Project: "Differential estimators distance transformation"

Introduction

The objective of this project is to estimate differential estimators from an implicit representation of a digital surface.

We expect from you:

- A short report with answers to the "formal" questions and a description of the your implementation choices and results.

- A C++ project (`CMakeLists.txt` plus several **commented** cpp program files).

1   Project Description

The idea is to model the a digital surface as the zero-crossing of a implicit function and to estimate differential quantities from this implicit parametrization.
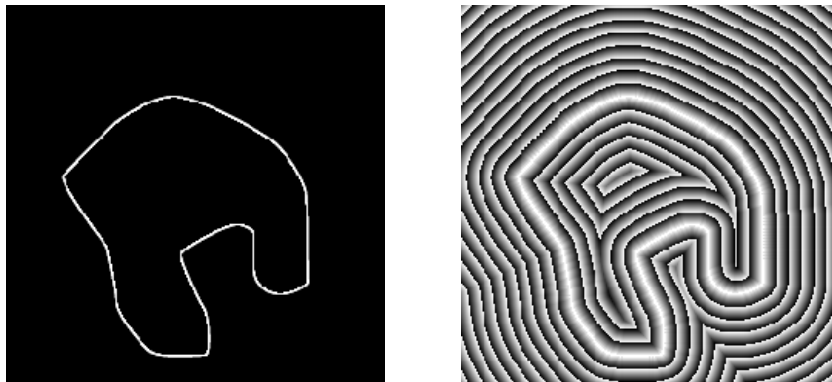
Question 1 *Implement a function that digitizes an implicit shape (see MicroTutorial) on a digital grid with step h.*

Question 2 *Using a distance transformation on the shape and its complement, construct an implicit parametrization of the shape.*

Question 3 *From this parametrization, implement differential estimators such as normal vector field and curvature on surface point.*

2   Multigrid Analysis

Question 4 *From this parametrization, implement differential estimators such as normal vector field and curvature on boundary points. For example, you could consider finite difference analysis of the implicit function.*

Question 5 *Perform a complete multigrid convergence evaluation with comparison to both expected quantities (available in DGTAL for implicit shapes, cf documentation) and estimated ones from other estimators (e.g. estimators based on maximal DSS computations, cf documentation).*

Question 6 *Please discuss about the quality of implicit parametrization based estimators (speed, quality...).*

3   Extensions

Question 7 *Implement the same estimation on volumetric objects (*i.e. *in $\mathbb{Z}^3$). For comparison, please consider normal vector and curvature estimators on digital surface implemented in* DGTAL.