code review
[Inference]

Yolo_EfficientNet_Inference 구성 및 진행 순서

[폴더]

dataset: 프로젝트에 사용할 모든 데이터
models: yolo models
utils: yolo utils
weights: train 결과물 pt파일

[이미지]

black.png: 이미지 crop, resize용

Yolo_EfficientNet_Inference 구성 및 진행 순서

[코드]

data_gen.py:
dataset 폴더에서 필요한 데이터를 필요한 폴더로 복사하는 코드

bounding_box_crop.py:
yolo inference 결과물로 만들어진 바운딩박스를 자르고, efficientnet inference에 필요한 사이즈로 resize하는 코드

Yolo_Efficient_inference_image.py:
이미지 하나씩 yolo-crop-resize-efficientnet 진행
+ 최종 csv 파일 작성 코드

	A	B	C	D	E	F
1	img_name	prediction	Negative for Pneumonia	Typical Appearance	Indeterminate Appearance	Atypical Appearance
2	00000001_000-crop.png	Negative for Pneumonia	0.90145284	0.033508554	0.048705816	0.016332895
3	00000001_001-crop.png	Negative for Pneumonia	0.9341554	0.014215147	0.019472033	0.03215734
4	00000001_002-crop.png	Typical Appearance	0.018052375	0.8054181	0.15171266	0.024816832
5	00000002_000-crop.png	Typical Appearance	0.09750793	0.808047	0.07355589	0.02088925
6	00000003_000-crop.png	Negative for Pneumonia	0.9130746	0.01371222	0.052219454	0.020993756
7	00000003_001-crop.png	Negative for Pneumonia	0.9482369	0.01862332	0.022300016	0.010839734
8	00000003_002-crop.png	Negative for Pneumonia	0.9800847	0.005151562	0.009058088	0.005705531
9	00000003_003-crop.png	Negative for Pneumonia	0.81564146	0.036714032	0.13310932	0.014535208
10	00000003_004-crop.png	Negative for Pneumonia	0.48281038	0.4494023	0.04791225	0.019875022
11	00000003_005-crop.png	Negative for Pneumonia	0.8498921	0.025677934	0.09607066	0.02835936
12	00000003_006-crop.png	Negative for Pneumonia	0.807123	0.06913641	0.11888384	0.004856698
13	00000003_007-crop.png	Negative for Pneumonia	0.9735791	0.003419584	0.008040861	0.014960443
14	00000004_000-crop.png	Negative for Pneumonia	0.8542615	0.005879921	0.1350534	0.004805235
15	00000005_000-crop.png	Negative for Pneumonia	0.9981834	0.000297072	0.000641035	0.000878488
16	00000005_001-crop.png	Negative for Pneumonia	0.7394481	0.16618563	0.064970076	0.029396232
17	00000005_002-crop.png	Negative for Pneumonia	0.42280686	0.34325278	0.16437617	0.069564186
18	00000005_003-crop.png	Negative for Pneumonia	0.42760745	0.07995102	0.100567766	0.39187378
19	00000005_004-crop.png	Negative for Pneumonia	0.98389775	0.001731803	0.006476831	0.007893628
20	00000005_005-crop.png	Negative for Pneumonia	0.94005185	0.00074124	0.00113879	0.058068164
21	00000005_006-crop.png	Negative for Pneumonia	0.8543313	0.02069701	0.012718328	0.11225335
22	00000005_007-crop.png	Negative for Pneumonia	0.9027193	0.002138512	0.046842758	0.048299365

Yolo_EfficientNet_Inference 구성 및 진행 순서

[기타]

data_total.py: 데이터셋이 여러 폴더로 나뉘어져 있을 때 한 폴더로 합치는 코드

check_shape.py: resize 전후 shape을 확인하는 코드

efficient_model.py: efficientnet train을 진행하는 model 코드

except_data_check.py: Inference 결과물 csv에서 빠진 데이터가 있는지 확인하는 코드

Yolo_Efficient_inference_one.py:
이미지 하나 yolo-crop-resize-efficientnet 코드 + 최종 csv 파일 작성 코드

Yolo_Efficient_inference_function.py:
이미지 전체가 yolo-crop-resize-efficientnet + 최종 csv 파일 작성 코드

Yolo_EfficientNet_Inference : main code review

data_gen.py: dataset 폴더에서 필요한 데이터를 필요한 폴더로 복사하는 코드

```python
import os
import shutil

data_path = "D:/NIH-git/poc1/Yolo_EfficientNet_Inference/dataset/TOTAL"
data_list = os.listdir(data_path)

#dst = "D:/NIH-git/poc1/Yolo_EfficientNet_Inference/dataset/effi/"
dst = "D:/NIH-git/poc1/Yolo_EfficientNet_Inference/dataset/yolo/"
#dst = "D:/NIH-git/poc1/Yolo_EfficientNet_Inference/dataset/yolo_effi/"

for i in range(1000):
        img_path = data_path + data_list[i]
        print(img_path)
        print(dst+data_list[i])
        print()
        shutil.copyfile(img_path,dst+data_list[i] )
```

Yolo_EfficientNet_Inference : main code review

bounding_box_crop.py: yolo inference 결과물로 만들어진 바운딩박스를 자르고, efficientnet inference에 필요한 사이즈로 resize하는 코드

```python
import os
import numpy as np
import cv2

#파일내 이미지 하나 crop and resize
def crop_merge_one(img):
    #print("\ncrop_merge_one")
    #print(img)
    back_dir = './black.png'
    back = cv2.imread(back_dir)
    #print(back.shape)

    try:
        if img.endswith("yolo.png"):
            name = img[:-9]
```

yolo inference의 결과물로 만들어진 이미지 불러오기
*yolo inference의 결과물은 000.png -> 000-yolo.png로 저장

yolo inference의 결과물로 만들어진 이미지 원본이름 찾기

Yolo_EfficientNet_Inference : main code review

bounding_box_crop.py: yolo inference 결과물로 만들어진 바운딩박스를 자르고, efficientnet inference에 필요한 사이즈로 resize하는 코드

```
17          # bounding box 위치 찾기
18          image = cv2.imread(img)
19          image = cv2.resize(image, dsize=(380, 380), interpolation=cv2.INTER_AREA)
20          image_gray = cv2.cvtColor(image, cv2.COLOR_BGR2GRAY)
21          image_gray = cv2.resize(image_gray, dsize=(380, 380), interpolation=cv2.INTER_AREA)
22
23          image_hsv = cv2.cvtColor(image, cv2.COLOR_BGR2HSV)
24          rect_img = cv2.inRange(image_hsv, (30, 100, 0), (90, 255, 255))
25          cor = np.where(rect_img > 0 )
26
27          cor0_set = set(cor[0])
28          cor0_list = list(cor0_set)
29          cor1_set = set(cor[1])
30          cor1_list = list(cor1_set)
31
```

rgb -> hsv로 수정해
바운딩박스를 찾아내고 모든 좌표를 저장하는 코드

*RGB 이미지에서 색 정보를 검출하기 위해서는 R, G, B 세가지 속성을 모두 참고해야 하는데,
HSV 이미지에서는 H(Hue)가 일정한 범위를 갖는 순수한 색 정보를 가지고 있기 때문에 RGB 이미지보다 쉽게 색을 분류할 수 있다.

