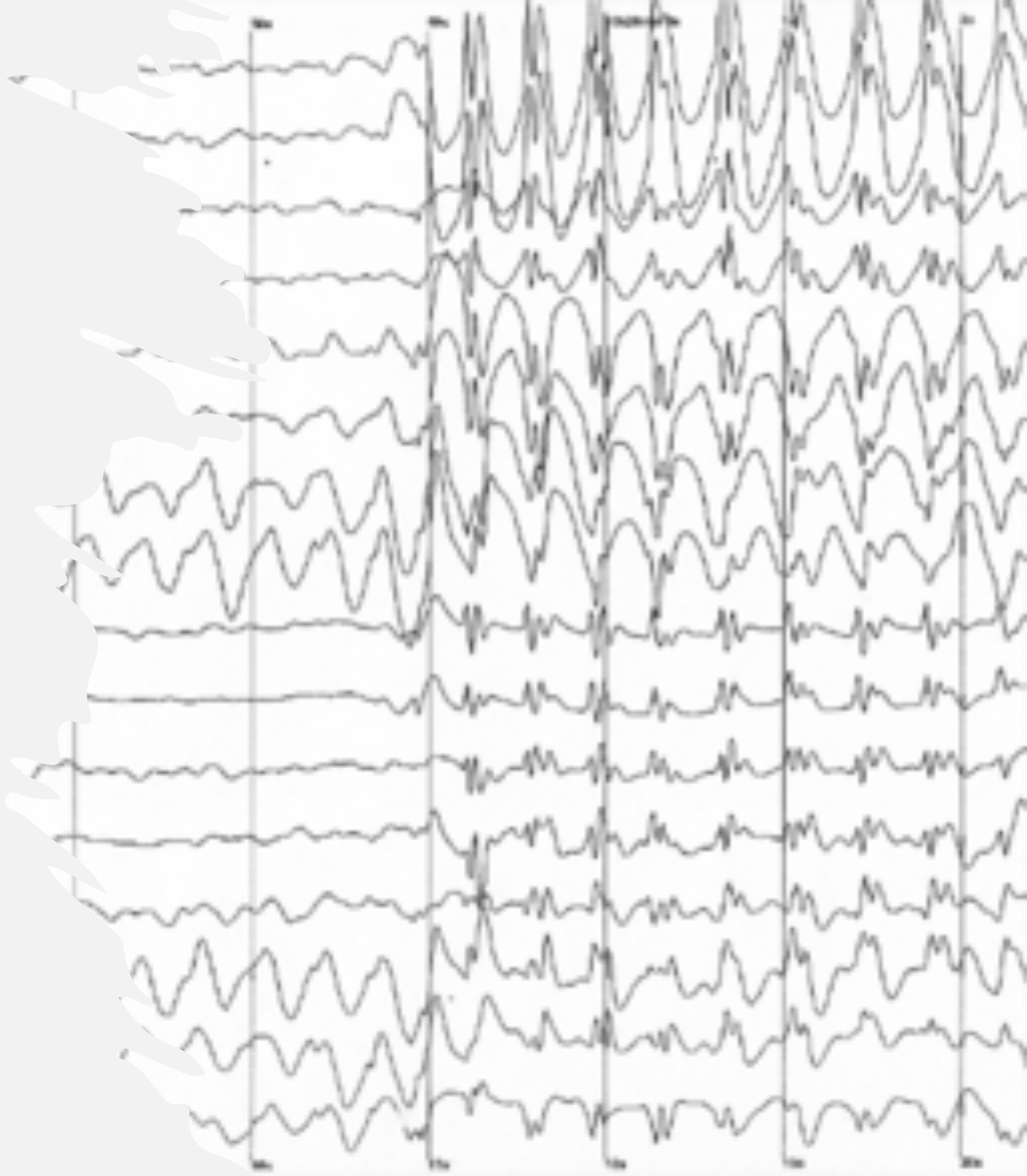
Lightning Talk

My Bachelor Thesis in 3 minutes

Sleep Stage Scoring

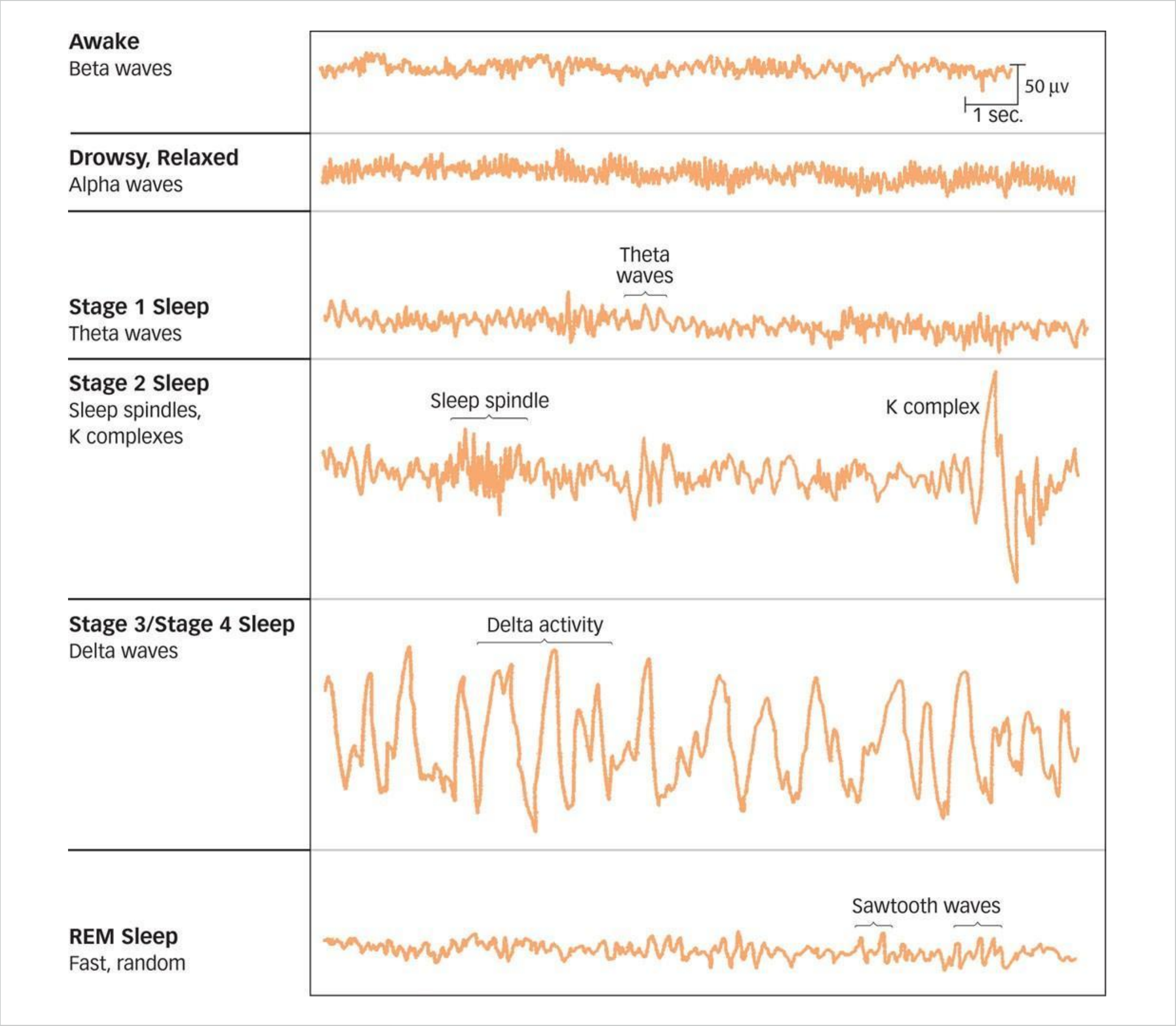


Maëlys Solal, BX2021

Supervised by Alexandre Gramfort and Dr Olivier Pallanca

Sleep

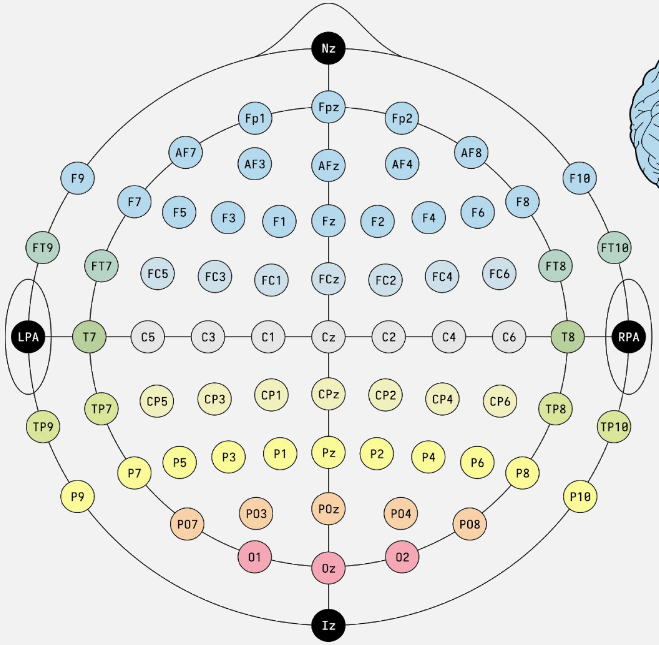
- **Sleep stages and sleep cycle**
  - Wake (W)
  - Rapid Eye Movement (REM)
  - Non REM1 (N1)
  - Non REM2 (N2)
  - Non REM3 (N3)
- **Polysomnography**
  - Includes EEG (brain's electrical activity), EOG (eyes), EMG (muscles), ECG (heart)
  - Used for clinical diagnosis (insomnia, sleep apnea etc.)
- **Sleep stage scoring**
  - According to a precise set of rules
  - Done by hand by sleep scorers
  - Quite tedious process

