KTH Stockholm
CSC :: HPCViz
Visualization, Spring 2015, DD2257
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Homework assignment No. 07

Due May 20, 2015

Task 7.1: Topology of 2D Vector Fields **10+3+2 P**

Load a 2D vector field and visualize its topological skeleton, i.e., its critical points and separatrices. The assignment comes with several data sets for testing. See Figure 1 for examples. In particular, implement the following features:

(a) Extraction of the critical points. This means to find the location of all critical points in the data set. Show them as thick points in GeoX.
Hint: The VectorField2 *class represents a uniform grid with bilinear interpolation. To find critical points, you can use the* domain decomposition & change-of-sign test *from the lecture.*

(b) Classification of the critical points. This means to determine the type of each critical point. Show this by coloring the points as follows:

- source: red
- repelling focus: orange
- saddle: yellow
- center: green
- sink: blue
- attracting focus: violet

Hint: The VectorField2 *class has a function* sampleJacobian() *to compute the Jacobian at a given location. The result is a* Matrix2f*, which in turn has a function* solveEigenProblem() *to compute eigenvalues and eigenvectors.*

(c) Compute the separatrices. This means to integrate four stream lines from each saddle into the direction of the eigenvectors. Show them as lines in GeoX.

Task 7.2: Topology of 2D Scalar Fields **5 P**

Load a 2D scalar field and visualize the topological skeleton of its gradient. The assignment comes with several data sets for testing.

Task 7.3: Combination with other flow visualization method (Bonus) **5 P**

A topological visualization is often more intuitive when it is combined with other flow visualization methods. For example, a LIC texture can be displayed in the background and the topological skeleton in front of it (GeoX takes care of the proper ordering when rendering). Another option would be to display additional stream lines.

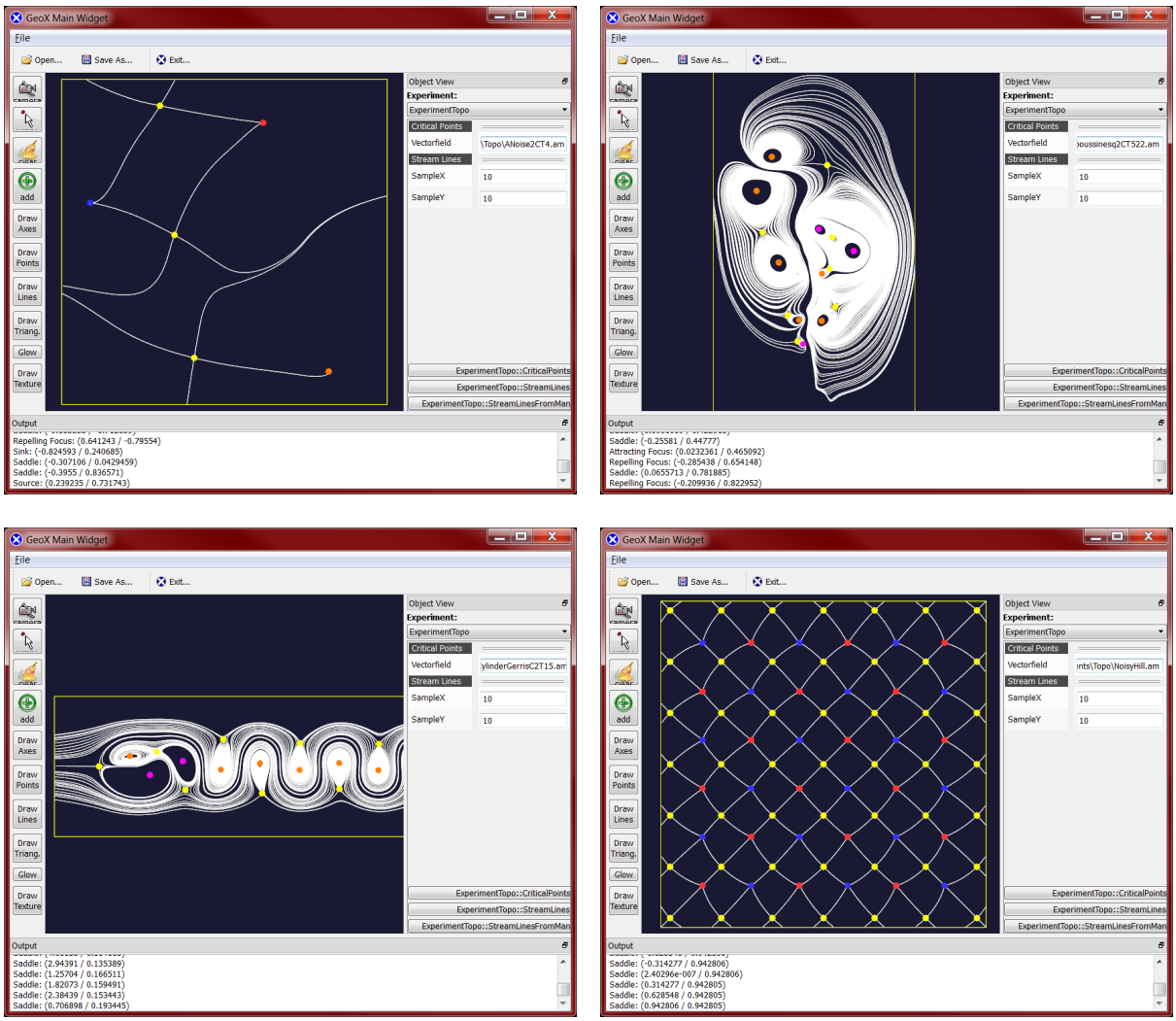

Figure 1: Topological skeletons of different data sets.