Weekly Report

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1 Progress

- Implement open-set identification on the 30-subjects dataset[2] as a baseline method.

2 Implementation detail

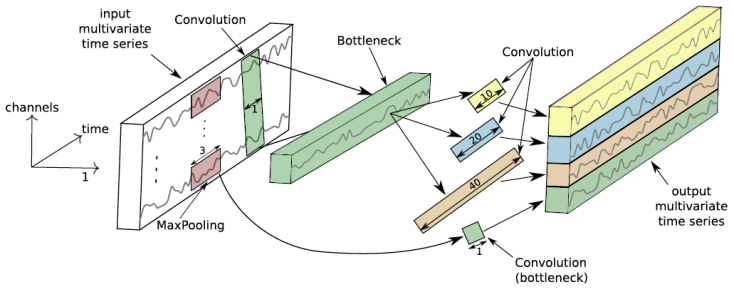

Figure 1: The architecture of InceptionTime

Using a model called Inception Time[1], we tried identifying 30-subjects using heartbeat signals generated from radar. Table1 shows the hyper parameter, and Adam was used as an optimizer.

Table 1: Hyper parameter

batch size	64
learning rate	0.001
epochs	10
Sampling rate	250 Hz
window size	5s
overlap	1.5s

Here is the definition of the openness index[3].

$$openness = 1 - \sqrt{\frac{C_{train}}{C_{test}}} \tag{1}$$

where C_{train} and C_{test} are the number of known identities in the training and test set, respectively. The openness index is used to quantify how many unknowns a model encounter during testing. The higher the index is, the more difficult the problem is.

3 Results

A threshold is needed because the Softmax function only outputs labels for the number of classes used in the training. Figure 2 shows the change in accuracy as the threshold value is varied.

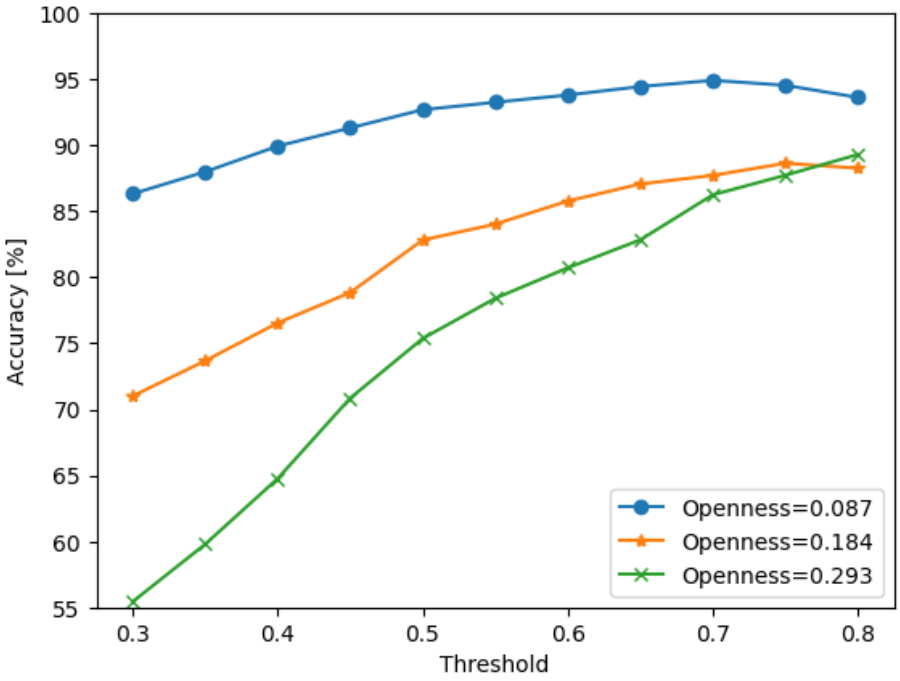

Figure 2: Change in Accuracy with Threshold Varying

Here is the openness index table. This table shows the correspondence between openness and known/unknown classes.

Table 2: Correspondence between openness and known/unknown classes

openness	C_{train}/C_{test}	num of unknown
0.087	25/30	5
0.184	20/30	10
0.293	15/30	15

Here is an example of Confusion Matrix. When the threshold is increased, the percentage of correct answers for Unknown labels increases, but the percentage of correct answers for Known labels decreases.

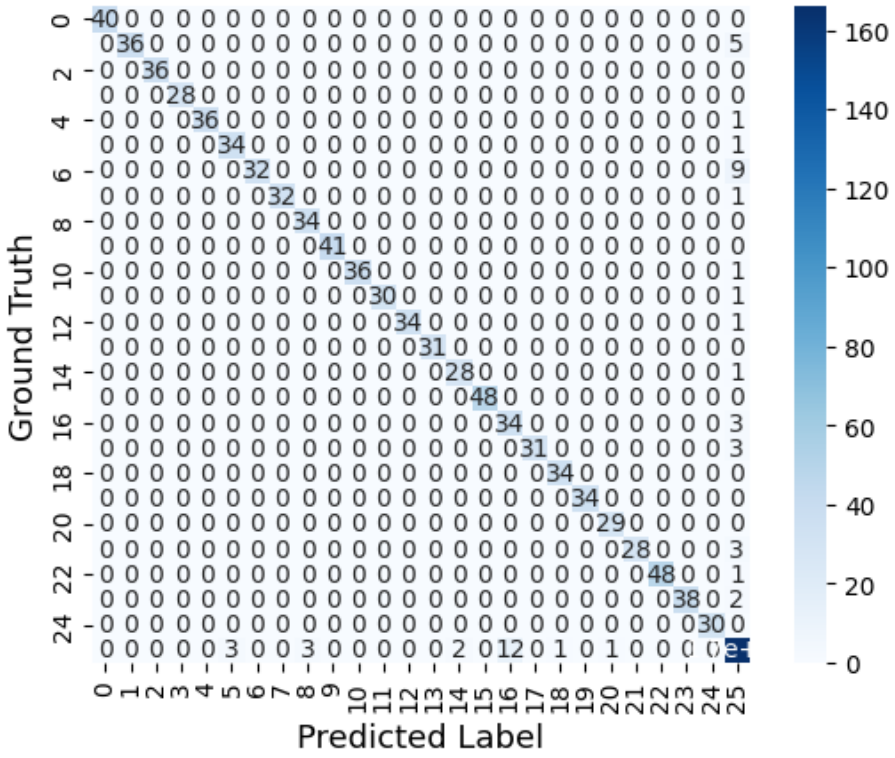

Figure 3: Confusion Matrix (openness=0.087, threshold=0.70)

4 Next Plan

- Submit a brief report for graduation thesis to Canvas LMS
- Consider improvement plan

- Change the structure of model, loss function
- Change the scenario
- Evaluate another noisy dataset

References

[1] Ismail Fawaz, H., Lucas, B., Forestier, G. et al. InceptionTime: Finding AlexNet for time series classification. Data Min Knowl Disc 34, 1936–1962 (2020). https://doi.org/10.1007/s10618-020-00710-y

[2] `https://figshare.com/articles/dataset/A_dataset_of_clinically_recorded_radar_vital_signs_with_synchronised_reference_sensor_signals/12186516?file=22515782`

[3] Yan, Baiju, et al. "Heart signatures: Open-set person identification based on cardiac radar signals." Biomedical Signal Processing and Control 72 (2022): 103306.