**Exercise Sheet SoSe 2014**
**Wirtschaftsinformatik und Maschinelles Lernen (ISMLL)**
**Prof. Dr. Dr. Lars Schmidt-Thieme, Carlotta Schatten, M.Eng.**

# Exercise Sheet Image Processing 8

Submission: 08.07.14 09:00 to voss@ismll.de & schatten@ismll.de

## Exercise 1 Theory (7 Points)

a) What is the mathematical concept behind the gradient algorithm for edge detection? How is this concept translated into something the computer can process? (2 Points)

b) What are the two mathematical concepts behind the Marr-Hildreth algorithm for edge detection? How are these concepts translated into something the computer can process? (4 Points)

c) What is the computational advantage of the Sobel Edge Detector? (1 Points)

## Exercise 2 Gradient Algorithm (5 Points)

a) Given the algorithm of the gradient for Edge Detection, compute the Edges of the following image:

$$\begin{matrix} 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 \\ 1 & 1 & 1 & 1 & 1 \end{matrix}$$

Give all the algorithm steps, write the final edge image considering that the allowed intensity values are 0, 0.5, 1, 1.5. The point 0,0 is in the upper left corner, y indicates columns and increases in the right direction and x indicates rows and increases in the downward direction. (5 Points)

## Exercise 2 Marr-Hildreth Algorithm (3 Points)

a) Compute the convolution Kernel $K_{yy}$ for the Marr-Hildreth algorithm showing all the steps. (3 Points)