

## Quadric Machine Homework

For this assignment you will practice with devising features for and learning with a quadric machine.

- Assume a 2 input perceptron expanded to be a quadric perceptron.
- It outputs 1 if  $\text{net} > 0$ , else 0.
- Note that with binary inputs of -1, 1, that  $x^2$  and  $y^2$  would always be 1 and thus do not add info and are not needed (they would just act like two more bias weights). You must decide what added feature(s) is needed to make the problem linearly separable.
- Assume a bias input of 1.
- Assume a learning rate  $c$  of .4 and initial weights all 0:  $\Delta w_i = c(t - z) x_i$
- Show weights after each pattern for one epoch with the following non-linearly separable training set (XOR):

$x$	$y$	<i>Target</i>
-1	-1	0
-1	1	1
1	-1	1
1	1	0

- Answer the following questions:
  1. Has it learned to solve the problem after just one epoch? How do you know?
  2. Which of the quadric features are actually needed to solve this training set?