

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

APPENDIX. 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 presented in Table A1 and Table A2.

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. Devuyt, 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 |