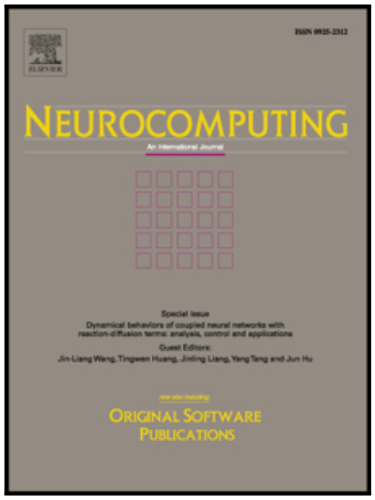
Communicated by Dr. Wang QI

Accepted Manuscript



Discretization and OpenCL-based Implementation of Social Field Pedestrian Model

Bin Yu, Kaiteng Wu, Ke Zhu, Yuhan Ji, Michael Zhang, Xinwen Yang

PII: S0925-2312(18)30856-7
DOI: 10.1016/j.neucom.2018.06.074
Reference: NEUCOM 19776

To appear in: *Neurocomputing*

Received date: 18 February 2018
Revised date: 9 May 2018
Accepted date: 29 June 2018

Please cite this article as: Bin Yu, Kaiteng Wu, Ke Zhu, Yuhan Ji, Michael Zhang, Xinwen Yang, Discretization and OpenCL-based Implementation of Social Field Pedestrian Model, *Neurocomputing* (2018), doi: 10.1016/j.neucom.2018.06.074

Discretization and OpenCL-based Implementation of Social Field Pedestrian Model

Bin Yu [*] Kaiteng Wu [†] Ke Zhu [‡] Yuhan Ji [§]
Michael Zhang [¶] Xinwen Yang [‖]

Abstract

A discretization is applied to the continuous field-based pedestrian model to derive a discrete version. The concept of walk period is introduced so that pedestrians' varied walking velocities can be studied without introducing any modification to the underlying logic. This further allows the discrete model to analyze a flow of randomly mixed population. Next, starting from the discrete model, a high performance GPU model targeting at the OpenCL heterogeneous parallel framework is developed. Advanced techniques are developed to allow efficient access to stored field strength, avoid atomic operations, and so on. Numerical experiments disclose that the GPU model can bring a as high as 30.8x performance improvement, with contrast to the previously developed CPU model. Thus, when equipped with proper functional modules such as a macroscopic/mesoscopic route selection and so on, the GPU model can act as a core engine for simulation of a large/very-large population.
Keywords: Continuous Model, Discretization, Field Theory, Parallel Computation, Pedestrian Flow

1 Literature Review

The term "Graphics Processing Unit", known as GPU, was populated by Nvidia in the year of 1999. Originally, it was designed to be a high performance device tailored towards the needs of the 3-D gaming industry for high performance, real-time graphics engines. Initially, the only programming interfaces were shading languages such as Cg (C for Graphics) or GLSL (OpenGL Shading Language). Although researchers already had the experience of solving general

[*]Corresponding author, Key Laboratory of Road and Traffic Engineering of the Ministry of Education, Tongji University, P.R.C., by@tongji.edu.cn
[†]Tongji University, P.R.C., kaitengwu@163.com
[‡]Tongji University, P.R.C., 1213235421@qq.com
[§]Tongji University, P.R.C., aubrey_co@163.com
[¶]University of California at Davis, U.S.A., hmzhang@ucdavis.edu
[‖]Corresponding author, Tongji University, P.R.C., yangxinwen0603@163.com