Lab1 & Environment settings

TA: Frank

Important Rule

Submission Deadline: 2025/10/12 (Sun.) 23：59

Late submission: grade * 80%

Turn in:

1）Experiment Report (.pdf) to E3「LAB1_yourstudentID_name.pdf」

eg :「LAB1_311xxxxx_陳小川.pdf」

2）Source Code (.py) to your own github

(a)「train.py」「inference.py」.....

(b) README.md

Lab Objective

Pneumonia Classification in chest X-ray images

Object 1: write your own custom DataLoader

Object 2: Pneumonia Classification

Object 3: Evaluation

Requirements

1. Implement the **at least 2 ResNet architectures** (ResNet18, ResNet50, ResNet101 … or others), calling model from pytorch API is allowed.

2. **Visualize the accuracy and F1-score trend between the models**, you need to plot each epoch accuracy and F1-score **during training phase (necessary)** or validation phase (optional, bonus).

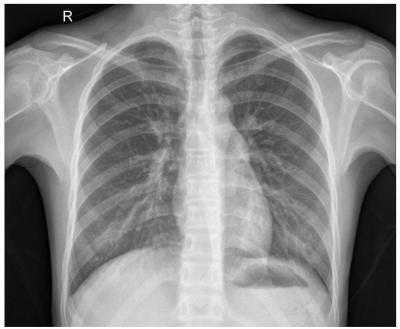
3. **Plot the confusion matrix** of the final result.

4. **Upload you code to your own github** including README.md

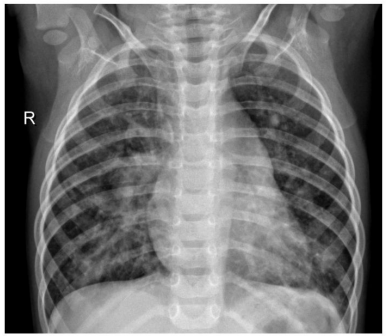
Dataset - Chest X-ray (kaggle)

- Download the dataset from the url below:
  - https://www.kaggle.com/datasets/paultimothymooney/chest-xray-pneumonia
- Train / Val (optional) / Test
- **Train the model on the “train” dataset**
- **Evaluate the model on the “test” dataset**
- “Val” dataset is optional, you could choose the best performance model on train dataset or val dataset to do the final evaluation

