**Supplementary Figure 1:** Distribution of the number of 30s EEG segments of five sleep stages in the SHHS and six levels of MOAA/S scores in the UMCG datasets used for the analysis in this study. Abbreviations: EEG-Electroencephalogram; MOAA/S - Modified Observer's Assessment of Alertness/Sedation Scale; UMCG- University Medical Center Groningen.

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**Supplementary Figure 2:** Examples of 30s awake and deep hypnotic EEG segments from four subjects (dexmedetomidine UMCG dataset) used for testing. First two rows illustrate correctly predicted EEG segments and the last two rows illustrates incorrectly predicted EEG segments. The predicted probability is shown above each EEG panel. Higher values indicate deep hypnotic state and lower values indicate awake state. **Abbreviations**: EEG-Electroencephalogram; A - awake EEG segment (MOAA/S = 5); H - deep hypnotic (MOAA/S =0) EEG segment; MOAA/S - Modified Observer's Assessment of Alertness/Sedation Scale.

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**Supplementary Figure 3:** Confusion matrix to differentiate between awake (MOAA/S = 5) and dexmedetomidine induced deep hypnotic state (MOAA/S = 0) in UMCG dataset (in channel C4/A1) using different sleep stages. **Abbreviations**: WN1- trained on W and N1; WN2 -trained on W and N2; WN3 - trained on W and N3; WR -trained on W and R; MOAA/S - Modified Observer's Assessment of Alertness/Sedation Scale.

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**Supplementary Table 1:** Mean AUC (95% confidence interval) of the deep learning model to predict deep sedation (MOAA/S = 0) using WN3 model for individual patients.

|  |  |
| --- | --- |
| **Patient no.** | **AUC (95% CI)** |
| 1 | 0.93 (0.89 -0.94 ) |
| 2 | 0.87 (0.79 -0.91 ) |
| 3 | 0.86 (0.78 -0.91 ) |
| 4 | 0.90 (0.84 -0.93 ) |
| 5 | 0.90 (0.85 -0.93 ) |
| 6 | 0.89 (0.83 -0.92 ) |
| 7 | 0.89 (0.83 -0.93 ) |
| 8 | 0.89 (0.82 -0.93 ) |
| 9 | 0.88 (0.81 -0.92 ) |
| 10 | 0.87 (0.78 -0.92 ) |
| 11 | 0.87 (0.79 -0.91 ) |
| 12 | 0.90 (0.82 -0.93 ) |
| 13 | 0.92 (0.87 -0.94 ) |
| 14 | 0.84 (0.75 -0.89 ) |
| 15 | 0.89 (0.83 -0.92 ) |
| 16 | 0.86 (0.78 -0.90 ) |
| 17 | 0.89 (0.80 -0.92 ) |
| 18 | 0.89 (0.81 -0.93 ) |
| 19 | 0.90 (0.84 -0.93 ) |
| 20 | 0.93 (0.90 -0.94 ) |
| 21 | 0.88 (0.81 -0.92 ) |
| 22 | 0.85 (0.77 -0.91 ) |
| 23 | 0.89 (0.83 -0.92 ) |
| 24 | 0.89 (0.83 -0.93 ) |
| 25 | 0.88 (0.81 -0.92 ) |
| 26 | 0.87 (0.80 -0.92 ) |
| 27 | 0.87 (0.78 -0.91 ) |
| 28 | 0.89 (0.82 -0.92 ) |
| 29 | 0.89 (0.83 -0.92 ) |
| 30 | 0.91 (0.86 -0.93 ) |

*AUC = area under the receiver operator characteristic curve; MOAA/S - Modified Observer's Assessment of Alertness/Sedation Scale; WN3 = trained on W and N3 sleep state.*

**Supplementary Table 2:** Mean AUC (95% confidence interval ) of the deep learning model to predict different levels of sedation (without balancing the testing data) using different sleep stages in SHHS data. The model trained on WN3 had highest accuracy to predict deep sedation (MOAA/S = 0).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Testing**  **Training** | M54 | M53 | M52 | M51 | M50 |
| WN1 | 0.61  (0.54 -0.67) | 0.63  (0.55 -0.68) | 0.65  (0.57 -0.69) | 0.62  (0.57 -0.68) | 0.61  (0.50 -0.69) |
| WN2 | 0.63  (0.58 -0.67) | 0.65  (0.56 -0.68) | 0.65  (0.58 -0.69) | 0.62  (0.56 -0.67) | 0.66  (0.56 -0.70) |
| **WN3** | **0.72**  **(0.66 -0.77)** | **0.75**  **(0.64 -0.79)** | **0.79**  **(0.67 -0.82)** | **0.82**  **(0.74 -0.87)** | **0.88**  **(0.80 -0.95)** |
| WR | 0.64  (0.62 -0.68) | 0.66  (0.64 -0.70) | 0.69  (0.60 -0.72) | 0.62  (0.55 -0.69) | 0.65  (0.58 -0.70) |

*AUC = area under the receiver operator characteristic curve; MOAA/S - Modified Observer's Assessment of Alertness/Sedation Scale; LSTM – long short-term memory; CNN = convolutional neural networks; WN1 = model trained on wake (W) and N1 sleep state; WN2 = trained on W and N2 sleep state; WN3 = trained on W and N3 sleep state; WR = trained on W and rapid eye movement (R) sleep state; M54 = model tested to discriminate between MOAA/S = 5 and 4; M53 = model tested to discriminate between MOAA/S = 5 and 3; M52 = model tested to discriminate between MOAA/S = 5 and 2; M51 = model tested to discriminate between MOAA/S = 5 and 1; M50 = model tested to discriminate between MOAA/S = 5 and 0.*