BLAST: Towards Robust Detection of Sleep Spindles Across Clinical Settings: Appendix

Appendix A: Details of the experimental datasets

1) Montreal Archives of Sleep Studies dataset: The second subset (SS2) of *MASS* dataset [1] contains overnight PSG recordings with a sampling frequency of 256 Hz from 19 healthy subjects (1 female and 8 males, age: 23.6±3.7 years). They are recorded by a digital 32-channel machine (Grass Model 12) and stored in European Data Format (EDF). Two independent experts annotate sleep spindles in the C3-CLE channel data. A total of 15 subjects are annotated by two human experts, whereas the remaining four subjects are annotated by only one expert. This study adopts the union of annotations ('OR' criterion) from both experts (15 subjects) as the gold standard for sleep spindles.

2) DREAMS dataset: The *DREAMS* dataset [2] comprises 30-minute PSG recordings with a sampling frequency of 50-200 Hz from 8 subjects (4 males and 4 females, age: 45.88±7.87 years) in various sleep pathologies (e.g., dyssomnia, insomnia, apnea syndrome and Periodic Limb Movements of Sleep (PLMS)). These recordings are collected from a digital 32-channel polygraph (BrainnetTM System of MEDATEC, Brussels, Belgium). Spindles are annotated on channel C3-A1 or CZ-A1 by two experts. One expert scores events for all 8 subjects, whereas the other expert only focuses on the first 6 patients. Notably, one of the experts scores all sleep spindles except two as having exactly a 1-second duration. This study takes the union of annotations from both experts (6 subjects) as the ground truth.

3) BCH-Children dataset: The BCH-Children dataset consists of overnight PSG recordings with a sampling frequency of 256 Hz, collected by Compumedics E Series EEG/PSG Recording System from 10 healthy children (age: 5-10 years) and 20 children with Obstructive Sleep Apnea (OSA) by Beijing Children's Hospital. The dataset contains manual annotations of spindles performed by a trained expert across all recordings. All these annotations are based on 30-second epochs, spanning across the sleep stages of awake, N1, N2, N3 and rapid eye movement (REM).

The detailed statistics for spindle events pertaining to each subject of the three datasets are available at *https://github.com/NeuronVibe/BLAST*.

References

[1] C. O'reilly, N. Gosselin, J. Carrier, and T. Nielsen, "Montreal archive of sleep studies: an open-access resource for instrument benchmarking and exploratory research," *Journal of sleep research*, vol. 23, no. 6, pp. 628–635, 2014.

[2] S. Devuyst, T. Dutoit, and M. Kerkhofs, "The dreams databases and assessment algorithm," *Zenodo: Geneva, Switzerland*, 2005.

TABLE A1: Detailed statistics of spindles in *MASS* & *DREAMS* datasets after preprocessing.

Dataset	Subject	Number of Spindles	Average Duration (s)	Std of Duration	Number of Positive Samples
MASS	0001	7488	1.16	0.50	2007
	0002	6813	1.19	0.48	2397
	0003	1815	0.96	0.39	942
	0005	3603	0.92	0.36	1527
	0006	2529	0.93	0.72	1410
	0007	5112	1.30	0.58	1815
	0009	5157	1.30	0.62	1824
	0010	5934	1.18	0.51	1956
	0011	4689	1.24	0.57	1656
	0012	3798	1.20	0.60	1608
	0013	4536	1.50	0.75	2085
	0014	5001	1.23	0.62	1893
	0017	3696	1.28	0.51	1785
	0018	5370	1.00	0.40	1998
	0019	3216	1.03	0.44	1764
	Total	68757	1.18	0.57	26667
DREAMS	excerpt 1	1635	0.98	0.19	765
	excerpt 2	915	0.92	0.22	501
	excerpt 3	544	0.98	0.16	348
	excerpt 4	762	1.06	0.28	462
	excerpt 5	1242	0.95	0.16	624
	excerpt 6	1383	0.94	0.19	648
	Total	6481	0.97	0.20	3348

TABLE A2: Detailed statistics of spindle events for each subject in BCH-children dataset after preprocessing.

Health States	Subject	Total Number of Spindles	Average Duration (s)	Std of Duration	Number of Positive Samples
Healthy	1	3081	1.25	0.59	1620
	2	2262	1.44	0.55	1155
	3	1116	1.16	0.34	876
	4	1320	1.32	0.49	801
	5	3162	1.58	0.58	1518
	6	2807	1.66	0.70	1320
	7	2412	1.23	0.38	1398
	8	690	1.54	0.60	510
	9	1607	1.19	0.41	927
	10	1644	1.09	0.31	1047
	Total	20089	1.40	0.56	11172
OSA	11	632	1.25	0.43	507
	12	2174	1.66	0.67	1188
	13	1167	1.28	0.58	810
	14	2246	1.32	0.36	1170
	15	594	1.50	0.58	468
	16	1173	1.38	0.51	843
	17	1518	1.42	0.53	1068
	18	1173	1.35	0.50	810
	19	2805	1.32	0.53	1320
	20	669	1.86	0.69	543
	21	3012	1.58	0.60	1623
	22	413	1.35	0.67	345
	23	456	1.33	0.52	372
	24	4761	1.86	0.69	2178
	25	573	1.30	0.39	468
	26	345	1.36	0.37	315
	27	1116	1.48	0.54	807
	28	758	1.48	0.56	522
	29	630	1.32	0.43	519
	30	1011	1.33	0.51	699
	Total	27213	1.54	0.62	16575