Yolo_EfficientNet_Inference : main code review

bounding_box_crop.py: yolo inference 결과물로 만들어진 바운딩박스를 자르고, efficientnet inference에 필요한 사이즈로 resize하는 코드

```
32
33          # yolo bounding box 없으면
34          if (len(cor0_list) ==0 & len(cor1_list)==0):
35              back_resize = image
36              cv2.imshow('crop', back_resize)
37              cv2.imwrite(name + "-crop.png", back_resize)
38              #print(name + "-crop.png")
39
```

Yolo_EfficientNet_Inference : main code review

bounding_box_crop.py: yolo inference 결과물로 만들어진 바운딩박스를 자르고, efficientnet inference에 필요한 사이즈로 resize하는 코드

```
43          else:
44              cor_list = []
45              y = []
46              for n in range(len(cor0_list)-1):
47                  if cor0_list[n] + 2 > cor0_list[n + 1]:
48                      y.append(cor0_list[n])
49                  #print("x",x)
50                  y1 = min(y)
51                  y2 = max(y)
52
53              x = []
54              for m in range(len(cor1_list)-1):
55                  if cor1_list[m] + 2 > cor1_list[m+1]:
56                      x.append(cor1_list[m])
57                  #print("y",y)
58                  x1 = min(x)
59                  x2 = max(x)
60
61              box_org = [x1,x2,y1,y2]
62              cor_list.append(box_org)
63
64              mask = cor_list[0]
65              x1 = mask[0]
66              x2 = mask[1]
67              y1 = mask[2]
68              y2 = mask[3]
69              h = mask[3] - mask[2]
70              w = mask[1] - mask[0]
71              #print(h)
72              #print(w)
73
```

바운딩박스가 있다면(=Negative for Pneumonia),
모든 좌표를 비교해 바운딩 박스의 최종 좌표를
구하는 코드

Yolo_EfficientNet_Inference : main code review

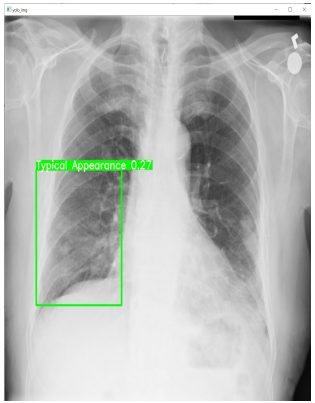
bounding_box_crop.py: yolo inference 결과물로 만들어진 바운딩박스를 자르고, efficientnet inference에 필요한 사이즈로 resize하는 코드

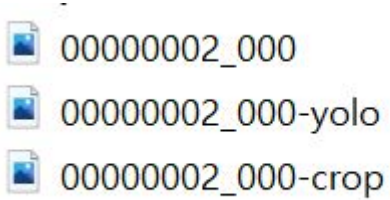
```
74          # merge_img
75          if h > w:
76              ori_img = name + ".png"
77              ori_img = cv2.imread(ori_img)
78              ori_img = cv2.resize(ori_img, dsize=(380, 380), interpolation=cv2.INTER_AREA)
79              #cv2.imshow('ori_img', ori_img)
80
81              back_resize = cv2.resize(back, dsize=(w, h), interpolation=cv2.INTER_AREA)
82              ori_imgcopy = ori_img.copy()
83              image[y1:y2,x1:x2] = back_resize
84              crop = cv2.subtract(ori_imgcopy, image)
85              #cv2.imshow('crop', crop)
86              #cv2.waitKey(0)
87              cv2.imwrite(name + "-crop.png", crop)
88              #print(name + "-crop.png")
89
```

Yolo_EfficientNet_Inference : main code review

bounding_box_crop.py: yolo inference 결과물로 만들어진 바운딩박스를 자르고, efficientnet inference에 필요한 사이즈로 resize하는 코드

```
            elif h < w:
                ori_img = name + ".png"
                ori_img = cv2.imread(ori_img)
                ori_img = cv2.resize(ori_img, dsize=(380, 380), interpolation=cv2.INTER_AREA)
                #cv2.imshow('ori_img', ori_img)

                back_resize = cv2.resize(back, dsize=(w, h), interpolation=cv2.INTER_AREA)
                ori_imgcopy = ori_img.copy()
                image[y1:y2,x1:x2] = back_resize
                #cv2.imshow('image', image)
                crop = cv2.subtract(ori_imgcopy, image)
                #cv2.imshow('crop', crop)
                #cv2.waitKey(0)
                cv2.imwrite(name + "-crop.png", crop)
                #print(name + "-crop.png")

            elif h == w:
                ori_img = name + ".png"
                ori_img = cv2.imread(ori_img)
                ori_img = cv2.resize(ori_img, dsize=(380, 380), interpolation=cv2.INTER_AREA)

                back_resize = cv2.resize(back, dsize=(w, h), interpolation=cv2.INTER_AREA)
                ori_imgcopy = ori_img.copy()
                image[y1:y2,x1:x2] = back_resize
                crop = cv2.subtract(ori_imgcopy, image)
                #cv2.imshow('crop', crop)
                cv2.imwrite(name + "-crop.png", crop)
                #print(name + "-crop.png")
        except:
            pass

        return name
```





Yolo_EfficientNet_Inference : main code review

Yolo_Efficient_inference_image.py: 이미지 하나씩 yolo-crop-resize-efficientnet 진행

```python
import os
import albumentations as A
import cv2
import glob
import torch.nn.functional as F
import time
from albumentations.pytorch import ToTensorV2
import imutils
import pandas as pd
import argparse
import time
from pathlib import Path
import cv2
import torch
import torch.backends.cudnn as cudnn
from numpy import random

from efficient_model import Classifier
from models.experimental import attempt_load
from utils.datasets import LoadStreams, LoadImages
from utils.general import check_img_size, check_requirements, check_imshow, \
    non_max_suppression, apply_classifier, scale_coords, xyxy2xywh, strip_optimizer, set_logging, increment_path
from utils.plots import plot_one_box,plot_one_box_only
from utils.torch_utils import select_device, load_classifier, time_synchronized
from bounding_box_crop import crop_merge_one

```

Yolo_EfficientNet_Inference : main code review

Yolo_Efficient_inference_image.py - Yolo: 이미지 하나씩 yolo-crop-resize-efficientnet 진행

```
29  def Yolo():
30      parser = argparse.ArgumentParser()
31      parser.add_argument('--weights', nargs='+', type=str, default='yolov5-V5.0_best_weight_batch16_epoch20.pt',
32                          help='model.pt path(s)')
33      parser.add_argument('--source', type=str, default='D:/NIH-git/poc1/Yolo_EfficientNet_Inference/dataset/yolo', help='source')
34      parser.add_argument('--img-size', type=int, default=640, help='inference size (pixels)')
35      parser.add_argument('--conf-thres', type=float, default=0.25, help='object confidence threshold')
36      parser.add_argument('--iou-thres', type=float, default=0.45, help='IOU threshold for NMS')
37      parser.add_argument('--device', default='', help='cuda device, i.e. 0 or 0,1,2,3 or cpu')
38      parser.add_argument('--view-img', action='store_true', help='display results')
39      parser.add_argument('--save-txt', action='store_true', help='save results to *.txt')
40      parser.add_argument('--save-conf', action='store_true', help='save confidences in --save-txt labels')
41      parser.add_argument('--nosave', action='store_true', help='do not save images/videos')
42      parser.add_argument('--classes', nargs='+', type=int, help='filter by class: --class 0, or --class 0 2 3')
43      parser.add_argument('--agnostic-nms', action='store_true', help='class-agnostic NMS')
44      parser.add_argument('--augment', action='store_true', help='augmented inference')
45      parser.add_argument('--update', action='store_true', help='update all models')
46      parser.add_argument('--project', default='result', help='save results to project/name')
47      parser.add_argument('--name', default='exp', help='save results to project/name')
48      parser.add_argument('--exist-ok', action='store_true', help='existing project/name ok, do not increment')
49      opt = parser.parse_args()
```

Yolo_EfficientNet_Inference : main code review

Yolo_Efficient_inference_image.py - Yolo: 이미지 하나씩 yolo-crop-resize-efficientnet 진행

```
    source, weights, view_img, save_txt, imgsz = opt.source, opt.weights, opt.view_img, opt.save_txt, opt.img_size
    save_img = not opt.nosave and not source.endswith('.txt')  # save inference images
    webcam = source.isnumeric() or source.endswith('.txt') or source.lower().startswith(
        ('rtsp://', 'rtmp://', 'http://', 'https://'))

    # Directories
    #save_dir = Path(increment_path(Path(opt.project) / opt.name, exist_ok=opt.exist_ok))  # increment run
    #(save_dir / 'labels' if save_txt else save_dir).mkdir(parents=True, exist_ok=True)  # make dir
    save_dir = opt.source

    # Initialize
    set_logging()
    device = select_device(opt.device)
    half = device.type != 'cpu'  # half precision only supported on CUDA

    # Load model
    model = attempt_load(weights, map_location=device)  # load FP32 model
    stride = int(model.stride.max())  # model stride
    imgsz = check_img_size(imgsz, s=stride)  # check img_size
    if half:
        model.half()  # to FP16
```

