

Problem Set 1:

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Instructions: This problem set is not a part of your final grade. Solve at least 3 of these problems and submit your solutions on t-square. We will not grade them, but we will provide solutions at the end of the deadline for you to compare your answers. If your final score falls very close to the switchover point to the next higher grade, we will grade your submission of this problem set for input into determining your final grade.

7) Give the VC dimension of the following hypothesis spaces. Briefly explain your answers.

1. An origin-centered circle (2D)

Hypothesis space is infinite, there are infinite points on a circle. . VC is dimension of hyperplane plus 1. The dimension of the hyperplane is 2d (cartesian or polar). Thus, VC is 3 for an origin-centered circle.

2. An origin-centered sphere (3D)

Hypothesis space is infinite, there are infinite points on a sphere. . VC is dimension of hyperplane plus 1. The dimension of the hyperplane is 3d (cartesian or spherical). Thus, VC is 4 for an origin-centered sphere.

6) Imagine you had a learning problem with an instance space of points on the plane and a target function that you knew took the form of a line on the plane where all points on one side of the line are positive and all those on the other are negative. If you were constrained to only use decision tree or nearest-neighbor learning, which would you use? Why?

To use nearest neighbor (NN), we would take the list of points, multiply them by their labels, and train the NN learner with neighbor size large enough to split the points into two groups. This would group them into positive and negative values, with the caveat that the border is a bit fuzzy depending on the neighbor size used. To use decision tree (DT) for this problem, labels will be if the point is positive or negative. The inputs are

I would need to use the coordinates as the feature inputs and +/- for labels. Then train the decision tree to get the target function. To recover the target function, we would grab the weights.