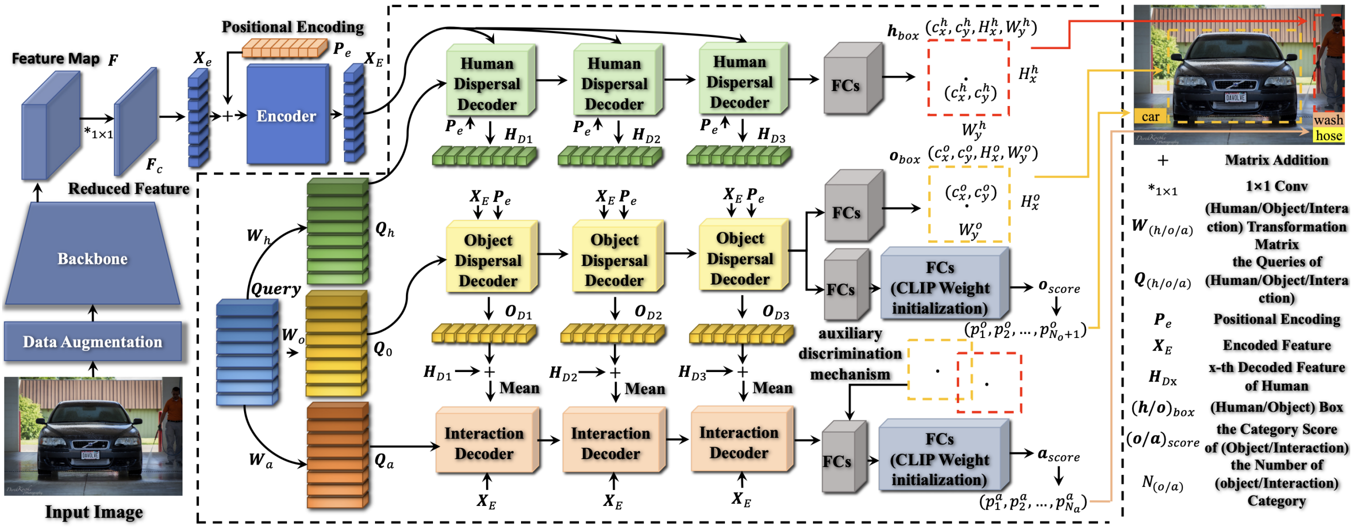
TED-Net

Code for our paper "TED-Net: Dispersal Attention for Perceiving Interaction Region in Indirectly-Contact HOI Detection".


Positional Encoding
Feature Map F
X_e
P_e
X_E
Encoder
$*_{1\times1}$
F_c
Reduced Feature
Backbone
Data Augmentation
Input Image
Human Dispersal Decoder
P_e
H_{D1}
H_{D2}
H_{D3}
W_h
Q_h
Query
W_o
Q_o
W_a
Q_a
Object Dispersal Decoder
X_E P_e
o_{D1}
o_{D2}
o_{D3}
Mean
Interaction Decoder
FCs
FCs (CLIP Weight initialization)
h_{box} $(c_x^h, c_y^h, H_x^h, W_y^h)$
(c_x^h, c_y^h)
H_x^h
W_y^h
o_{box} $(c_x^o, c_y^o, H_x^o, W_y^o)$
(c_x^o, c_y^o)
H_x^o
W_y^o
o_{score}
$(p_1^o, p_2^o, \dots, p_{N_o+1}^o)$
auxiliary discrimination mechanism
a_{score}
$(p_1^a, p_2^a, \dots, p_{N_a}^a)$
car
wash hose
$+$ Matrix Addition
$*_{1\times1}$ 1×1 Conv
$W_{(h/o/a)}$ (Human/Object/Interaction) Transformation Matrix
$Q_{(h/o/a)}$ the Queries of (Human/Object/Interaction)
P_e Positional Encoding
X_E Encoded Feature
H_{Dx} x-th Decoded Feature of Human
$(h/o)_{box}$ (Human/Object) Box
$(o/a)_{score}$ the Category Score of (Object/Interaction)
$N_{(o/a)}$ the Number of (object/Interaction) Category

Installation

Our environment was established on the foundation of Ubuntu 22.04 with Python 3.8. Install the pytorch==1.7.1 and torchvision==0.8.2.

```
pip install torch==1.7.1+cu110 torchvision==0.8.2 -f
https://download.pytorch.org/whl/torch_stable.html
```

Install the dependencies.

```
pip install -r requirements.txt
```

Clone and build CLIP.

```
git clone https://github.com/openai/CLIP.git && cd CLIP && python setup.py
develop && cd ..
```

Data preparation

HICO-Det

HICO-Det dataset can be downloaded here. After finishing downloading, unpack the tarball (`hico_20160224_det.tar.gz`) to the `data` directory.