Yolo_EfficientNet_Inference : main code review

Yolo_Efficient_inference_image.py - Yolo: 이미지 하나씩 yolo-crop-resize-efficientnet 진행

```
74      # Second-stage classifier
75      classify = False
76      if classify:
77          modelc = load_classifier(name='resnet101', n=2)  # initialize
78          modelc.load_state_dict(torch.load('weights/resnet101.pt', map_location=device)['model']).to(device).eval()
79
80      # Set Dataloader
81      vid_path, vid_writer = None, None
82      if webcam:
83          view_img = check_imshow()
84          cudnn.benchmark = True  # set True to speed up constant image size inference
85          dataset = LoadStreams(source, img_size=imgsz, stride=stride)
86      else:
87          dataset = LoadImages(source, img_size=imgsz, stride=stride)
88
89      # Get names and colors
90      names = model.module.names if hasattr(model, 'module') else model.names
91      colors = [[random.randint(0, 255) for _ in range(3)] for _ in names]
92
```

Yolo_EfficientNet_Inference : main code review

Yolo_Efficient_inference_image.py - Yolo: 이미지 하나씩 yolo-crop-resize-efficientnet 진행

```
    # Run inference
    if device.type != 'cpu':
        model(torch.zeros(1, 3, imgsz, imgsz).to(device).type_as(next(model.parameters())))  # run once
    t0 = time.time()
    for path, img, im0s, vid_cap in dataset:

        name = path.split(".")[0]
        #print(name)
        img = torch.from_numpy(img).to(device)
        img = img.half() if half else img.float()  # uint8 to fp16/32
        img /= 255.0  # 0 - 255 to 0.0 - 1.0
        if img.ndimension() == 3:
            img = img.unsqueeze(0)

        # Inference
        t1 = time_synchronized()
        pred = model(img, augment=opt.augment)[0]

        # Apply NMS
        pred = non_max_suppression(pred, opt.conf_thres, opt.iou_thres, classes=opt.classes, agnostic=opt.agnostic_nms)
        t2 = time_synchronized()

        # Apply Classifier
        if classify:
            pred = apply_classifier(pred, modelc, img, im0s)
```

Yolo_EfficientNet_Inference : main code review

Yolo_Efficient_inference_image.py - Yolo: 이미지 하나씩 yolo-crop-resize-efficientnet 진행

```
        # Process detections
        for i, det in enumerate(pred):  # detections per image
            if webcam:  # batch_size >= 1
                p, s, im0, frame = path[i], '%g: ' % i, im0s[i].copy(), dataset.count
            else:
                p, s, im0, frame = path, '', im0s, getattr(dataset, 'frame', 0)

            p = Path(p)  # to Path
            #print(p.name)
            #(save_dir / p.name).mkdir(parents=True, exist_ok=True)
            #save_path = str(save_dir / p.name / p.name)  # img.jpg
            save_path = save_dir
            #txt_path = str(save_dir / 'labels' / p.stem) + ('' if dataset.mode == 'image' else f'_{frame}')  # img.txt
            txt_path = str(save_dir) + ('' if dataset.mode == 'image' else f'_{frame}')  # img.txt
            # s += '%gx%g ' % img.shape[2:]  # print string
            gn = torch.tensor(im0.shape)[[1, 0, 1, 0]]  # normalization gain whwh
            if len(det):
                # Rescale boxes from img_size to im0 size
                det[:, :4] = scale_coords(img.shape[2:], det[:, :4], im0.shape).round()

                # Print results
                for c in det[:, -1].unique():
                    n = (det[:, -1] == c).sum()  # detections per class
                    s += f"{n} {names[int(c)]}{'s' * (n > 1)}, "  # add to string

```

Yolo_EfficientNet_Inference : main code review

Yolo_Efficient_inference_image.py - Yolo: 이미지 하나씩 yolo-crop-resize-efficientnet 진행

```
144                 # Write results
145                 for *xyxy, conf, cls in reversed(det):
146                     if save_txt:  # Write to file
147                         xywh = (xyxy2xywh(torch.tensor(xyxy).view(1, 4)) / gn).view(-1).tolist()  # normalized xywh
148                         line = (cls, *xywh, conf) if opt.save_conf else (cls, *xywh)  # label format
149                         with open(txt_path + '.txt', 'a') as f:
150                             f.write(('%g ' * len(line)).rstrip() % line + '\n')
151 
152                     if save_img or view_img:  # Add bbox to image
153                         label = f'{names[int(cls)]} {conf:.2f}'
154                         plot_one_box(xyxy, im0, label=label, color=colors[int(cls)], line_thickness=3)
155 
156             # Print time (inference + NMS)
157             print(f'{s}Done. ({t2 - t1:.3f}s)')
158 
159             # Stream results
160             if view_img:
161                 cv2.imshow(str(p), im0)
162                 cv2.waitKey(1)  # 1 millisecond
163 
```

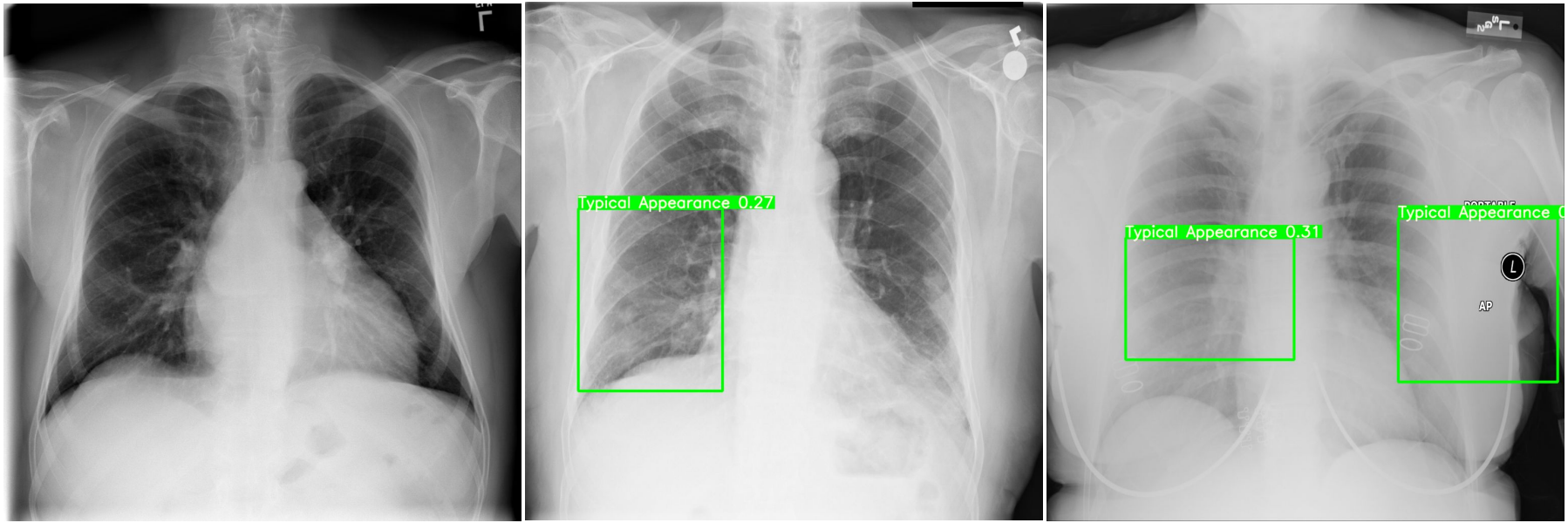
Yolo_EfficientNet_Inference : main code review

