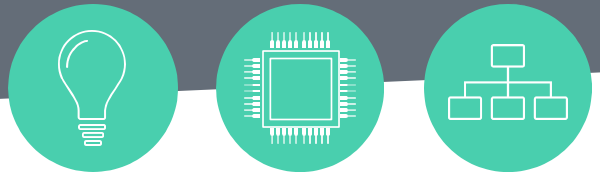
Get Me the Same Picture!



17 김찬영, 21 유지원

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Content

- What We Made
- Used Model
- Project Pipeline
- Code Review
- Demo

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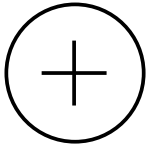
What We Made



"AI를 활용한 Web Based Service"

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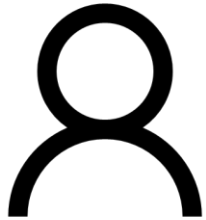
What We Made

INSERT



CLIP

"Give me an image of the same kind as this"

Matches or Not

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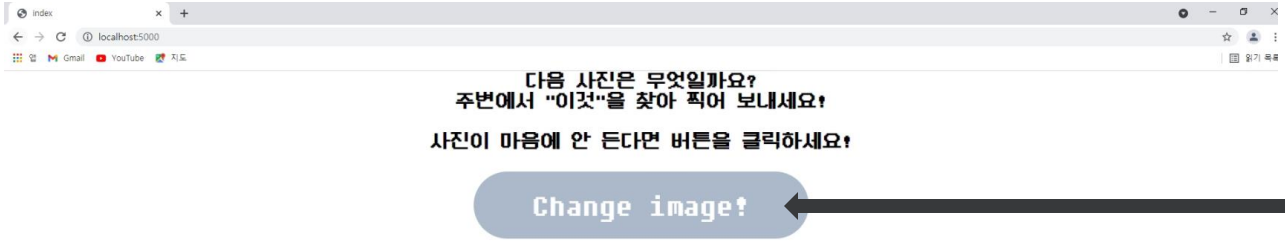
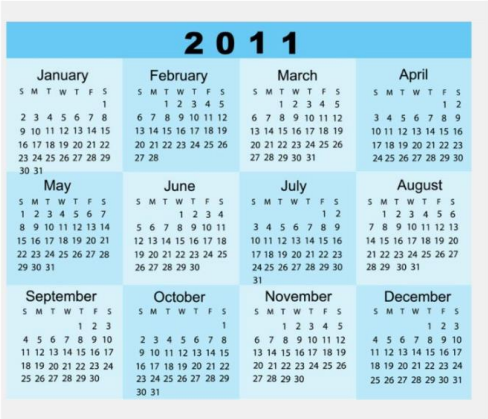
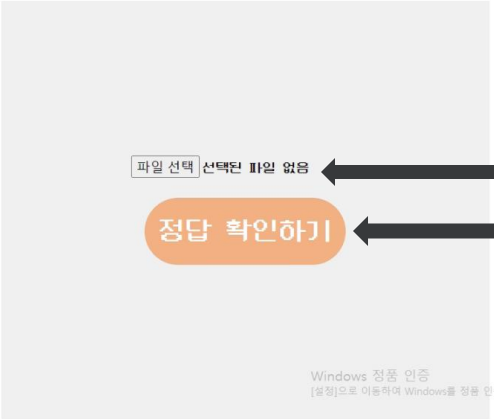
What We Made

