

Sleep Stages Predicted From Heart Rate and Movement Data

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Motivation

- ❖ Health and Wellbeing
- ❖ Memory Consolidation
- ❖ Blood flow increases to muscles
- ❖ Sleep trackers

The 4 Stages of Sleep



NREM Stage 1

- transition period between wakefulness and sleep
- lasts around 5 to 10 minutes



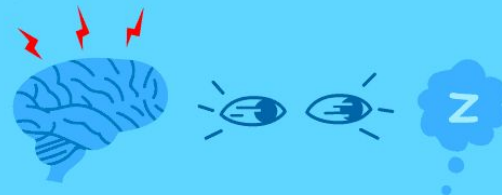
NREM Stage 3

- muscles relax
- blood pressure and breathing rate drop
- deepest sleep occurs



NREM Stage 2

- body temperature drops and heart rate begins to slow
- brain begins to produce sleep spindles
- lasts approximately 20 minutes



REM Sleep

- brain becomes more active
- body becomes relaxed and immobilized
- dreams occur
- eyes move rapidly

DATA SET

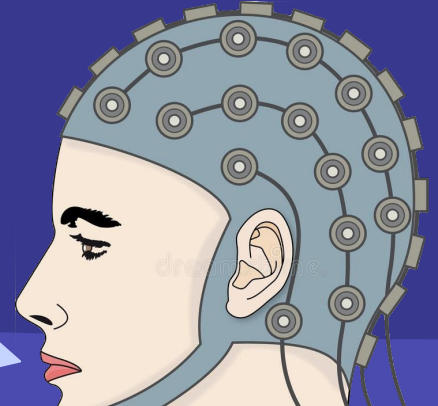
187 Columns

1 Million Rows

Heart Rate	Accelerometer	Gyroscope	FFT Heart Rate	FFT Accelerometer	FFT Gyroscope
Bpm	X,Y,Z m/s ²	X,Y,Z deg/s	60 columns	60 Columns	60 Columns

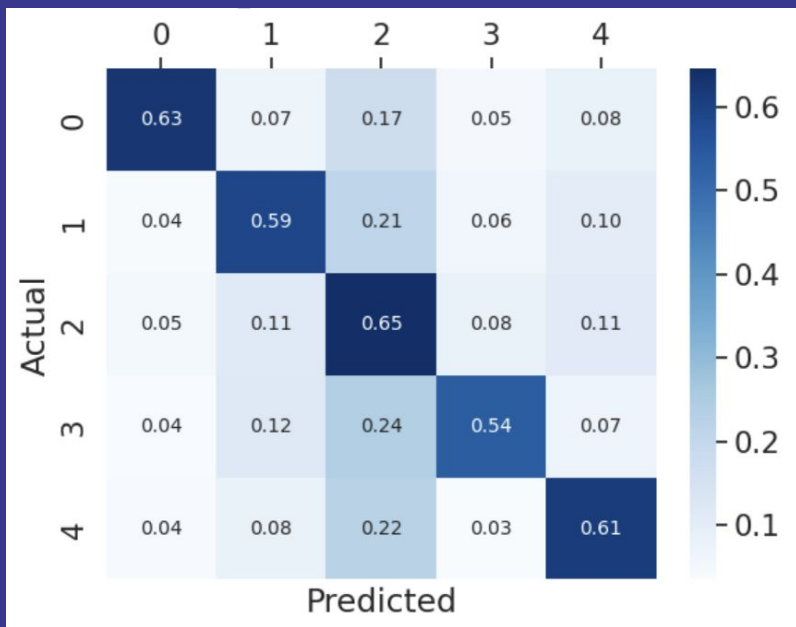


Electroencephalogram measures the electrical activity of the brain when awake and asleep. Gives the ground truth data.