Yolo_Efficient_inference_image.py - Yolo: 이미지 하나씩 yolo-crop-resize-efficientnet 진행

```
            # Stream results
            if view_img:
                cv2.imshow(str(p), im0)
                cv2.waitKey(1)  # 1 millisecond

            # Save results (image with detections)
            #cv2.imwrite(save_path, img) #원본
            if save_img:
                if dataset.mode == 'image':
                    #cv2.imwrite(save_path, im0)
                    #print(name + "_yolo.png")
                    cv2.imwrite(name + "-yolo.png", im0)

                else:  # 'video' or 'stream'
                    if vid_path != save_path:  # new video
                        vid_path = save_path
                        if isinstance(vid_writer, cv2.VideoWriter):
                            vid_writer.release()  # release previous video writer
                        if vid_cap:  # video
                            fps = vid_cap.get(cv2.CAP_PROP_FPS)
                            w = int(vid_cap.get(cv2.CAP_PROP_FRAME_WIDTH))
                            h = int(vid_cap.get(cv2.CAP_PROP_FRAME_HEIGHT))
                        else:  # stream
                            fps, w, h = 30, im0.shape[1], im0.shape[0]
                            save_path += '.mp4'
                        vid_writer = cv2.VideoWriter(save_path, cv2.VideoWriter_fourcc(*'mp4v'), fps, (w, h))
                    vid_writer.write(im0)

    if save_txt or save_img:
        s = f"\n{len(list(save_dir.glob('labels/*.txt')))} labels saved to {save_dir / 'labels'}" if save_txt else ''
        print(f"Results saved to {save_dir}{s}")

    print(f'Done. ({time.time() - t0:.3f}s)')
```

Yolo_EfficientNet_Inference : main code review

Yolo_Efficient_inference_image.py - Yolo: 이미지 하나씩 yolo-crop-resize-efficientnet 진행



Yolo_EfficientNet_Inference : main code review

Yolo_Efficient_inference_image.py - EfficientNet: 이미지 하나씩 yolo-crop-resize-efficientnet 진행

```
199  def EfficientNet():
200      parser = argparse.ArgumentParser(description='PyTorch Classification')
201      parser.add_argument('--model_name', type=str, default="efficientnet_b4", metavar='S', help='model name')
202      parser.add_argument('--model_path', type=str, default="./weights/efficientnet_b4_fold1_best_accuracy.pt", metavar='S',
203                          help='model path')
204      parser.add_argument('--num_classes', type=int, default=4, metavar='N', help='num classes')
205      parser.add_argument('--dataset_dir', type=str, default="D:/NIH-yolo-efficientnet/KAGGLE-IMAGE/archive/TEST_EFFICIENT",
206                          metavar='S',
207                          help='model path')
208      opt = parser.parse_args()
209
210      device = torch.device('cuda:0' if torch.cuda.is_available() else 'cpu')
211
212      model = Classifier(opt)
213      model.load_state_dict(torch.load(opt.model_path))
214      model.to(device)
215      model.eval()
216
217      source_path = opt.dataset_dir
218      #print(source_path)
219      source_path_list = os.listdir(source_path)
220      #print(source_path_list)
221      data_folder_image = []
222      image_list = []
```

Yolo_EfficientNet_Inference : main code review

Yolo_Efficient_inference_image.py - EfficientNet: 이미지 하나씩 yolo-crop-resize-efficientnet 진행

```
222     image_list = []
223     for i in range (len(source_path_list)):
224         data_image = source_path + "/" + source_path_list[i] #폴더
225         print(data_image)
226         #if data_image.endswith("crop.png"):
227         #        image_list.append(data_image)
228         image_list.append(data_image)
229
230     #print(image_list)
231     dur_sum=0
232     csv_list = []
233     for idx, img_path in enumerate(image_list):
234         transform = A.Compose([
235             A.Resize(height=380, width=380),
236             A.Normalize(
237                 mean=[0.485, 0.456, 0.406],
238                 std=[0.229, 0.224, 0.225]),
239             ToTensorV2()
240         ])
```

Yolo_EfficientNet_Inference : main code review

Yolo_Efficient_inference_image.py - EfficientNet: 이미지 하나씩 yolo-crop-resize-efficientnet 진행

```
241         image0 = cv2.imread(img_path)
242         img_path0 = os.path.basename(img_path)
243         start_time = time.time()
244         image = cv2.cvtColor(image0, cv2.COLOR_BGR2RGB)
245         image = transform(image=image)['image']
246         image = image.unsqueeze(0)
247         input = image.to(device)
248         with torch.no_grad():
249             pred = model(input)
250             prob = F.softmax(pred, dim=1)
251             prob = prob.cpu().data.numpy()[0]
252         end_time = time.time()
253         dur = end_time - start_time
254         class_id = prob.argmax()
255         fps = 1 / dur
256         if idx==0 : # 최초 frame은 느리므로 평균에서 제외
257             avg_fps = 0
258         else :
259             dur_sum += dur
260             avg_fps = idx / dur_sum
```

Yolo_EfficientNet_Inference : main code review

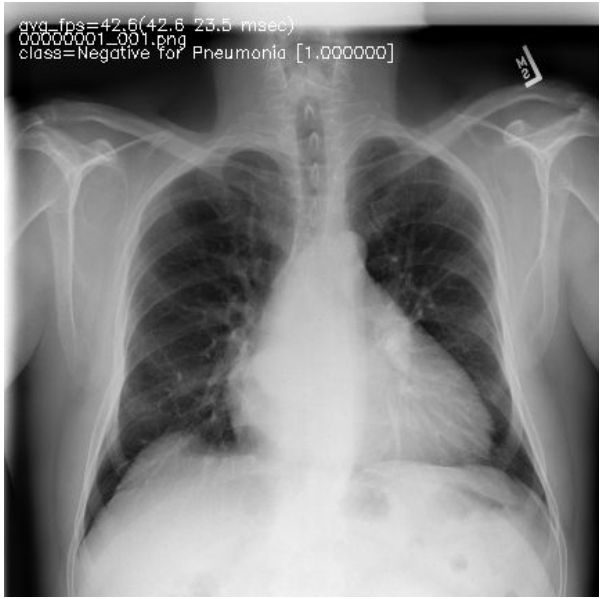
Yolo_Efficient_inference_image.py - **EfficientNet**: 이미지 하나씩 yolo-crop-resize-efficientnet 진행

```
280
281         msg_img = "%s" % (
282             img_path0)
283         msg_fps = "avg_fps=%.1f(%.1f %.1f msec)" % (
284             avg_fps, fps, dur * 1000)
285         msg_class = "class=%s [%.6f]" % (
286             class_name, max_prob)
287
288         image1 = cv2.resize(image0, dsize=(0, 0), fx=0.42, fy=0.42)
289         image1_copy = image1.copy()
290         cv2.putText(image1_copy, msg_fps, (10, 20), cv2.FONT_HERSHEY_SIMPLEX, 0.4, (255, 255, 255), 1)
291         cv2.putText(image1_copy, msg_img, (10, 30), cv2.FONT_HERSHEY_SIMPLEX, 0.4, (255, 255, 255), 1)
292         cv2.putText(image1_copy, msg_class, (10, 40), cv2.FONT_HERSHEY_SIMPLEX, 0.4, (255, 255, 255), 1)
293
294         effi_img_path = img_path[:-3]
295         cv2.imwrite(effi_img_path + "-efficientnet.png", image1_copy)
296         cv2.imshow("Efficientnet", image1_copy)
297
298         key=cv2.waitKey(1)
299         if key==27 :
300             break
301         elif key==32 :
302             cv2.waitKey(0)
303
304
305     col_name = ["img_name", "prediction", "Negative for Pneumonia", "Typical Appearance",
306                 "Indeterminate Appearance", "Atypical Appearance"]
307     csv_df = pd.DataFrame(csv_list, columns=col_name)
308     csv_df.to_csv("./efficientnet_classification.csv", index=None)  # 수정; classify 결과 csv파일 이름
309
```

