EEG Spikes

v0.1.0 eeg scalp-eeg electrophysiology epilepsy neurology neuroscience spike-detection biomarkers sleep

Detects interictal epileptiform discharges (spikes) on clinical scalp EEG with epycom's Janca et al.

Repository	`https://github.com/pennsieve-apps/eeg-spikes`	License	Apache-2.0
Authors	Pennsieve (University of Pennsylvania)	Generated	2026-11-13 18:46 UTC
Sample run	`pipeline:917ddb79-8f97-4e8e-a84f-df7f77d873d3:06a2ac3d261f`	Run time	11 s

This document shows what **EEG Spikes** produces. Pennsieve ran version v0.1.0 once, on the test inputs the app declares for itself, and collected what it wrote. It is not the app's documentation and not its output: the outputs are the files listed under Results. Read it to decide whether the app does what you need before you run it on your own data.

Parts marked AI-WRITTEN were written by a language model (us.anthropic.claude-opus-5-5) from the files and records cited in this document; every number in them was checked against that material. Everything else, including every figure, table and value, is copied from the run's output files and its record. No figure was drawn or altered; images are downscaled copies.

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1 · At a glance

The EEG Spikes app detects interictal epileptiform discharges (spikes) on clinical scalp EEG using epycom's Janca et al. 2015 detector (or Barkmeier et al. 2012), run on the longitudinal bipolar montage, leaving out seizures and bad segments. This was a sample run on test data written by the app's own test-data generator: a set of EEG files and a sleep file. From the EEG recordings the app produced a table of every spike, spike rates per channel, multi-channel spike events with their leading channel and hemisphere, and the lateralisation of each recording. Because a sleep hypnogram was supplied, it also produced spike rates per sleep stage. Figures show example spikes, per-channel spike rates, laterality index and spikes by sleep stage, and the output is marked as research output to be reviewed against the EEG. AI-WRITTEN

RAN ON
2 inputs · 12 files · 6.6 MB

PRODUCED
1 output · 14 files · 1.4 MB

SHOWN HERE
6 figures

RUN TIME
11 s

2 · About the app

Detects interictal epileptiform discharges (spikes) on clinical scalp EEG with epycom's Janca et al. 2015 detector (or Barkmeier et al. 2012), both developed and validated on intracranial EEG and run here on the longitudinal bipolar montage. Writes every spike, the spike rate per channel, multi-channel spike events with their leading channel and hemisphere, the lateralisation of each recording and, when eeg-sleep's hypnogram is linked, spike rates per sleep stage. Seizures and bad segments are left out. Research output, to be reviewed against the EEG.

Takes

Input	What	Formats
eeg	The BIDS-EEG derivative of eeg-prep (recordings.csv, *_desc-preproc_eeg.edf with _channels.tsv and _events.tsv), or any BIDS-EEG dataset (HED-SCORE seizure events such as BIDS Siena's are read), or plain EDF/BDF/BrainVision/FIF/EEGLAB files with 10-20 channel names, referential or bipolar (CHB-MIT summary files give the seizures). Folders and symlinks are followed.	`application/edf, text/csv, text/tab-separated-values, application/json`
sleep	Optional: eeg-sleep's output (hypnogram.csv, 30 s epochs, stages W/N1/N2/N3/R). Each spike gets the stage of its epoch and rates_by_stage.csv is written. Without it, annotated sleep/wake events are used when the recording has them.	`text/csv, application/json`

Produces

Output	What	Formats
spikes	eeg-spikes/: spikes.csv, spike_rates.csv, spike_events.csv, lateralisation.csv, rates_by_stage.csv (when stages are known), features.csv (spikerate_<detector>), figures/*.png (spike-rate topomap, spikes per sleep stage, example spikes, laterality index), summary.json and provenance.json.	`text/csv, image/png, application/json`

3 · Test inputs

What the app ran on for this sample: the test data its app.yml declares, built for this run and discarded afterwards (app commit `126793e0e188`).

eeg 11 files · 6.6 MB

Written by the app's own test-data generator (python -m tests.make_fixture "$REVIEW_INPUT_DIR").

In the app's input directory as `eeg/`.

sleep 1 file · 981 B

Written by the app's own test-data generator (python -m tests.make_fixture "$REVIEW_INPUT_DIR").

In the app's input directory as `sleep/`.

