

```
!pip -q install torch
```

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

```
0
```

Start coding or [generate](#) with AI.

```
!python /content/sample_data/ \
--silencemap_path /content/sample_data/SilenceMap_final.mat \
--save_figs \
--fig_dir /content/sample_data/figs/
```

```
Device: cpu
Loading SilenceMap file: /content/sample_data/SilenceMap_final.mat
beta length: 1662
coords shape: (1662, 3)
|GT silence| (from MATLAB): 50
|det silence| (MATLAB SilenceMap): 2
mean(beta GT silent) : 0.6312295794487
mean(beta GT active) : 0.8614711165428162
beta min/max after norm: 0.0 1.0
Building k-NN graph...
k_silent (from GT) = 50
```

```
Laplacian baseline: P=0.540 R=0.540 F1=0.540
```

```
Laplacian cluster metrics:
```

Jaccard	:	0.370
ΔCOM (mm)	:	11.151
size_gt	:	50
size_pred	:	50

```
size_rel_err : 0.000

Training GNN...
[0200] loss=0.21228 data=0.03225 smooth=0.01063 seed=0.25376
[0400] loss=0.19289 data=0.03104 smooth=0.01119 seed=0.21179
[0600] loss=0.18163 data=0.03334 smooth=0.01113 seed=0.18531
[0800] loss=0.17774 data=0.02622 smooth=0.01221 seed=0.18088
[1000] loss=0.17721 data=0.02861 smooth=0.01220 seed=0.17518
[1200] loss=0.17592 data=0.02921 smooth=0.01208 seed=0.17262
[1400] loss=0.17515 data=0.02821 smooth=0.01214 seed=0.17246
```

GNN: P=0.740 R=0.740 F1=0.740

GNN cluster metrics:

```
Jaccard      : 0.587
ΔCOM (mm)    : 1.612
size_gt      : 50
size_pred    : 50
size_rel_err : 0.000
```

```
[saved figure → /content/sample_data/figs/1_gt.png]
[saved figure → /content/sample_data/figs/2_laplacian.png]
[saved figure → /content/sample_data/figs/3_gnn.png]
[saved figure → /content/sample_data/figs/4_curves.png]
```

```
!git clone https://github.com/DIKSHAAGARWAL2015/SilenceMap-Localization.git
%cd /content/SilenceMap-Localization
!git status
```

```
Cloning into 'SilenceMap-Localization'...
fatal: could not read Username for 'https://github.com
```

```
!pwd
```

```
/content/SilenceMap-Localization
```

```
%cd /content/SilenceMap-Localization
```

```
/content/SilenceMap-Localization
```

```
!git status
```

On branch main

Your branch is up to date with 'origin/main'.

Changes not staged for commit:

(use "git add <file>..." to update what will be committed)  
(use "git restore <file>..." to discard changes in working directory)

- modified: \_\_pycache\_\_/beta.cpython-312.pyc
- modified: \_\_pycache\_\_/clusters\_ranking.cpython-312.pyc
- modified: \_\_pycache\_\_/compute\_eeg.cpython-312.pyc
- modified: \_\_pycache\_\_/dataloader.cpython-312.pyc
- modified: \_\_pycache\_\_/eval\_silence\_localization.cpython-312.pyc
- modified: \_\_pycache\_\_/gnn.cpython-312.pyc
- modified: \_\_pycache\_\_/graph.cpython-312.pyc
- modified: \_\_pycache\_\_/plotting.cpython-312.pyc
- modified: figs/1\_gt.png
- modified: figs/2\_laplacian.png
- modified: figs/3\_gnn.png
- modified: figs/4\_curves.png
- modified: figs/brain\_rotate.gif
- modified: figs/gnn\_ranked\_clusters.png
- modified: figs/gt\_gnn\_clusters\_3x5.png
- modified: figs\_ventral/ventral\_clusters\_2x2.png
- modified: main.py