Yolo_EfficientNet_Inference : main code review

Yolo_Efficient_inference_image.py - EfficientNet: 이미지 하나씩 yolo-crop-resize-efficientnet 진행

```
avg_fps=43.2(39.4 25.4 msec) 00000057_001.png class=0 [1.000000 0.000000 0.000000 0.000000]
avg_fps=43.2(42.6 23.5 msec) 00000057_002.png class=0 [0.997245 0.000000 0.000000 0.002755]
avg_fps=43.2(44.5 22.5 msec) 00000057_003.png class=0 [1.000000 0.000000 0.000000 0.000000]
avg_fps=43.3(46.5 21.5 msec) 00000057_004.png class=0 [1.000000 0.000000 0.000000 0.000000]
avg_fps=43.3(44.5 22.5 msec) 00000058_000.png class=0 [0.951103 0.000000 0.000001 0.048896]
avg_fps=43.3(44.5 22.5 msec) 00000059_000.png class=0 [1.000000 0.000000 0.000000 0.000000]
avg_fps=43.3(42.6 23.5 msec) 00000059_001.png class=0 [1.000000 0.000000 0.000000 0.000000]
avg_fps=43.3(44.5 22.5 msec) 00000060_000.png class=0 [1.000000 0.000000 0.000000 0.000000]
avg_fps=43.3(40.9 24.4 msec) 00000061_000.png class=0 [1.000000 0.000000 0.000000 0.000000]
avg_fps=43.3(46.5 21.5 msec) 00000061_001.png class=0 [0.999655 0.000000 0.000001 0.000344]
avg_fps=43.3(44.5 22.5 msec) 00000061_002.png class=0 [0.922137 0.000017 0.000024 0.077822]
avg_fps=43.3(44.5 22.5 msec) 00000061_003.png class=0 [0.687298 0.000065 0.000008 0.312629]
avg_fps=43.3(40.9 24.4 msec) 00000061_004.png class=0 [0.997711 0.000003 0.000000 0.002286]
avg_fps=43.2(28.4 35.2 msec) 00000061_005.png class=0 [0.999858 0.000000 0.000000 0.000141]
avg_fps=43.2(44.5 22.5 msec) 00000061_006.png class=0 [0.998894 0.000000 0.000000 0.001106]
avg_fps=43.2(39.4 25.4 msec) 00000061_007.png class=0 [1.000000 0.000000 0.000000 0.000000]
avg_fps=43.2(44.5 22.5 msec) 00000061_008.png class=0 [1.000000 0.000000 0.000000 0.000000]
```



Yolo_EfficientNet_Inference : main code review

Yolo_Efficient_inference_image.py - EfficientNet: 이미지 하나씩 yolo-crop-resize-efficientnet 진행

	A	B	C	D	E	F
1	img_name	prediction	Negative for Pneumonia	Typical Appearance	Indeterminate Appearance	Atypical Appearance
2	00000001_000.png	Negative for Pneumonia	1	2.34E-27	2.32E-25	9.46E-18
3	00000001_001.png	Negative for Pneumonia	1	2.21E-26	5.48E-30	2.75E-23
4	00000001_002.png	Negative for Pneumonia	1	1.13E-28	7.88E-28	5.12E-17
5	00000002_000.png	Negative for Pneumonia	1	6.32E-23	7.05E-23	3.05E-15
6	00000003_000.png	Negative for Pneumonia	1	5.04E-19	4.69E-19	1.37E-11
7	00000003_001.png	Negative for Pneumonia	1	5.41E-27	5.09E-29	4.85E-21
8	00000003_002.png	Negative for Pneumonia	1	1.99E-23	9.68E-23	1.10E-16
9	00000003_003.png	Negative for Pneumonia	1	1.36E-27	6.68E-27	1.91E-17
10	00000003_004.png	Negative for Pneumonia	1	2.19E-25	8.31E-29	9.15E-20
11	00000003_005.png	Negative for Pneumonia	1	5.77E-21	4.32E-22	3.16E-16
12	00000003_006.png	Negative for Pneumonia	1	4.37E-20	1.94E-24	8.89E-16
13	00000003_007.png	Negative for Pneumonia	1	4.83E-19	2.45E-21	3.24E-16
14	00000004_000.png	Negative for Pneumonia	1	1.26E-29	6.66E-31	1.81E-24
15	00000005_000.png	Negative for Pneumonia	1	2.19E-26	3.85E-28	4.43E-20
16	00000005_001.png	Negative for Pneumonia	1	6.60E-44	0	4.40E-32
17	00000005_002.png	Negative for Pneumonia	1	0	0	1.35E-29
18	00000005_003.png	Negative for Pneumonia	1	2.34E-36	1.89E-41	6.48E-21
19	00000005_004.png	Negative for Pneumonia	1	2.49E-26	9.08E-35	2.43E-21
20	00000005_005.png	Negative for Pneumonia	1	1.18E-22	1.92E-21	9.22E-15
21	00000005_006.png	Negative for Pneumonia	1	3.06E-18	4.28E-20	2.74E-13
22	00000005_007.png	Negative for Pneumonia	1	1.73E-20	1.21E-17	6.17E-14
23	00000006_000.png	Negative for Pneumonia	1	9.65E-30	7.22E-30	1.28E-20
24	00000007_000.png	Negative for Pneumonia	1	3.15E-34	2.83E-38	8.03E-25
25	00000008_000.png	Negative for Pneumonia	0.9999641	1.28E-10	4.74E-11	3.58E-05
26	00000008_001.png	Negative for Pneumonia	0.99999964	6.01E-15	4.63E-15	3.36E-07
27	00000008_002.png	Negative for Pneumonia	1	4.42E-18	8.57E-18	2.17E-11
28	00000009_000.png	Negative for Pneumonia	0.9999999	1.15E-14	1.33E-13	1.13E-07
29	00000010_000.png	Negative for Pneumonia	1	5.24E-15	5.73E-13	9.09E-09
30	00000011_000.png	Negative for Pneumonia	1	2.13E-14	1.42E-14	5.28E-09
31	00000011_001.png	Negative for Pneumonia	1	2.97E-18	1.63E-16	6.53E-10
32	00000011_002.png	Negative for Pneumonia	1	6.95E-14	2.10E-13	5.21E-08

Yolo_EfficientNet_Inference : main code review

Yolo_Efficient_inference_image.py - Yolo_EfficientNet:

```
298  def Yolo_Efficient():
299      parser = argparse.ArgumentParser()
300      parser.add_argument('--weights', nargs='+', type=str, default='yolov5-V5.0_best_weight_batch16_epoch20.pt',help='model.pt path(s)')
301      parser.add_argument('--source', type=str, default='D:/NIH-yolo-efficientnet/KAGGLE-IMAGE/archive/TEST_FULL',help='source')  # file/folder, 0 for webcam
302      parser.add_argument('--img-size', type=int, default=640, help='inference size (pixels)')
303      parser.add_argument('--conf-thres', type=float, default=0.25, help='object confidence threshold')
304      parser.add_argument('--iou-thres', type=float, default=0.45, help='IOU threshold for NMS')
305      parser.add_argument('--device', default='', help='cuda device, i.e. 0 or 0,1,2,3 or cpu')
306      parser.add_argument('--view-img', action='store_true', help='display results')
307      parser.add_argument('--save-txt', action='store_true', help='save results to *.txt')
308      parser.add_argument('--save-conf', action='store_true', help='save confidences in --save-txt labels')
309      parser.add_argument('--nosave', action='store_true', help='do not save images/videos')
310      parser.add_argument('--classes', nargs='+', type=int, help='filter by class: --class 0, or --class 0 2 3')
311      parser.add_argument('--agnostic-nms', action='store_true', help='class-agnostic NMS')
312      parser.add_argument('--augment', action='store_true', help='augmented inference')
313      parser.add_argument('--update', action='store_true', help='update all models')
314      parser.add_argument('--project', default='D:/NIH-yolo-efficientnet/KAGGLE-IMAGE/archive/TEST_FULL', help='save results to project/name')
315      parser.add_argument('--name', default='exp', help='save results to project/name')
316
317      parser.add_argument('--exist-ok', action='store_true', help='existing project/name ok, do not increment')
318      parser.add_argument('--model_name', type=str, default="efficientnet_b4", metavar='S', help='model name')
319      parser.add_argument('--model_path', type=str, default="efficientnet_b4.pt", metavar='S', help='model path')
320      parser.add_argument('--num_classes', type=int, default=4, metavar='N', help='num classes')
321      #parser.add_argument('--dataset_dir', type=str, default="KAGGLE-IMAGE/archive/TEST_FULL", metavar='S',help='model path')
322      opt = parser.parse_args()
323
```