MODEL

Confusion Matrix after 50 Epochs

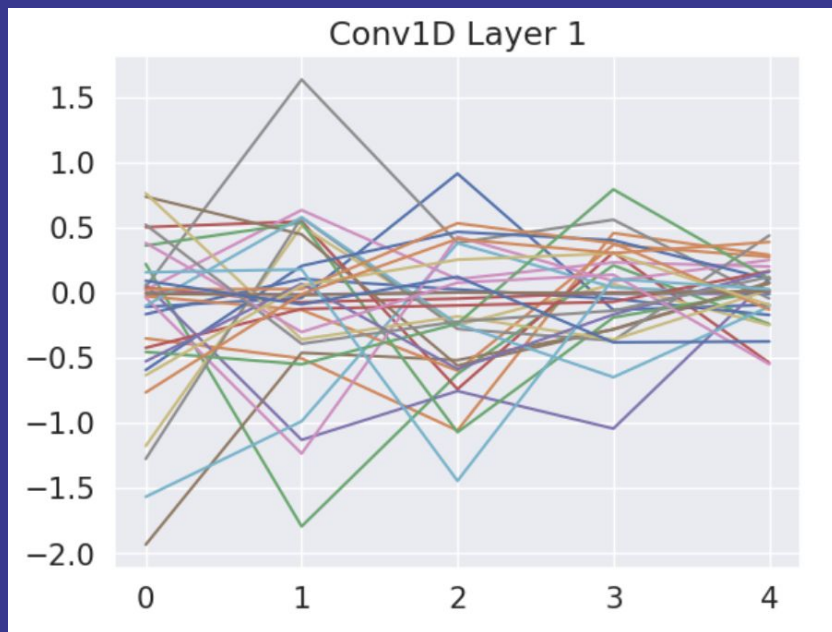


0: Wake
1: S1
2: S2
3: S3
4: REM

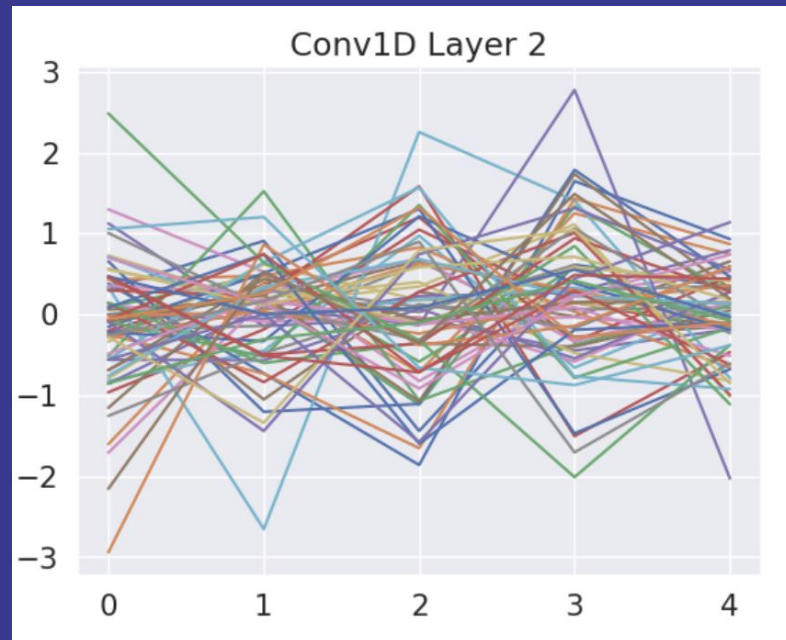
- ❖ 2 Conv1D Layers trained on 800,000 data points
- ❖ Training Accuracy = 0.65
- ❖ Testing Accuracy = 0.61

FILTERS

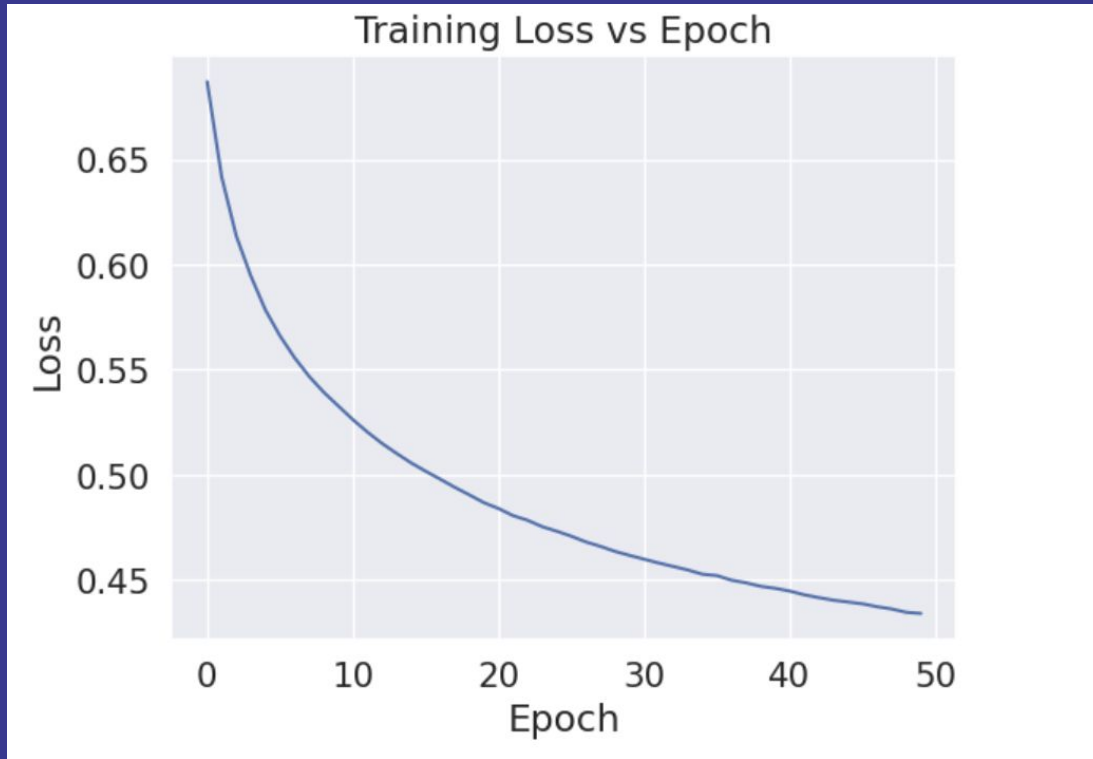
Layer 1 (32 Filters)



