KTH Stockholm
CSC :: CST
Visualization, Autumn 2017, DD2257
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Homework assignment No. 03

Due September 21, 2017

Download the zip-File with the code and place the contents in the same folder as the previous modules. Follow the same process to activate the `IVW_MODULE_DD2257LAB2` module in CMake and build Inviwo.

You find the workspaces for this assignment under *File* → *Example Workspaces* → *DD2257Lab0* in the Inviwo application or in the `dd2257lab2/data/workspaces` folder. The workspace for the first and second task are `singleIsoValue.inv` and `multipleIsoValues.inv` respectively. You will need to modify only the file(s) `marchingsquares.cpp` (and `marchingsquares.h`). See these files for additional comments.

Task 3.1: Marching Squares Implementation **2+9+4 P**

You are given different two-dimensional scalar fields sampled on a regular grid. Table 1 gives an overview of the data sets that come with this task. We may load other data sets during the interview. We may use any isovalue during the interview.

(a) Load a given data set from disk and visualize the mesh of the regular grid using line primitives. Respect the bounding box size and the relative cell size of the data set for the visualization.

(b) Implement the *Marching Squares* algorithm for the extraction of isocontours of the scalar field. Visualize both the grid mesh and the isocontours for a given isovalue c using line primitives. The isovalue c is a property of the processor that can be changed by the user. To solve ambiguities, implement the *Midpoint Decider* strategy. A good test data set is `SimpleGrid.am`.

(c) Implement the *Asymptotic Decider* strategy to solve ambiguities. Compare the results with the Midpoint Decider strategy. Find examples (data set and isovalue) for which the visualizations differ significantly.

Task 3.2: Isocontour Visualization of Complex Data Set **5 P**

You are given a larger two-dimensional scalar field `IsabelTemparature.am`. It represents the temperature over North America during the Isabel hurricane in 2010. See Figure 1.

Use your implementation of the *Marching Squares* algorithm to visualize n different equidistant isocontours of the data set between the minimal and maximal temperature in that data set. The integer n is a property of the processor that can be changed by the user. *Do not visualize the grid mesh in this task.*

(Bonus Points: +2) Assign a different color to each isocontour in a perceptually appropriate manner using a transfer function.

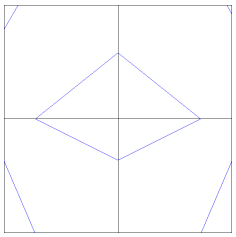
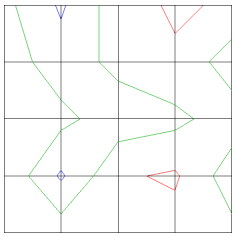
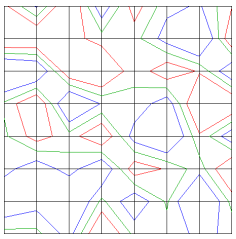
Data Set	Isovalues	Visualization
`SmallGrid.am`	-.5	
`SimpleGrid.am`	1.5, 5, 8.5	
`WideGrid.am`	0.35, 0.5, 0.65	

Table 1: Scalar fields for Task 1. The structure of the uniform grid is shown together with different isocontours.

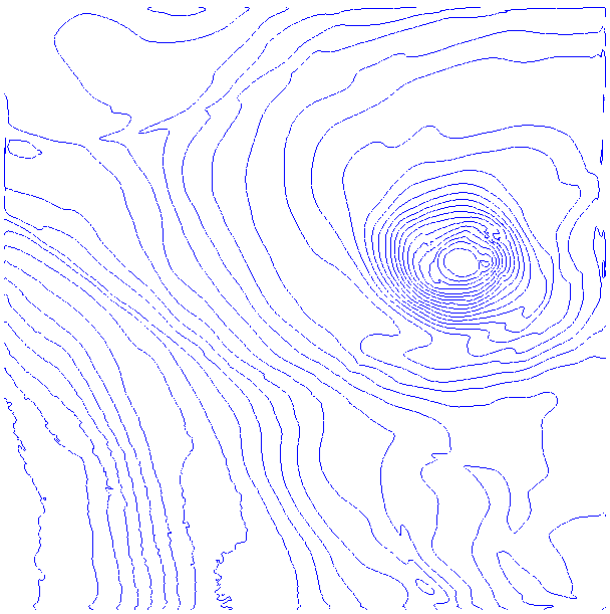


Figure 1: Isocontour visualization of the temperature over North America during the Isabel hurricane in 2010.