Yolo_EfficientNet_Inference : main code review

Yolo_Efficient_inference_image.py - Yolo_EfficientNet:

```
    # Yolo
    source, weights, view_img, save_txt, imgsz = opt.source, opt.weights, opt.view_img, opt.save_txt, opt.img_size
    save_img = not opt.nosave and not source.endswith('.txt')  # save inference images
    webcam = source.isnumeric() or source.endswith('.txt') or source.lower().startswith(
        ('rtsp://', 'rtmp://', 'http://', 'https://'))

    # Directories
    # save_dir = Path(increment_path(Path(opt.project) / opt.name, exist_ok=opt.exist_ok))  # increment run
    # (save_dir / 'labels' if save_txt else save_dir).mkdir(parents=True, exist_ok=True)  # make dir
    save_dir = opt.project

    # Initialize
    set_logging()
    device = select_device(opt.device)
    half = device.type != 'cpu'  # half precision only supported on CUDA

    # Load model
    model = attempt_load(weights, map_location=device)  # load FP32 model
    stride = int(model.stride.max())  # model stride
    imgsz = check_img_size(imgsz, s=stride)  # check img_size
    if half:
        model.half()  # to FP16

    # Second-stage classifier
    classify = False
    if classify:
        modelc = load_classifier(name='resnet101', n=2)  # initialize
        modelc.load_state_dict(torch.load('weights/resnet101.pt', map_location=device)['model']).to(device).eval()

```

Yolo_EfficientNet_Inference : main code review

Yolo_Efficient_inference_image.py - Yolo_EfficientNet:

```
353     # Set Dataloader
354     vid_path, vid_writer = None, None
355     if webcam:
356         view_img = check_imshow()
357         cudnn.benchmark = True  # set True to speed up constant image size inference
358         dataset = LoadStreams(source, img_size=imgsz, stride=stride)
359     else:
360         dataset = LoadImages(source, img_size=imgsz, stride=stride)
361
362     # Get names and colors
363     names = model.module.names if hasattr(model, 'module') else model.names
364     colors = [[random.randint(0, 255) for _ in range(3)] for _ in names]
365
366     # Run inference
367     if device.type != 'cpu':
368         model(torch.zeros(1, 3, imgsz, imgsz).to(device).type_as(next(model.parameters())))  # run once
369     t0 = time.time()
370     csv_list = []
371
```

Yolo_EfficientNet_Inference : main code review

Yolo_Efficient_inference_image.py - Yolo_EfficientNet:

```
for path, img, im0s, vid_cap in dataset:
    ori_img = cv2.imread((path))
    cv2.imshow("ORIGIN IMAGE", ori_img)
    # cv2.waitKey(0)  # 1 millisecond

    print("\n\n=======================================Yolo=============================================")
    # print("im0s",im0s)
    # print("img", img)

    name = path.split(".")[0]
    # print(name)
    img = torch.from_numpy(img).to(device)
    img = img.half() if half else img.float()  # uint8 to fp16/32
    img /= 255.0  # 0 - 255 to 0.0 - 1.0
    if img.ndimension() == 3:
        img = img.unsqueeze(0)

    # Inference
    t1 = time_synchronized()
    # print("img",img)
    pred = model(img, augment=opt.augment)[0]

    # Apply NMS
    pred = non_max_suppression(pred, opt.conf_thres, opt.iou_thres, classes=opt.classes, agnostic=opt.agnostic_nms)
    t2 = time_synchronized()

    # Apply Classifier
    if classify:
        pred = apply_classifier(pred, modelc, img, im0s)
```

Yolo_EfficientNet_Inference : main code review

Yolo_Efficient_inference_image.py - Yolo_EfficientNet:

```
        # Process detections
        for i, det in enumerate(pred):  # detections per image
            if webcam:  # batch_size >= 1
                p, s, im0, frame = path[i], '%g: ' % i, im0s[i].copy(), dataset.count
            else:
                p, s, im0, frame = path, '', im0s, getattr(dataset, 'frame', 0)
            p = Path(p)  # to Path
            # print(p.name)
            # (save_dir / p.name).mkdir(parents=True, exist_ok=True)
            # save_path = str(save_dir / p.name / p.name)  # img.jpg
            save_path = save_dir
            # txt_path = str(save_dir / 'labels' / p.stem) + ('' if dataset.mode == 'image' else f'_{frame}')  # img.txt
            txt_path = str(save_dir) + ('' if dataset.mode == 'image' else f'_{frame}')  # img.txt
            # s += '%gx%g ' % img.shape[2:]  # print string
            gn = torch.tensor(im0.shape)[[1, 0, 1, 0]]  # normalization gain whwh

            if len(det):
                # Rescale boxes from img_size to im0 size
                det[:, :4] = scale_coords(img.shape[2:], det[:, :4], im0.shape).round()
                # Print results
                for c in det[:, -1].unique():
                    n = (det[:, -1] == c).sum()  # detections per class
                    s += f"{n} {names[int(c)]}{'s' * (n > 1)}, "  # add to string
                # Write results
                im0_copy_box = im0.copy()
                im0_copy_text = im0.copy()
                for *xyxy, conf, cls in reversed(det):
                    if save_txt:  # Write to file
                        xywh = (xyxy2xywh(torch.tensor(xyxy).view(1, 4)) / gn).view(-1).tolist()  # normalized xywh
                        line = (cls, *xywh, conf) if opt.save_conf else (cls, *xywh)  # label format
                        with open(txt_path + '.txt', 'a') as f:
                            f.write(('%g ' * len(line)).rstrip() % line + '\n')
```

Yolo_EfficientNet_Inference : main code review

Yolo_Efficient_inference_image.py - Yolo_EfficientNet:

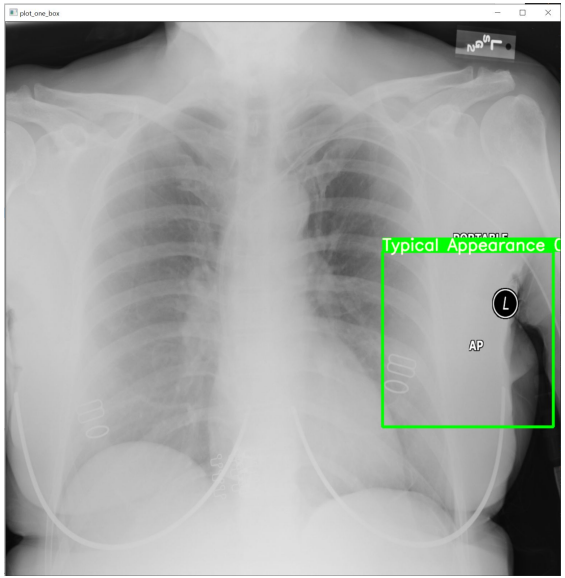
```
435                 if save_img or view_img:  # Add bbox to image
436                     label = f'{names[int(cls)]} {conf:.2f}'
437
438                     img0_box = plot_one_box_only(xyxy, im0_copy_box, color=colors[int(cls)], line_thickness=3)
439                     cv2.imwrite(name + "-efficientnet.png", img0_box)
440                     #cv2.imshow("plot_one_box_only", img0_box)
441
442                     im0_copy_text = plot_one_box(xyxy, im0_copy_text, label=label, color=colors[int(cls)], line_thickness=3)
443                     cv2.imwrite(name + "-yolo.png", im0_copy_text)
444                     #cv2.imshow("plot_one_box", im0_text)
445
446                     '''key = cv2.waitKey(0) & 0xFF
447                     if key == ord('q') or key == 27:  # 'q' 이거나 'esc' 이면 종료
448                         cv2.destroyAllWindows()'''
449             if len(det)==0 :
450                 cv2.imwrite(name + "-yolo.png", im0)
451                 #cv2.imshow("yolo", im0)
452
```