no changes added to commit (use "git add" and/or "git commit -a")

```
!git add .
```

```
!git commit -m "move to gpu"
```

```
[main cc9ded3] move to gpu  
17 files changed, 46 insertions(+), 2 deletions(-)
```

```
rewrite figs/1_gt.png (72%)
rewrite figs/2_laplacian.png (96%)
rewrite figs/3_gnn.png (94%)
rewrite figs/4_curves.png (98%)
rewrite figs/brain_rotate.gif (76%)
rewrite figs/gnn_ranked_clusters.png (72%)
rewrite figs/gt_gnn_clusters_3x5.png (86%)
rewrite figs_ventral/ventral_clusters_2x2.png (68%)
```

```
TOKEN = "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"
USER = "DIKSHAAGARWAL2015"
REPO = "SilenceMap-Localization"
!git remote set-url origin https://{}{TOKEN}@github.com/{}{USER}/{}{REPO}.git
```

```
!git branch -a
```

```
* main
  remotes/origin/HEAD -> origin/main
  remotes/origin/main
```

```
!git pull
```

```
Already up to date.
```

```
!git config pull.rebase false
```

```
!git push
```

```
Enumerating objects: 36, done.
Counting objects: 100% (36/36), done.
Delta compression using up to 2 threads
Compressing objects: 100% (22/22), done.
Writing objects: 100% (22/22), 3.97 MiB | 5.57 MiB/s, done.
Total 22 (delta 3), reused 0 (delta 0), pack-reused 0
```

```
remote: Resolving deltas: 100% (3/3), completed with 3 local objects.  
To https://github.com/DIKSHAAGARWAL2015/SilenceMap-Localization.git  
 6d23fa4..cc9ded3 main -> main
```

```
!pwd  
!git status  
!git remote -v
```

```
/content/SilenceMap-Localization  
On branch main  
Your branch is up to date with 'origin/main'.
```

```
Changes to be committed:  
(use "git restore --staged <file>..." to unstage)  
  modified: __pycache__/beta.cpython-312.pyc  
  modified: __pycache__/clusters_ranking.cpython-312.pyc  
  modified: __pycache__/compute_eeg.cpython-312.pyc  
  modified: __pycache__/dataloader.cpython-312.pyc  
  modified: __pycache__/eval_silence_localization.cpython-312.pyc  
  modified: __pycache__/gnn.cpython-312.pyc  
  modified: __pycache__/graph.cpython-312.pyc  
  modified: __pycache__/plotting.cpython-312.pyc  
  modified: figs/1_gt.png  
  modified: figs/2_laplacian.png  
  modified: figs/3_gnn.png  
  modified: figs/4_curves.png  
  modified: figs/brain_rotate.gif  
  modified: figs/gnn_ranked_clusters.png  
  modified: figs/gt_gnn_clusters_3x5.png  
  modified: figs_ventral/ventral_clusters_2x2.png  
  modified: main.py
```

```
origin https://ghp\_83jNsLwx7uCJEtPfsavZqpekWBxwVa08CUUL@github.com/DIKSHAAGARWAL2015/SilenceMap-Localization.git (fetch)  
origin https://ghp\_83jNsLwx7uCJEtPfsavZqpekWBxwVa08CUUL@github.com/DIKSHAAGARWAL2015/SilenceMap-Localization.git (push)
```

```
!git config --global user.email "dikshaagarwal738@gmail.com"  
!git config --global user.name "DIKSHAAGARWAL2015!"
```

```
%matplotlib inline
```

```
from mpl_toolkits.mplot3d import Axes3D # noqa: F401 (ensures 3D is registered)
import matplotlib.pyplot as plt
```

```
!pip -q install mat73
```

```
from IPython.display import Image, display
import glob
for fn in sorted(glob.glob("/content/sample_data/figs/*.png")):
    display(Image(fn))
```

```
!pip install h5py
```

```
Requirement already satisfied: h5py in /usr/local/lib/python3.12/dist-packages (3.15.1)
Requirement already satisfied: numpy>=1.21.2 in /usr/local/lib/python3.12/dist-packages (from h5py) (2.0.2)
```

```
import mat73, pprint
pprint.pprint(mat73.loadmat("/content/sample_data/OT_leadfield_symmetric_1662-128.mat").keys())
pprint.pprint(mat73.loadmat("/content/sample_data/OT_headmodel_symmetric_1662-128.mat").keys())
```

```
dict_keys(['L', 'sensor_locs'])
dict_keys(['Cortex', 'headmodel'])
```

```
!pip -q install mat73 torch tqdm scikit-learn scipy
```

```
import torch  
print(torch.__version__)
```

2.9.0+cu126

```
!pip install torch torchvision torchaudio --index-url https://download.pytorch.org/whl/cu121
```

