Visualizing and Enhancing Environment-Aware Pedestrian Trajectory Prediction for Autonomous Driving

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Content

➢ Motivation
➢ Related work
➢ Problem
➢ My approach
  ○ Data loader
  ○ Network architecture
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Motivation

➢ Autonomous driving is growing!

➢ Concerns
  ○ Pedestrian safety
  ○ Efficient/safe driving
Related Work: Multimodal Future Prediction

[Overcoming Limitations of Mixture Density Networks: A Sampling and Fitting Framework for Multimodal Future Prediction; Osama Makansi, Eddy Ing, Ozgun Cicek and Thomas Brox; University of Freiburg; 2019]
Related Work (cont.): DESIRE
Related Work (cont.): Social LSTM

(Social LSTM: Human Trajectory Prediction in Crowded Spaces; Alexandre Alahi, Kratarth Goel, Vignesh Ramanathan, Alexandre Robicquet, Li Fei-Fei, Silvio Savarese; Stanford University)
Related Work (cont.): SoPhie GAN

[SoPhie: An Attentive GAN for Predicting Paths Compliant to Social and Physical Constraints; Amir Sadeghian and Vineet Kosaraju and Ali Sadeghian and Noriaki Hirose and S. Hamid Rezatofighi and Silvio Savarese; 2018]
Related Work (cont.): Social GAN

[Social GAN: Socially Acceptable Trajectories with Generative Adversarial Networks; Agrim Gupta, Justin Johnson, Li Fei-Fei, Silvio Savarese, Alexandre Alahi; 29 Mar 2018]
Problem

➢ Complex architectures
  ○ CNN/RNN

➢ Location-awareness
  ○ Location bias map

➢ Versatility
  ○ Multiple agents
Trajectory Inference Library (TraIL)

- Multiple approaches
- Same datasets
- DESIRE, SoPhie, Behavior CNN
Our Datasets (2 environments)

[Collected from ETH main building, Zurich, by Stefano Pellegrini and Andreas Ess in 2009]

[Collected from hotel in Bahnhofstr, Zurich, by Stefano Pellegrini and Andreas Ess in 2009]
Visualizing Dataset
Data Loader

Walking paths

Pedestrian i

Displacement vector i

Pedestrian j

Displacement vector j

Displacement volume

[Pedestrian Behavior Understanding and Prediction with Deep Neural Networks; Shuai Yi, Hongsheng Li, Xiaogang Wang; 2016]
Architecture

[Pedestrian Behavior Understanding and Prediction with Deep Neural Networks; Shuai Yi, Hongsheng Li, Xiaogang Wang; 2016]
Enhancing Training

❖ Data: training, validation, evaluation

❖ Loss function

\[ L = \frac{1}{N} \frac{1}{M} \sum_{n=1}^{N} \sum_{m=1}^{M} (d_{n}[2m]^2 - \hat{d}_{n}[2m]^2) + (d_{n}[2m+1]^2 - \hat{d}_{n}[2m+1]^2) \]

❖ Split training
Visuals (in progress)
Status/Future Work

➢ Location bias map improvements
   ○ Train on multiple locations

➢ Train on multiple agents
   ○ Pedestrians, cars, cyclists, scooters

➢ Multimodal approach; Comparing to other methods
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Thank you for listening! Questions?