1. Index page



Button 1





Button 2

Button 3

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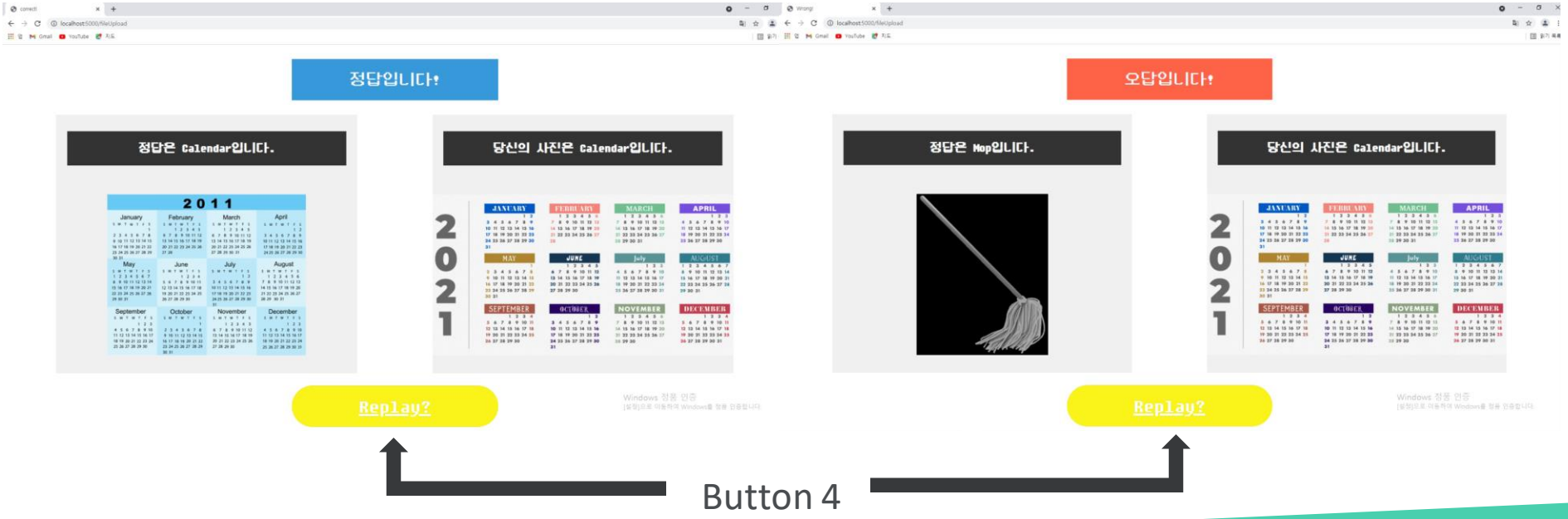
What We Made