4 · Figures

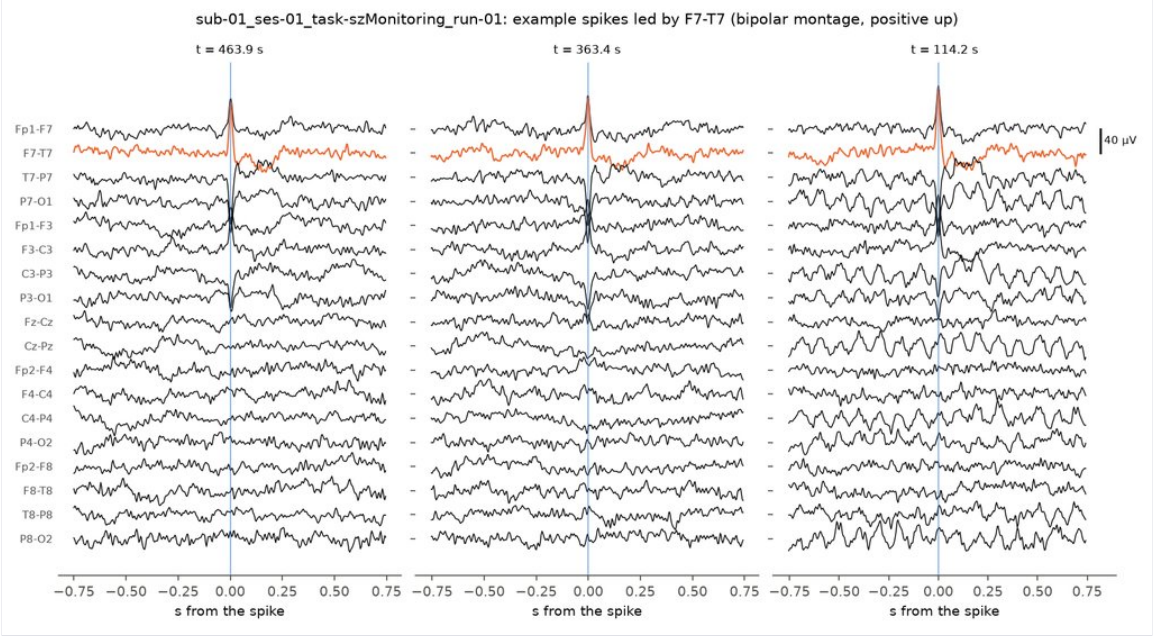


Figure 1. Example interictal spikes detected by the eeg-spikes app (version 0.1.0, janca detector) in recording sub-01_ses-01_task-szMonitoring_run-01. Each panel shows bipolar-montage EEG traces centred on a spike led by channel F7-T7. AI-WRITTEN

spikes · eeg-spikes/figures/sub-01_ses-01_task-szMonitoring_run-01_example_spikes.png R7

