Albert-Ludwigs-Universität Freiburg
Institut für Informatik
Lecture: Introduction to Mobile Robotics
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Prof. Dr. W. Burgard
Dipl.-Inf. B. Frank
Dipl.-Inf. D. Joho
MSc ACS H. Strasdat

Sheet 10

Topic: Exploration

Submission deadline: Tue 15.7.2008, 11:00 a.m. (before class)

Exercise 1: Pursuit Evasion Problem

Suppose a certain number of robots are chasing a moving intruder through a known, bounded environment. The robots have omni-vision and can detect the intruder at any distance if the intruder is in the line-of-sight. Can you draw an environment where k robots can succeed in finding the intruder in finite time, but $k-1$ robots cannot? Draw such an environment for $k = 2$, $k = 3$, and $k = 4$ robots. Describe the successful search strategy for k robots and explain why $k-1$ robots could not accomplish the task.

Exercise 2: Entropy

1. Compute the entropy $H(p)$ in bits (therefore use $\log_2$) of the following discrete distribution p:

$p(x_1)$	$p(x_2)$	$p(x_3)$	$p(x_4)$
0.04	0.06	0.2	0.7

2. Prove that the entropy of a grid map cell $m_{x,y}$ is maximal for $p(m_{x,y}) = 0.5$.

3. Consider a discrete uniform distribution of a random variable with n possible outcomes. Prove that the entropy of the distribution decreases if you change the distribution by increasing the probability of a single event and accordingly reducing the probability of another event.

Exercise 3: Line Extraction

Assume you have an array of 2d-points (ordered by the x coordinate). These points should be approximated by a set of lines. Implement the Douglas-Peucker-Line-Approximation-Algorithm ("Split and Merge").

A sample program you should complete (written in C/C++) is available on our web page.