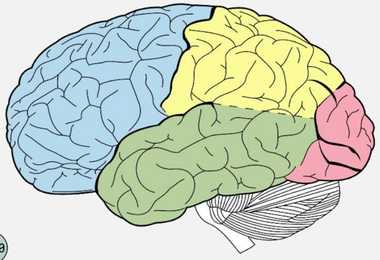


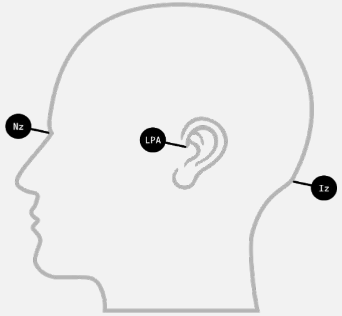
Motivations and main objectives

Data

- MASS (Montreal Archive of Sleep Study)
- SleepPhysionet
- Clinical dataset from Dr Olivier Pallanca







Model

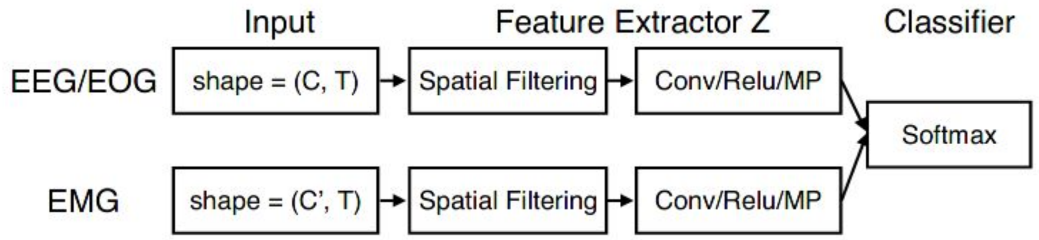


Fig. 1. Network general architecture: the network processes C EEG/EOG channels and C' EMG channels through separate pipelines. For each modality, it performs spatial filtering and applies convolutions, non linear operations and max pooling (MP) over the time axis. The outputs of the different pipelines are finally concatenated to feed a softmax classifier.

<u>Ref.</u> *Chambon, S., Galtier, M., Arnal, P., Wainrib, G. and Gramfort, A. (2018) A Deep Learning Architecture for Temporal Sleep Stage Classification Using Multivariate and Multimodal Time Series. IEEE Trans. on Neural Systems and Rehabilitation Engineering 26: (758-769)*

Results: Balanced Accuracy depending on training and testing dataset

	SleepPhysionet	MASS
SleepPhysionet	0.680	0.545
MASS	0.650	0.734

- EEG channels: FpzCz, PzOz

- Learning rate: 0.0005
- Batch size: 8
- Number of epochs: 10

Converting PSG data to BIDS

- Simple way to organise neuroimaging and behavioral data

mass-bids	08/03/2021 16:44	folder	
SS3	26/02/2021 10:25	folder	
derivatives	08/03/2021 23:15	folder	
sub-030001	10/02/2021 15:01	folder	
eeg	26/02/2021 11:40	folder	
sub-030001_channels.tsv	10/02/2021 16:32	TSV document	1,6 KiB
sub-030001_eeg.edf	10/02/2021 16:32	unknown	396,1 MiB
sub-030001_eeg.json	10/02/2021 16:32	JSON document	513 B
sub-030001_events.tsv	10/02/2021 16:32	TSV document	295,5 KiB
sub-030001_scans.tsv	10/02/2021 16:32	TSV document	71 B
sub-030002	10/02/2021 15:33	folder	

BIDS
BRAIN IMAGING DATA STRUCTURE

- Meticulous work : channels names, types, units, annotations, EEG reference
- Simplifies how we load the data
  - `write_raw_bids`
  - `read_raw_bids`
- Simplifies preprocessing + saving preprocessed data

MNE-BIDS

MNE
MEG + EEG ANALYSIS & VISUALIZATION

Gorgolewski, K.J., Auer, T., Calhoun, V.D., et al. (2016). The brain imaging data structure, a format for organizing and describing outputs of neuroimaging experiments. Scientific Data, 3 (160044). doi:10.1038/sdata.2016.44