CEA-LSEA: Out-of-Distribution & Anomaly Detection using DNN Latent Representation Uncertainty

Description

CEA-LSEA example for the ***Out-of-Distribution (OoD) detection in DNN latent space*** package.

The current example covers the following DNN architectures for semantic segmentation:

- `Deeplabv3+`

The `Deeplabv3+` DNN was slightly modified to capture *epistemic* uncertainty using the Monte-Carlo Dropout approach, and adding a `DropBlock2D` layer.

Requirements DNN

Overview of required deep learning libraries to train/eval the DNN model:

```
albumentations==1.3.0
dropblock==0.3.0
pytorch-lightning==1.7.2
lightning-bolts==0.5.0
rich==12.5.1
tensorboard==2.10.0
torch==1.12.1
torchmetrics==0.10.0rc0
torchvision==0.13.1
tqdm==4.64.0
```

For model training. fine-tuning or evaluation, use the `train_deeplab_v3p.py` script. For example:

```
>$ python3 train_deeplab_v3p.py -m deeplabv3p-backbone-dropblock2d -b 2 -e 30 --loss_type fo
```

Requirements OoD/Anomaly detection

Install and use our **CEA OoD & Anomaly detection library**:

```
>$ git clone https://repository-url/dnn_ood_detection.git
>$ mv dnn_ood_detection
>$ pip install .
```

To train the OoD detector, we assume access to In-Distribution (InD) and OoD Samples. To generate a dataset with synthetic anomalies, check the datasets scripts and look for the anomaly transformations.

Usage OoD anomaly detection library

For a detailed usage, check this document.

In addition, two jupyter notebooks are available showing the general steps and obtained results in detail:

- `NB_1_ood_anomaly_semseg_deeplabv3p_ws_samples.ipynb`
- `NB_2_ood_anomaly_semseg_deeplabv3p_ws_ds_shift_detect.ipynb`

Publications and Technical Reports

For more technical and implementation details, we refer the user to the following technical reports and publications:

Technical Reports: - EC3-FA06 Run-Time Monitoring - EC3-FA18 Run-Time Monitoring

Publications - Out-of-Distribution Detection using Deep Neural Network Latent Space

Citing this work

```
@article{arnez2023out,
  title={Out-of-Distribution Detection Using Deep Neural Network Latent Space Uncertainty},
  author={Arnez, Fabio and Radermacher, Ansgar and Terrier, Fran{\c{c}}ois},
  year={2023}
}
```

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