Pre-CRADA Meeting on Epilepsy Warning

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Topics

- Pre-CRADA analysis and results
- Technical issues to be addressed in CRADA
- CRADA issues, particularly the work plan
- Potential proposal on NIH Human Brain Project

Nonlinear Analysis Gives Substantial Warning

- ORNL evaluated 20 EEG datasets
  - Nine from Knoxville Neurology Clinic
  - Eleven from NBI's colleagues (several sites)
- Nonlinear techniques provide >8 minutes of warning
  - No false positives or negatives in 19 datasets (95%)
  - 1 other with $T_{seizure}$ unknown: warnings present (emu14)
- Warning of ³8 minutes
  - 11% (2/19) provide 5-10 minutes warning
  - 21% (4/19) provide 10-20 minutes warning
  - 26% (5/19) provide 20-40 minutes warning
  - 42% (8/19) provide >40 minutes warning

Warning Methodology Is Robust

- For different data sampling rates (200 and 512 Hz)
- For different EEG machines (digital and analog)
- For different clinical sites (Knoxville and NBI colleagues)
- Without and with substantial noise
- Without and with data quality difficulties

Dataset	Channels	Seizure(s)	Total Time(s)	Channel(s)	Sampling (Hz)
109310	16	2,775	3,115.3	13	512
109314	16	2,480	2,742.4	13	512
119230	16	2,491	2,917.4	13	512
119234	16	2,560	2,649.6	13	512
62723t	16	2,620	3,060.8	13	512
69212	16	2,356	2,547.8	13	512
73305d	16	1,245	1,380	13	512
c8492d	16	966	1,603.6	13	512
wm12sd	16	1,041	1,428.6	13	512
Szpr00	23	5,236	5,401	Fp1 **Fp2**(02) F3 F4	200
Szprec	32	1,930	2,217	P3 **F7**(11)	200
Szpr03	32	1,932	2,217	**T4**(14) T5	200
Szpr04	23	3,794	3,963	T3 **T4**(14) T6	200
Szpr05	23	4,888	6,000.2	**T4**(14) T6 Fp1 Fp2	200
EMU03	27	13,200	16,228	**C3**(5) P3	200
EMU04	27	15,750	18,423	C4(6)	200
EMU14	27		20,000.2	F4(04)	200
EMU02	27	4,320	15,006	F4(04)	200
EMU18	27	4,200	18,000.2	T3(13)	200
EMU26	27	13,987	16,224	Fp1(01)	200

Dataset	D	K	M_1	L_c	L	c_c^2	c^2	Comment
109310	1,134	1,095	0	**1,173**	**1,173**	**1,173**	**1,173**	
109314	1,894	1,835	1,855	**1,953**	**1,953**	**1,953**	**1,953**	
119230	1,953	–9	1,905	**2,061**	2,042	**2,061**	**2,042**	
119234	**2,111**	0	**2,111**	**2,111**	**2,111**	**2,111**	**2,111**	
62723t	1,409	0	1,683	**1,975**	**1,975**	**1,975**	**1,975**	
69212	1,653	1,594	1,008	**2,258**	1,516	**2,258**	1,516	
73305d	776	679	0	**796**	**796**	**796**	**796**	
c8492d	–30	204	341	380	380	**478**	380	
wm12sd	64	416	0	45	**514**	45	45	
szprec	630	0	630	**730**	**730**	**730**	–70	
szpr00	2,136	1,586	2,436	**4,036**	3,786	**4,036**	3,686	
szpr03	–68	–118	482	232	**632**	482	582	
szpr04	2,244	144	3,644	**3,738**	3,688	**3,738**	3,688	
szpr05	3,588	3,538	3,638	**3,738**	3,688	**3,738**	3,688	
emu002	–80	–80	–280	**2,770**	**2,770**	2,520	2,520	
emu003	9,350	0	0	**2,650**	0	0	0	
emu004	0	9,500	2,000	**13,700**	13,500	**13,700**	**13,700**	
emu014	0	–7,000	–4,250	–2,800	–800	–2800	–3300	Need sz time
emu018	–50	–150	–200	**3700**	**3700**	**3700**	**3700**	
emu026	4,837	10,287	4,787	**11,637**	11,287	**11,637**	11,287	check sz time

Technical Issues to be Addressed in the CRADA

- Check the data quality (noise, data scaling, sample rate)
- Understand good choice of channel(s)
- Intelligently choose phase-space parameters
- Accumulate reasonable statistics
- UNDERSTAND what's going on BEYOND blind statistics
- Improve upon nonlinear detection methods and measures
- Create software: interface, black box program, measures
- Test and objectively validate the product