Next Steps for Social Force with Big Data

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Abstract

The Social Force model [2] is a cornerstone of pedestrian modeling. It is a micro-simulation of pedestrian behavior based on simple interaction potentials that exhibit complex behaviors at scale. Social Forces are the gradients of interpretable potentials. We review common choices for potentials and reproduce the results for critical situations: pedestrian behavior at narrow doors and in long corridors.

While the interpretability of the interaction potentials is a feature of the Social Force model, their shape constraint to a family of falling exponential functions, or any other parametric form, is unnatural. The model would preserve its interpretability if the interaction potentials were replaced by arbitrary continuous and differentiable functions.

We propose to describe interaction potentials by arbitrary function approximators in the form of neural networks. In this form, Social Forces are derived from gradients of the neural network using automatic differentiation with efficient BackProp [3].

Moving from parametric descriptions to neural networks requires more efficient methods to infer the much higher dimensional parameters. We propose to create a differentiable simulation and to use Stochastic Gradient Descent [1] to train the networks on large datasets.

References

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