

HW0: Basic machine learning concepts

1 Student Survey

Please note the following information on your assignment:

1. Which of the following courses have you taken: Differential calculus; Integral calculus; Multivariate calculus; Linear algebra; Probability and statistics; Artificial Intelligence; Algorithms; Computer vision; Natural language processing; Robotics; Optimization (linear, quadratic, convex, etc.)
2. List a few (research) topics that interest you.
3. How would you rate your programming skills (1-10, 10 best)? How would you rate your math skills?

2 Written Exercises

Answer the following questions in 25-100 words each:

1. What is the difference between supervised, unsupervised and reinforcement learning?
2. List at least two real-world problems (other than those discussed in class) for each of the categories: supervised, unsupervised and reinforcement. For one of the supervised problems, what is the form of the output and what might be a reasonable input? For the reinforcement learning problem, what might be the state space, action space and reward function?
3. What is inductive bias?
4. What is generalization?

3 Matlab Exercises

Read the Matlab tutorial at <http://www.math.utah.edu/faq/matlab/tutorial/> What are each of the following operations doing? What is their result? (If an operation fails, tell me why.)

1. `>> [1 2 3 ; 4 5 6 ; 7 8 9] * [10 ; 11 ; 12]`
2. `>> [eye(3) ; 0 1 2]`
3. `>> x = rand(4);`
`>> repmat(x,2,2) - [x x ; x x]`
4. `>> [0 1 2 ; 2 1 0 ; 1 2 0] * [0 1 1]`
5. `>> [0 1 2 ; 2 1 0 ; 1 2 0] * [0 1 1]'`
6. `>> x = [];`
`>> for i=1:10, x = [x i]; end;`
`>> x`
7. `>> inv(eye(5))`
8. `>> x = rand(10000);`
`>> sum(sum(x>0.5)) / 10000`
9. `>> x = rand(20);`
`>> x([1 5 20], 5:10);`