

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

```
True
```

```
!pip install detecto
```

```
Collecting detecto
```

```
  Downloading detecto-1.2.2-py3-none-any.whl (25 kB)
```

```
Requirement already satisfied: matplotlib in /usr/local/lib/python3.10/dist-packages (from detecto) (3.7.1)
Requirement already satisfied: opencv-python in /usr/local/lib/python3.10/dist-packages (from detecto) (4.7.0.72)
Requirement already satisfied: pandas in /usr/local/lib/python3.10/dist-packages (from detecto) (1.5.3)
Requirement already satisfied: torch in /usr/local/lib/python3.10/dist-packages (from detecto) (2.0.1+cu118)
Requirement already satisfied: torchvision in /usr/local/lib/python3.10/dist-packages (from detecto) (0.15.2+cu118)
Requirement already satisfied: tqdm in /usr/local/lib/python3.10/dist-packages (from detecto) (4.65.0)
Requirement already satisfied: contourpy>=1.0.1 in /usr/local/lib/python3.10/dist-packages (from matplotlib->detecto) (1.1.0)
Requirement already satisfied: cycler>=0.10 in /usr/local/lib/python3.10/dist-packages (from matplotlib->detecto) (0.11.0)
Requirement already satisfied: fonttools>=4.22.0 in /usr/local/lib/python3.10/dist-packages (from matplotlib->detecto) (4.41.0)
Requirement already satisfied: kiwisolver>=1.0.1 in /usr/local/lib/python3.10/dist-packages (from matplotlib->detecto) (1.4.4)
Requirement already satisfied: numpy>=1.20 in /usr/local/lib/python3.10/dist-packages (from matplotlib->detecto) (1.22.4)
Requirement already satisfied: packaging>=20.0 in /usr/local/lib/python3.10/dist-packages (from matplotlib->detecto) (23.1)
Requirement already satisfied: pillow>=6.2.0 in /usr/local/lib/python3.10/dist-packages (from matplotlib->detecto) (8.4.0)
Requirement already satisfied: pyparsing>=2.3.1 in /usr/local/lib/python3.10/dist-packages (from matplotlib->detecto) (3.1.0)
Requirement already satisfied: python-dateutil>=2.7 in /usr/local/lib/python3.10/dist-packages (from matplotlib->detecto) (2.8.2)
Requirement already satisfied: pytz>=2020.1 in /usr/local/lib/python3.10/dist-packages (from pandas->detecto) (2022.7.1)
Requirement already satisfied: filelock in /usr/local/lib/python3.10/dist-packages (from torch->detecto) (3.12.2)
Requirement already satisfied: typing-extensions in /usr/local/lib/python3.10/dist-packages (from torch->detecto) (4.7.1)
Requirement already satisfied: sympy in /usr/local/lib/python3.10/dist-packages (from torch->detecto) (1.11.1)
Requirement already satisfied: networkx in /usr/local/lib/python3.10/dist-packages (from torch->detecto) (3.1)
Requirement already satisfied: Jinja2 in /usr/local/lib/python3.10/dist-packages (from torch->detecto) (3.1.2)
Requirement already satisfied: triton==2.0.0 in /usr/local/lib/python3.10/dist-packages (from torch->detecto) (2.0.0)
Requirement already satisfied: cmake in /usr/local/lib/python3.10/dist-packages (from triton==2.0.0->torch->detecto) (3.25.2)
Requirement already satisfied: lit in /usr/local/lib/python3.10/dist-packages (from triton==2.0.0->torch->detecto) (16.0.6)
Requirement already satisfied: requests in /usr/local/lib/python3.10/dist-packages (from torchvision->detecto) (2.27.1)
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.10/dist-packages (from python-dateutil>=2.7->matplotlib->detecto) (1.16.0)
Requirement already satisfied: MarkupSafe>=2.0 in /usr/local/lib/python3.10/dist-packages (from Jinja2->torch->detecto) (2.1.3)
Requirement already satisfied: urllib3<1.27,>=1.21.1 in /usr/local/lib/python3.10/dist-packages (from requests->torchvision->detecto) (1.26.15)
Requirement already satisfied: certifi>=2017.4.17 in /usr/local/lib/python3.10/dist-packages (from requests->torchvision->detecto) (2022.9.24)
Requirement already satisfied: charset-normalizer~=2.0.0 in /usr/local/lib/python3.10/dist-packages (from requests->torchvision->detecto) (2.0.12)
Requirement already satisfied: idna<4,>=2.5 in /usr/local/lib/python3.10/dist-packages (from requests->torchvision->detecto) (3.4)
Requirement already satisfied: mpmath>=0.19 in /usr/local/lib/python3.10/dist-packages (from sympy->torch->detecto) (1.3.0)
Installing collected packages: detecto
Successfully installed detecto-1.2.2
```

```
import numpy as np
import cv2
import matplotlib.pyplot as plt
from torchvision import transforms
from detecto import core, utils, visualize
from detecto.visualize import show_labeled_image, plot_prediction_grid
```

```
custom_transforms = transforms.Compose([
    transforms.ToPILImage(),
    transforms.Resize(900),
    transforms.RandomHorizontalFlip(0.5),
    transforms.ColorJitter(saturation=0.2),
    transforms.ToTensor(),
    utils.normalize_transform(),
])
```

```
Train_dataset=core.Dataset('train/',transform=custom_transforms)#L1
Test_dataset = core.Dataset('test/')#L2
loader=core.DataLoader(Train_dataset, batch_size=2, shuffle=True)#L3
model = core.Model(['nozzle'])#L4
losses = model.fit(loader, Test_dataset, epochs=25, lr_step_size=5, learning_rate=0.001, verbose=True)#L5
```

```

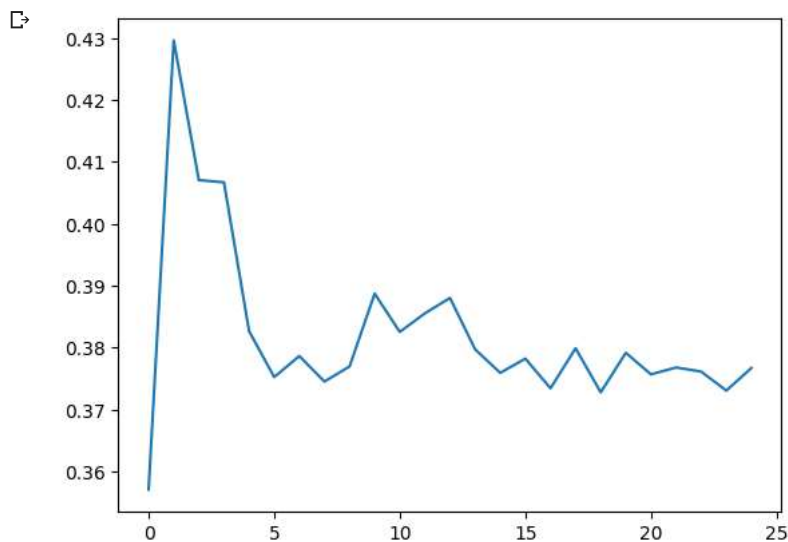
Begin iterating over training dataset
100%|██████████| 18/18 [00:10<00:00, 1.64it/s]
Begin iterating over validation dataset
100%|██████████| 15/15 [00:02<00:00, 7.42it/s]
Loss: 0.3798999398946762
Epoch 19 of 25
Begin iterating over training dataset
100%|██████████| 18/18 [00:10<00:00, 1.64it/s]
Begin iterating over validation dataset
100%|██████████| 15/15 [00:02<00:00, 7.37it/s]
Loss: 0.37278058578570683
Epoch 20 of 25
Begin iterating over training dataset
100%|██████████| 18/18 [00:10<00:00, 1.64it/s]
Begin iterating over validation dataset
100%|██████████| 15/15 [00:02<00:00, 7.45it/s]
Loss: 0.379163126150767
Epoch 21 of 25
Begin iterating over training dataset
100%|██████████| 18/18 [00:10<00:00, 1.64it/s]
Begin iterating over validation dataset
100%|██████████| 15/15 [00:02<00:00, 7.39it/s]
Loss: 0.3756830876072248
Epoch 22 of 25
Begin iterating over training dataset
100%|██████████| 18/18 [00:10<00:00, 1.67it/s]
Begin iterating over validation dataset
100%|██████████| 15/15 [00:02<00:00, 7.36it/s]
Loss: 0.37678976307312645
Epoch 23 of 25
Begin iterating over training dataset
100%|██████████| 18/18 [00:10<00:00, 1.66it/s]
Begin iterating over validation dataset
100%|██████████| 15/15 [00:02<00:00, 7.24it/s]
Loss: 0.37613667398691175
Epoch 24 of 25
Begin iterating over training dataset
100%|██████████| 18/18 [00:11<00:00, 1.63it/s]
Begin iterating over validation dataset
100%|██████████| 15/15 [00:02<00:00, 6.91it/s]
Loss: 0.37306078175703683
Epoch 25 of 25
Begin iterating over training dataset
100%|██████████| 18/18 [00:10<00:00, 1.65it/s]
Begin iterating over validation dataset
100%|██████████| 15/15 [00:02<00:00, 7.22it/s]Loss: 0.3767098645369212