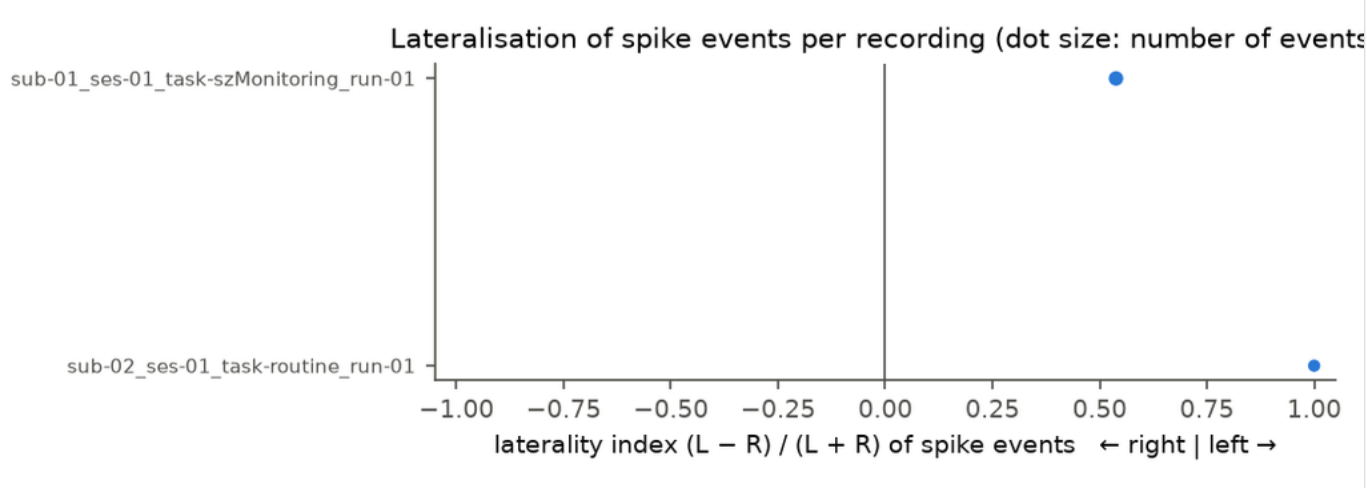


Figure 2. Laterality index of detected spike events for each recording, from the eeg-spikes app. Dot size indicates the number of events, and the axis runs from right to left lateralisation. AI-WRITTEN

spikes · eeg-spikes/figures/laterality_index.png R8

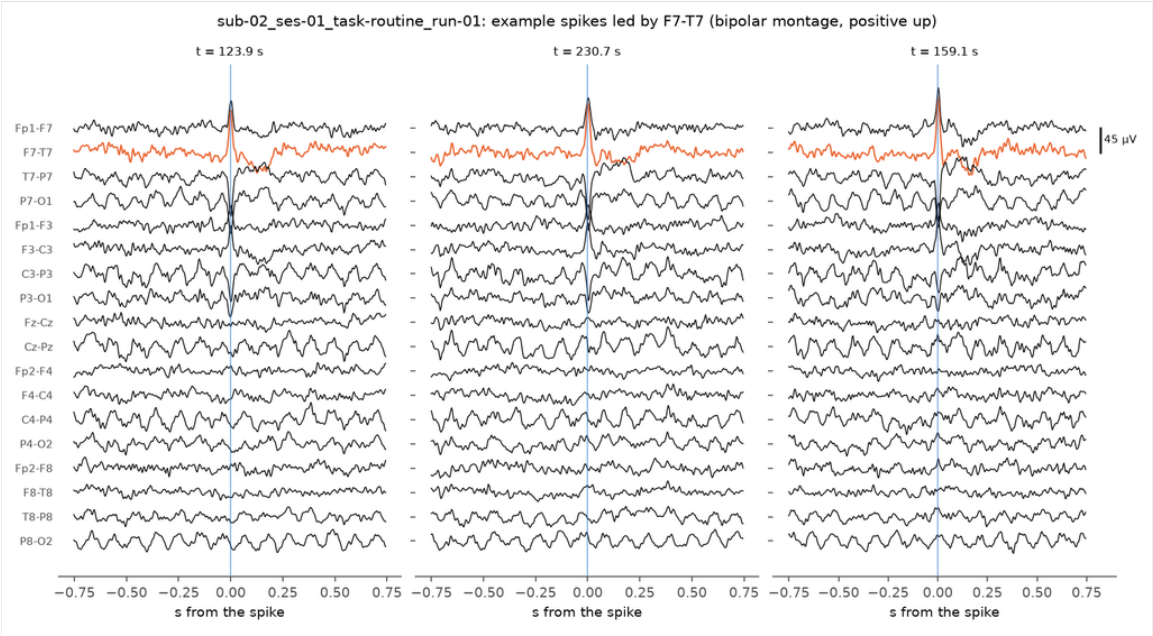


Figure 3. Example interictal spikes detected by the eeg-spikes app (version 0.1.0, janca detector) in recording sub-02_ses-01_task-routine_run-01. Each panel shows bipolar-montage EEG traces centred on a spike led by channel F7-T7.

AI-WRITTEN

spikes · eeg-spikes/figures/sub-02_ses-01_task-routine_run-01_example_spikes.png R9