NORMAL

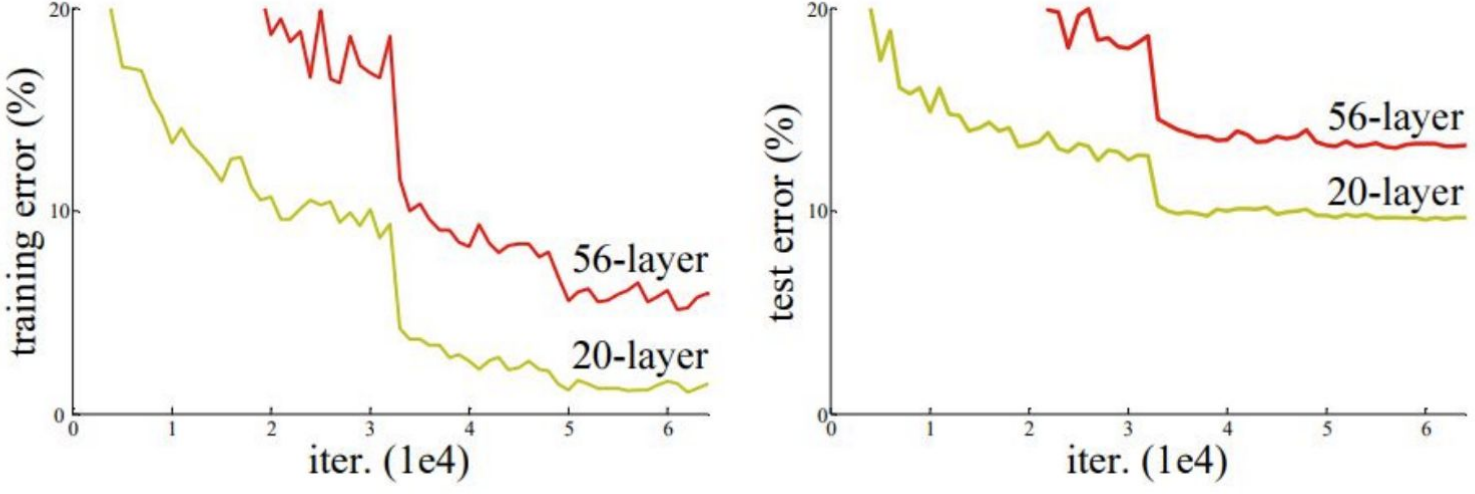


Pneumonia



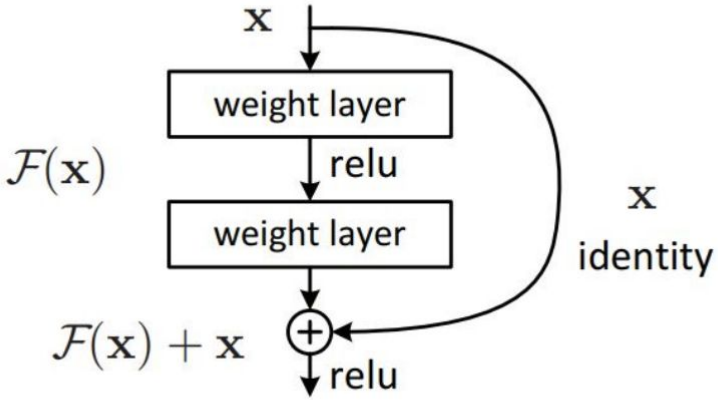
ResNet

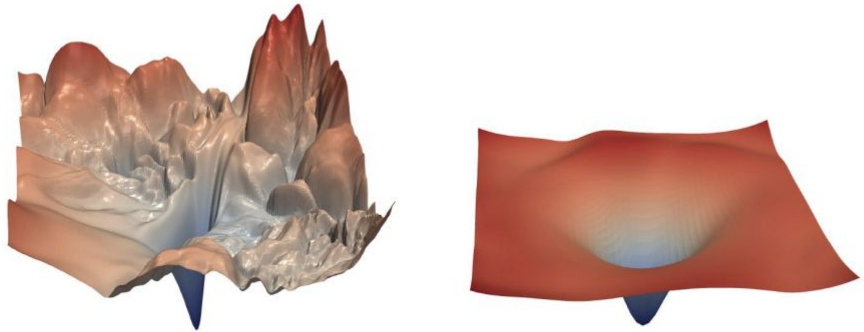
ResNet (Residual Network) is the Winner of ILSVRC 2015 in image classification, detection, and localization, as well as Winner of MS COCO 2015 detection, and segmentation



ResNet

To solve the problem of vanishing/exploding gradients, a skip / shortcut connection is added to add the input x to the output after few weight layers as below





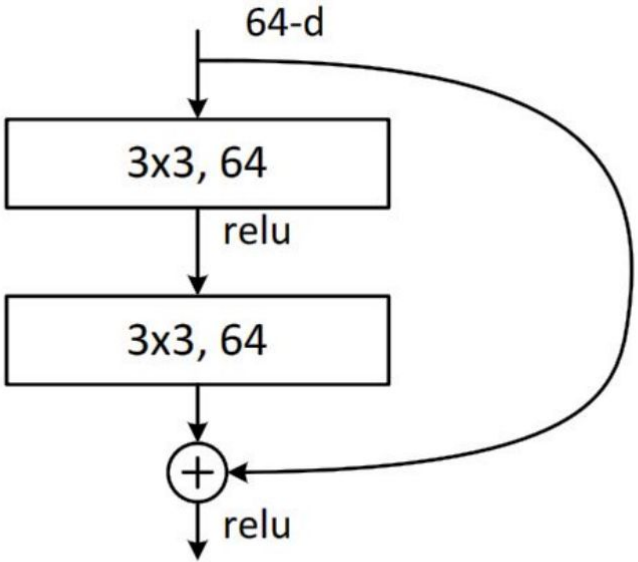
(a) without skip connections (b) with skip connections