바운딩박스 + 예상 레이블 바운딩박스

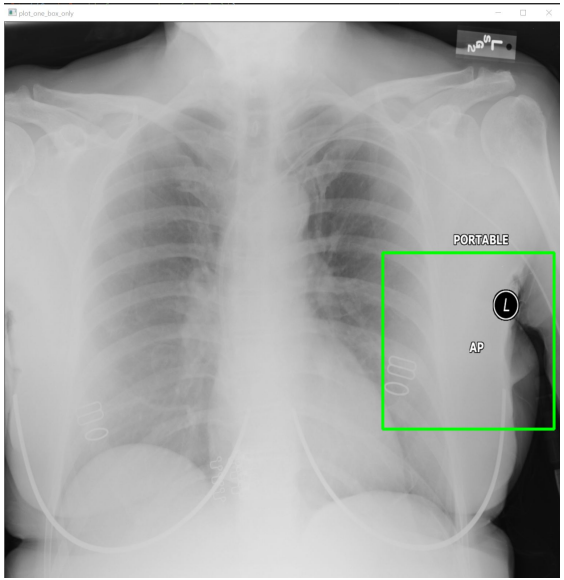
*결과물:
000.png -> 000-yolo.png로 저장
000.png -> 000-efficientnet.png로 저장

Yolo_EfficientNet_Inference : main code review

Yolo_Efficient_inference_image.py - Yolo_EfficientNet:



바운딩박스 + 예상 레이블



바운딩박스

Yolo_EfficientNet_Inference : main code review

Yolo_Efficient_inference_image.py - Yolo_EfficientNet:

```
453
454             # Print time (inference + NMS)
455             print(f'{s} Done. ({t2 - t1:.3f}s)')
456             # Stream results
457             if view_img:
458                 cv2.imshow(str(p), im0)
459                 cv2.waitKey(0)  # 1 millisecond
460             # Save results (image with detections)
461             # cv2.imwrite(save_path, img) #원본
462             if save_img:
463                 if dataset.mode == 'image':
464                     yolo_img_show = cv2.imread(name + "-yolo.png")
465                     cv2.imshow("yolo", yolo_img_show)
466
467                 elif dataset.mode == 'video' or 'stream':  # 'video' or 'stream'
468                     if vid_path != save_path:  # new video
469                         vid_path = save_path
470                         if isinstance(vid_writer, cv2.VideoWriter):
471                             vid_writer.release()  # release previous video writer
472                         if vid_cap:  # video
473                             fps = vid_cap.get(cv2.CAP_PROP_FPS)
474                             w = int(vid_cap.get(cv2.CAP_PROP_FRAME_WIDTH))
475                             h = int(vid_cap.get(cv2.CAP_PROP_FRAME_HEIGHT))
476                         else:  # stream
477                             fps, w, h = 30, im0.shape[1], im0.shape[0]
478                             save_path += '.mp4'
479                         vid_writer = cv2.VideoWriter(save_path, cv2.VideoWriter_fourcc(*'mp4v'), fps, (w, h))
480                     vid_writer.write(im0)
481
482
```

Yolo_EfficientNet_Inference : main code review

Yolo_Efficient_inference_image.py - Yolo_EfficientNet:

```
483         # bounding box crop and resize
484         print("============================bounding box crop and resize=================================")
485         #print(name +"-yolo.png")
486         crop_merge_one(name + "-yolo.png")
487
```

Yolo_EfficientNet_Inference : main code review

Yolo_Efficient_inference_image.py - Yolo_EfficientNet:

```
488         # EfficientNet
489         print("====================================EfficientNet==========================================\n")
490         device = torch.device('cuda:0' if torch.cuda.is_available() else 'cpu')
491         model_eff = Classifier(opt)
492         model_eff.load_state_dict(torch.load(opt.model_path))
493         model_eff.to(device)
494         model_eff.eval()
495
496         image_list = []
497         data_image = name + "-crop.png"  # 폴더
498
499         try:
500             #crop 실패한 이미지 기록
501             if os.path.isfile(data_image) == False:
502                 value = (data_image,"","","","","","")
503                 csv_list.append(value)
```

혹시 crop 이미지가 저장되지 않았다면 efficientnet의 결과물 csv에 표시 (이미지의 절대경로 기록)

Yolo_EfficientNet_Inference : main code review

Yolo_Efficient_inference_image.py - Yolo_EfficientNet:

```
505             elif os.path.isfile(data_image):
506                 image_list.append(data_image)
507
508             dur_sum = 0
509             for idx, img_path in enumerate(image_list):
510                 transform = A.Compose([
511                     A.Resize(height=380, width=380),
512                     A.Normalize(
513                         mean=[0.485, 0.456, 0.406],
514                         std=[0.229, 0.224, 0.225]),
515                     ToTensorV2()
516                 ])
517                 image0 = cv2.imread(img_path)
518                 img_path0 = os.path.basename(img_path)
519                 start_time = time.time()
520                 image = cv2.cvtColor(image0, cv2.COLOR_BGR2RGB)
521                 image = transform(image=image)['image']
522                 image = image.unsqueeze(0)
523                 input = image.to(device)
524                 with torch.no_grad():
525                     pred = model_eff(input)
526                     prob = F.softmax(pred, dim=1)
527                     prob = prob.cpu().data.numpy()[0]
528
529                 end_time = time.time()
530                 dur = end_time - start_time
531                 class_id = prob.argmax()
532                 max_prob = prob[int(class_id)]
533
```

Yolo_EfficientNet_Inference : main code review

Yolo_Efficient_inference_image.py - Yolo_EfficientNet:

```
534                 fps = 1 / dur
535                 if idx == 0:  # 최초 frame은 느리므로 평균에서 제외
536                     avg_fps = 0
537                 else:
538                     dur_sum += dur
539                     avg_fps = idx / dur_sum
540
541                 # print("class_id", class_id)
542                 # print("class_id type", type(class_id))
543                 class_name = ""
544                 if str(class_id) == "0":
545                     class_name = "Negative for Pneumonia"
546                 elif str(class_id) == "1":
547                     class_name = "Typical Appearance"
548                 elif str(class_id) == "2":
549                     class_name = "Indeterminate Appearance"
550                 elif str(class_id) == "3":
551                     class_name = "Atypical Appearance"
552                 value = (img_path0, class_name, prob[0], prob[1], prob[2], prob[3])
553                 csv_list.append(value)
554
555                 msg_img = "%s" % (
556                     img_path0)
557                 msg_fps = "avg_fps=%.1f(%.1f %.1f msec)" % (
558                     avg_fps, fps, dur * 1000)
559                 msg_class = "class=%s [%.6f]" % (
560                     class_name, max_prob)
561
```

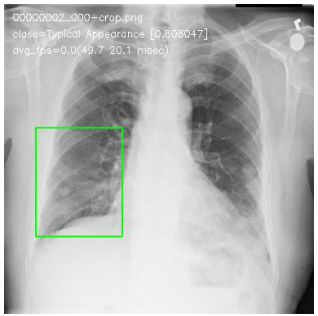
	A	B	C	D	E	F
1	img_name	prediction	Negative for Pneumonia	Typical Appearance	Indeterminate Appearance	Atypical Appearance
2	00000001_000-crop.png	Negative for Pneumonia	0.90145284	0.033508554	0.048705816	0.016332895
3	00000001_001-crop.png	Negative for Pneumonia	0.9341554	0.014215147	0.019472033	0.03215734
4	00000001_002-crop.png	Typical Appearance	0.018052375	0.8054181	0.15171266	0.024816832
5	00000002_000-crop.png	Typical Appearance	0.09750793	0.808047	0.07355589	0.02088925
6	00000003_000-crop.png	Negative for Pneumonia	0.9130746	0.01371222	0.052219454	0.020993756
7	00000003_001-crop.png	Negative for Pneumonia	0.9482369	0.01862332	0.022300016	0.010839734
8	00000003_002-crop.png	Negative for Pneumonia	0.9800847	0.005151562	0.009058088	0.005705531
9	00000003_003-crop.png	Negative for Pneumonia	0.81564146	0.036714032	0.13310932	0.014535208
10	00000003_004-crop.png	Negative for Pneumonia	0.48281038	0.4494023	0.04791225	0.019875022
11	00000003_005-crop.png	Negative for Pneumonia	0.8498921	0.025677934	0.09607066	0.02835936
12	00000003_006-crop.png	Negative for Pneumonia	0.807123	0.06913641	0.11888384	0.004856698

