Computer Vision Group
Institut für Informatik
Technische Universität München

Weekly Exercises 7

Room: 02.09.023

Wed, 05.07.2017, 14:00-16:00

Submission deadline: Tue, 04.07.2017, 23:59 to laehner@in.tum.de

Mathematics: Curvature

Exercise 1 (1 point)**.** Show that the principle curvature can be calculated if the mean and Gauss curvature are given.

Exercise 2 (4 points)**.** Show that the gaussian curvature of the torus in 3D (see Exercise sheet 2) integrates to zero. Tip: the parametrization and differential of the torus can be found in the solutions, choose arbitrary values for a, r to simplify the calculations. ($a = 2, r = 1$ for example) First, try to find the Gauss Map and calculate its differential. It suffices to write the Gauss Map as a function $N : U \to \mathbb{S}^2$. Then write the differential in an basis of the tangent space (the columns of Dx for example).

Programming: Also Curvature

Exercise 3 (3 points)**.** Download the supplementary material from the homepage. It contains a triangle mesh of a torus.

1. Calculate the point-wise Gaussian curvature using the formula from the lecture. Plot it onto the mesh. If you want to improve your Matlab skills, try to use as few for-loops as possible. (For-loop are super slow in comparison to matrix operations in Matlab.)

2. Integrate the Gaussian curvature over the entire surface, once by simply summing and once using the mass matrix. Which one gives the (approximately) correct result?