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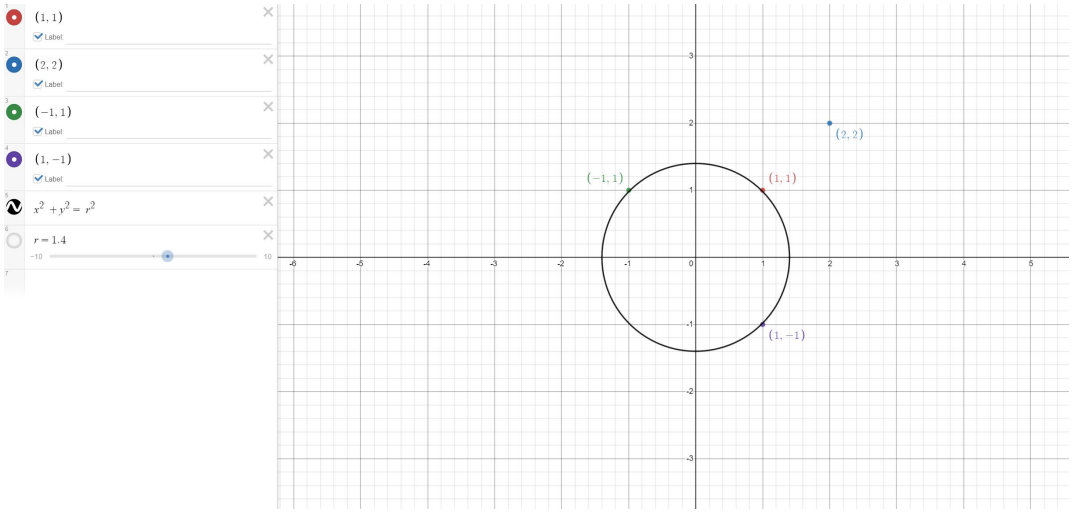
Machine Learning HW 1

Q1. a) There is no origin-centered circle classifier that can classify the positive and negative points.

Consider the plot below. From the points given, there is no way to classify positive points within the circle and negative points outside the circle, since the farthest point from the origin is (2, 2), a positive point. This means that for all positive points to be within the circle, the circle would require a radius of $2\sqrt{2}$, and all points would then be within the circle. Conversely, if we were to consider all points outside the circle as positive, and points within the circle as negative, for the circle to contain all negative points, it would require a radius of 1.5 (at r=1.4, points would be touching the circle as shown below). However, this would mean that the positive point (1,1) would also be inside the circle since the distance between (1, 1), (1, -1) and (-1, 1) from the origin is the same.



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b) There is no line through the origin that can classify the points. The equation of the line through the negative points is $y = -x$ and the line passes through the origin. From the graph, modifying the gradient of this equation would cause the negative points to always be on opposite sides of the line.