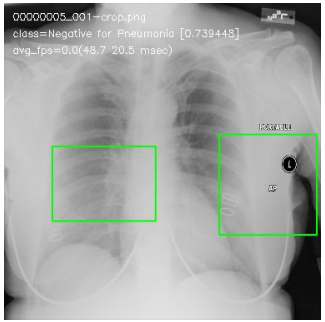
index(0,1,2,3)로 기록되는데,
사용자 편의를 위해 레이블로 기록

Yolo_EfficientNet_Inference : main code review

Yolo_Efficient_inference_image.py - Yolo_EfficientNet:

```
            #yolo_img = name + "-yolo-only.png"
            yolo_img = name + "-efficientnet.png"
            yolo_img_split=yolo_img.split("\\")[-1]
            ori_img = name + ".png"
            ori_img_split = ori_img.split("\\")[-1]
            images = os.listdir(source)
            #print(images)
            #print(yolo_img_split)
            #print(ori_img_split)

            if yolo_img_split in images:
                yolo_img = cv2.imread(yolo_img)
                # cv2.imshow("yolo-only", yolo_img)
                yolo_img = cv2.resize(yolo_img, dsize=(380, 380), fx=0.42, fy=0.42)
                cv2.putText(yolo_img, msg_img, (10, 20), cv2.FONT_HERSHEY_SIMPLEX, 0.4, (255, 255, 255), 1)
                cv2.putText(yolo_img, msg_class, (10, 40), cv2.FONT_HERSHEY_SIMPLEX, 0.4, (255, 255, 255), 1)
                cv2.putText(yolo_img, msg_fps, (10, 60), cv2.FONT_HERSHEY_SIMPLEX, 0.4, (255, 255, 255), 1)
                cv2.imwrite(name + "-efficientnet.png", yolo_img)
                cv2.imshow("Efficientnet", yolo_img)
                # cv2.waitKey(0)
            elif ori_img_split in images:
                ori_img = cv2.imread(ori_img)
                # cv2.imshow("ori_img", ori_img)
                ori_img = cv2.resize(ori_img, dsize=(380, 380), fx=0.42, fy=0.42)
                cv2.putText(ori_img, msg_img, (10, 20), cv2.FONT_HERSHEY_SIMPLEX, 0.4, (255, 255, 255), 1)
                cv2.putText(ori_img, msg_class, (10, 40), cv2.FONT_HERSHEY_SIMPLEX, 0.4, (255, 255, 255), 1)
                cv2.putText(ori_img, msg_fps, (10, 60), cv2.FONT_HERSHEY_SIMPLEX, 0.4, (255, 255, 255), 1)
                cv2.imwrite(name + "-efficientnet.png", ori_img)
                cv2.imshow("Efficientnet", ori_img)
                # cv2.waitKey(0)

            key = cv2.waitKey(1)
            if key == 27:
                break
            elif key == 32:
                cv2.waitKey(0)
```





Yolo_EfficientNet_Inference : main code review

Yolo_Efficient_inference_image.py - Yolo_EfficientNet:

```
598
599             col_name = ["img_name", "prediction", "Negative for Pneumonia", "Typical Appearance",
600                         "Indeterminate Appearance", "Atypical Appearance"]
601             csv_df = pd.DataFrame(csv_list, columns=col_name)
602             csv_df.to_csv("./yolo_efficientnet_classification.csv", index=None)  # 수정; classify 결과 csv파일 이름
603             cv2.waitKey(1000)
604             cv2.destroyAllWindows()
605         except:
606             pass
607
608     if save_txt or save_img:
609         s = f"\n{len(list(save_dir.glob('labels/*.txt')))} labels saved to {save_dir / 'labels'}" if save_txt else ''
610         print(f"Results saved to {save_dir}{s}")
611     print(f'Done. ({time.time() - t0:.3f}s)')
612     print()
613
```

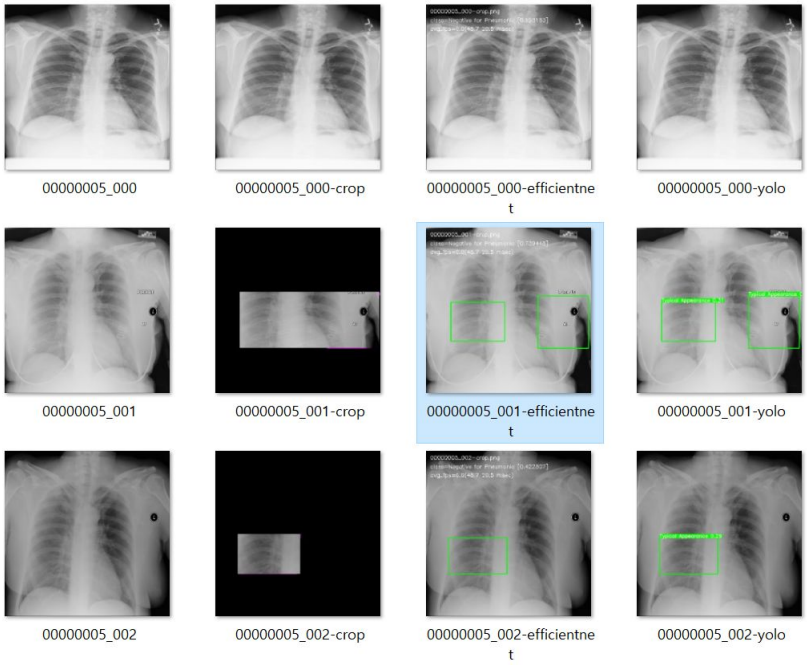
Yolo_EfficientNet_Inference : main code review

Yolo_Efficient_inference_image.py - __main__:

```
618 ▶ if __name__ == '__main__':
619       #check_requirements(exclude=('pycocotools', 'thop'))
620       #with torch.no_grad():
621       #    Yolo()
622
623       #EfficientNet()
624
625       Yolo_Efficient()
```

Yolo_EfficientNet_Inference : main code review

Yolo_Efficient_inference_image.py - __main__:



	A	B	C	D	E	F
1	img_name	prediction	Negative for Pneumonia	Typical Appearance	Indeterminate Appearance	Atypical Appearance
2	00000001_000-crop.png	Negative for Pneumonia	0.90145284	0.033508554	0.048705816	0.016332895
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4	00000001_002-crop.png	Typical Appearance	0.018052375	0.8054181	0.15171266	0.024816832
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7	00000003_001-crop.png	Negative for Pneumonia	0.9482369	0.01862332	0.022300016	0.010839734
8	00000003_002-crop.png	Negative for Pneumonia	0.9800847	0.005151562	0.009058088	0.005705531
9	00000003_003-crop.png	Negative for Pneumonia	0.81564146	0.036714032	0.13310932	0.014535208
10	00000003_004-crop.png	Negative for Pneumonia	0.48281038	0.4494023	0.04791225	0.019875022
11	00000003_005-crop.png	Negative for Pneumonia	0.8498921	0.025677934	0.09607066	0.02835936
12	00000003_006-crop.png	Negative for Pneumonia	0.807123	0.06913641	0.11888384	0.004856698
13	00000003_007-crop.png	Negative for Pneumonia	0.9735791	0.003419584	0.008040861	0.014960443
14	00000004_000-crop.png	Negative for Pneumonia	0.8542615	0.005879921	0.1350534	0.004805235