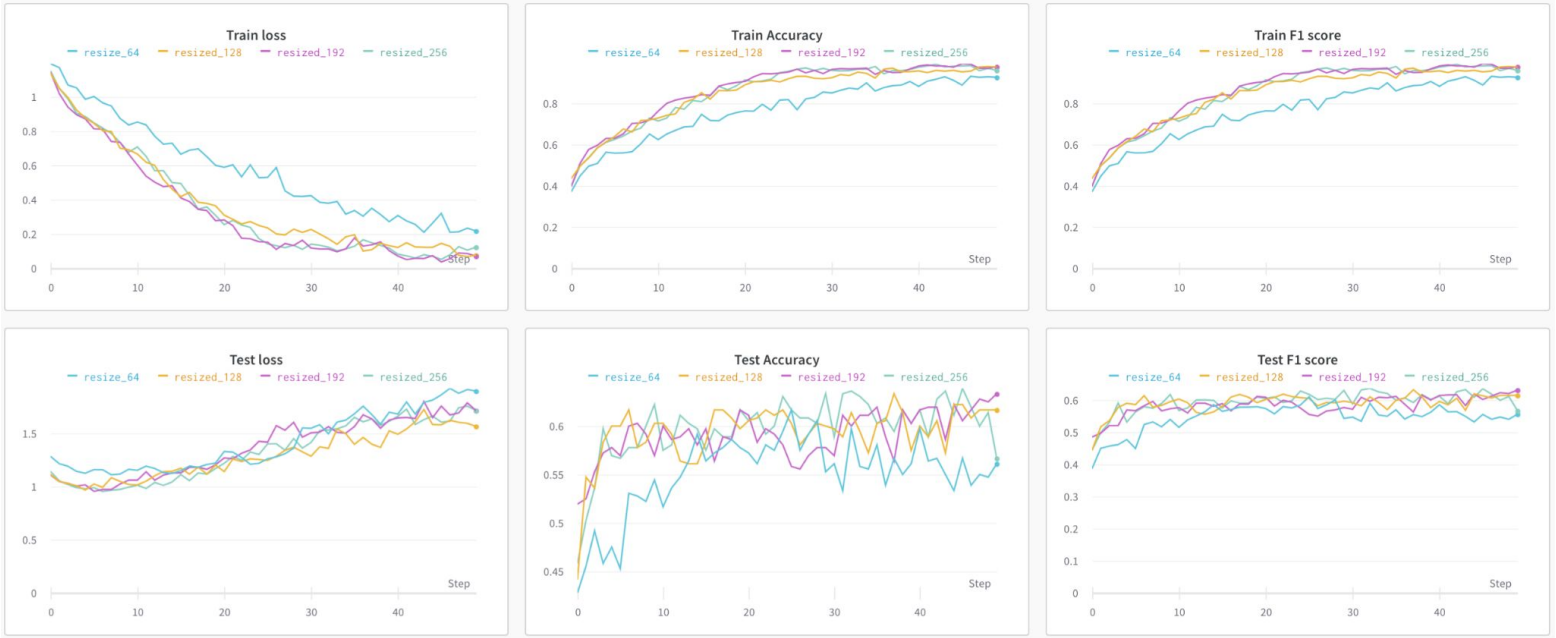
Discussion

Discussion

- Preprocessing
- 2-class v.s. 3-class (poor performance of typical/atypical)
  - weighted loss
  - data imbalance / augmentation
  - ensemble
- BInary classification
  - 0 / 1 : 0.77
  - 1 / 2 : 0.61
  - 0 / 2 : 0.68
- proper image size
  - 64 / 128: 0.55~0.58(few param)
  - 192 / 224: 0.59~0.64
  - 264 / 272: 0.57~0.61(too complex)

Discussion

- Proper image size
  - 64 / 128: 0.55~0.58(few param)
  - 192 / 224: 0.59~0.64
  - 264 / 272: 0.57~0.61(too complex)



Reference

- Tan, M., & Le, Q.V. (2019). EfficientNet: Rethinking Model Scaling for Convolutional Neural Networks. *ArXiv, abs/1905.11946*.
- https://github.com/ieee8023/covid-chestxray-dataset
- COVID-19 detection using deep learning models to exploit Social Mimic Optimization and structured chest X-ray images using fuzzy color and stacking approaches

Thank you !

The codes for this experiment are available at

https://github.com/tim310579/Digital-Medicine-Case-Presentation.git

Team Member Contribution

	Dataset Parsing	Preprocessing	Data Augmentation	Model/Analysis	Result Presentation	
					Slides	Oral
林亦盛 309551074	V	V	V	V	V	V
周君諦 310551136	V	V	V	V	V	V
陳昱銘 310554007	V	V	V	V	V	V