Report of ERPP and RMTPP

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In this course project, two marked temporal point process models(ERPP and RMTPP) are implemented.

1. Data processing

I take the ATM_day.csv as the raw data. For each sequence generated from the same machine, I fetch the consequent 7 events and their corresponding time in the sequence as a sample. After generating the samples, I split them into three part: training set, validation set and test set according the ratio 8:1:1.

2. Model

There are three models implemented in the model.py: MLP, RMTPP and ERPP.

1) MLP

This is model is used as an baseline and used to test the code. In this model, the event sequence and time sequence are concatenated and go through a fully connected layer to generate a hidden embedding. Then take the hidden embedding as the input of two fully connected layer to generate time and event prediction respectively.

The event loss function is cross entropy and time loss function is l2 loss.

2) RMTPP

For the detail please see [1].

Here are some details of specific choice of hyper-parameters:

1. The event is embedded into 12 dimensional vector
2. I replace the vanilla RNN in the orginal paper by LSTM for better performance. And the hidden representation has dimension 32.
3. The output of lstm is fedded into a fully connected layer with 16 dimension.

The event loss function is cross entropy and the time loss is negative likelihood loss.

The predicted time is by calculating the expectation of the next event time (by numerical integration).

3) ERPP

For the detail please see [2].

Here are some details of specific choice of hyper-parameters:

1. The event is embedded into 12 dimensional vector
2. The hidden representation in LSTM is 32.
3. The output of the last time of LSTM is taken as the input of a fully connected layer with 16 units.

The event loss function is cross entropy and the time loss function is Gaussian penalty(which is equivalent to L2 loss here, so in code, l2 loss is used).

3. Evaluation

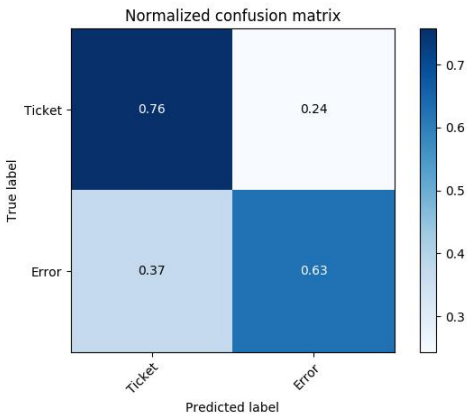
Model	F1 score	Accuracy	Precision	Recall	Time MAE
MLP	0.607	0.625	0.624	0.658	**3.413**
RMTPP	0.826	0.870	0.829	**0.823**	6.024
ERPP	**0.827**	**0.871**	**0.838**	0.819	5.102

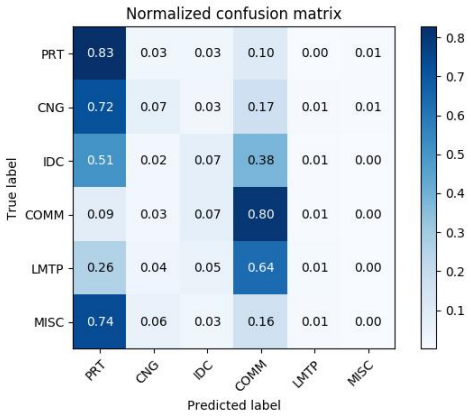
Table 1 Main-type and Time MAE

Model	F1 score	Accuracy	Precision	Recall
MLP	0.290	0.575	0.428	0.328
RMTPP	0.526	0.674	0.518	0.561
ERPP	**0.568**	**0.695**	**0.554**	**0.595**

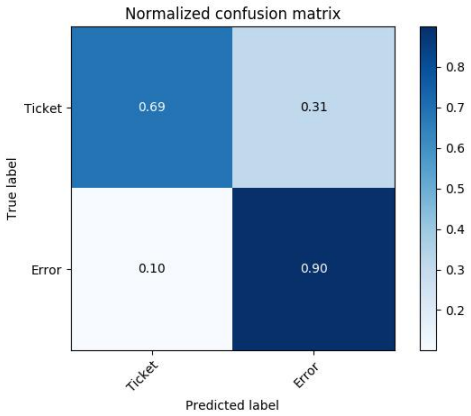
Table 2 Sub-type

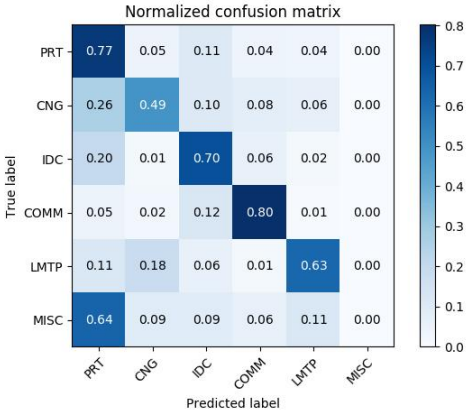
MLP



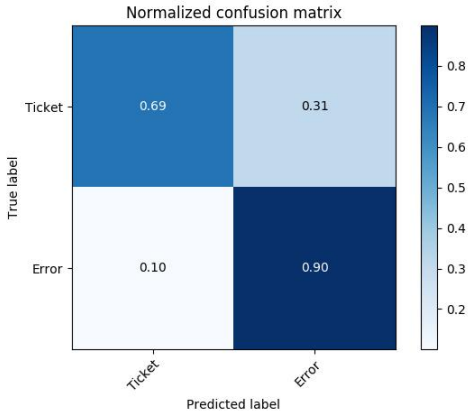


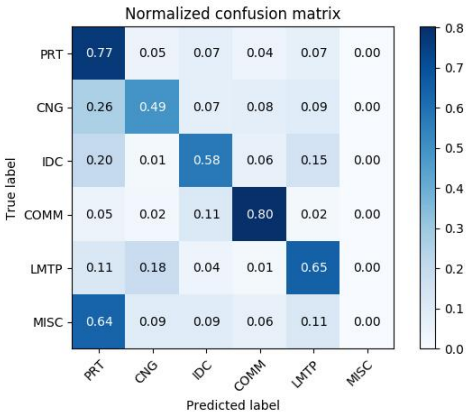
RMTPP





ERPP





4. Environment and Usage

The lagnuage is python and library is pytorch.
Just see the main.py to know how to run the code (You can know it from the definition of argparser).

5. Reference

[1] Nan Du, Hanjun Dai, Rakshit Trivedi, Utkarsh Upadhyay, Manuel Gomez-Rodriguez, and Le Song. 2016. Recurrent Marked Temporal Point Processes: Embedding Event History to Vector.
[2] S. Xiao, J. Yan, X. Yang, H. Zha, and S. Chu. Modeling the intensity function of point process via recurrent neural networks. In AAAI, 2017.