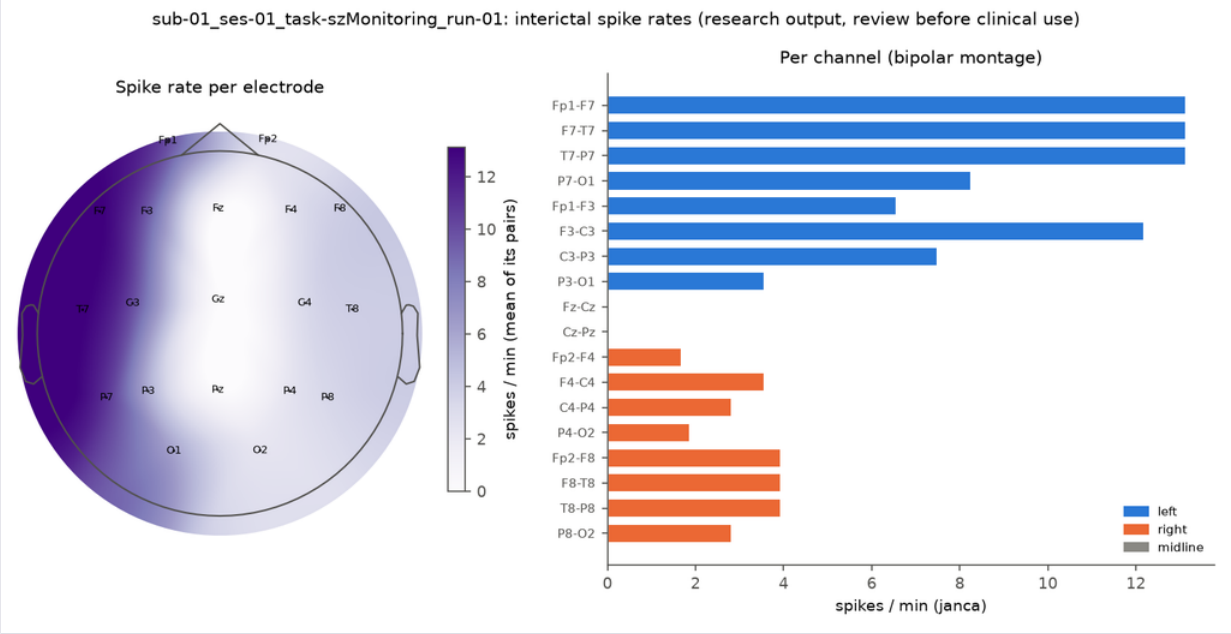


Figure 4. Interictal spike rates for recording sub-01_ses-01_task-szMonitoring_run-01 from the eeg-spikes app, shown as a scalp map per electrode and as a per-channel bar chart in the bipolar montage. Bars are coloured by left, right or midline channel.

AI-WRITTEN

spikes · eeg-spikes/figures/sub-01_ses-01_task-szMonitoring_run-01_spike_rates.png R10

