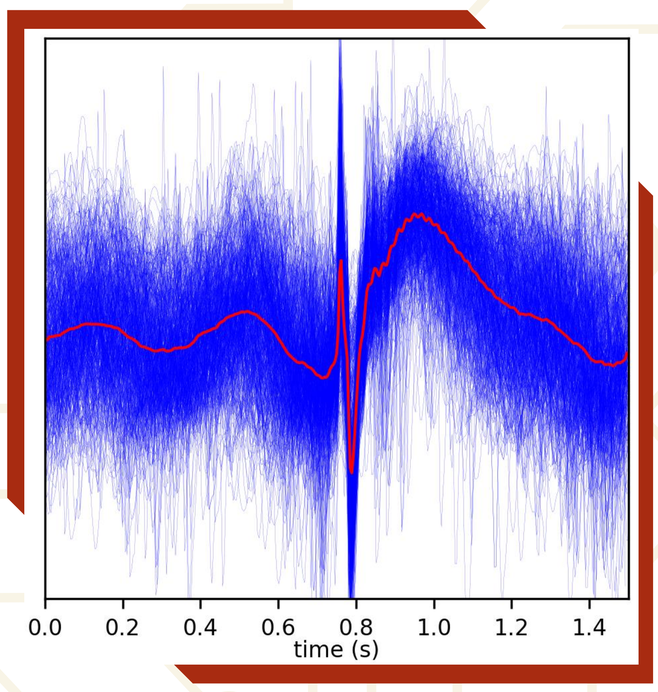
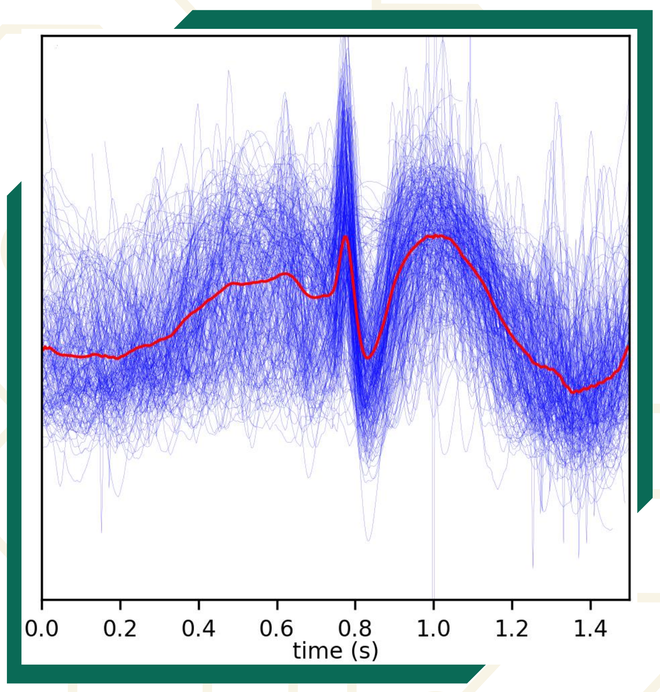
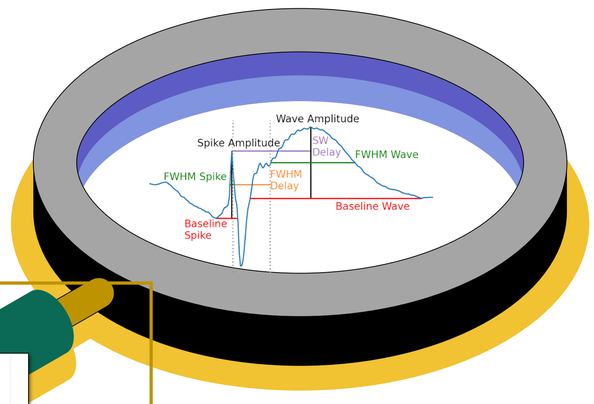
Can **Interictal Epileptiform Discharges** predict the **Epileptogenic Zone**?

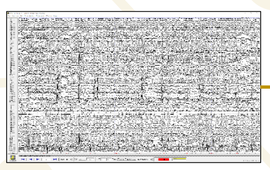
Remo Lazazzera[1*], Elif Köksal-Ersöz[1], Maxime Yochum[1], Isabelle Merlet[1], Julia Scholly[1], Giulio Ruffini[2], Fabrice Bartolomei[3], Pascal Benquet[1] & Fabrice Wendling[1]

[1] Univ Rennes, INSERM, LTSI – UMR 1099, Rennes, France ([*] **remo.lazazzera@gmail.com**)
[2] Neuroelectrics, Barcelona, Spain
[3] Assistance Publique – Hôpitaux de Marseille, Service d'Épileptologie et de Rythmologie Cérébrale, Hôpital La Timone, Marseille, France









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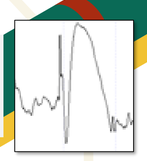


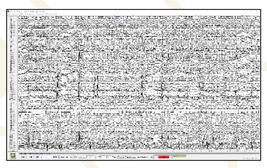
1 Bipolar **sEEG** **Inter-ictal** recordings

SWs Detection
Spike and Wave
(Wavelet + Page-Hinkley)

Selection of **ROIs**:
Electrodes Contacts reduction

2 Bipolar **sEEG** **Ictal** recordings

Subset of Bipolar Channels



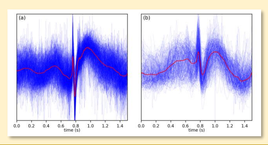
Selection of **EZ** and **NEZ** bipolar channels per patient

