Smartphone Data Fusion and Deep Learning for Travel Mode Detection

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Introduction

With the increasing availability of GPS-enabled devices, massive spatio-temporal trajectory data can be acquired effortlessly. Dabiri and Heaslip[1] deployed a convolutional neural network to infer travel mode from GPS. **However**, the CNN architecture does not specialize in handling temporal feature of GPS traces compared with RNN trajectories[2].

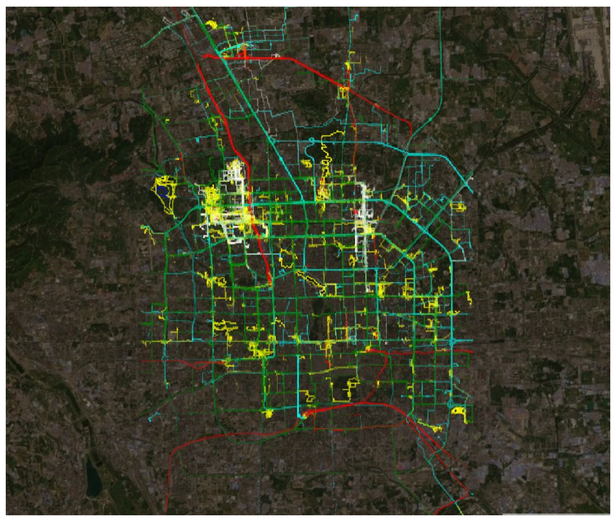
Key contributions:

- Improve of existing CNN
- kinematic attributes based RNN

Mode Encoding::

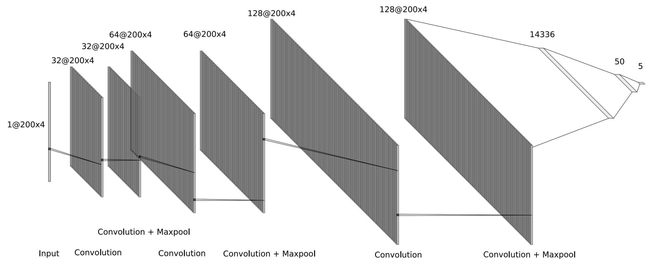
0	BUS
1	Train & Subway
2	Walk & Run
3	Car & Taxi & Motocycle
4	Bike
100	Others (not included in the NN)

Visualization

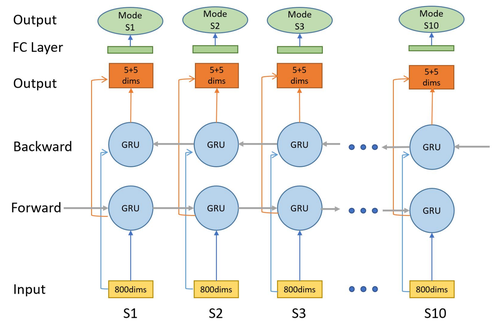


Model

Convolutional Neural Network fully replicate from Dabiri[1]



Bidirectional GRU network



Results

Model	Train_acc	Valid_acc	Test_acc
CNN			
RNN			

Computation

Four-channel Kinetic Attributes[1]

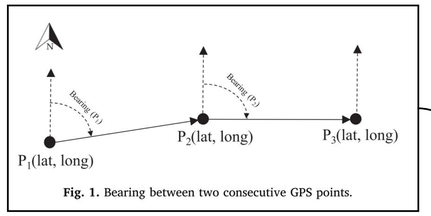
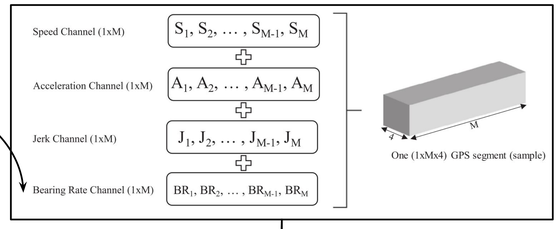
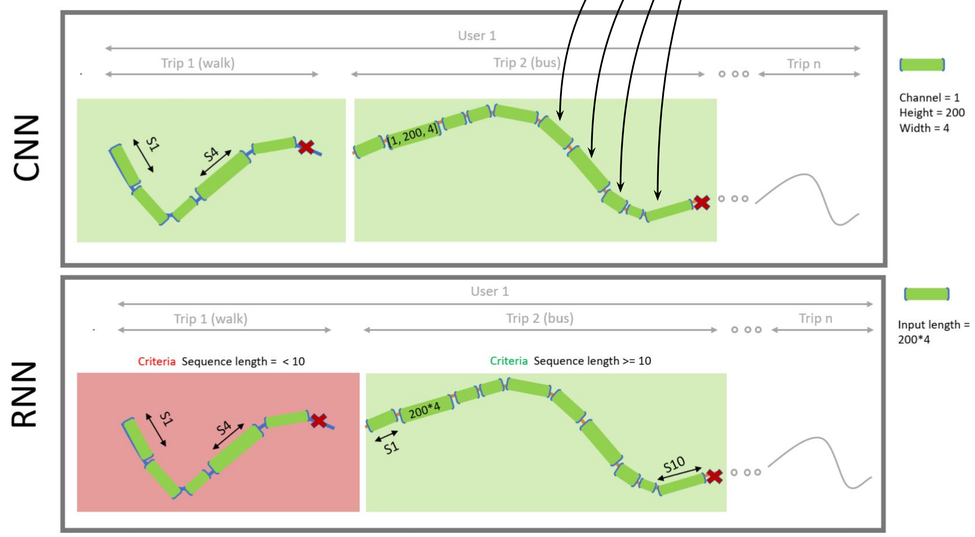


Fig. 1. Bearing between two consecutive GPS points.

Input data preparation[1]



Trajectory Segmentation:
CNN: Trajectories of a user is split into distinct trips by mode status, and then split into segments with each segments contains 200 continuous points.
RNN: Trajectories of a user is split into distinct trips by mode status, and then split into segments with each segments contains 200 continuous points. Every 10 segments are aggregated into a sequence. Sequence which contains less than 10 segments are dropped.



References

1. Dabiri, S., & Heaslip, K. (2018). Inferring transportation modes from GPS trajectories using a convolutional neural network. Transportation research part C: emerging technologies, 86, 360-371.
2. Jiang, X., de Souza, E. N., Pesaranghader, A., Hu, B., Silver, D. L., & Matwin, S. (2017, November). Trajectorynet: An embedded gps trajectory representation for point-based classification using recurrent neural networks. In Proceedings of the 27th Annual International Conference on Computer Science and Software Engineering (pp. 192-200). IBM Corp..
3. Zheng, Y., Chen, Y., Li, Q., Xie, X., & Ma, W. Y. (2010). Understanding transportation modes based on GPS data for web applications. ACM Transactions on the Web (TWEB), 4(1), 1.