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Assignment in Computer Graphics II – Assignment 12 – Computer Graphics and Multimedia Systems Group

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Assignment 1 [2 Points] Free Form Deformation (FFD), 2D

In this task you will implement the Bezier based Free Form Deformations. Download the framework deformation-framework.zip and take an initial look on the code.

All relevant files for this programming task can be found in the Deformation folder. Everything else can be assumed to be a black box. Since this framework is based on previous frameworks, you can find here some classes that you have already implemented in previous assignments.

To build the project in your preferred development environment use the included CMake project ("CMake-Lists.txt"). CMake can be downloaded from the following website: http://www.cmake.org/. Use the instructions on the page

http://www.cmake.org/cmake/help/runningcmake.html and the tutorial page to create the project.

The program has three tabs. Chaikin and 4Point contain subdivision controls you know already from previous tasks. The new tab Deformation allows deformation related controls. With the Controls settings you can choose if you want to manipulate the Bezier grid or the control polygon of the subdivision curve.

Implement the Free Form Deformation in Deformation/FreeFormDeform.hpp and Deformation/FreeFormDeform.cpp as presented in the lecture.

- 1. initialize: This function should do two things.
 - 1.1. Initialize the member variable Bezier_of class BezierSurface, which has been implemented in a previous assignment.
 - 1.2. Find min and max values for the x and the y parameter and store them in the corresponding member variables.
- getDeformPoint: In this function you have to implement the mapping of a given point on its deformed version. Thus, first, normalize the input point and, second, use the Bezier based mapping.
 Hint: Use member variables computed in the initialize function.
- 3. getDeformPointArray: In this function you have to compute the deformed versions of a whole Array of points.

Assignment 2 [2 Points] Quadtree vs. BSP Tree

Create schematically both, a quadtree and a BSP tree on the basis of a given space with positioned objects (A - P). When creating the BSP-Trees, the subdivisions should be made in the way that the divided space divides objects into two subspaces of equal numbers. The subdivision has to be repeated until only one object per segment is present. Example:



1. Draw the quadtree and the BSP partitioning, and specify the corresponding trees for the following objects:



2. Evaluate your results: What can be said about the complexity of locating an object within a Tree? Note: Consider possible extreme situations for the distribution of objects in the room!

Assignment 3 [2 Points] Robot arm

Given is a simplified robot arm, consisting of two unit cubes (-0.5...0.5).



- 1. Sketch the transformations depicted in an x-y-coordinate system.
- 2. Calculate: On what world coordinate the point (0.5, 0, 0) of each upper and lower arm is mapped?

Hand in: 25.1.2015, at beginning of the lecture or until 12:00 in the mailbox of the chair (next to room H-A 7107) and send files corresponding to the programming task to johnfr93@gmail.com.