Human Activity Recognition

Shengbo Wang

and

Junmao Liao

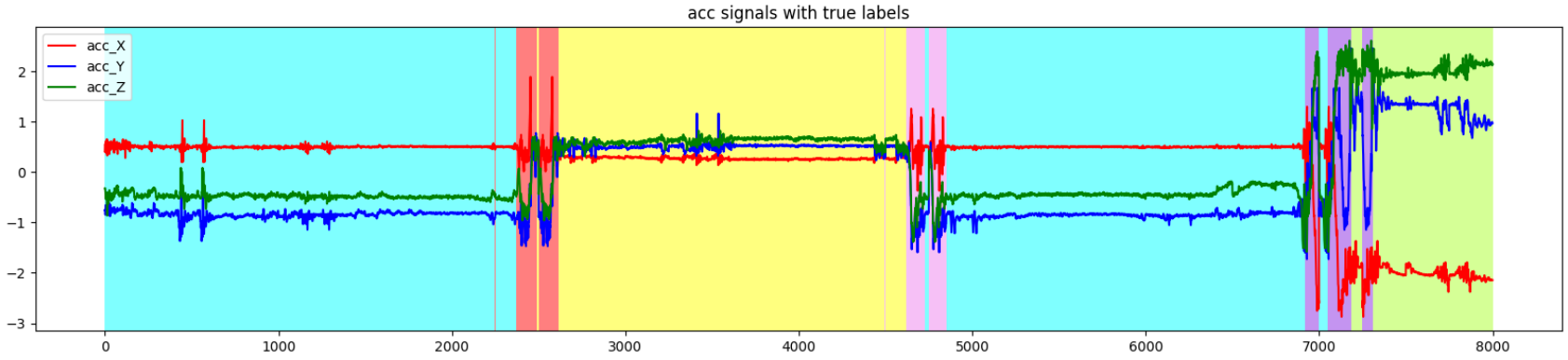
Input Pipeline

❖ HAPT Dataset

- HAPT raw data with tri-axial acc and gyro data(50 Hz).

❖ Input Pipeline

- Remove unlabeled data from the dataset
- Z-Score normalization for multi-channel data
- Sliding window for data augmentation: window size of 250 samples with 50% overlap
- Create TFRecord files for a Sequence-to-Sequence Task

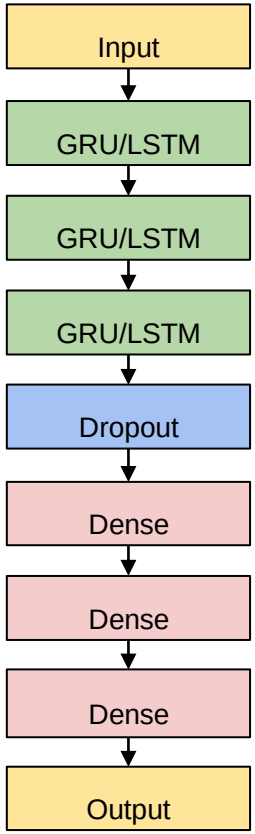


A sequence of acc signals read from TFRecord

Model and Training

Model

- GRU- and LSTM-based models
- Spare categorical cross-entropy as loss function
- Adam optimizer to train network for 10000 steps
- Save the checkpoints with best validation accuracy