Looking in indexes: <https://download.pytorch.org/whl/cu121>

```
Requirement already satisfied: torch in /usr/local/lib/python3.12/dist-packages (2.9.0+cu126)
Requirement already satisfied: torchvision in /usr/local/lib/python3.12/dist-packages (0.24.0+cu126)
Requirement already satisfied: torchaudio in /usr/local/lib/python3.12/dist-packages (2.9.0+cu126)
Requirement already satisfied: filelock in /usr/local/lib/python3.12/dist-packages (from torch) (3.20.0)
Requirement already satisfied: typing-extensions>=4.10.0 in /usr/local/lib/python3.12/dist-packages (from torch) (4.15.0)
Requirement already satisfied: setuptools in /usr/local/lib/python3.12/dist-packages (from torch) (75.2.0)
Requirement already satisfied: sympy>=1.13.3 in /usr/local/lib/python3.12/dist-packages (from torch) (1.14.0)
Requirement already satisfied: networkx>=2.5.1 in /usr/local/lib/python3.12/dist-packages (from torch) (3.6)
Requirement already satisfied: jinja2 in /usr/local/lib/python3.12/dist-packages (from torch) (3.1.6)
Requirement already satisfied: fsspec>=0.8.5 in /usr/local/lib/python3.12/dist-packages (from torch) (2025.3.0)
Requirement already satisfied: nvidia-cuda-nvrtc-cu12==12.6.77 in /usr/local/lib/python3.12/dist-packages (from torch) (12.6.77)
Requirement already satisfied: nvidia-cuda-runtime-cu12==12.6.77 in /usr/local/lib/python3.12/dist-packages (from torch) (12.6.77)
Requirement already satisfied: nvidia-cuda-cupti-cu12==12.6.80 in /usr/local/lib/python3.12/dist-packages (from torch) (12.6.80)
Requirement already satisfied: nvidia-cudnn-cu12==9.10.2.21 in /usr/local/lib/python3.12/dist-packages (from torch) (9.10.2.21)
Requirement already satisfied: nvidia-cublas-cu12==12.6.4.1 in /usr/local/lib/python3.12/dist-packages (from torch) (12.6.4.1)
Requirement already satisfied: nvidia-cufft-cu12==11.3.0.4 in /usr/local/lib/python3.12/dist-packages (from torch) (11.3.0.4)
Requirement already satisfied: nvidia-curand-cu12==10.3.7.77 in /usr/local/lib/python3.12/dist-packages (from torch) (10.3.7.77)
Requirement already satisfied: nvidia-cusolver-cu12==11.7.1.2 in /usr/local/lib/python3.12/dist-packages (from torch) (11.7.1.2)
Requirement already satisfied: nvidia-cusparse-cu12==12.5.4.2 in /usr/local/lib/python3.12/dist-packages (from torch) (12.5.4.2)
Requirement already satisfied: nvidia-cusparselt-cu12==0.7.1 in /usr/local/lib/python3.12/dist-packages (from torch) (0.7.1)
Requirement already satisfied: nvidia-nccl-cu12==2.27.5 in /usr/local/lib/python3.12/dist-packages (from torch) (2.27.5)
Requirement already satisfied: nvidia-nvshmem-cu12==3.3.20 in /usr/local/lib/python3.12/dist-packages (from torch) (3.3.20)
Requirement already satisfied: nvidia-nvtx-cu12==12.6.77 in /usr/local/lib/python3.12/dist-packages (from torch) (12.6.77)
Requirement already satisfied: nvidia-nvjitlink-cu12==12.6.85 in /usr/local/lib/python3.12/dist-packages (from torch) (12.6.85)
