| **Model** | **Model Explanation** | **Sequence Length** | **Epochs** | **Test Accuracy** | **Code** |
| --- | --- | --- | --- | --- | --- |
| CNN | For binary classification with numerical data, a Convolutional Neural Network (CNN) can be effective by treating the numerical data as one-dimensional signals.  The convolutional layers can extract relevant features from the data, while pooling layers can help reduce dimensionality. Dense layers can learn to classify the data into the desired binary classes | 200 | 20 | 0.9533271532787876 | [CNN Model.ipynb](https://colab.research.google.com/drive/1VYFgtvxLpo8oC_uIpLugrUFR--oEah6l#scrollTo=pmL0SU-aYdfh) |
| LTSM | An LSTM (Long Short-Term Memory) model is a type of recurrent neural network (RNN) designed to effectively capture and learn long-term dependencies in sequential data, making it suitable for tasks such as time series prediction and natural language processing. | 200 | 20 | Got to like 99 at epoch 13/20, took too long to run due to sequence length | [LTSM Model](https://colab.research.google.com/drive/1ZuUcOCEP9rmrFp9IC_W6lSRml8WWepAi#scrollTo=MUAD4haREqiH) |
| - | - | 50 | - | 0.976815951891122 | - |
| DNN | A DNN (Deep Neural Network) model is a type of artificial neural network characterized by multiple layers of interconnected neurons, enabling it to learn complex patterns in data without relying on handcrafted features. | 200 | 20 | 0.79 | [DNN model.ipynb](https://colab.research.google.com/drive/1-SEostOMW19dHfwmgTKYOdA8fmPY0pV3#scrollTo=Nmxu7bZsUcWw) |
| - | - | 300 | - | 0.813803518223746 | - |
| Random Forest Model |  | 400 | - | 0.8772270679178207 | [Random Forest Model.ipynb](https://colab.research.google.com/drive/1vYoUZaCMy-YQP0IZ8TeEbXJI8Aow-nIf) |
| - | - | 200 | - | 0.8752972471887469 | [Random Forest Model.ipynb](https://colab.research.google.com/drive/1vYoUZaCMy-YQP0IZ8TeEbXJI8Aow-nIf) |
| Gradient Boosting Machines |  | 50 | - | 0.7660626681436936 | [Gradient Boosting Machines Model.ipynb](https://colab.research.google.com/drive/14gp15ZVEIx3tD7QAZ6XVCrE-LfqiMwlQ) |
| - | - | 200 | - | 0.762000725484664 | - |
| SVM |  |  | - |  | [Super\_Vector\_Machines.ipynb](https://colab.research.google.com/drive/1MdxEgAaiAtj0-OBDtpSv6gfFUOqvt0sJ) |

Sequence length: number of heart rate readings we are taking in order to come to a conclusion about sleep stage (kind of like window size)

* Higher granularity data (e.g., data sampled at shorter intervals) may allow for shorter sequence lengths while still capturing relevant information.
* Lower granularity data may necessitate longer sequences to preserve temporal patterns.

Data: <https://physionet.org/content/sleep-accel/1.0.0/>

* Only using heart rate & sleep
* Preprocess heart to HRV
* Preprocess sleep to binary instead of multiclass
* From an Apple watch

TODO:

* Experiment LTSM epoch 30 (https://www.nature.com/articles/s41598-019-49703-y)