Minicolloque MCPG9 **[x] Oral** **☐ Poster**

Review of Pedestrian Trajectory Prediction methods: Comparing physics-based and data-based approaches

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Abstract :

In crowd scenarios, predicting trajectories of individuals is a challenging task because trajectories depend on many factors. The topologies of the scene and the interactions between the pedestrians are just some of them. In recent years, data-based methods (neural networks) have become a research hotspot in numerous domains. Therefore, it is no surprise that more and more researchers apply these methods to predict trajectories of pedestrians. In this state-of-the-art review, it is shown how neural networks predict trajectories. Furthermore, these relatively new methods are compared with physics-based models that are widely used to simulate pedestrian dynamics. Two popular physics-based models are the social force model by Helbing and Molnar (1995) as well as the cellular automaton model by Burstedde et al. (2001). The literature research in scope of this work highlights that the exploding interest in neural networks does not imply that physics-based models fall into oblivion. The social force model reaches maximum of citations in 2020 (see the figure 1) because it is often used as reference and extension for the neural networks. Implementation of physics-based models in neural networks (the hybrid approach) seems to improve the generality and the accuracy of the trajectory predictions of pedestrians [1,2].

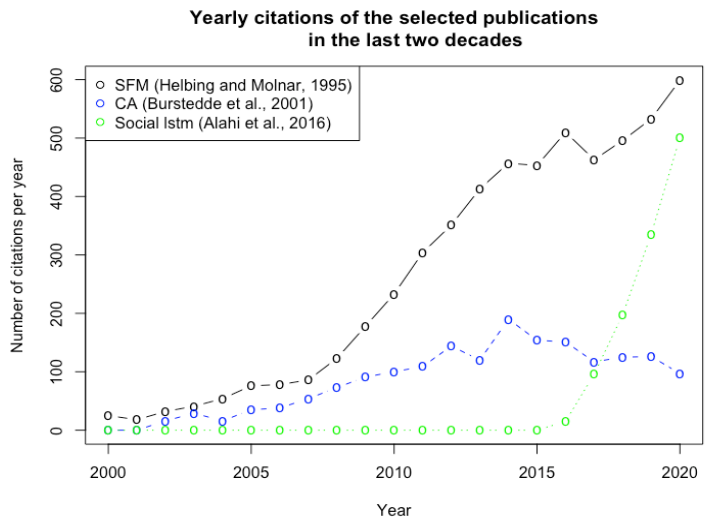

Figure 1 : Diagram of the yearly citations of the "social force model" by Helbing and Molnar (1995), the "cellular automaton model" by Burstedde et al. (2001) and the "Social lstm" by Alahi et al. (2016) in the last two decades [3].

References

[1] Bahari, M.; Nejjar, I.& A. Alahi: Injecting Knowledge in Data-driven Vehicle Trajectory Predictors (2021)

[2] A. Antonucci et al.:Generating Reliable and Efficient Predictions of Human Motion: A Promising Encounter between Physics and Neural Networks (2020)

[3] https://scholar.google.com/