2-1. Correct page

2-2. Wrong page



Button 4

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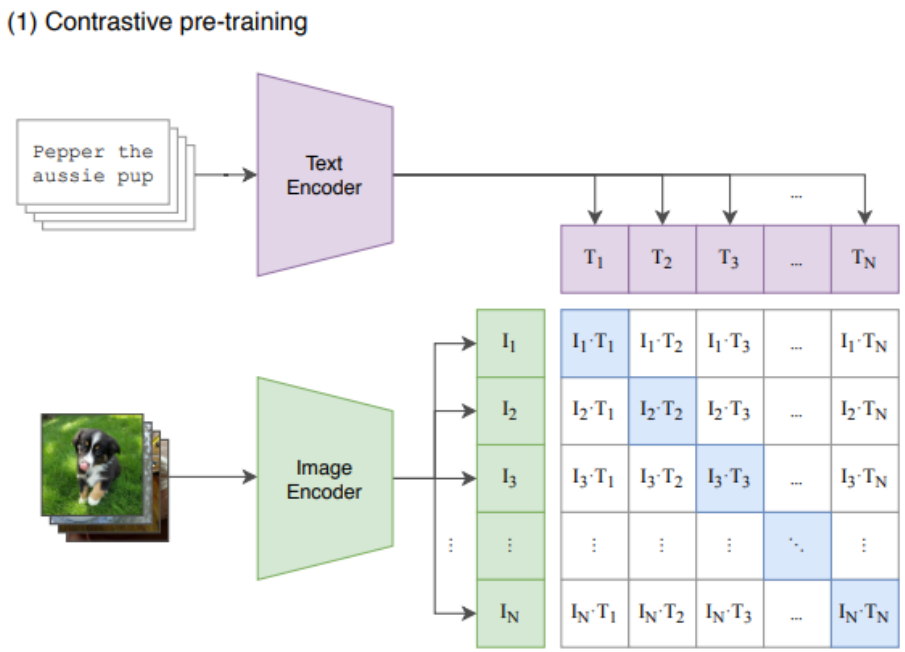
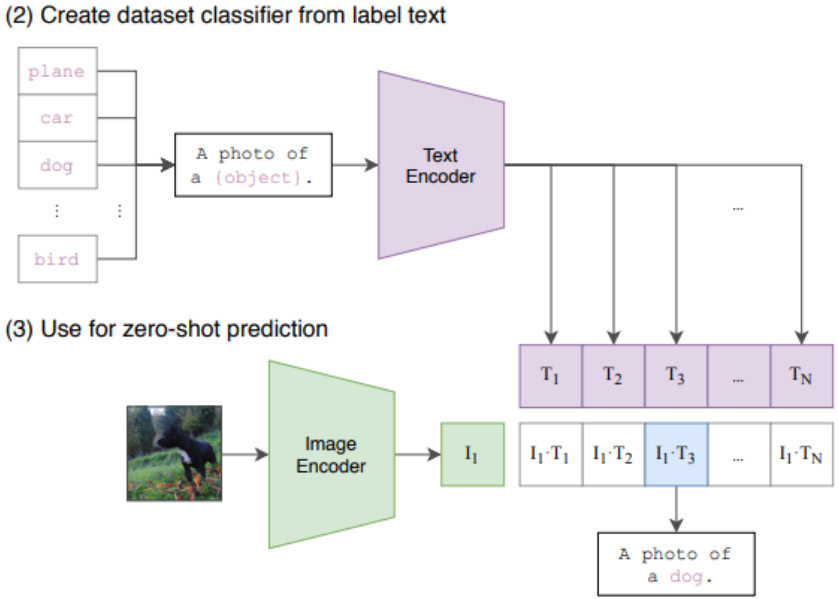
Used Model



OpenAI의 **CLIP**

- 4억장의 대용량 이미지 데이터
- Data Labeling 없이 웹크롤링을 통해 자동으로 이미지와 관련된 자연어 텍스트를 추출
- 주어진 이미지와 텍스트 사이의 올바른 연결 관계를 찾는 네트워크
  - Text Encoder : Transformer
  - Image Encoder : ViT, ResNet

Used Model



Zero-Shot Classifier

- Image의 Feature를 추출하고 주어진 Label을 Text Encoder에 통과시켜 Text Feature를 추출
- Text Feature 중 Image Feature과 가장 높은 상관관계를 갖는 텍스트를 이미지 분류 결과로 출력

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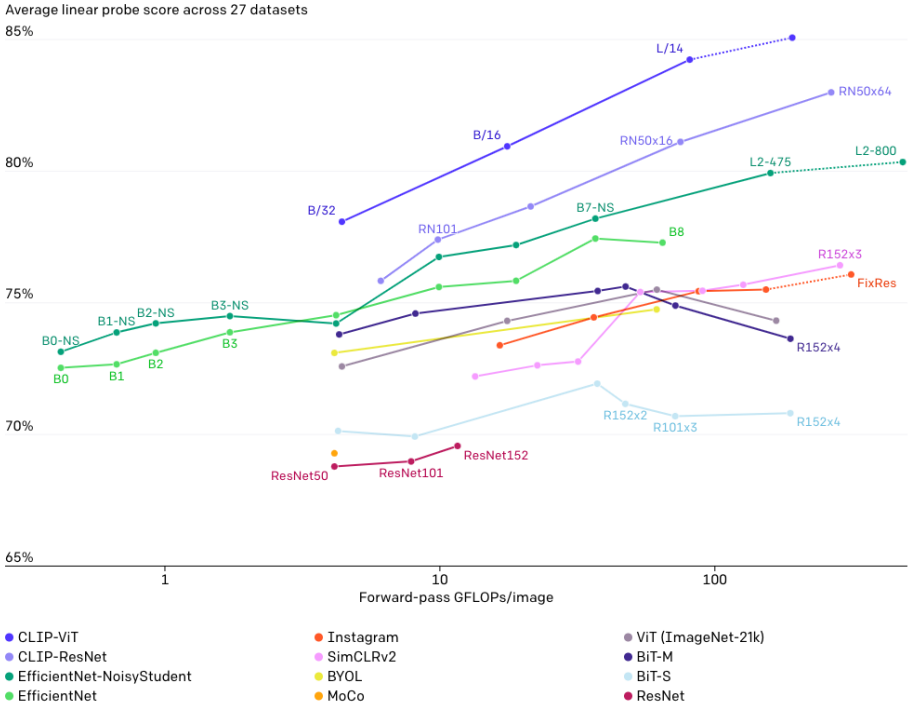
Used Model