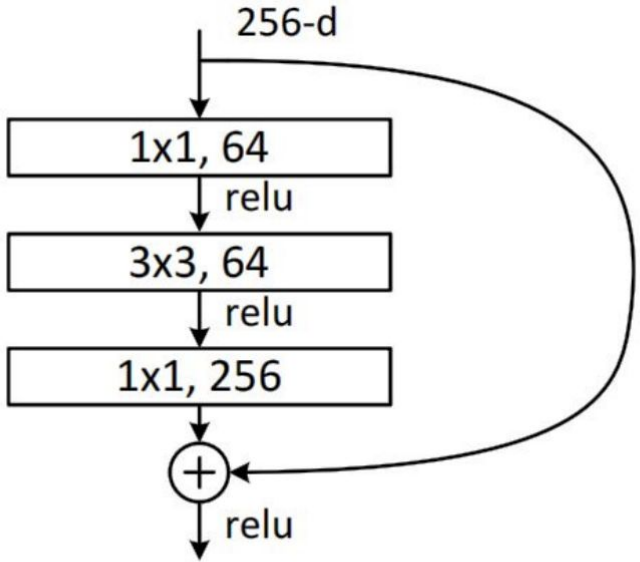
Figure 1: The loss surfaces of ResNet-56 with/without skip connections. The proposed filter normalization scheme is used to enable comparisons of sharpness/flatness between the two figures.

Source: Li, Hao, et al. "Visualizing the loss landscape of neural nets." Advances in Neural Information Processing Systems. 2018.

ResNet

ResNe18(Basic block), ResNet50(Bottleneck block)





Using Pretrained Model

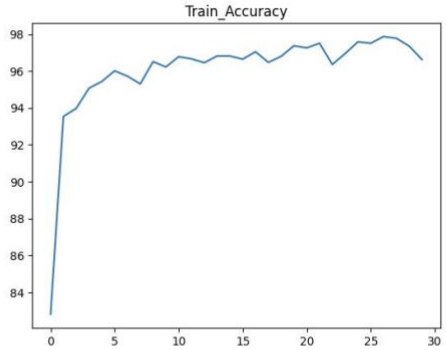
Using pretrained model by torchvision module

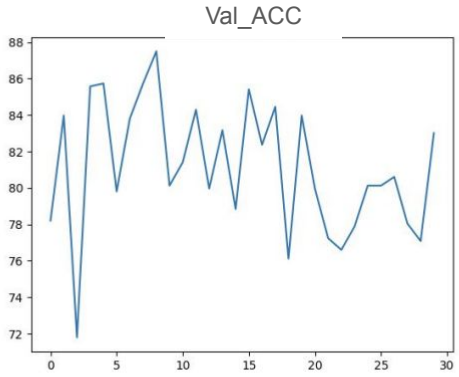
```
ResNet(
  (conv1): Conv2d(3, 64, kernel_size=(7, 7), stride=(2, 2), padding=(3, 3), bias=False)
  (bn1): BatchNorm2d(64, eps=1e-05, momentum=0.1, affine=True, track_running_stats=True)
  (relu): ReLU(inplace)
  (maxpool): MaxPool2d(kernel_size=3, stride=2, padding=1, dilation=1, ceil_mode=False)
  (layer1): Sequential(
              :
    )
  (layer2): Sequential(
              :
    )
  (layer3): Sequential(
              :
    )
  (layer4): Sequential(
              :
    )
  (avgpool): AvgPool2d(kernel_size=7, stride=1, padding=0)
  (fc): Linear(in_features=512, out_features=1000, bias=True)
)
```

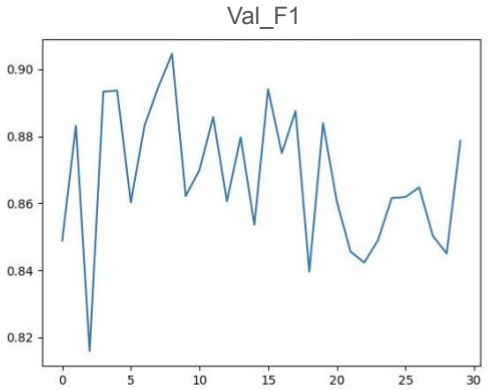
You need to reinitialize the specific layers