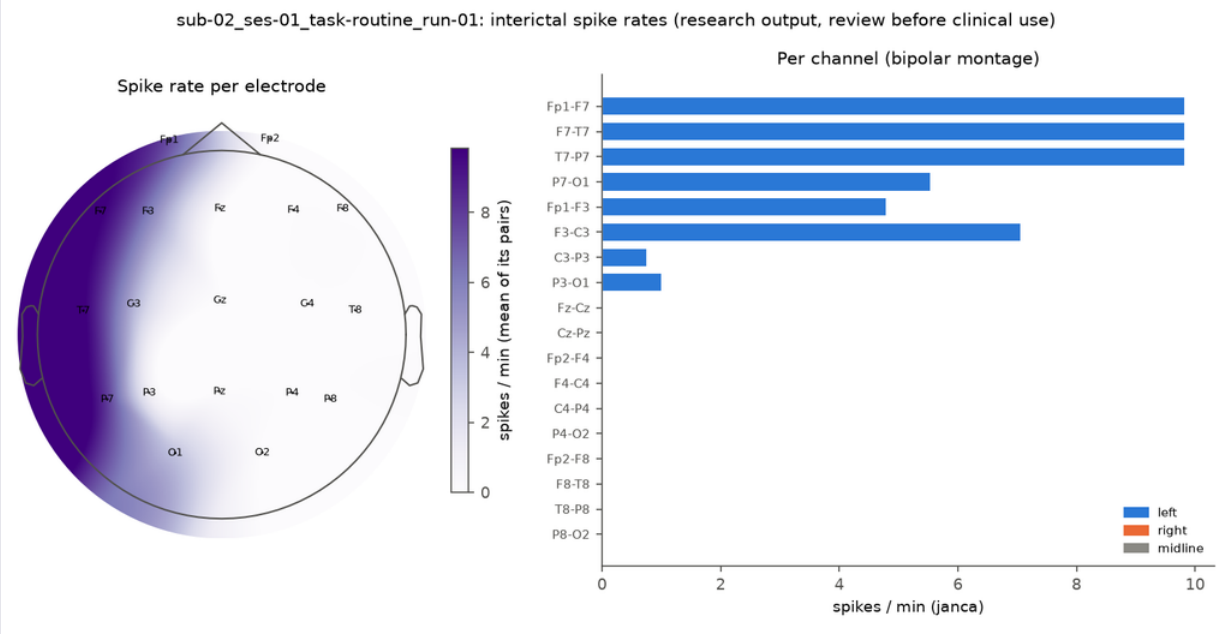


Figure 5. Interictal spike rates for recording sub-02_ses-01_task-routine_run-01 from the eeg-spikes app, shown as a scalp map per electrode and as a per-channel bar chart in the bipolar montage. Bars are coloured by left, right or midline channel. AI-WRITTEN

spikes · eeg-spikes/figures/sub-02_ses-01_task-routine_run-01_spike_rates.png R11

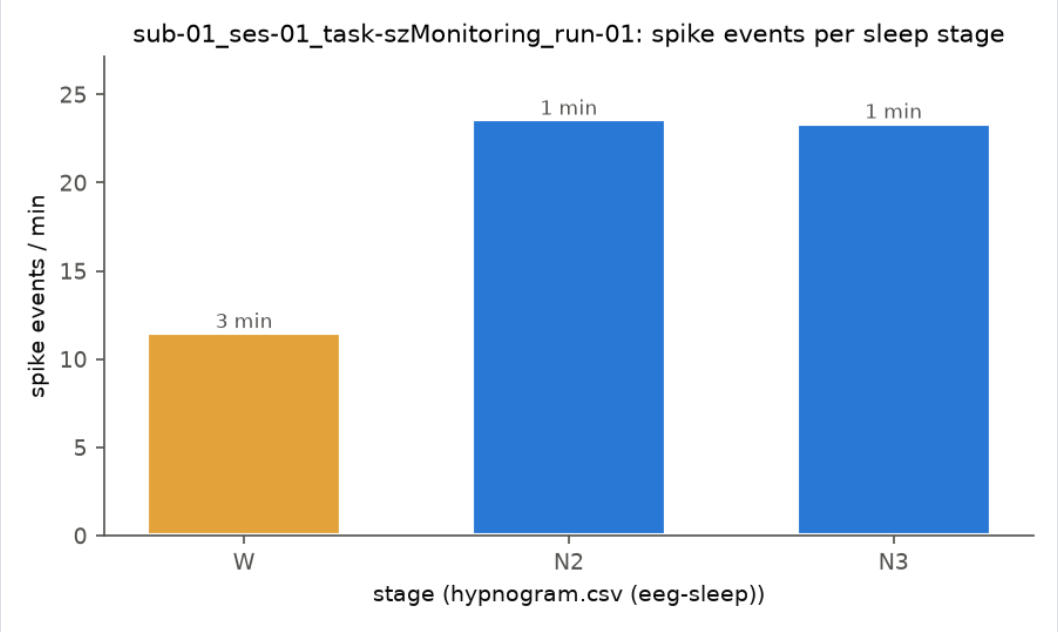


Figure 6. Spike events per minute in each sleep stage for recording sub-01_ses-01_task-szMonitoring_run-01, from the eeg-spikes app. Stages are taken from hypnogram.csv produced by eeg-sleep. AI-WRITTEN

spikes · eeg-spikes/figures/sub-01_ses-01_task-szMonitoring_run-01_spikes_by_stage.png R12

5 · Results

What the app wrote, by output port, as delivered in `EEG-Spikes-v0.1.0-sample.zip`.

spikes eeg-spikes/: spikes.csv, spike_rates.csv, spike_events.csv, lateralisation.csv, rates_by_stage.csv (when stages are known), features.csv (spikerate_<detector>), figures/*.png (spike-rate topomap, spikes per sleep stage, example spikes, laterality index), summary.json and provenance.json.