Hyperparameter optimization for GRU-based model

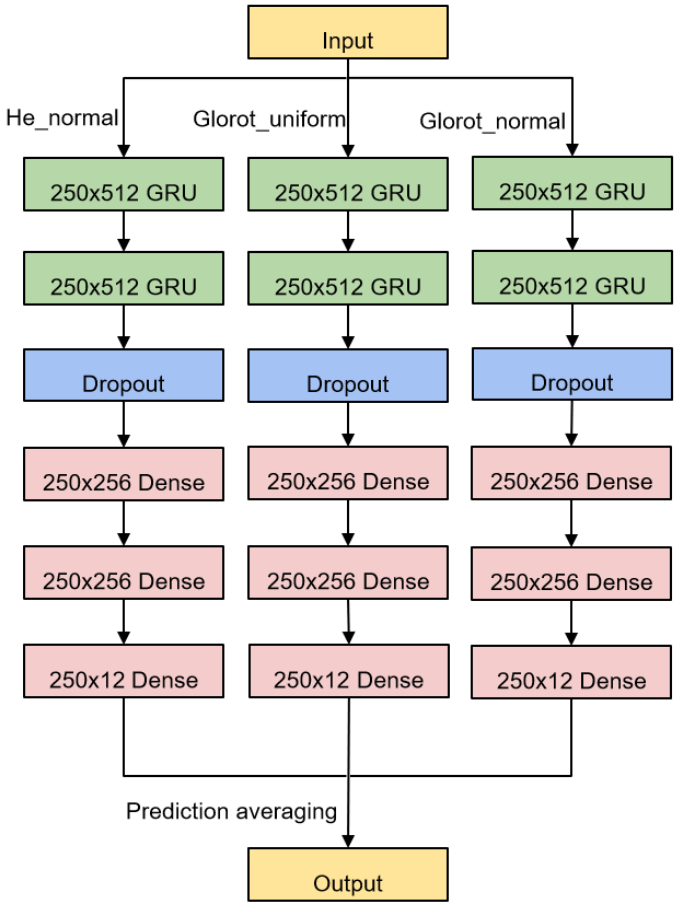
- The model with relative more GRU layers and more units tends to have a better performance.
- The best window size is still 250 with 50% overlap

Table 1: Results of the hyperparameter optimization

Trial	GRU layers	Dense layers	GRU units	Dense units	Window size	Shift size	Dropout rate	Val accuracy
1	**2**	**3**	**512**	**256**	**250**	**125**	**0.471**	**92.9%**
2	2	3	128	64	250	125	0.387	90.8%
3	1	2	32	128	250	75	0.566	85.1%
4	1	1	256	128	100	50	0.454	85.8%
5	1	1	256	64	250	125	0.248	88.4%

Model and Training

- Ensemble models to reduce generalization error by averaging the predictions



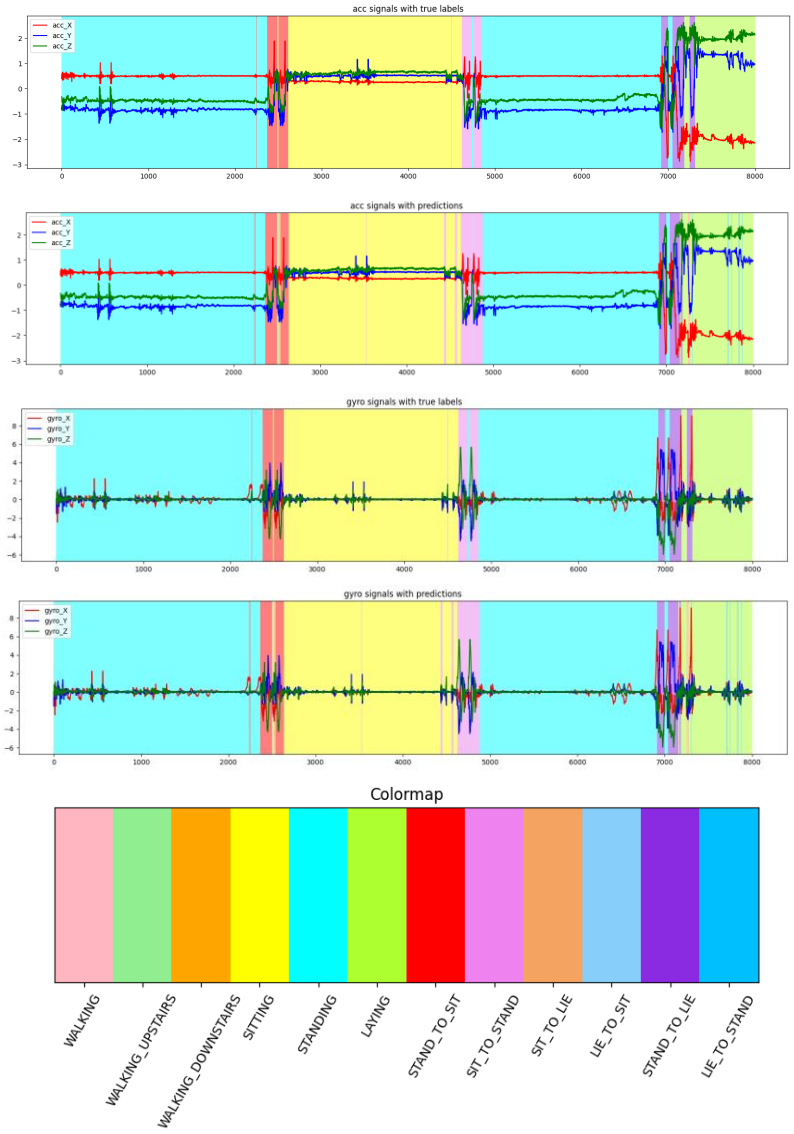
- Try different kernel initializers and select best three results

