

```
!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': No such device or address
```

```
[Errno 2] No such file or directory: '/content/SilenceMap-Localization'
```

```
/content
```

```
fatal: not a git repository (or any of the parent directories): .git
```

```
!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-cusparselt-cu12==0.7.1 in /usr/local/lib/python3.12/dist-packages (from torch) (0.7.1)
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-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) (1.3.0)
```

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/debugger.py --save_figs --use_m
--leadfield_path /content/sample_data/OT_leadfield_symmetr
--headmodel_path /content/sample_data/OT_headmodel_symmetr
```

Device: cpu

Loading .mat leadfield/headmodel...

Loaded leadfield: (128, 1662) vertices: (1662, 3)

Avg SNR \approx 12.05 dB

[0.51313055 0.4518721 0.32164642 ... 0.56000257 0.3839895 0.7893636]

(1662,)

[auto] q_silent set to 3.01% for |S|=50/1662

[0200] loss=0.69929 cls=0.45877 smooth=0.04811

[0400] loss=0.59460 cls=0.32307 smooth=0.05431

[0600] loss=0.54440 cls=0.29211 smooth=0.05046

[0800] loss=0.52042 cls=0.27044 smooth=0.05000

[1000] loss=0.51217 cls=0.26196 smooth=0.05004

[1200] loss=0.50366 cls=0.26125 smooth=0.04848

[1400] loss=0.49207 cls=0.24597 smooth=0.04922

[1600] loss=0.48781 cls=0.21582 smooth=0.05440

[1800] loss=0.47677 cls=0.20977 smooth=0.05340

[2000] loss=0.46528 cls=0.20728 smooth=0.05160

GNN(BCE): P=0.820 R=0.820 F1=0.820

==== GNN Component Report ====

Vertex-set Jaccard (IoU): 0.695

#Components: GT=5 Pred=5

Matched comp IoU: mean=0.709 median=0.692

Size error abs: mean=1.20 median=1.00

Size error rel: mean=0.120 median=0.100

✓ 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]

```
!python /content/sample_data/gnn_silencemap.gnn.py \
  --use_mat \
  --headmodel_path /content/sample_data/cortex_downsampled_v
  --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]
```