The spikes output holds CSV tables of detected spikes, spike events, per-channel spike rates, features, rates by sleep stage and per-recording lateralisation (left, right and midline counts, laterality index, dominant region and dominant channel), produced with the janca detector on the bipolar montage with seizure exclusion and a 60 s seizure margin. It also contains summary and provenance JSON files and PNG figures of example spikes, spike-rate scalp maps and bar charts, the laterality index and spikes by sleep stage, for recordings sub-01_ses-01_task-szMonitoring_run-01 and sub-02_ses-01_task-routine_run-01. AI-WRITTEN

Files

Total	14 files · 1.4 MB
.png	6 · 1.3 MB
.csv	6 · 77.1 KB
.json	2 · 9.6 KB

Recorded by the app R1

App	eeg-spikes 0.1.0
Ran	2026-11-13 18:45 UTC
Peak memory	299.6 MB
Tools	python 3.12.16 · epycom 0.3 · mne 1.12.1 · numpy 1.26.4 · scipy 1.17.1 · joblib 1.6.0 · numba 0.68.1 · matplotlib 3.11.2

eeg-spikes/summary.json R2

app	eeg-spikes
version	0.1.0
notice	Spikes are detected with detectors developed and validated on intracranial EEG (Janca et al. 2015; Barkmeier et al. 2012), run here on scalp EEG. Rates and lateralisation are research outputs to be r...

eeg-spikes/lateralisation.csv R3

2 of 2 rows, 8 of 14 columns.

recording_id	n_left	n_right	n_midline	laterality_index	dominant_region	n_events	minutes
sub-01_ses-01_task-szMonitoring_run-01	70	21	0	0.5385	left temporal	91	5.333
sub-02_ses-01_task-routine_run-01	39	0	0	1.0000	left temporal	39	3.967

eeg-spikes/spike_rates.csv R4

10 of 36 rows.

recording_id	channel	n_spikes	minutes	rate_per_min	detector
sub-01_ses-01_task-szMonitoring_run-01	Fp1-F7	70	5.333	13.1250	janca
sub-01_ses-01_task-szMonitoring_run-01	F7-T7	70	5.333	13.1250	janca
sub-01_ses-01_task-szMonitoring_run-01	T7-P7	70	5.333	13.1250	janca
sub-01_ses-01_task-szMonitoring_run-01	P7-O1	44	5.333	8.2500	janca
sub-01_ses-01_task-szMonitoring_run-01	Fp1-F3	35	5.333	6.5625	janca
sub-01_ses-01_task-szMonitoring_run-01	F3-C3	65	5.333	12.1875	janca
sub-01_ses-01_task-szMonitoring_run-01	C3-P3	40	5.333	7.5000	janca
sub-01_ses-01_task-szMonitoring_run-01	P3-O1	19	5.333	3.5625	janca
sub-01_ses-01_task-szMonitoring_run-01	Fz-Cz	0	5.333	0.0000	janca
sub-01_ses-01_task-szMonitoring_run-01	Cz-Pz	0	5.333	0.0000	janca

eeg-spikes/features.csv R5

10 of 36 rows.

recording_id	channel	feature	value
sub-01_ses-01_task-szMonitoring_run-01	Fp1-F7	spikerate_janca	13.1250
sub-01_ses-01_task-szMonitoring_run-01	F7-T7	spikerate_janca	13.1250
sub-01_ses-01_task-szMonitoring_run-01	T7-P7	spikerate_janca	13.1250
sub-01_ses-01_task-szMonitoring_run-01	P7-O1	spikerate_janca	8.2500
sub-01_ses-01_task-szMonitoring_run-01	Fp1-F3	spikerate_janca	6.5625
sub-01_ses-01_task-szMonitoring_run-01	F3-C3	spikerate_janca	12.1875
sub-01_ses-01_task-szMonitoring_run-01	C3-P3	spikerate_janca	7.5000
sub-01_ses-01_task-szMonitoring_run-01	P3-O1	spikerate_janca	3.5625
sub-01_ses-01_task-szMonitoring_run-01	Fz-Cz	spikerate_janca	0.0000
sub-01_ses-01_task-szMonitoring_run-01	Cz-Pz	spikerate_janca	0.0000

1 more table(s) were read but are not shown: eeg-spikes/rates_by_stage.csv R6.

6 · Run it yourself

On Pennsieve

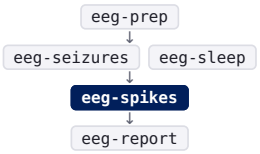
1. Open **EEG Spikes** in the Pennsieve App Store and choose **Try this app**, or add it as a step in a workflow.
2. Give it **eeg** (application/edf, text/csv, text/tab-separated-values), **sleep** (text/csv, application/json) from one of your datasets. The sample's generated inputs are small synthetic files the app's repository can regenerate (`tests/` in the repository).
3. Pick a compute node and start the run.
4. Collect the results from the run's page: as a download, or into a dataset folder when the app is a workflow step.