EZ and **NEZ** bipolar channel per patient

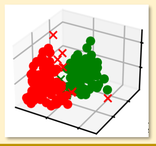
Mean Waveform per bipolar channel

SWs Features Extraction per bipolar channel

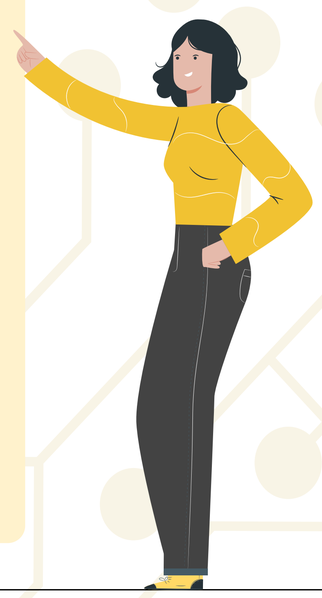
Unsupervised Classification **k-means clustering**



EZ SWs vs. **NEZ SWs** **qualitative** differences



EZ SWs vs. **NEZ SWs** **quantitative** differences



Database: Temporal Lobe Epilepsy

Patient with TLE	P1	P2	P3	P4	P5	Average
Ictal records	2	4	1	4	1	-
Average ictal records duration [min]	25	38	60	22	30	-
Inter-ictal records	5	2	9	6	5	-
Average inter-ictal records duration [min]	52	60	56	53	60	-
SEEG contacts	93	116	95	116	62	-
Detected SWs per bipolar channel over all interictal records	3850	555	7103	3987	4269	3953
Total detected SWs on interictal records	358024	64402	674809	462518	264683	364887

Experts considered two parameters to define the **EZ**:

- the capability of a given region to **generate high-frequency oscillations** (rapid discharges) at seizure onset;
- the **delay of involvement** of the region to the **seizure onset** and the seizure-related signal amplitude.

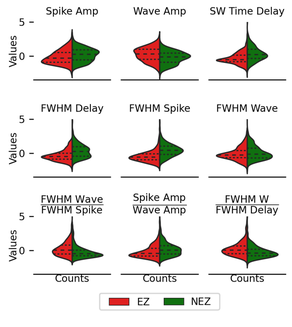
NEZ still presenting SWs, has opposite characteristics respect to the **EZ**.

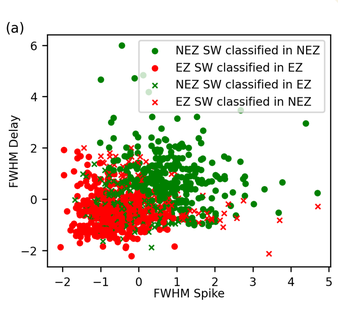
Detected SWs per selected bipolar channel

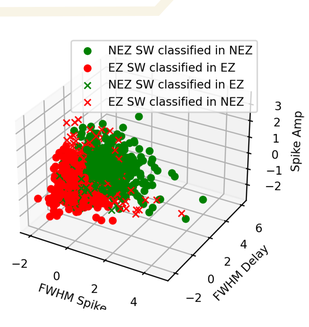
Patient	P1		P2		P3		P4		P5	
Zone	EZ	NEZ	EZ	NEZ	EZ	NEZ	EZ	NEZ	EZ	NEZ
Bipolar Channel	TB1-TB2	TB9-TB10	TP2-TP3	TB5-TB6	A1-A2	TB6-TB7	TP9-TP10	PH3-PH4	B1-B2	A9-A10
SWs	4918	2386	2679	607	7821	11006	9810	3191	11337	10562
SWs Sum	7304		3286		18827		13001		21899	

Merging **All Patients Data**, features were extracted from:

- 500 **SWs** in **EZ**
- 500 **SWs** in **NEZ**



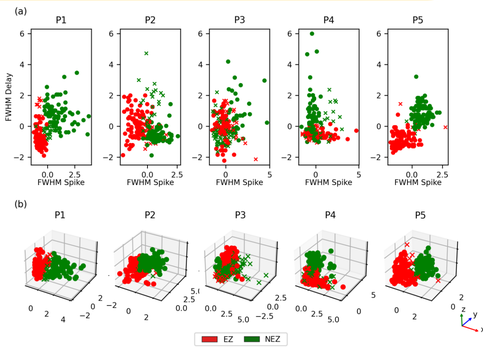


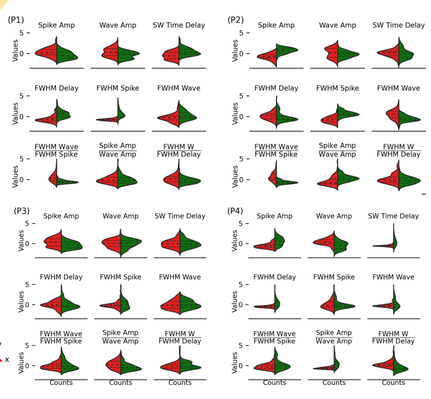


Feature 1	Feature 2	Feature 3	Classification Accuracy [%]
FWHM Delay	FWHM Spike	-	**72.6**
FWHM Delay	FWHM Spike	Spike Amp	**73.2**

Performing **Patient Specific Analysis**, features were extracted per patient, from:

- 100 **SWs** in **EZ**
- 100 **SWs** in **NEZ**





Feature 1	Feature 2	Feature 3	Classification Accuracy [%]					
			P1	P2	P3	P4	P5	Tot
FWHM Delay	FWHM Spike	-	85.5	80	59.5	55.5	96.0	**75.3**
FWHM Delay	FWHM Spike	Spike Amp	86.5	91.5	59.5	79.5	93.5	**82.1**