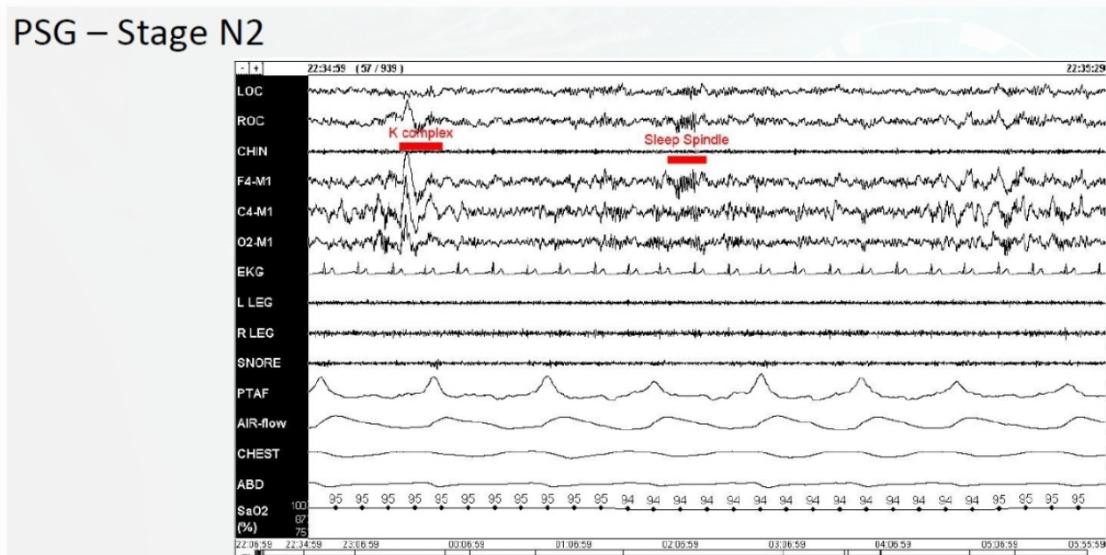


Bid signal

Sleep state score • รูดกันปั๊ะสิทธิ์ กາທການອະນຸມອງດຸ

- ອະນຸມອງດຸ ເປັນ EEG, EOG, ECG, EMG
- ຜົນຂອງ class ຍ່ອຳນວຍ
 1. N1 ~ Sleep onset
 2. N2 - light sleep
 3. N3 ~ Deep sleep
 4. REM - Dream
 5. Awake

PSG – Stage N2



Formula :

- Total Sleep Time (TST) = total minutes of sleep (i.e., N1+N2+N3+REM)
- Time in Bed (TIB) = total recording time (i.e., Lights out to lights on)
- Sleep Efficiency (%) = $(TST/TIB) \times 100\%$

Dataset : SleepEDF dataset

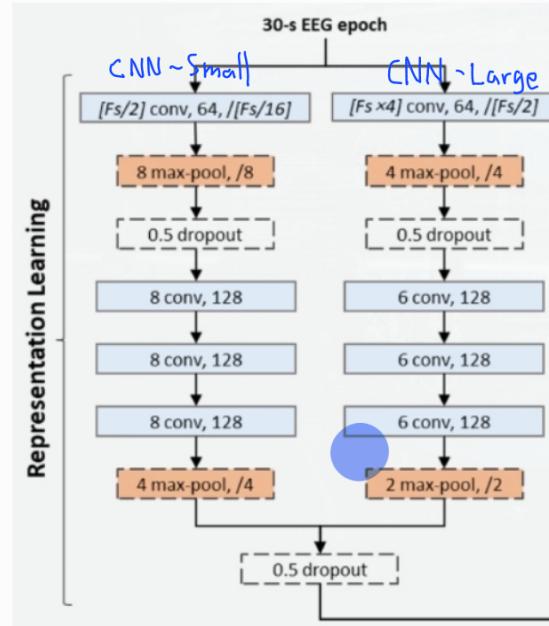
Model

• Deep Sleep Net

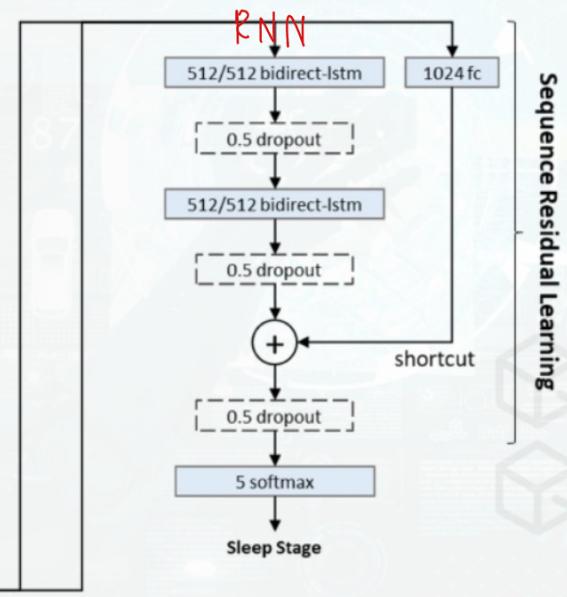
RNN: Recurrent Neural Net

mostly used in a classifier layer for classifier a sequence data such as video, graph, wave, etc.

Representation Learning



Sequence Residual Learning



• Loss function formula

- Cross-entropy loss
- Adam optimizer
- f_{θ} is the DeepSleepNet
- $x^{(i)}$ is a 30-s EEG epoch
- $y^{(i)}$ is a sleep stage label

$$\theta^* = \arg \min_{\theta} J(\theta) = \arg \min_{\theta} \frac{1}{m} \sum_{i=1}^m L(f_{\theta}(x^{(i)}), y^{(i)})$$

Tiny SleepNet

- Representation Learning

- CNN မျှော်လွှာ

- Parameter မျှော်

- ဆုတေသန time-invariant raw data feature

- Sequence Learning

- Using uni-directional RNNs.

- ဆုတေသနအားဖြူစီးပွားရန် DeepSleepNet

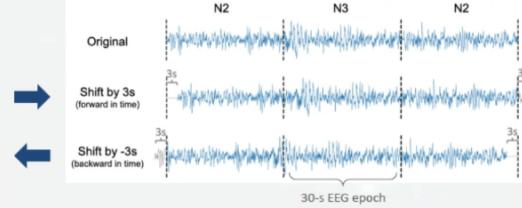
- Using Weighted Cross-entropy loss (Prioritize on minority (N1))

- Data Augmentation

1.

Signal Augmentation

- Randomly shift signals forward or backward in time



2.

Sequence Augmentation

- A few EEG epochs at the beginning of each sleep sequence are skipped by a random amount



Model Evaluation

- Experimental Setup
 - k -fold cross-validation (non-overlapping patient split)
- Performance Metrics
 - Overall: accuracy (ACC), macro-averaged F1-Score (MF1), Cohen's Kappa (κ)
 - Per-class: precision (PR), recall (RE), F1-Score (F1)
- Visualization
 - Hypnogram