- 기존 CNN을 사용한 SoTA급 Image Classification 모델보다 CLIP의 ViT 모델이 더 좋은 성능을 보이고 있음

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Used Model

```
ViT-B/32 Accurcy: 0.83
inference time : 0.2632873058319092 seconds
```

- Vision Transfomer B/32 Encoder Model 실험 결과

```
ResNet50 Accurcy: 0.79
inference time : 0.5844781398773193 seconds
```

- ResNet50 Encoder Model 실험 결과

Model 실험 결과

- Office-Home Dataset의 4357장의 이미지와 Label을 input으로 가져가고 실험함
- CPU i5-10400F, RAM 16GB, GPU GTX1070

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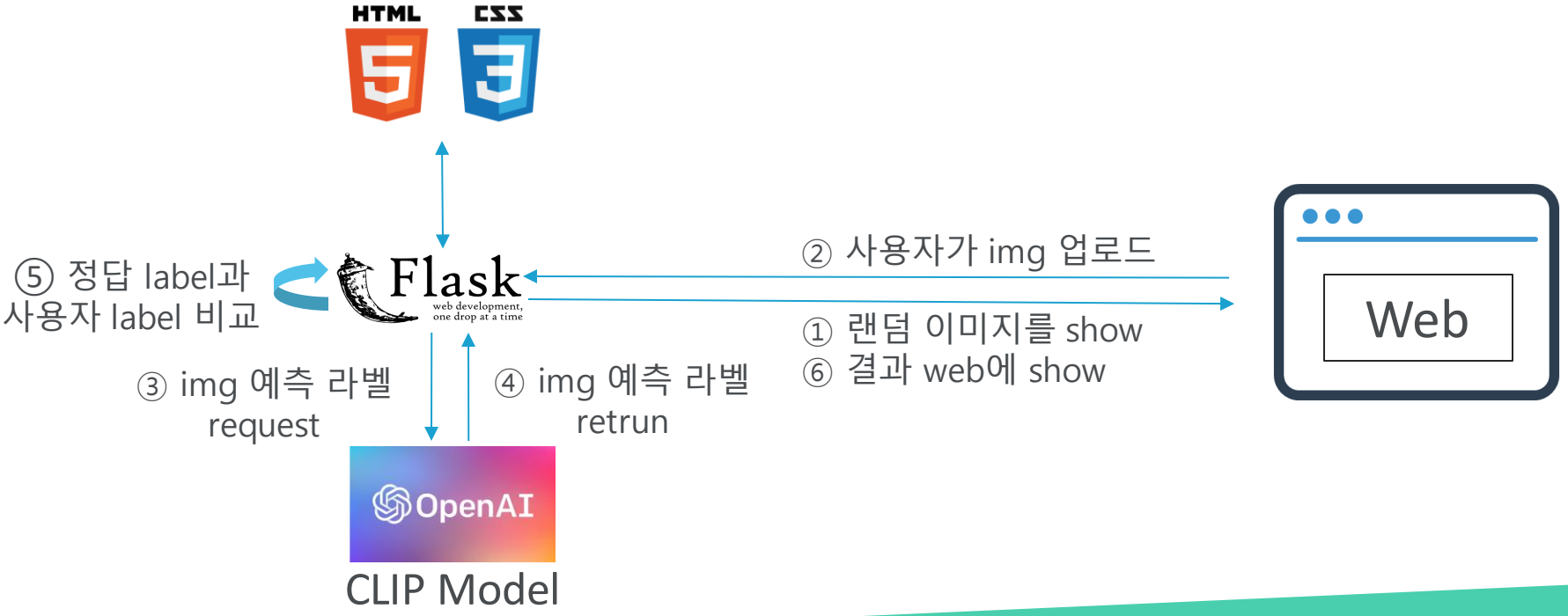
Project Pipeline



