Dear Sampling-Assisted Pathloss Radio Map Prediction Challenge Organizing Team,

This file gives a brief description to the proposed method of training a deep learning model for sampling-assisted indoor pathloss map prediction.

First, the input of the deep learning model includes five channels for low sampling rates and six channels for high sampling rates. Specifically, the first three channels correspond to the RGB images from the original dataset. The fourth channel is a model channel defined by the 3GPP InH model. The fifth channel is a frequency channel that encodes the frequency of the model channel. The sixth channel is the sampled radio map which is specifically designed when high sampling rates are applied.

Second, the deep learning model adopts a UNet-like encoder-decoder architecture, utilizing standard convolutions and dilated convolutions for feature extraction, max-pooling for down-sampling, and transposed convolutions for up-sampling. We have designed different training methods for different sampling rates. For the low sampling rate of 0.02%, we use the sampled values to fine-tune a pre-trained model (which is trained without using any sampled values). For the higher sampling rate of 0.5%, the sampled radio map is used as an additional input channel (the sixth one) to the model, and supervised learning is performed.

For Task 2, we have designed a prioritized sampling strategy, in which areas farther from the transmitter and areas with larger gradient variations in the estimated radio map are assigned higher sampling probabilities.

**Project structure description:**

**ground\_truth/:** Storing the ground-truth radio maps and being used only during the evaluation of Task 2. You can either copy the ground-truth maps into this folder or modify `ground\_truth\_path` in the codes accordingly during evaluation.

**inferred\_PL\_radiomaps/:** Storing the estimated radio maps. After the code runs successfully, you can find the estimated maps for different tasks and sampling rates here.

**lib/:** Containing the codes for data loading and deep learning model definitions, being used for testing (for sample rate 0.5%) and fine-tuning (for sample rate 0.02%).

**samples\_for\_task1/:** Being used only during the evaluation of Task 1. You can copy the random sampled ground truth radio maps under different sampling rates into this folder.

**sample\_locations\_for\_task2/:** Storing the sampling locations we designed for different sampling rates, being used only during the evaluation of Task 2.

**trained\_models/:** Storing the trained models, being used for testing and fine-tuning.

**utils/:** Containing utility codes for input feature extraction.

**test\_for\_rate0.5.py:** Testing codes for 0.5% sampling rate, being used for both Task 1 and Task 2.

**finetune\_and\_test\_for\_rate0.02.py:** Fine-tuning and testing codes for 0.02% sampling rate, being used for both Task 1 and Task 2.

**Instructions for running the evaluations:**

1. Sample rate 0.5% (for both Task 1 and Task 2)

Please modify line 11 in `test\_for\_rate0.5.py` by setting `task = 1` or `task = 2` according to the task you are evaluating and then run the code. This code includes runtime statistics (covering data preprocessing, data loading, model inference, and data postprocessing). On an Nvidia RTX 3080Ti GPU, the average runtime per sample is approximately 16ms. Once completed, the estimated maps will be saved in `inferred\_PL\_radiomaps/task1/rate0.5` and `inferred\_PL\_radiomaps/task2/rate0.5`, respectively.

2. Sample rate 0.02% (for both Task 1 and Task 2)

Please modify line 15 in `finetune\_and\_test\_for\_rate0.02.py` by setting `task = 1` or `task = 2` according to the task you are evaluating and then run the code. Once completed, the estimated maps will be saved in `inferred\_PL\_radiomaps/task1/rate0.02` and `inferred\_PL\_radiomaps/task2/rate0.02`, respectively.

3.Notes:

For Task 1, we directly read the randomly sampled radio maps provided by you. For Task 2, we have already included in our data loading codes the operation that generates sampling values from the designed sampling locations (which we submitted) and the ground-truth maps.

Please do not hesitate to contact us if you have any questions when evaluating our method.

Best regards,

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