Machine Learning based Epileptic Seizure Prediction

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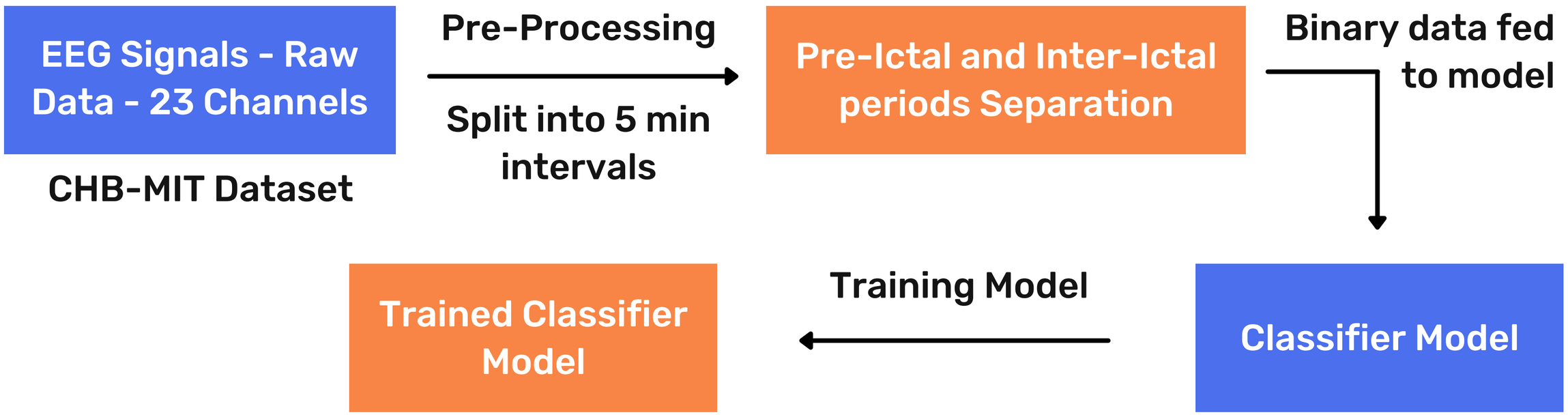
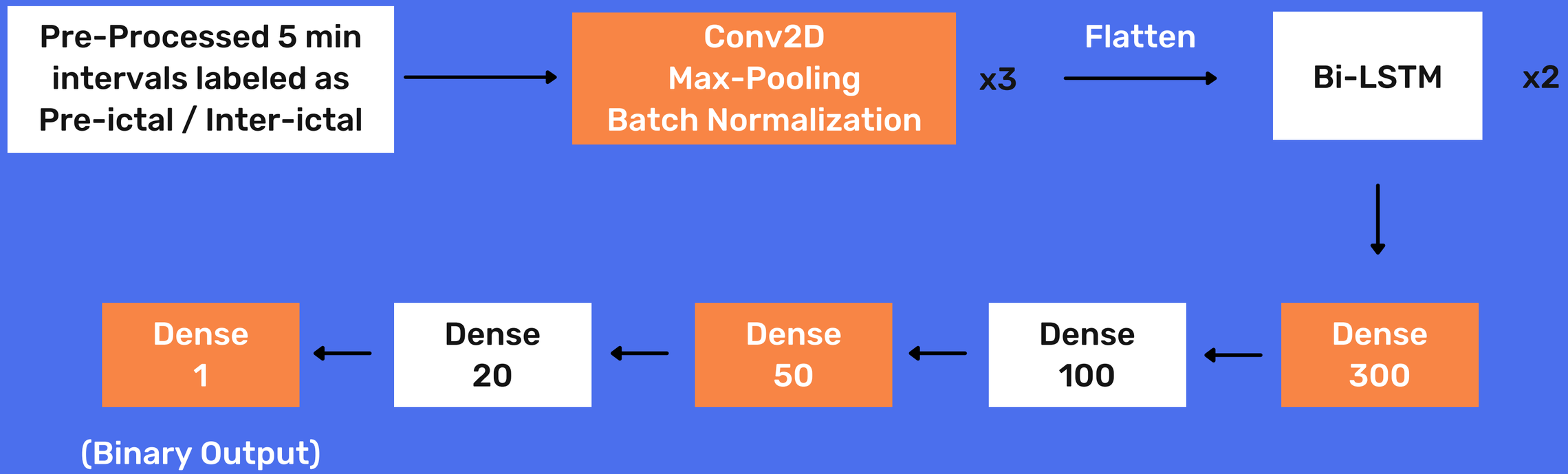
Block Diagram

Training



Bi-LSTM Model Architecture



Model Summary

Total params: 2,690,475
Trainable params: 2,690,347
Non-trainable params: 128

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_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
conv2d_3 (Conv2D)            (None, 1278, 22, 32)      224
_________________________________________________________________
max_pooling2d_3 (MaxPooling2 (None, 639, 11, 32)       0
_________________________________________________________________
batch_normalization_2 (Batch (None, 639, 11, 32)       128
_________________________________________________________________
conv2d_4 (Conv2D)            (None, 637, 10, 32)       6176
_________________________________________________________________
max_pooling2d_4 (MaxPooling2 (None, 318, 5, 32)        0
_________________________________________________________________
batch_normalization_3 (Batch (None, 318, 5, 32)        128
_________________________________________________________________
conv2d_5 (Conv2D)            (None, 316, 4, 32)        6176
_________________________________________________________________
max_pooling2d_5 (MaxPooling2 (None, 158, 2, 32)        0
_________________________________________________________________
flatten_1 (Flatten)          (None, 10112)             0
_________________________________________________________________
repeat_vector_1 (RepeatVecto (None, 1, 10112)          0
_________________________________________________________________
bidirectional_2 (Bidirection (None, 1, 64)             2597120
_________________________________________________________________
bidirectional_3 (Bidirection (None, 64)                24832
_________________________________________________________________
dense_5 (Dense)              (None, 300)               19500
_________________________________________________________________
dense_6 (Dense)              (None, 100)               30100
_________________________________________________________________
dense_7 (Dense)              (None, 50)                5050
_________________________________________________________________
dense_8 (Dense)              (None, 20)                1020
_________________________________________________________________
dense_9 (Dense)              (None, 1)                 21
=================================================================
```

Block Diagram

Testing

Outcomes

- Machine Learning has been employed to classify raw EEG signal data into Pre-ictal and Inter-ictal periods.
- Classifier model is trained using CHB-MIT EEG Dataset.
- Classification is carried out on 5-minute intervals of 23-channel EEG signal collected using Brain-Computer Interface.
- The model makes use of Convolutional layers to find spatial relationships and Bi-directional LSTM layers to find temporal relationships, so as to classify pre-ictal and inter-ictal periods.
- When this model is fed real-time data, classification can be done in real-time so as to identify potential pre-ictal periods, allowing pre-emptive indication of an impending Epileptic seizure.
- This alarm would allow for medication to be taken ahead of an Epileptic Seizure to reduce the effects of the seizure or even avoid it completely.