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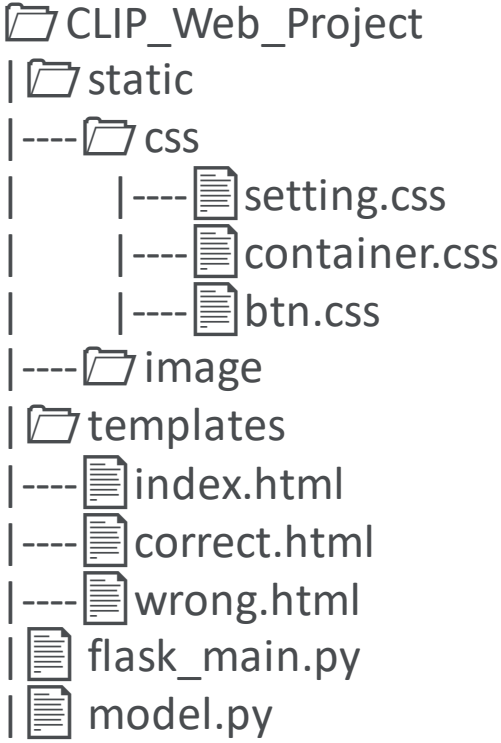
Code Review



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Code Review

flask_main.py

```python
from flask import Flask, render_template, request, url_for
from model import clip_class
from werkzeug.utils import secure_filename

app = Flask(__name__)

@app.route("/")
def index():
    global g_gt, g_cut_rfile, g_rfile
    gt, rfile = clip_class.get_ramdom_path()
    g_rfile = rfile
    rfile_cut = rfile[9:]
    g_gt = gt
    g_cut_rfile = rfile_cut
    return render_template("index.html",  image_file=g_cut_rfile)


@app.route('/fileUpload', methods = ['GET', 'POST'])
def upload_file():
    if request.method == 'POST':
        f = request.files['file']
        f.save('./static/image/uploads/' + secure_filename(f.filename))
        upload = 'image/uploads/'+secure_filename(f.filename)
        submit_path = "./static/" + upload

        given_answer, _ = clip_class.clip_predict(submit_path)

        if g_gt == given_answer:
            print(upload)
            return render_template('correct.html', value = g_gt, image_file=g_cut_rfile, predict = upload,
predict_class = given_answer)
        else:
            print(upload)
            return render_template('wrong.html', value = g_gt, image_file=g_cut_rfile, predict = upload,
predict_class = given_answer)


if __name__ == '__main__':
    app.run(debug=True)
```

Main Page

- Clip_class의 get_random_path를 사용해 랜덤으로 불러올 이미지를 생성
- Index.html에 랜덤으로 불러온 사진을 plot
- 사진의 경로와 Ground Truth값을 전역변수로 선언
- Index.html에서는 사용자에게 이미지를 받습니다

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Code Review

flask_main.py

```python
from flask import Flask, render_template, request, url_for
from model import clip_class
from werkzeug.utils import secure_filename

app = Flask(__name__)

@app.route("/")
def index():
    global g_gt, g_cut_rfile, g_rfile
    gt, rfile = clip_class.get_ramdom_path()
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    rfile_cut = rfile[9:]
    g_gt = gt
    g_cut_rfile = rfile_cut
    return render_template("index.html",  image_file=g_cut_rfile)

@app.route('/fileUpload', methods = ['GET', 'POST'])
def upload_file():
    if request.method == 'POST':
        f = request.files['file']
        f.save('./static/image/uploads/' + secure_filename(f.filename))
        upload = 'image/uploads/'+secure_filename(f.filename)
        submit_path = "./static/" + upload

        given_answer, _ = clip_class.clip_predict(submit_path)

        if g_gt == given_answer:
            print(upload)
            return render_template('correct.html', value = g_gt, image_file=g_cut_rfile, predict = upload,
predict_class = given_answer)
        else:
            print(upload)
            return render_template('wrong.html', value = g_gt, image_file=g_cut_rfile, predict = upload,
predict_class = given_answer)

if __name__ == '__main__':
    app.run(debug=True)
```