Requirement already satisfied: nvidia-cufile-cu12==1.11.1.6 in /usr/local/lib/python3.12/dist-packages (from torch) (1.11.1.6)
Requirement already satisfied: triton==3.5.0 in /usr/local/lib/python3.12/dist-packages (from torch) (3.5.0)
Requirement already satisfied: numpy in /usr/local/lib/python3.12/dist-packages (from torchvision) (2.0.2)
Requirement already satisfied: pillow!=8.3.*,>=5.3.0 in /usr/local/lib/python3.12/dist-packages (from torchvision) (11.3.0)
Requirement already satisfied: mpmath<1.4,>=1.1.0 in /usr/local/lib/python3.12/dist-packages (from sympy>=1.13.3->torch)
```

```
Requirement already satisfied: MarkupSafe>=2.0 in /usr/local/lib/python3.12/dist-packages (from jinja2->torch) (3.0.3)
```

```
!pip install mat73
```

```
Collecting mat73
```

```
  Downloading mat73-0.65-py3-none-any.whl.metadata (3.6 kB)
```

```
Requirement already satisfied: h5py in /usr/local/lib/python3.12/dist-packages (from mat73) (3.15.1)
```

```
Requirement already satisfied: numpy in /usr/local/lib/python3.12/dist-packages (from mat73) (2.0.2)
```

```
  Downloading mat73-0.65-py3-none-any.whl (19 kB)
```

```
Installing collected packages: mat73
```

```
Successfully installed mat73-0.65
```

```
!pip install plotly --quiet # "--quiet" hides installation logs
```

```
!python /content/sample_data/feature_gnn.py --save_figs --use_mat \
--leadfield_path /content/sample_data/OT_leadfield_symmetric_3002
--headmodel_path /content/sample_data/OT_headmodel_symmetric_3002
```

```
Device: cpu
```

```
Loading .mat leadfield/headmodel...
```

```
ERROR:root:ERROR: not a MATLAB datatype: <HDF5 dataset "L": shape (128, 3004), type "<f4">, (float32)
```

```
ERROR:root:ERROR: not a MATLAB datatype: <HDF5 dataset "sensor_locs": shape (128, 3), type "<f4">, (float32)
```

```
ERROR:root:ERROR: not a MATLAB datatype: <HDF5 dataset "src_xyz": shape (3004, 3), type "<f4">, (float32)
```

```
Loaded leadfield: (128, 3004) vertices: (3004, 3)
```

```
Avg SNR ≈ 10.00 dB (target=10 dB)
```

```
[0.7873082  0.7899602  0.7936272 ... 0.82372224 0.7996216  0.8760529 ]
```

```
(3004,)
```

```
[auto] q_silent set to 1.60% for |S|=48/3004
```

```
[0200] loss=0.53954 cls=0.30514 smooth=0.04688
```

```
[0400] loss=0.43436 cls=0.21203 smooth=0.04447
```

```
[0600] loss=0.38219 cls=0.17687 smooth=0.04107
```

```
[0800] loss=0.37298 cls=0.15970 smooth=0.04266
```

```
[1000] loss=0.35562 cls=0.14449 smooth=0.04223
```

```
[1200] loss=0.35545 cls=0.15483 smooth=0.04012
```

```
[1400] loss=0.34068 cls=0.13659 smooth=0.04082
```

```
[1600] loss=0.34093 cls=0.13174 smooth=0.04184
```

```
[1800] loss=0.33149 cls=0.12837 smooth=0.04062
[2000] loss=0.32608 cls=0.12590 smooth=0.04004
GNN(BCE):  P=0.937 R=0.937 F1=0.937
Mean Jaccard: 0.8914835164834456
Mean COM error: 0.3262838125228882
Mean size error: 0.04166666666663195
```

