A Neonatal EEG Dataset Graded for Severity of Background Abnormalities

The dataset consists of 169 multichannel EEG files of 1-hour in duration, recorded from 53 full-term newborns in the neonatal intensive care unit of the Cork University Maternity Hospital, Ireland. All 53 infants had received a diagnosis of hypoxic-ischaemic encephalopathy. The study to record the EEG was approved by the Cork Research Ethics Committee of the Cork Teaching Hospitals. Neonates were enrolled in the study after obtaining written and informed consent from a guardian or parent. The Cork Research Ethics Committee approved the publication of this fully-anonymised data set.

Each 1-hour EEG was graded for severity of background abnormalities. Two experts in neonatal EEG graded each epoch independently. When grades differed between the experts, they jointly reviewed the EEG and agreed on a consensus grade. The grading system, detailed in reference 1, assesses EEG attributes such as amplitude and frequency, continuity, sleep–wake cycling, symmetry and synchrony, and abnormal waveforms. Four grades were used: normal or mildly abnormal (grade 1), moderately abnormal (grade 2), severely abnormal (grade 3), and inactive (grade 4).

The EEG data could be used to develop automated grading algorithms (e.g. see reference 2) or to assist in training for the review of background neonatal EEG. Further details on the dataset can be found at reference 3.

EEG file formats

The EEG data is provided in 2 formats: European data format (EDF) files and as compressed comma separated value (CSV) files. Each 1-hour epoch is stored as a separate file, using the file name convention `IDXX_epochY` . For example, file `ID10_epoch2` is the 2nd epoch for baby 10. All IDs are anonymised. The EDF files are stored in the `EDF_format/` folder and the CSV files are stored in the `CSV_format/` folder. The grade associated with each file is stored in the CSV `eeg_grades.csv` file. Information on each EEG epoch is contained in the `metadata.csv` file, which includes a description of the signal quality of the EEG, whether seizures are present or not, sampling frequency, and reference electrode used in the recording (EEG is recorded as a referential montage).

EDF format is a standard open format that most EEG viewers can read, for example the EDFbrowser viewer can display EDF files.

The CSV files are compressed using the XZ compression format.

Importing the data in programming environments

The CSV files are the easiest format to import the EEG data. The following provides examples for file `filename.csv.xz` in Python, R, Matlab, and Julia

In Python and R, the compressed file can be read in directly. For example, in Python as

```
import pandas as pd

eeg_df = pd.read_csv("filename.csv.xz")
```

and in `R` as

```
eeg_df <- read.csv('filename.csv.xz')
```

In Matlab and Julia, the file must be uncompressed first. Then the CSV file is imported. For example, in Matlab:

```
eeg_tb = readtable("filename.csv");
```

where `filename.csv` is the uncompressed version of `filename.csv.xz` . In Julia,

```
using CSV
using DataFrames
```

```
eeg_df = CSV.read("filename.csv", DataFrame)
```

References

1. DM Murray, GB Boylan, CA Ryan & S Connolly (2009) 'Early EEG findings in hypoxic-ischemic encephalopathy predict outcomes at 2 years.', Pediatrics 124, e459–67 DOI:10.1542/peds.2008-2190
2. SA Raurale, GB Boylan, SR Mathieson, WP Marnane & JM O'Toole (2021) 'Grading hypoxic-ischemic encephalopathy in neonatal EEG with convolutional neural networks and quadratic time–frequency distributions', Journal of Neural Engineering 18, 046007 DOI:10.1088/1741-2552/abe8ae
3. JM O'Toole, SR Mathieson, SA Raurale, F Magarelli, WP Marnane, G Lightbody, GB Boylan (2022). Neonatal EEG graded for severity of background abnormalities in hypoxic-ischaemic encephalopathy. arXiv preprint arXiv:2206.04420

Contact

John M O'Toole, Sean R Mathieson, Fabio Magarelli, William P Marnane, Gordon Lightbody, Geraldine B Boylan

INFANT Research Centre at University College Cork,
Paediatric Academic Unit,
Cork University Hospital,
Wilton,
Cork,
Ireland

Tel: +353 (0)21 4205082
Email: infant @ ucc .ie