Result Comparision

Compare and visualize the accuracy and F1-score trend in training phase (validation phase is optional, **you'll get a 5 point bonus if you visualize the result of validation phase**)

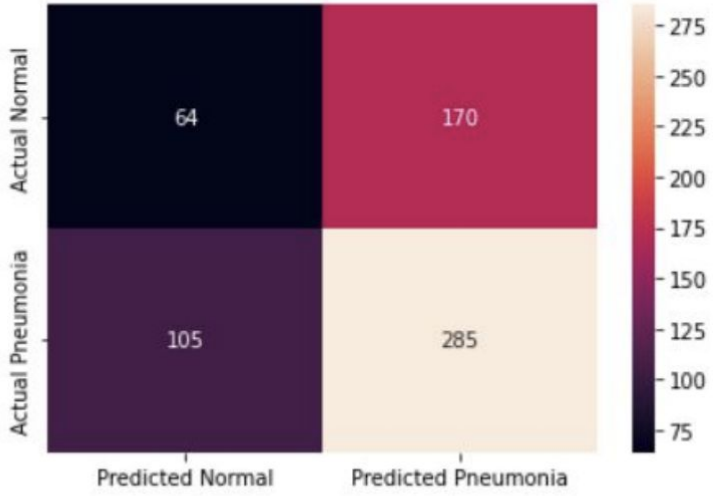






Confusion Matrix

Calculate the confusion matrix and plotting



How to plot on Python

Tutorial:

https://matplotlib.org/stable/tutorials/introductory/pyplot.html
https://seaborn.pydata.org/generated/seaborn.heatmap.html

Report Spec

1. Introduction (5%)
2. Experiment setups (25%)
    a. The detail of your model
    b. The detail of you Dataloder (e.g. different data augmentation methods)
3. Experiment result (30%)
    a. Highest testing accuracy and F1-score (screenshot)
    b. Ploting the comparsion figure
        i. Training and testing accuracy curve
        ii. Testing F1-score curve
        iii. Highest testing accuracy heatmap
    c. Anything you want to present

Report Spec

4. Discussion (35%) (**Most important part**)

    a. Discuss your discovery or share anything you want

5. Github Link (5%) (Do not forget)

6. Bonus (**Optional**, 10%)

a. Implemet other model like DenseNet121 / Vision Transformer … (or other models) and then discuss in the discussion section
b. Display the result confusion matrix

Score criterion of Lab1

Score: 30% experimental results + 70% report

---- Criterion of result (30%) ----

Accuracy > = 90% = 100 pts

Accuracy 80~90% = 90 pts

Accuracy 70~80% = 80 pts

Accuracy < 70% = 70 pts

Note

1. If the report exists **format errors** (file name or the report spec), it will be 5-point penalty (-5)
2. **Do not cheat by training the test dataset** to achieve high performance, it's illegal, and I will check the code and report. Anyone who cheats will be 30-point penalty (-30)

Reference

[1] He, Kaiming, et al. "Deep residual learning for image recognition." Proceedings of the IEEE conference on computer vision and pattern recognition. 2016.

[2] https://www.kaggle.com/paultimothymooney/chest-xray-pneumonia

Download the dataset after registration

SSH

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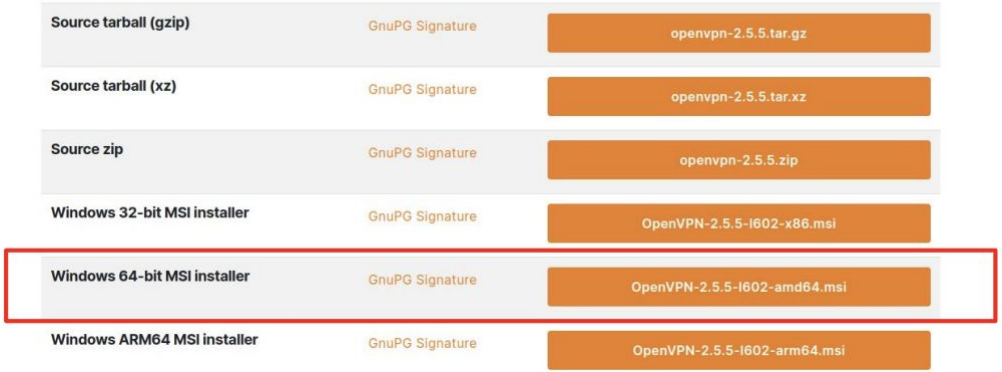
VPN使用方法如以下說明:

1. 請先至: https://openvpn.net/community-downloads/ 下載安裝好openvpn
2. 接著匯入以下連結的設定檔 : https://www.dropbox.com/s/p8uukyhf4xi22vd/GPU-research.ovpn?dl=0
3. 匯入方式: 至 openvpn 的 config 目錄, 以win平台來說會在 %USERPROFILE%\OpenVPN\config 之後以管理權限(因要對 routing table 增加資料)啟動 openvpn 以進行連線 (帳號密碼在csv中的第一欄位跟第二欄位 , VPN的)
4. 然後以 ssh client(如 pietty...等)連至所屬的 container IP,可 sudo 成 root.
5. SSH 進入主機後的密碼為最後一欄的密碼

How to use SSH to connect to GPU (VPN)

VPN使用方法如以下說明:

(1) 請先至: https://openvpn.net/community-downloads/ 下載安裝好openvpn



(2) 接著下載要匯入的設定檔，下載連結:
https://www.dropbox.com/s/p8uukyhf4xi22vd/GPU-research.ovpn?dl=0

How to use SSH to connect to GPU (VPN)

(3) 匯入方式: 至 openvpn 的 config 目錄, 以win平台來說會在 %USERPROFILE%\OpenVPN\config 之後以管理權限(因要對 routing table 增加資料)啟動 openvpn 以進行連線

(4) 然後以 ssh client(如 pietty...等)連至所屬的 container IP,可 sudo 成 root.

How to use SSH to connect to GPU (SSH)

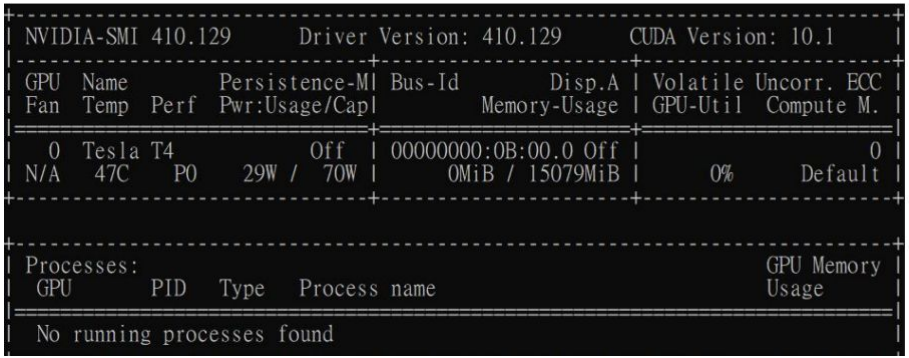
登入連線:

