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Calibrating walker models: variations of parameters due to traffic regimes

Modelling the wide range of walking behaviours is not a simple task and several type of walker models have been proposed such as CA [1], discrete choice [2], social force [3] and utility based models [4]. Albeit different in their mathematical properties, these models share a modelling assumption in dividing the pedestrian behaviours in components such as path following, pedestrian avoidance and obstacle avoidance behaviours. In all these models the path following component describes the free-flow conditions and the other two components describe how pedestrians deviate from their free-flow behaviours due to the presence of other pedestrians. The effects of the components are simply added and their parameters remain constant regardless of external conditions. In this investigation we show that the hypothesis of invariance of the parameters is incorrect leading to significant modelling errors.

To investigate the pedestrian behaviours we perform a series of calibrations of the Nomad model [4] with empirical data from experiments representing different types of flows such as bidirectional, crossing and unidirectional flows. Each pedestrian trajectory is used to estimate one set of parameters using the methodology developed in [5]. The estimated parameter set is then associated with the average speed of the pedestrian that produced the trajectory. The average speed accounts for the traffic flow intensity that pedestrians had encountered. We show that the values of the path following parameter display two distinct regimes that correspond to free-flow and congestion, and that between the two regimes there is a smooth variation resembling a sigmoid curve. The parameters of the pedestrian avoidance component also display significant variation with walking speeds. The consequences of these findings is that by showing that the behavioural components are affected by traffic regimes, they should incorporate variation of parameters to improve their estimation quality.

References

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