GPU accelerated vessel density

Supervision

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Project type

Internship or Master project with extension

Requirements

The candidate should have a passport from a NATO country, preferably West-European.

Context

The results of this project will be part of the Poseidon Project (www.esi.nl/poseidon and www.win.tue.nl/~cwillems), where Dutch universities are challenged by the industrial partners Thales Nederland (www.thales.nl) and Noldus IT (www.noldus.nl). The visualization group conducts research in the area of visualization of spatio-temporal data. In practice this means that we try to visually analyze moving objects (Thales → ships, Noldus → animals) to find behavioral patterns. Data of moving objects is per object a list of tuples (trajectory) containing: time, position, and other attributes such as speed or direction. Since the data is obtained by sensors with a high frequency the data size is often large.

Description

Recently we have published a visualization method [1] to show variations in speed for ship trajectories. Figure 1, shows one of the results for ship data. Our current tool is a sequential implementation, with space for performance improvements. The computational model for the visualization is a per-line-segment-convolution which can be computed in parallel as well.

This project should result in a component that can compute vessel density in parallel using CUDA. This can be done in C++ or in Java with JNI/JNA or the new Java CUDA bindings Jacuzzi (apps.sourceforge.net/wordpress/jacuzzi/).

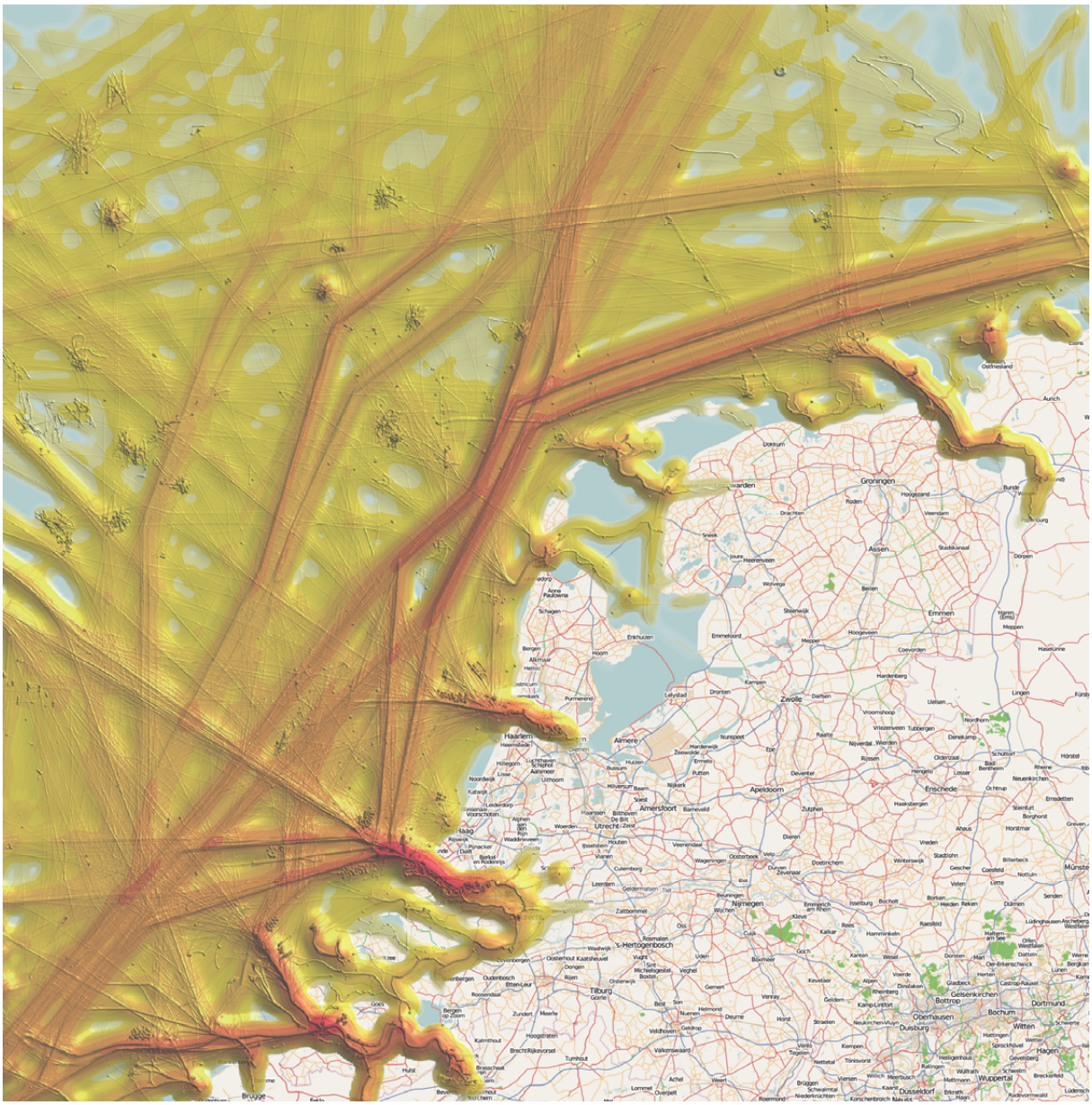

Figure 1: Vessel density in front of the Dutch coast

Extension to master project

This project can be extended to a master project by exploring the following:

- Improve the performance by exploring other numerical schemes for computing the density for one pixel.
- Improve the performance by exploring analytical (closed-form) formulas, for various kernels (Gaussian, polynomial) possibly with some relaxations of the given model [1].

Literature

[1] Visualization of vessel movements, Niels Willems, Huub van de Wetering, and Jarke J. van Wijk, 11th Eurographics/IEEE-VGTC Symposium on Visualization (Computer Graphics Forum; Proceedings of EuroVis 2009), 2009