(1)輸入帳號與IP　ssh uername@IP_number　ex: ssh 309553052@172.30.17.51

(2)輸入密碼

(3)輸入bash

(4)輸入nvidia-smi 確認顯卡驅動存在



File transfer

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Install FileZilla

(1) SCP

(2) Download and Install https://filezilla-project.org/ port : 22

Anaconda env

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Install anaconda

#更新apt sudo apt update

#安裝curl sudo apt install curl

下載 Anaconda 安裝檔案

curl -O https://repo.anaconda.com/archive/Anaconda3-2019.10-Linux-x86_64.sh

bash Anaconda3-2019.10-Linux-x86_64.sh

生效conda 指令

conda init

source ~/.bashrc

export PATH=~/anaconda3/bin:$PATH

#查看環境 conda info --env

#建立新環境 conda create --name myenv python=3.8

#啟動新環境 source activate myenv

Pytorch

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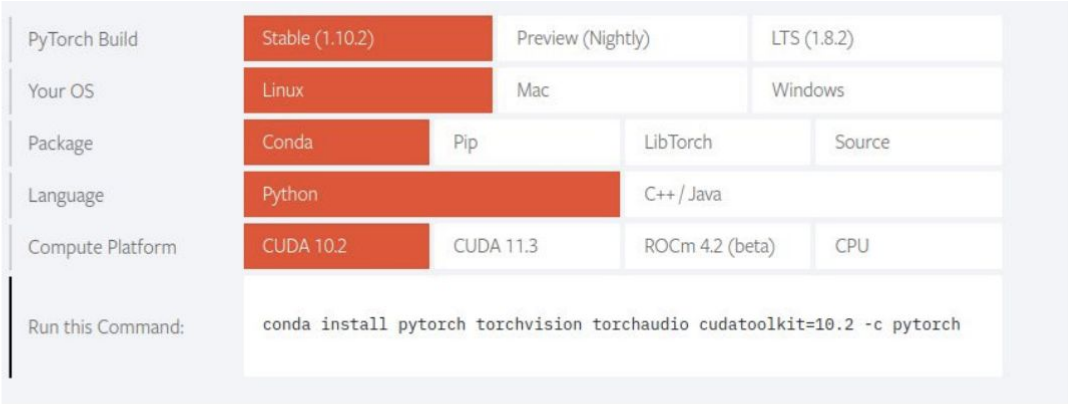
Install pytorch GPU

(1) https://pytorch.org/



(2) Old version : https://pytorch.org/get-started/previous-versions/

conda install pytorch==1.7.0 torchvision==0.8.0 torchaudio==0.7.0 cudatoolkit=10.1 -c pytorch

(3) Test :

```
import torch
torch.cuda.is_available()
```

→ True

install pytorch

URL: https://pytorch.org/get-started/locally/

write the code in the terminal in virtual enviroment:

```
pip3 install torch torchvision torchaudio --index-url https://download.pytorch.org/whl/cu118
```

(1) https://pytorch.org/

(2) Old version : https://pytorch.org/get-started/previous-versions/
conda install pytorch==1.7.0 torchvision==0.8.0 torchaudio==0.7.0 cudatoolkit=10.1 -c pytorch

```
C:\Users\bsplab>ssh 310553043@172.30.17.71
310553043@172.30.17.71's password:
Welcome to Ubuntu 18.04.3 LTS (GNU/Linux 4.4.0-143-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage

This system has been minimized by removing packages and content that are
not required on a system that users do not log into.

To restore this content, you can run the 'unminimize' command.
Last login: Wed Mar  9 07:15:36 2022 from 192.168.249.46
$ bash
(base) 310553043@c007:~$ conda activate myenv
(myenv) 310553043@c007:~$ python
Python 3.7.11 (default, Jul 27 2021, 14:32:16)
[GCC 7.5.0] :: Anaconda, Inc. on linux
Type "help", "copyright", "credits" or "license" for more information.
>>> import torch
>>> torch.cuda.is_available()
True
>>> exit()
```