Instead of using the original annotations files, we use the annotation files provided by the PPDM authors. The annotation files can be downloaded from here. The downloaded annotation files have to be placed as follows.

```
data
 └─ hico_20160224_det
     |─ annotations
     |   |─ trainval_hico.json
     |   |─ test_hico.json
     |   └─ corre_hico.npy
     :
```

V-COCO

First clone the repository of V-COCO from here, and then follow the instruction to generate the file `instances_vcoco_all_2014.json`. Next, download the prior file `prior.pickle` from here. Place the files and make directories as follows.

```
GEN-VLKT
 |─ data
 |   └─ v-coco
 |       |─ data
 |       |   |─ instances_vcoco_all_2014.json
 |       |   :
 |       |─ prior.pickle
 |       |─ images
 |       |   |─ train2014
 |       |   |   |─ COCO_train2014_000000000009.jpg
 |       |   |   :
 |       |   └─ val2014
 |       |       |─ COCO_val2014_000000000042.jpg
 |       |       :
 |       |─ annotations
 :       :
```

For our implementation, the annotation file have to be converted to the HOIA format. The conversion can be conducted as follows.

```
PYTHONPATH=data/v-coco \
        python convert_vcoco_annotations.py \
        --load_path data/v-coco/data \
        --prior_path data/v-coco/prior.pickle \
        --save_path data/v-coco/annotations
```

Note that only Python2 can be used for this conversion because `vsrl_utils.py` in the v-coco repository shows a error with Python3.

V-COCO annotations with the HOIA format, `corre_vcoco.npy`, `test_vcoco.json`, and `trainval_vcoco.json` will be generated to `annotations` directory.

Create link

You should use the following code to create symbolic links for the dataset:

```
cd /path/to/TED-Net
mkdir data
ln -s /path/to/dataset/* /path/to/TED-Net/data/
```

Replace /path/to/dataset with the actual path to your dataset and /path/to/TED-Net with the actual path to your project directory.

Pre-trained model

Download the pretrained model of DETR detector for ResNet50, and put it to the `params` directory.

```
python ./tools/convert_parameters.py \
        --load_path params/detr-r50-e632da11.pth \
        --save_path params/detr-r50-pre-2branch-hico.pth \
        --num_queries 64

python ./tools/convert_parameters.py \
        --load_path params/detr-r50-e632da11.pth \
        --save_path params/detr-r50-pre-2branch-vcoco.pth \
        --dataset vcoco \
        --num_queries 64
```

Training

After the preparation, you can start training with the following commands.

HICO-Det

```
sh ./config/hico_s.sh
```

V-COCO

```
sh ./configs/vcoco_s.sh
```

Evaluation

You can conduct the evaluation with trained parameters for HICO-Det and V-COCO as follows.

```
# HICO-Det
sh ./config/hico_eval.sh
# V-COCO
sh ./config/vcoco_eval.sh
```

For the official evaluation (reported in paper), you need to covert the prediction file to a official prediction format following this file, and then follow PPDM evaluation steps.

HICO-Det-IC and V-COCO-IC

Training on HICO-Det-IC

```
cd /path/to/TED-Net
mv datasets/hico.py ./
cp IC/hico.py datasets/
sh ./configs/hico.sh
```

Training on V-COCO-IC

```
cd /path/to/TED-Net
mv datasets/vcoco.py ./
cp IC/vcoco.py datasets/
sh ./configs/vcoco.sh
```

Evaluation on HICO-Det-IC and V-COCO-IC

You can conduct the evaluation with trained parameters for HICO-Det-IC and V-COCO-IC as follows.

```
# HICO-Det-IC
sh ./config/hico_eval.sh
# V-COCO-IC
sh ./config/vcoco_eval.sh
```