Suggested workflows

Public workflows on Pennsieve that run EEG Spikes as a step; open one and run it on your data.

Scalp EEG Seizure Detection & Monitoring

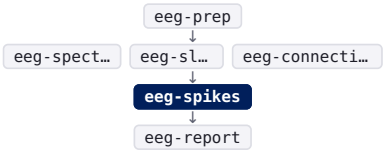
Scalp EEG: seizure candidates in SzCORE format, scored; spikes by sleep stage;



5 steps · **Open on Pennsieve ↗**

Scalp EEG Interictal Biomarkers

Scalp EEG: spectral biomarkers, PDR, spikes by sleep stage, sleep, connectivity,



6 steps · **Open on Pennsieve ↗**

Locally, as a container

Every Pennsieve app is a container that reads `INPUT_DIR`, writes `OUTPUT_DIR` and takes its parameters from the environment, so it runs anywhere Docker does. Build it from the release's source and run it on a folder laid out as in section 3 (one subfolder per input port):

```
git clone https://github.com/pennsieve-apps/eeg-spikes eeg-spikes
cd eeg-spikes && git checkout v0.1.0
docker build -t eeg-spikes:v0.1.0 .

mkdir -p input output        # your inputs under ./input
docker run --rm \
  -v "$PWD/input:/input:ro" -v "$PWD/output:/output" \
  -e INPUT_DIR=/input -e OUTPUT_DIR=/output \
  eeg-spikes:v0.1.0
```

The app declares 3 GB of memory; give Docker at least that. The results land in `./output`, the same files as section 5.

7 · How to cite

Results made with this app rest on three things. Please cite all three.

1. **THE METHOD**
   The app's citation file names no single work it implements; cite the works it builds on, below.
2. **THIS RELEASE**
   Pennsieve (University of Pennsylvania) (2026). EEG Spikes (version v0.1.0). Pennsieve Discover. `doi:10.26275/ldnj-jzo4`
3. **PENNSIEVE**
   Name the platform as a resource, with its Research Resource Identifier `RRID:SCR_021677`.

> **FOR YOUR METHODS SECTION**
> Analyses were run with EEG Spikes v0.1.0 (doi:10.26275/ldnj-jzo4) on Pennsieve (RRID:SCR_021677).

Also builds on

1. Radek Janca, Petr Jezdik, Roman Cmejla, Martin Tomasek, Gregory A. Worrell, Matt Stead, et al. (2015). Detection of Interictal Epileptiform Discharges Using Signal Envelope Distribution Modelling: Application to Epileptic and Non-Epileptic Intracranial Recordings. Brain Topography. `doi:10.1007/s10548-014-0379-1`
2. Daniel T. Barkmeier, Aashit K. Shah, Danny Flanagan, Marie D. Atkinson, Rajeev Agarwal, Darren R. Fuerst, et al. (2012). High inter-reviewer variability of spike detection on intracranial EEG addressed by an automated multi-channel algorithm. Clinical Neurophysiology. `doi:10.1016/j.clinph.2011.09.023`
3. Alexandre Gramfort, Martin Luessi, Eric Larson, Denis A. Engemann, Daniel Strohmeier, Christian Brodbeck, et al. (2013). MEG and EEG data analysis with MNE-Python. Frontiers in Neuroscience. `doi:10.3389/fnins.2013.00267`
4. Beth A. Malow, Xihong Lin, Ramesh Kushwaha, Michael S. Aldrich (1998). Interictal Spiking Increases with Sleep Depth in Temporal Lobe Epilepsy. Epilepsia. `doi:10.1111/j.1528-1157.1998.tb01329.x`
5. Erin C. Conrad, Andrew Y. Revell, Adam S. Greenblatt, Ryan S. Gallagher, Akash R. Pattnaik, Nicole Hartmann, et al. (2023). Spike patterns surrounding sleep and seizures localize the seizure-onset zone in focal epilepsy. Epilepsia. `doi:10.1111/epi.17482`
6. Nan Lin, Mengxuan Zheng, Lian Li, Peng Hu, Weifang Gao, Heyang Sun, et al. (2025). An EEG dataset for interictal epileptiform discharge with spatial distribution information. Scientific Data. `doi:10.1038/s41597-025-04572-1`
7. Nan Lin, Mengxuan zheng, Lian Li, Peng Hu, Weifang Gao, Heyang Sun, et al. (2025). An EEG dataset for interictal epileptiform discharge with spatial distribution information. `doi:10.6084/m9.figshare.28069568.v2`
8. Paolo Detti (2020). Siena Scalp EEG Database. `doi:10.13026/5d4a-j060`
9. Paolo Detti, Giampaolo Vatti, Garazi Zabalo Manrique de Lara (2020). EEG Synchronization Analysis for Seizure Prediction: A Study on Data of Noninvasive Recordings. Processes. `doi:10.3390/pr8070846`
10. Jonathan Dan, Paolo Detti (2024). BIDS Siena Scalp EEG Database. `doi:10.5281/zenodo.10640762`
11. Ali Shoeb (2010). CHB-MIT Scalp EEG Database. `doi:10.13026/c2k01r`
12. Ary L. Goldberger, Luis A. N. Amaral, Leon Glass, Jeffrey M. Hausdorff, Plamen Ch. Ivanov, Roger G. Mark, et al. (2000). PhysioBank, PhysioToolkit, and PhysioNet. Circulation. `doi:10.1161/01.cir.101.23.e215`

