

Using synthetic data to improve performance of data-driven algorithms in high density pedestrian situations

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Abstract

In recent years, there has been a rising interest in pedestrian trajectory prediction methods. The advancement of machine learning algorithms and real-world applications, such as autonomous vehicles or social robots, are reasons for that. These methods mainly focus on learning local interactions and single pedestrian trajectory prediction over a relatively short time horizon. To learn these interaction behaviors, the algorithms are trained with data taken from low-density situations where just a few pedestrians are involved.

In our work, we aim to investigate how supervised machine learning methods can address crowded pedestrian situations. For this task, high-density trajectory data-sets are necessary. To the best of our knowledge, there exist, however, only few available real-world data-sets containing dense situations. To overcome the lack of data, we train the algorithms on experimental data [1] as well as synthetic data generated by running simulations in the GAMA platform [2]. In previous studies, error-metrics like the average-displacement error (ADE) or final displacement error (FDE) allow quantifying the prediction accuracy [3]. However, we argue that these metrics are not sufficient for high-density situations. Indeed, dense dynamics are mainly governed by physical body-exclusion of the pedestrians. Yet, ADE and FDE metrics do not account for such features. Instead, we propose an evaluation process consisting of three phases. First, the predictions are visualized in GAMA to qualitatively assess how realistic the pedestrians behave. Second, the ADE, FDE, and the number of collisions (overlappings) that occur in the predicted trajectories are analysed. Especially the last metrics is important for high-density situations. In the last step, we compare the predicted pedestrian flow/density relationship to the fundamental diagram of experimental data [4]. By using this mixture of quantitative and qualitative metrics, the performance of the algorithms can be better evaluated.

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