```

```

plt.plot(losses)
plt.show()

```



```

model.save('model_weights.pth')
model = core.Model.load('model_weights.pth', ['nozzle'])

```

```

image = cv2.imread('pressure_vessel.jpg')
gray_image = cv2.cvtColor(image, cv2.COLOR_BGR2GRAY)

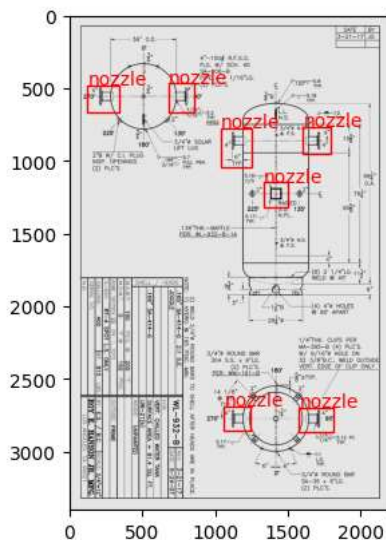
```

```
thresh, im_bw = cv2.threshold(gray_image, 210, 230, cv2.THRESH_BINARY)
cv2.imwrite("bw_image.jpg", im_bw)
```

True

```
image = utils.read_image('bw_image.jpg')
predictions = model.predict(image)
labels, boxes, scores = predictions
# show_labeled_image(image, boxes, labels)
```

```
thresh=0.6
filtered_indices=np.where(scores>thresh)
filtered_scores=scores[filtered_indices]
filtered_boxes=boxes[filtered_indices]
num_list = filtered_indices[0].tolist()
filtered_labels = [labels[i] for i in num_list]
show_labeled_image(image, filtered_boxes, filtered_labels)
```



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