

Example: Perceptron Training (Reflected Prototypes)

$$\underline{w}(i+1) = \underline{w}(i) + \alpha \tilde{y}_m^{(k)} \quad \text{if } \underline{w}^T(i) \tilde{y}_m^{(k)} \leq 0$$

(i.e., if $\tilde{y}_m^{(k)}$ is misclassified)

$$= \underline{w}(i) \quad \text{if } \underline{w}^T(i) \tilde{y}_m^{(k)} > 0$$

Perceptron Example

<u>Prototypes(augmented)</u>	<u>Class</u>	<u>Desired Condition</u>
\underline{y}_1 1 1 -1 0 2 1	S ₂	$\underline{w}^T \underline{y}_1 < 0$
\underline{y}_2 0 0 1 2 0 1	S ₁	$\underline{w}^T \underline{y}_2 > 0$
\underline{y}_3 -1 -1 1 1 0 1	S ₂	$\underline{w}^T \underline{y}_3 < 0$
\underline{y}_4 4 0 1 2 1 1	S ₁	$\underline{w}^T \underline{y}_4 > 0$
\underline{y}_5 -1 1 1 1 0 1	S ₁	$\underline{w}^T \underline{y}_5 > 0$
\underline{y}_6 -1 -1 -1 1 0 1	S ₁	$\underline{w}^T \underline{y}_6 > 0$
\underline{y}_7 -1 1 1 2 1 1	S ₂	$\underline{w}^T \underline{y}_7 < 0$

<u>Reflected Prototypes</u>	<u>Class</u>	<u>Desired Condition</u>
-1 -1 1 0 -2 -1	S ₂	$-\underline{w}^T \underline{y}_1 > 0$
0 0 1 2 0 1	S ₁	$\underline{w}^T \underline{y}_2 > 0$
1 1 -1 -1 0 -1	S ₂	$-\underline{w}^T \underline{y}_3 > 0$
4 0 1 2 1 1	S ₁	$\underline{w}^T \underline{y}_4 > 0$
-1 1 1 1 0 1	S ₁	$\underline{w}^T \underline{y}_5 > 0$
-1 -1 -1 1 0 1	S ₁	$\underline{w}^T \underline{y}_6 > 0$
1 -1 -1 -2 -1 -1	S ₂	$-\underline{w}^T \underline{y}_7 > 0$

Use fixed increment, $\alpha(i)=1$, one-at-a-time update

<u>Reflected Prototypes</u>	<u>Weight Vector, w</u>	<u>$w^T y$</u>	
<u>y_1</u> -1 -1 1 0 -2 -1	1 1 1 -1 -1 1	0	
<u>y_2</u> 0 0 1 2 0 1	0 0 2 -1 -3 0	0	
<u>y_3</u> 1 1 -1 -1 0 -1	0 0 3 1 -3 1	-5	
<u>y_4</u> 4 0 1 2 1 1	1 1 2 0 -3 0	3	
<u>y_5</u> -1 1 1 1 0 1	1 1 2 0 -3 0	2	
<u>y_6</u> -1 -1 -1 1 0 1	1 1 2 0 -3 0	-4	
<u>y_7</u> 1 -1 -1 -2 -1 -1	0 0 1 1 -3 1	-1	First Epoch
<u>y_1</u> -1 -1 1 0 -2 -1	1 -1 0 -1 -4 0	8	
<u>y_2</u> 0 0 1 2 0 1	1 -1 0 -1 -4 0	-2	
<u>y_3</u> 1 1 -1 -1 0 -1	1 -1 1 1 -4 1	-3	
<u>y_4</u> 4 0 1 2 1 1	2 0 0 0 -4 0	4	
<u>y_5</u> -1 1 1 1 0 1	2 0 0 0 -4 0	-2	
<u>y_6</u> -1 -1 -1 1 0 1	1 1 1 1 -4 1	-1	
<u>y_7</u> 1 -1 -1 -2 -1 -1	0 0 0 2 -4 2	-2	Second Epoch