13. Ali Hossam Shoeb (2009). Application of machine learning to epileptic seizure onset detection and treatment. https://dspace.mit.edu/handle/1721.1/54669
14. Dorottya Cserpan, Ece Boran, Richard Rosch, San Pietro Lo Biundo, Georgia Ramantani, Johannes Sarnthein (2021). Dataset of EEG recordings of pediatric patients with epilepsy based on the 10-20 system. doi:10.18112/openneuro.ds003555.v1.0.1
15. Dorottya Cserpan, Ece Boran, Santo Pietro Lo Biundo, Richard Rosch, Johannes Sarnthein, Georgia Ramantani (2021). Scalp high-frequency oscillation rates are higher in younger children. Brain Communications. doi:10.1093/braincomms/fcab052
16. International Clinical Research Center, St. Anne's University Hospital Brno (FNUSA-ICRC), Biomedical Engineering. epycom: ElectroPhYsiology COmputational Module. https://pypi.org/project/epycom/0.3/
17. MNE-Python contributors. MNE-Python. https://mne.tools

From the app's citation file (CITATION.cff) and the release's record on Pennsieve Discover.

8 · Files in this document

Every figure, table and value above is copied from one of these files in `EEG-Spikes-v0.1.0-sample.zip`, the sample run's download.

Ref	File	Size
R1	`eeg-spikes/provenance.json`	3.5 KB
R2	`eeg-spikes/summary.json`	6.1 KB
R3	`eeg-spikes/lateralisation.csv`	411 B
R4	`eeg-spikes/spike_rates.csv`	2.3 KB
R5	`eeg-spikes/features.csv`	2.3 KB
R6	`eeg-spikes/rates_by_stage.csv`	3.4 KB
R7	`eeg-spikes/figures/sub-01_ses-01_task-szMonitoring_run-01_example_spikes.png`	508.9 KB
R8	`eeg-spikes/figures/laterality_index.png`	33.6 KB
R9	`eeg-spikes/figures/sub-02_ses-01_task-routine_run-01_example_spikes.png`	499.5 KB
R10	`eeg-spikes/figures/sub-01_ses-01_task-szMonitoring_run-01_spike_rates.png`	153.5 KB
R11	`eeg-spikes/figures/sub-02_ses-01_task-routine_run-01_spike_rates.png`	141.8 KB
R12	`eeg-spikes/figures/sub-01_ses-01_task-szMonitoring_run-01_spikes_by_stage.png`	27.5 KB

About this document

- Generated 2026-11-13 18:46 UTC by Pennsieve's curation-service for EEG Spikes v0.1.0, sample run pipeline: 917ddb79-8f97-4e8e-a84f-df7f77d873d3:06a2ac3d261f, app commit 126793e0e188.
- Material: the files the app wrote in the sample run (6 read, up to 256.0 KB each, headers only for large data files), the fixtures step's record of the test inputs, the app's app.yml and CITATION.cff, and the run's record.
- Model: us.anthropic.claude-opus-5-5. It wrote the captions and prose marked **AI-WRITTEN**; sentences with a number not found in the material were removed.
- A release report is generated for each release of the app; this one describes v0.1.0. It is a derived document, not part of the app's published release.