Mean-Field Type Modeling of Non-Local Congestion in Pedestrian Crowd Dynamics

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Abstract : One of the latest trends in the modeling of human crowds is the mean-field game approach. In the mean-field game approach, the motion of a human crowd is described by a nonstandard stochastic optimal control problem. It is nonstandard since congestion is considered, introduced through a dependence in the performance functional on the distribution of the crowd. This study extends the class of mean-field pedestrian crowd models to allow for non-local congestion and arbitrary, but finitely, many interacting crowds. The new congestion feature grants pedestrians a 'personal space' where crowding is undesirable. The model is treated as a mean-field type game which is derived from a particle picture. This, in contrast to a mean-field game, better describes a situation where the crowd can be controlled by a central planner. The latter is suitable for decentralized situations. Solutions to the mean-field type game are characterized via a Pontryagin-type Maximum Principle.
Keywords : congestion, crowd dynamics, interacting populations, mean-field approximation, optimal control

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