GITHUB

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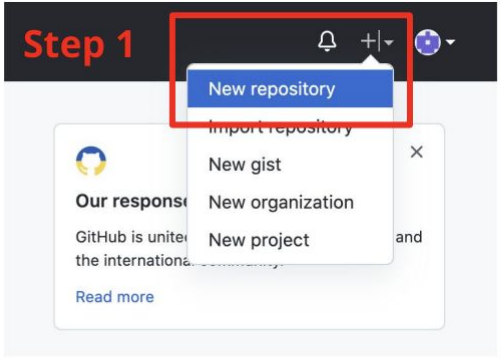
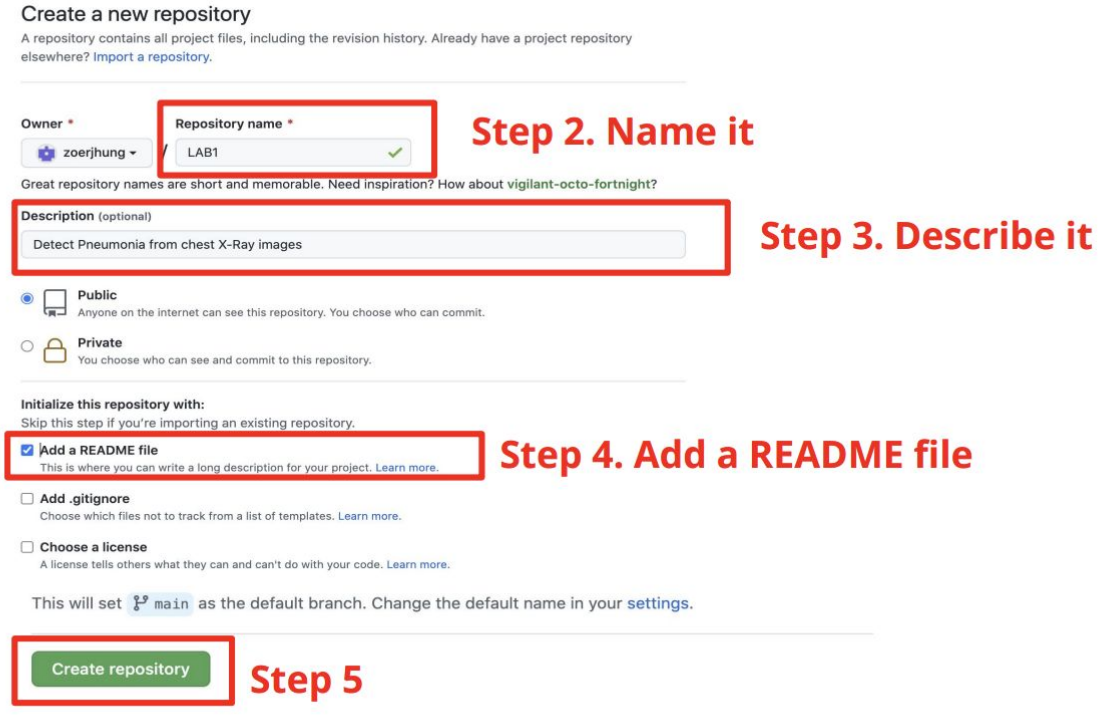
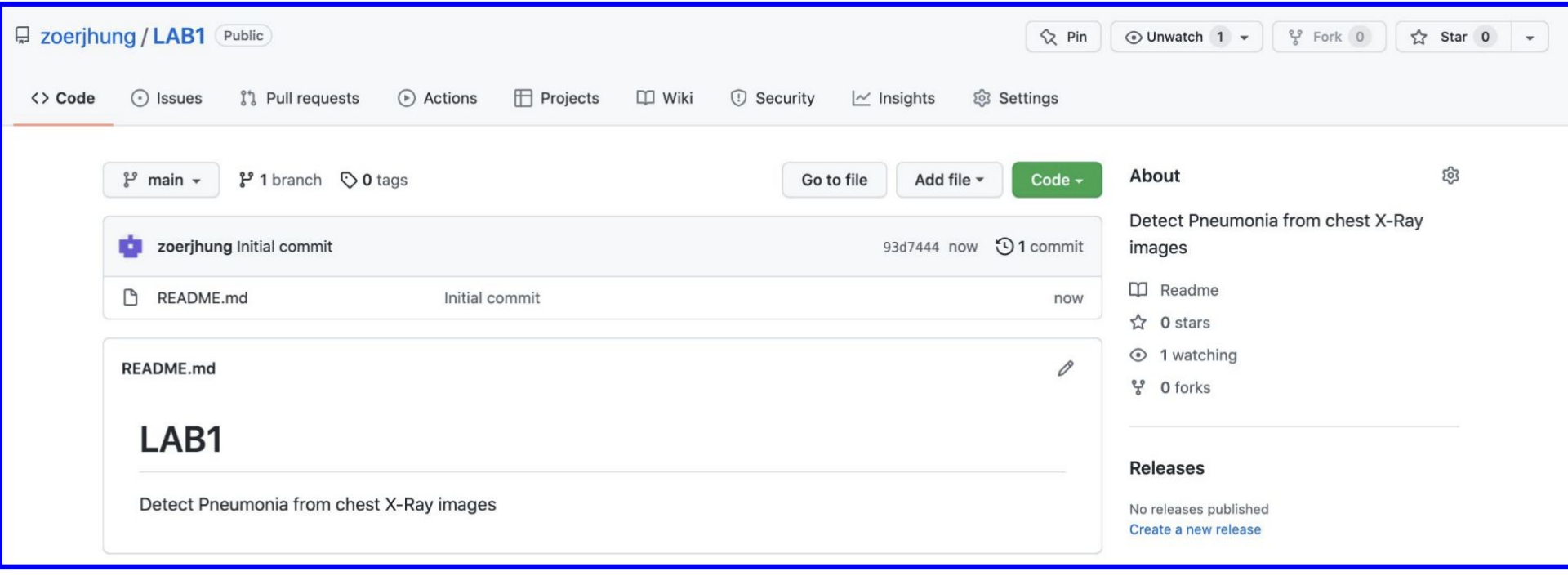
Creat a repository

