Parallel Visual Computing 2012/13

Assignment 5

December, 6 2012

1. **Histograms** (10 points, 3 extra)
    a. Use GL_POINTS to generate a luminance histogram with a configurable bin size. It will require the use of blending. Can you use integer texture formats here? OpenGL frame buffers make visualization easier (8 points)
    b. Discuss the precision issues! (2 points)
    c. Draw the luminance histogram as a 2D plot (x axis bins; y axis density) without reading it back to the GPU. (3 **extra** points)

2. **HistoPyramids** (20 points)
    a. Create a fragment program to find the local maxima in the input image stars.ppm. Make pixels that are maxima 1 and others 0. There should be exactly 13 maxima i.e., white pixels (5 points)
    b. Create a Histopyramid of the maxima image. (5 points) This requires multiple passes. It is helpful, to have the result of the maxima finding-pass already in level 0 of the Histopyramid. Use FBOs. Use MIP mapping. Read from level *i* when writing level *i*+1. Remember, that levels of increasing index have a lower resolution. Use a one-channel format. Can you use an integer textures here?
    c. Read back the "last pixel" to the CPU (.. and nothing else). It should say "13", the number of maxima.
    d. Create a compact texture that holds the position (x in red, y in green) of every maximum. (5 points)
    e. Draw a feature marker (e.g. a red circle) around every maximum by drawing a point for each feature and using a geometry shader to extend it to a circle. (5 points)

3. **Voroin diagrams** (7 points)
    a. Generate a discrete Voronoi diagram in a fixed resolution out of *k* random points. Draw points and use a geometry shader to extend them to an area. Combine with depth buffering. (5 points)
    b. Which methods exist, to extend a point into an area? Which one is fastest? Measure! (2 points)