Result Page

- 사용자에게 받은 이미지를 CLIP 모델에 넣어 결과를 받음
- 정답 결과에 따라 correct.html 또는 wrong.html을 반환

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Code Review

model.py

```python
import torch
import clip
from PIL import Image
import numpy as np
import cv2
import glob, random
import imutils, os, time

class clip_class:

    def get_ramdom_path():
        file_path = './static/image/Real World/'

        first_path = os.listdir(file_path)
        class_path = random.choice(first_path)
        rfile = os.path.join(file_path, class_path)
        img_list = os.listdir(rfile)
        sel_img = random.choice(img_list)
        rfile= rfile+'/'+ sel_img
        return class_path, rfile
```

CLIP Model

- clip_class: 랜덤 이미지를 불러오는 함수와 모델 실행 함수 두개로 구성
- get_random_path: 데이터셋을 탐색하며 랜덤 이미지의 경로와 True Label 값을 반환

Code Review

model.py

```python
def clip_predict(rfile):
    device = "cuda" if torch.cuda.is_available() else "cpu"

    model_use = "ViT-B/32"
    # model_use = "RN50x16" # ViT-B/32, RN50x16
    model, preprocess = clip.load(model_use, device=device)
    image = preprocess(Image.open(rfile)).unsqueeze(0).to(device)

    class_list = ['Alarm_Clock', 'Backpack', 'Batteries', 'Bed', 'Bike', 'Bottle', 'Bucket',
'Calculator', 'Calendar', 'Candles', 'Chair', 'Clipboards', 'Computer', 'Couch', 'Curtains', 'Desk_Lamp',
'Drill', 'Eraser', 'Exit_Sign', 'Fan', 'File_Cabinet', 'Flipflops', 'Flowers', 'Folder', 'Fork', 'Glasses',
'Hammer', 'Helmet', 'Kettle', 'Keyboard', 'Knives', 'Lamp_Shade', 'Laptop', 'Marker', 'Monitor', 'Mop',
'Mouse', 'Mug', 'Notebook', 'Oven', 'Pan', 'Paper_Clip', 'Pen', 'Pencil', 'Postit_Notes', 'Printer',
'Push_Pin', 'Radio', 'Refrigerator', 'Ruler', 'Scissors', 'Screwdriver', 'Shelf', 'Sink', 'Sneakers', 'Soda',
'Speaker', 'Spoon', 'Table', 'Telephone', 'ToothBrush', 'Toys', 'Trash_Can', 'TV', 'Webcam']

    start_time = time.time()
    text = clip.tokenize(class_list).to(device)

    with torch.no_grad():
        image_features = model.encode_image(image)
        text_features = model.encode_text(text)

        logits_per_image, logits_per_text = model(image, text)
        probs = np.array(logits_per_image.softmax(dim=-1).cpu().numpy())

    label = np.argmax(probs[0])
    end_time = time.time()
    print(probs[0][label])
    print("inference time :", end_time-start_time,"seconds")

    return class_list[label], rfile
```

CLIP Model

- clip_predict: get_random_path에서 받은 이미지에 대한 CLIP 모델의 예측값을 반환
- Pretrained ViT 모델을 불러옴
- Class list를 Office-Home Dataset의 class로 선언
- 모델 연산 후 예측 Label을 반환

Demo

- 동아리방 PC에 가상환경을 구축해 놓았음
- 해당 PC를 원격조정하여 프로그램 시연

감사합니다

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