Table 2: Comparison between different initializers

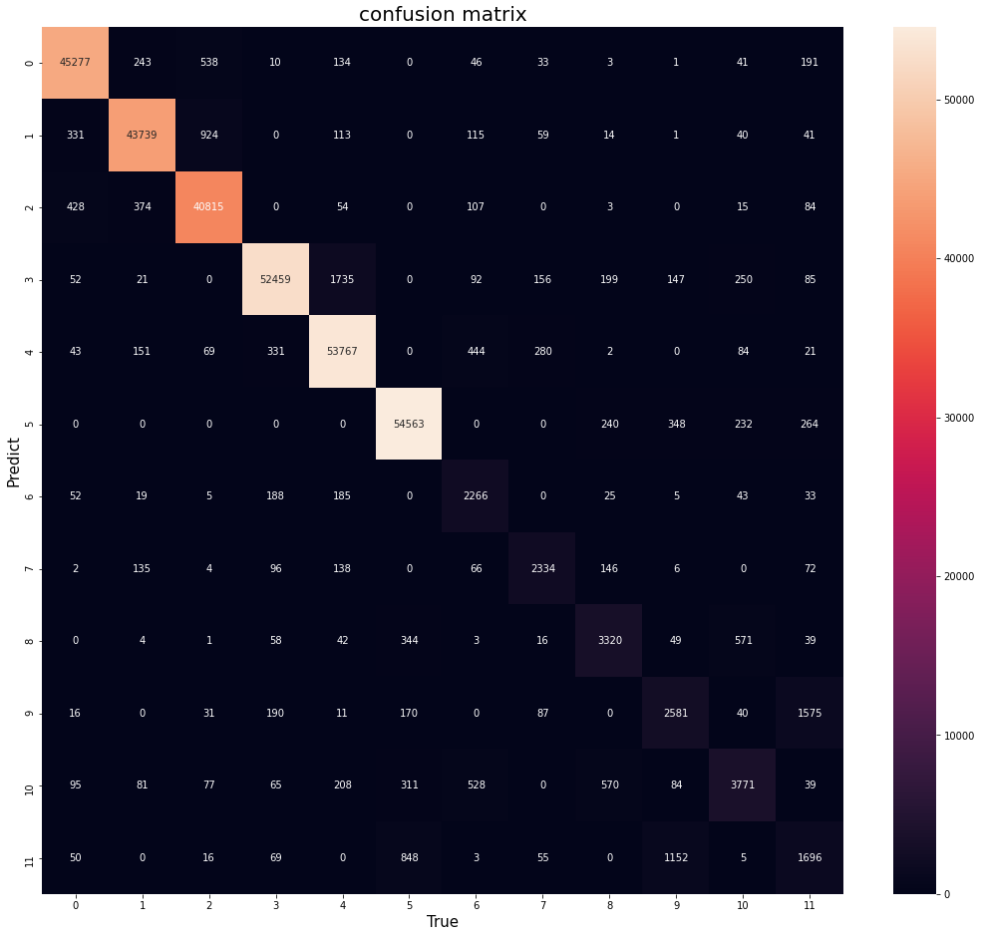
Kernel initializer	He_normal	Glorot_normal	Glorot_uniform
Test Accuracy	0.930	0.941	0.929

Evaluation and Results

- Test labels & predictions



- Confusion matrix



- Test accuracy: 94.48%

Thank you!