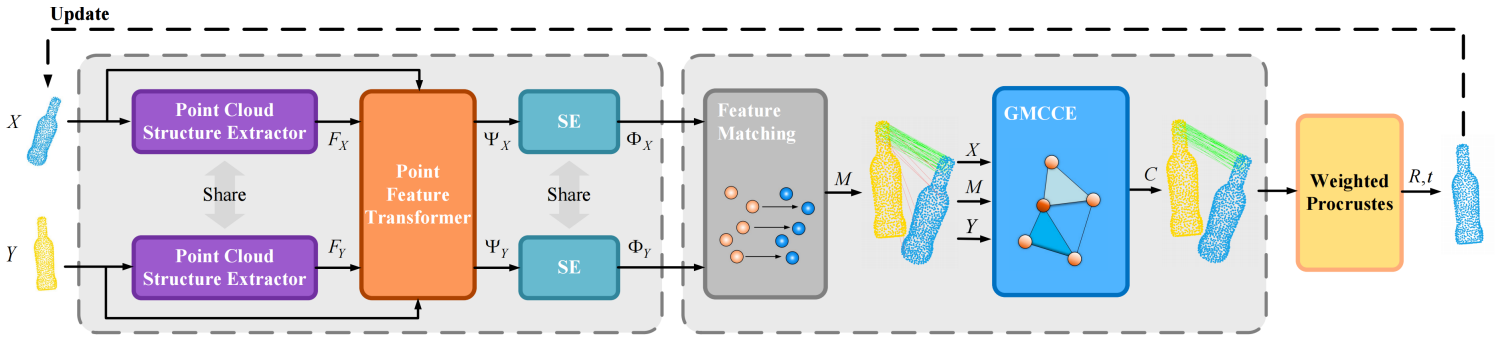
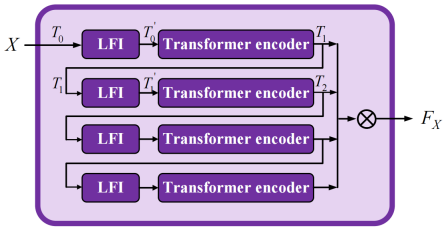
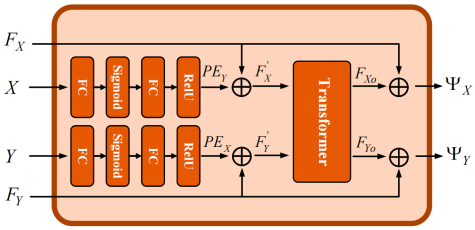
Full Transformer Framework for Robust Point Cloud Registration with Deep Information Interaction



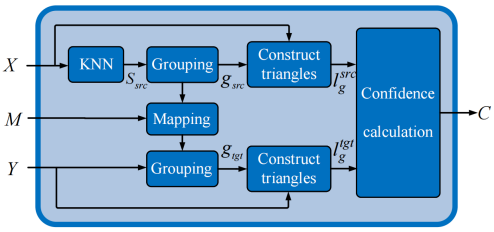
(a) Overview of our RPT



(b) Point Cloud Structure Extractor



(c) Point Feature Transformer



(d) GMCCE

This repository contains python scripts for training and testing [Deep Interaction Transformer (DIT)]

Deep Interaction Transformer (DIT) is a full Transformer framework for point cloud registration, which achieves superior performance compared with current state-of-the-art learning-based methods in accuracy and robustness. DIT consists of the following three main modules.

- A Point Cloud Structure Extractor (PSE) for modeling global relations.
- A Point Feature Transformer (PFT) for improving the discrimination of features.
- A GMCCE for correspondence confidence evaluation.

Configuration

This code is based on PyTorch implementation, and tested on:

- Ubuntu 18.04
- CUDA 11.1
- PyTorch 1.8.1
- Python 3.7.10

You can install the python requirements on your system with:

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

Training

We provide

- three files **1_train_clean.sh, 1_train_low_noise_partial.sh, 1_train_high_noise_partial.sh** to train the DIT model on clean, low noise partial, high noise partial point clouds in **/experiments** folder.

You can run the relevant commands under the **/DIT** path to train the DIT model in a specific environment, the network parameters will be saved in the **/models** folder. Specifically, we use the ModelNet40 dataset for this work, which will be automatically downloaded if necessary.

Train the DIT on the clean, low noise partial, high noise partial point clouds as

```
sh experiments/1_train_clean.sh
```

```
sh experiments/1_train_low_noise_partial.sh
```

```
sh experiments/1_train_high_noise_partial.sh
```

Evaluation and Visualization

We provide

- pretrained models on ModelNet40 on clean, low noise partial, high noise partial point clouds. You can download it from this link weight. Unzip and place it in the **/DIT** folder, such that there are three pretrained models under the **/DIT/models** path;
- three files **1_eval_clean.sh, 1_eval_low_noise_partial.sh, 1_eval_high_noise_partial.sh** to evaluate the DIT model on clean, low noise partial, high noise partial point clouds in **/experiments** folder;
- three files **1_eval_clean_vis.sh, 1_eval_low_noise_partial_vis.sh, 1_eval_high_noise_partial_vis.sh** to visualize the DIT registration process on clean, low noise partial, high noise partial point clouds in **/experiments** folder;

You can run the relevant commands under the **/DIT** path to evaluate the DIT model in a specific environment. If you want to evaluate your training results, you can change the model path in the sh file directly.

Evaluate the DIT on the clean, low noise partial, high noise partial point clouds as

```
sh experiments/1_eval_clean.sh
```

```
sh experiments/1_eval_low_noise_partial.sh
```

```
sh experiments/1_eval_high_noise_partial.sh
```

You can run the relevant commands under the **/DIT** path to visualize the DIT registration process in a specific environment as

```
sh experiments/1_eval_clean_vis.sh
```

```
sh experiments/1_eval_low_noise_partial_vis.sh
```

```
sh experiments/1_eval_high_noise_partial_vis.sh
```

Hope you enjoy this work~~~