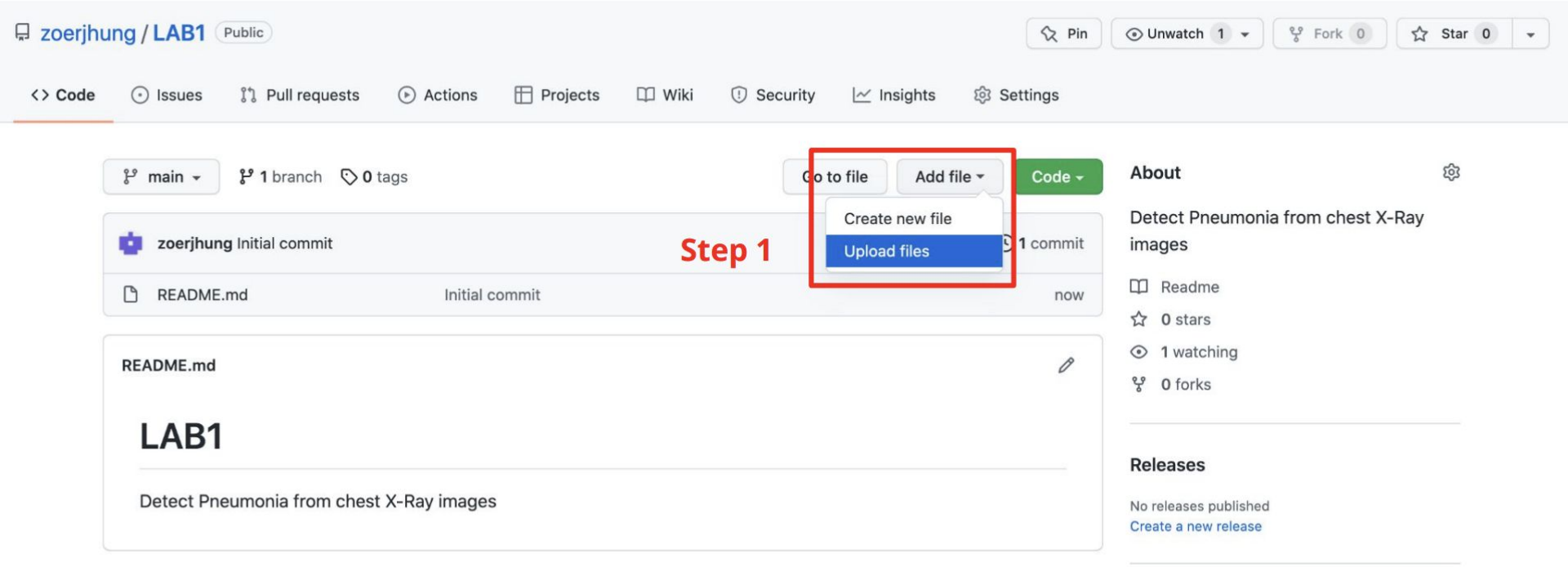




Creat a repository: This is what you get



Upload your files



Upload your files