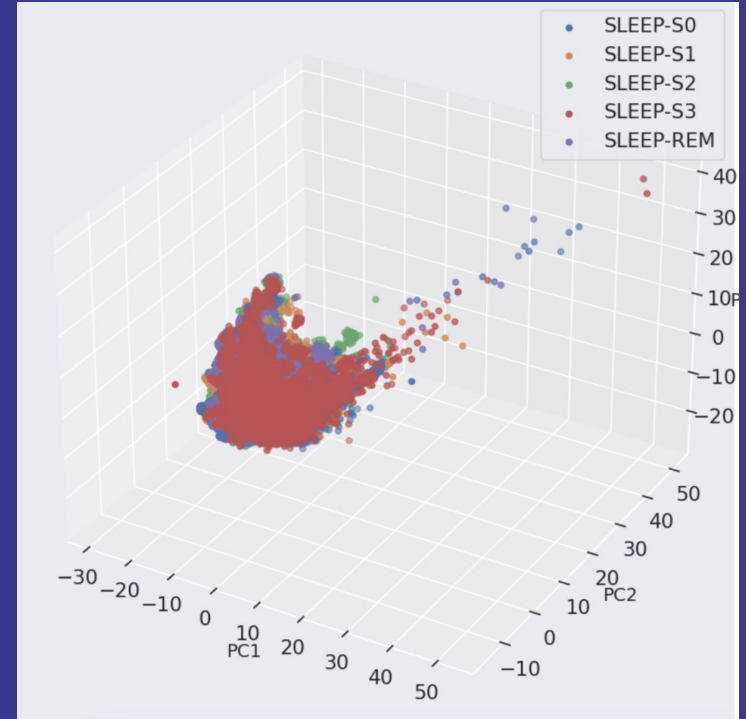
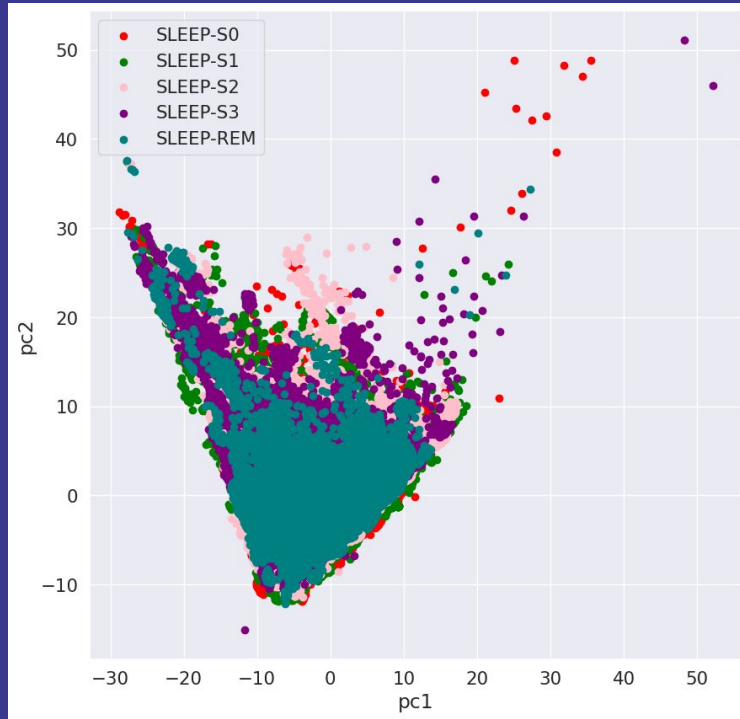
Layer 2 (64 Filters)



LEARNING/OPTIMIZATION



PCA 2D AND 3D + IMAGE OF DIAGRAM (20 EPOCHS)



PCA 2D AND 3D + IMAGE OF DIAGRAM (50 EPOCHS)

