UNIVERSITÄT ZU LÜBECK
INSTITUTE FOR ROBOTICS
AND COGNITIVE SYSTEMS

Artificial Intelligence II
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Daniel Wulff
wulff@rob.uni-luebeck.de

Exercise sheet 0

Submission deadline: November 6, 10:00 - **This sheet will be corrected, but not be graded!**

Task 1: Matlab Introduction

Prepare a MATLAB script called *myIntroduction* and perform the following tasks:

a) Create the vectors $a, b \in \mathbb{R}^{1\times5}$ with uniformly distributed random numbers.

b) Multiply the vectors a and b to get $c \in \mathbb{R}$ and $A \in \mathbb{R}^{5\times5}$. Transpose the vectors if necessary.

c) Perform element-wise multiplication with a and b to get vector $e \in \mathbb{R}^{1\times5}$.

d) Extract the elements at locations (1,2) and (2,3) from A

e) Extract and concatenate the elements in the upper and lower rows from A.

f) Set every value < 0.5 in A to 0 using logical indexing.

g) Create a diagonal matrix $B \in \mathbb{R}^{3\times3}$ using *magic()*.

h) Solve $Bx = f$ with $f = (1, 2, 3)^T$

i) Compute the eivenvalues of B

Task 2: Nearest Neighbor

Add the following tasks to your MATLAB script *myIntroduction*.
You received the following training data labeled with the classes 0 or 1:

x_1	2	2	2	3	3	4	4	5	7	7	8	9
x_2	5	6	8	4	6	5	9	9	7	9	8	7
y	0	0	0	0	0	0	1	1	1	1	1	1

You want to classify new datapoints U using nearest neighbor classification.

a) Import the data into your matlab script and visualize it in a scatter plot. (Hint: use *doc gscatter*)

b) Create the function `[ v, pred ] = bruteForce( X, Y, U )` and implement a brute force algorithm to classify U using a for-loop. The function returns the distance vector `v` that contains all distances between U and dataset X and the final classification `pred`. Use the function to classify the datapoints $U_1 = (4, 7)$ and $U_2 = (7, 5)$.

c) Use the MATLAB function *knnsearch()* to perform a nearest neighbor classification of the datapoints U_1 and U_2 using a kd-tree. Compare the result to task b).

Please prepare all of your submissions in english!