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Lagrangian discretization for crowd motions with congestion

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In this talk, I will focus on two models for crowd motion, which minimize an energy featuring a term penalizing high values for the density of the crowd during the motion. Due to the presence of this term, numerical computations of such minimizing motions is usually carried out in a "Eulerian" way, approximating the density of the crowd with piecewise simple functions. These dicretizations have the issue of not inheriting the mass conservation property verified by the distribution of the crowd during the motion, which characterizes the continuity of its trajectory and some non-trivial adaptations of the dynamical constraints are required. A way to circumvent these issues is to do the discretization in a "Lagrangian" way, as a finite number of individual trajectories. This does require some adaptations on the density penalization, which very naturally involve the semi-discrete formulation of Optimal Transport. This however yields a problem which is no more constrained and for which I will give guarantees of convergence of the minimizing trajectories to those for the initial problem. I will also illustrate these properties with numerical examples for both models.

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