- ✓ EVERYTHING SAVED SAFELY
- 📁 Folder: /content/sample\_data/safe\_save\_run1
- ➡ You can now move to MONKEY (NHP) data using these weights.
- [saved figure → /content/sample\_data/figs/1\_gt.png]
- [saved figure → /content/sample\_data/figs/3\_gnn.png]
- [saved figure → /content/sample\_data/figs/1\_gt\_overlay.png]
- [saved figure → /content/sample\_data/figs/3\_gnn\_overlay.png]

```
!python /content/sample_data/gnn_silencemap.gnn.py \
--use_mat \
--headmodel_path /content/sample_data/cortex_downsampled_v73.mat \
--save_figs \
--fig_dir /content/sample_data/figs_monkey/
```

```
Device: cpu
Loading cortex vertices from .mat using smart_loadmat ...
[smart_loadmat] Loading /content/sample_data/cortex_downsampled_v73.mat ...
[smart_loadmat] SciPy cannot read this file (likely v7.3): Please use HDF reader for matlab v7.3 files, e.g. h5py
[smart_loadmat] mat73 is not installed; skipping mat73.
[smart_loadmat] Falling back to raw h5py read ...
[smart_loadmat] Loaded keys (first 10): ['#refs#/a', 'DownsampledCortex/F', 'DownsampledCortex/V', 'DownsampledCortex/
Loaded vertices: (3004, 3)
Simulating 3 silent regions on cortex
Total silent nodes ≈ 30 (1.00% of 3004)
Target per-region size ≈ 10
Region 0: center index = 268
Region 0: picked 10 vertices
Region 1: center index = 2327
Region 1: picked 10 vertices
Region 2: center index = 1963
Region 2: picked 10 vertices
Final |S| = 30 silent nodes (1.00% of cortex)
mean(beta silent): 0.0
```

```
mean(beta active): 1.0
beta shape: (3004,)
beta min/max: 0.0 1.0
Building kNN graph ...
Solving Laplacian smoother ...
[auto] q_silent set to 1.00% for |S|=30/3004
Laplacian: P=0.967 R=0.967 F1=0.967
Building GNN ...
Training supervised GNN ...
[0200] loss=0.02213 cls=0.01723 smooth=0.00490
[0400] loss=0.02055 cls=0.01669 smooth=0.00386
[0600] loss=0.02025 cls=0.01596 smooth=0.00430
[0800] loss=0.02019 cls=0.01607 smooth=0.00412
[1000] loss=0.02022 cls=0.01606 smooth=0.00417
[1200] loss=0.02028 cls=0.01666 smooth=0.00362
[1400] loss=0.02009 cls=0.01561 smooth=0.00448
[1600] loss=0.02008 cls=0.01597 smooth=0.00411
[1800] loss=0.02059 cls=0.01651 smooth=0.00408
[2000] loss=0.02005 cls=0.01583 smooth=0.00422
GNN:      P=0.800 R=0.800 F1=0.800

[beta]
mean(silent): 0.0
mean(active): 1.0
corr with X_act: -1.0

[g_lap]
mean(silent): 0.23411522805690765
mean(active): 0.9662275910377502
corr with X_act: -0.7584455203423163

[g_gnn_prob]
mean(silent): 0.2554951310157776
mean(active): 0.001517578843049705
corr with X_act: 0.8234944564547522
[saved figure → /content/sample_data/figs_monkey/1_gt.png]
[saved figure → /content/sample_data/figs_monkey/2_laplacian.png]
[saved figure → /content/sample_data/figs_monkey/3_gnn.png]
```

```
!rm -f /content/sample_data/cache_dataset.npz
```

```
!python /content/sample_data/train_test_sim2real.py --use_mat \
--leadfield_path /content/sample_data/OT_leadfield_symmetric_3002
--headmodel_path /content/sample_data/OT_headmodel_symmetric_3002
--t 800 --steps 400 --n_train_sims 10 --n_test_sims 5 \
--snr_db 10 --i_ref0 63 --force_regen
```

```
Device: cpu
Loading leadfield/headmodel...
ERROR:root:ERROR: not a MATLAB datatype: <HDF5 dataset "L": shape (128, 3004), type "<f4">, (float32)
ERROR:root:ERROR: not a MATLAB datatype: <HDF5 dataset "sensor_locs": shape (128, 3), type "<f4">, (float32)
ERROR:root:ERROR: not a MATLAB datatype: <HDF5 dataset "src_xyz": shape (3004, 3), type "<f4">, (float32)
Loaded L: (128, 3004) src_xyz: (3004, 3)
[cache] TRAIN 1/10 seed=154405 (0.69s)
[cache] TRAIN 2/10 seed=6823518 (0.67s)
[cache] TRAIN 3/10 seed=5929477 (0.63s)
[cache] TRAIN 4/10 seed=538210 (0.57s)
[cache] TRAIN 5/10 seed=9090868 (0.70s)
[cache] TRAIN 6/10 seed=2203598 (0.64s)
[cache] TRAIN 7/10 seed=2550895 (0.74s)
[cache] TRAIN 8/10 seed=1843718 (0.75s)
[cache] TRAIN 9/10 seed=3336163 (0.61s)
[cache] TRAIN 10/10 seed=1759059 (0.65s)
[cache] TEST 1/5 seed=3478025 (0.49s)
[cache] TEST 2/5 seed=8120945 (0.44s)
[cache] TEST 3/5 seed=4513921 (0.41s)
[cache] TEST 4/5 seed=9233449 (0.41s)
[cache] TEST 5/5 seed=4494658 (0.43s)
[cache] saved → /content/sample_data/cache_dataset.npz
```

```
Training on cached TRAIN set (fast)...
[0050] loss=1.31312 cls=1.30875 smooth=0.00087
[0100] loss=1.37589 cls=1.37179 smooth=0.00082
[0150] loss=1.33638 cls=1.33211 smooth=0.00085
[0200] loss=1.37572 cls=1.36942 smooth=0.00126
[0250] loss=1.24554 cls=1.23334 smooth=0.00244
[0300] loss=1.35269 cls=1.33419 smooth=0.00370
[0350] loss=1.40023 cls=1.37860 smooth=0.00433
[0400] loss=1.25435 cls=1.24384 smooth=0.00210
```

```
Evaluating (no train=test leakage):
```

```
==== TRAIN (in-sample sanity) ====
F1@k: 0.0645833333303198
mean_jaccard: 0.043207299236708914
mean_com_error: 22.939458562930422
mean_size_error: 0.5958333333332859

==== TEST (held-out simulations) ====
F1@k: 0.00416666666656658
mean_jaccard: 0.0014705882352940743
mean_com_error: 24.657802255948386
mean_size_error: 0.5124999999999579
```