Illustrative Visualization of Biochemical Processes Featuring Multiple Temporal Scales

Towards interactive storytelling from computational biology data

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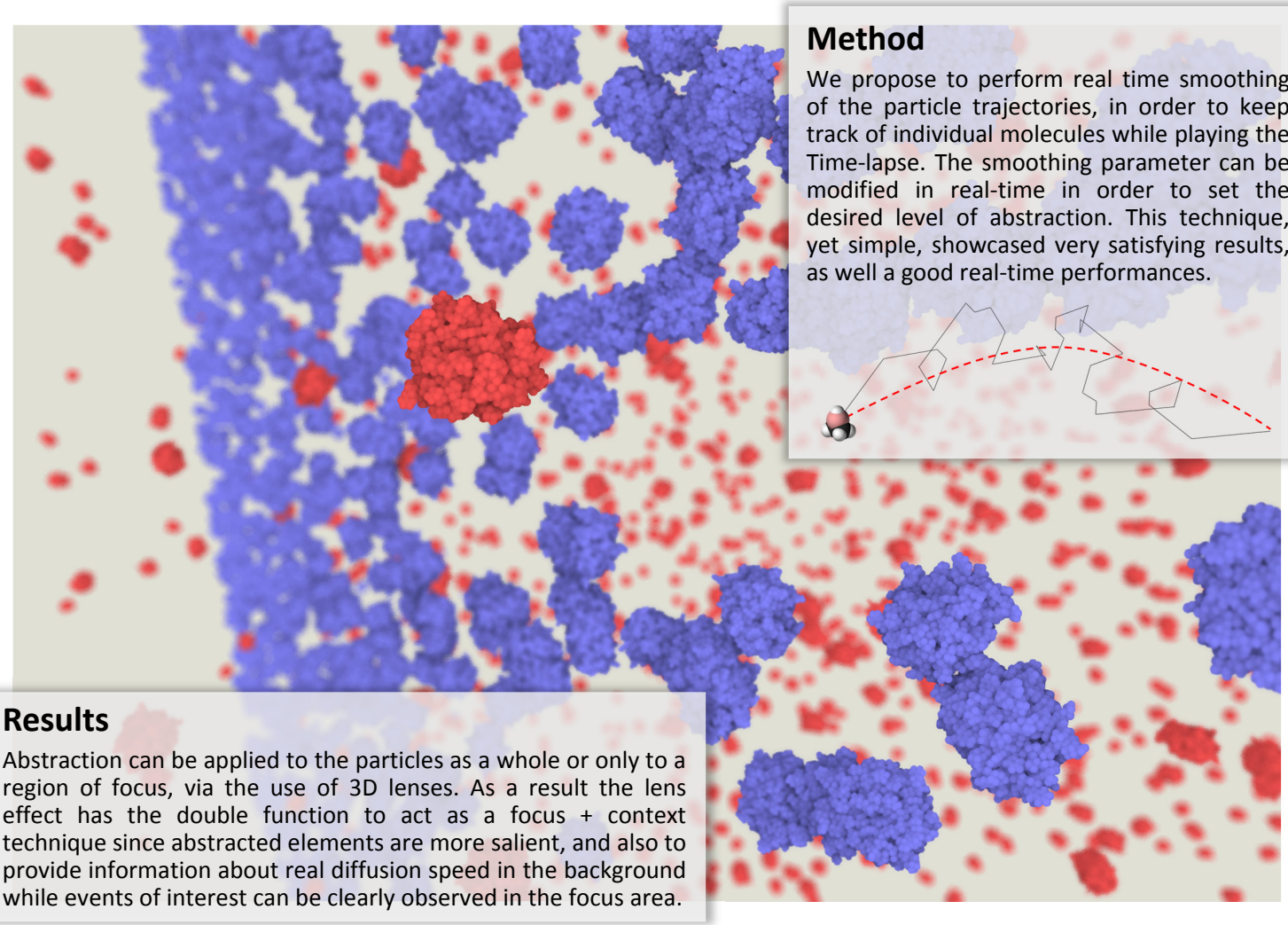
Motivation

Our goal is to improve visualization technology that communicates complex biological processes in a comprehensive way. In order to achieve our goal we want to exploit scientific data for automatic interactive and animated storytelling. In computational biology, particle-based modelling [1] provide spatial information about individual molecules, i.e. 3D position. This offers a lot of potential for automated creation of animated illustrations, because usually molecular behaviour has to animated manually by scientific illustrators in traditional movie production pipeline.

Challenges

Current techniques in mesoscale visualization [2] already provide ways to directly visualize results of particle-based simulation in a 3D scenes. This type of modelling technique can produce a very large number of frames due to very small simulation time steps. Viewing every single frame would simply take too much time. For this reason it is common to display only a frames at a certain time interval, in a Time-lapse fashion. The outcome in this case features a lot of visual clutter due to large diffusion displacements between two visualized frames, which is impractical for storytelling.



Method

We propose to perform real time smoothing of the particle trajectories, in order to keep track of individual molecules while playing the Time-lapse. The smoothing parameter can be modified in real-time in order to set the desired level of abstraction. This technique, yet simple, showcased very satisfying results, as well a good real-time performances.

Results

Abstraction can be applied to the particles as a whole or only to a region of focus, via the use of 3D lenses. As a result the lens effect has the double function to act as a focus + context technique since abstracted elements are more salient, and also to provide information about real diffusion speed in the background while events of interest can be clearly observed in the focus area.

Acknowledgments

This project has been funded by the Vienna Science and Technology Fund (WWTF) through project VRG11-010 and additionally supported by EC Marie Curie Career Integration Grant through project PCIG13-GA-2013-618680. Additionally, this work has been carried out within the PhysioIllustration research project #218023, which is funded by the Norwegian Research Council.

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