

## Coupling pedestrians with a simulated virtual crowd

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Our objective with this paper is to show how we can couple a group of real people and a simulated crowd of virtual humans. We attach group behaviors to the simulated humans to get a plausible reaction to real people. We use a two stage system: in the first stage, a group of people are segmented from a live video, then a human detector algorithm extracts the positions of the people in the video, which are finally used to feed the second stage, the simulation system. The positions obtained by this process allow the second module to render the real humans as avatars in the scene, while the behavior of additional virtual humans is

determined by using a simulation based on a social forces model. Developing the method required three specific contributions: a GPU implementation of the codebook algorithm that includes an auxiliary codebook to improve the background subtraction against illumination changes; the division of the human classification task into local binary patterns; the parallelization of a social forces model, in which we solve a case of agents merging with each other. The experimental results show how a large virtual crowd reacts to over a dozen humans in a real environment.