Code description for Head CT Motion Correction by Diffusion Model

<https://github.com/zhennongchen/Diffusion_for_CT_motion.git>

Note that “/mnt/camca\_NAS/” represents “/camca\_NAS/home/ZC”

**Part 0: Environment Setup**

For everything except simulation, use the image **“zc\_sam:1.0”** in GPU1-8. Run docker/docker\_run.sh to activate the container.

For data simulation, use the image “**ct\_projector:0.5.4**” in GPU1-6. Run *simulation\_data\_generation/docker/docker\_run.sh* to activate the container.

**Part 1: Model training**

To train DDPM, run **main\_train\_DDPM.py.**

To train EDM, run **main\_train\_EDM.py.**

Input:

The only input code that needs to be modified per experiments is to set the trial name, pre-trained model path (None if new training) and set the data paths (which is built as a **spreadsheet**, “/*mnt/camca\_NAS/diffusion\_ct\_motion/data/Patient\_list/Patient\_list\_train\_test\_simulated\_all\_motion\_v1.xlsx*” or “*/mnt/camca\_NAS/diffusion\_ct\_motion/data/Patient\_list/Patient\_list\_train\_test\_simulated\_partial\_motion\_v2.xlsx*”). The training batch is batch = [0,1,2,3] 🡪 haven’t update the data-path for new resampling process.

These spreadsheets can be generated using *Build\_lists/Build\_train\_test\_file\_spreadsheet\_simulation.ipynb* or *Build\_lists/Build\_train\_test\_file\_spreadsheet\_realdata.ipynb (reader study)*

The other codes should remain default.

Output:

the output is the **model files + training log**, saved in *“/mnt/camca\_NAS/diffusion\_ct\_motion/models/trial\_name*”.

**Part 2: Diffusion sampling**

To use EDM to sample, run **main\_sample\_EDM\_for\_simulated\_data.py (simulation study) or main\_sample\_EDM\_for\_realdata.py (reader study)**

To use DDPM to sample, run **main\_sample\_DDPM\_for\_simulated\_data.py (simulation study) or main\_sample\_DDPM\_for\_realdata.py (reader study)**

Input:

The only code that needs to be modified is to set the trial name, trained model filename and data path (built as a spreadsheet).

For simulation data, the data path is as above, with testing batch = [4].

For real data (Reader study), the data path is “*/mnt/camca\_NAS/diffusion\_ct\_motion/data/Patient\_list/Patient\_list\_real\_portable\_CT\_202404\_resample\_avg.xlsx*”.

Output:

the output is the **motion-corrected images**, saved in *“/mnt/camca\_NAS/diffusion\_ct\_motion/models/trial\_name/* *pred\_images\_portable\_simulated*” or

“*“/mnt/camca\_NAS/diffusion\_ct\_motion/models/trial\_name/* *pred\_images\_portable\_real\_resample\_avg”.*

**Part 3: Generate reader study data**

Please go through **reader\_study\_preparation/main.ipynb.**

Step 1: run main\_sample\_EDM\_for\_realdata.py

Step 2: prepare nii files data for reader study. Saved in “*/mnt/camca\_NAS/diffusion\_ct\_motion/examples/real\_data/data*”

Step 3: go to matlab, run nii\_to\_dcm.m to generate DICOM. Saved in “*/mnt/camca\_NAS/diffusion\_ct\_motion/examples/real\_data/data/Patient\_ID/Patient\_subid/dicoms or dicoms\_no\_description*”

Step 4: prepare for pilot study and wash-out study. Saved in “*/mnt/camca\_NAS/diffusion\_ct\_motion/examples/real\_data/pilot*” or “*/mnt/camca\_NAS/diffusion\_ct\_motion/examples/real\_data/full\_study*”

**Part 4: Motion simulation for model training**

First, Run **simulation\_data\_generation/main\_simulation.py**

Input (only two things to change):

1. give this simulation a name

2. define which patients you want to use for simulation (patient\_index\_list, from 0 to 100), and define how many simulations you want to do for each case (random\_index\_list, 0 represents the static image).

Other parameters should remain default.

Output:

the output is the **motion-simulated images**, saved in *“/mnt/camca\_NAS/Portable\_CT\_data/* *simulations\_202404/simulation\_name/Patient\_ID/Patient\_subID/random\_X/image\_data/recon\_resample.nii.gz*”, note the resampling is done by interpolation.

Second, if you’d like to resample by averaging, then run **utils/resample.py**. The output will be saved as *recon\_resample\_avg.nii.gz*

**Part 5: Comparison method (CNN and attention U-Net)**

TBD