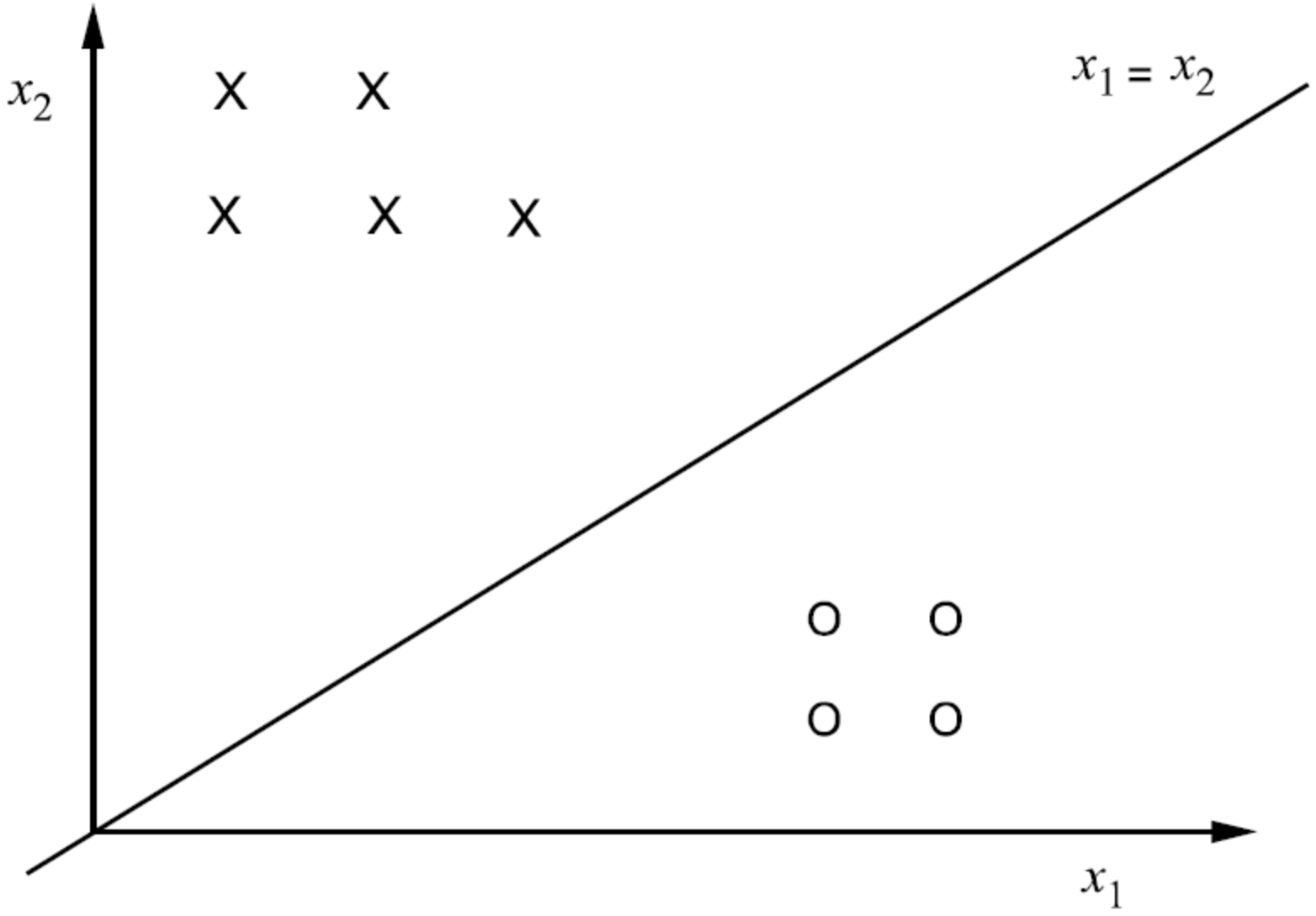
# Perceptron learning algorithm (single sample correction algo)

example

# Example data

Description of the patterns

| Pattern no. | 1 | 2 | Class |
|---|---|---|---|
| 1 | 0.5 | 3.0 | X |
| 2 | 1 | 3 | X |
| 3 | 0.5 | 2.5 | X |
| 4 | 1 | 2.5 | X |
| 5 | 1.5 | 2.5 | X |
| 6 | 4.5 | 1 | O |
| 7 | 5 | 1 | O |
| 8 | 4.5 | 0.5 | O |
| 9 | 5.5 | 0.5 | O |




Classification using a linear discriminant function

# Augmented + Normalized

Description of the patterns

| Pattern no. | 1 | 2 | Class |
|---|---|---|---|
| 1 | 0.5 | 3.0 | X |
| 2 | 1 | 3 | X |
| 3 | 0.5 | 2.5 | X |
| 4 | 1 | 2.5 | X |
| 5 | 1.5 | 2.5 | X |
| 6 | 4.5 | 1 | O |
| 7 | 5 | 1 | O |
| 8 | 4.5 | 0.5 | O |
| 9 | 5.5 | 0.5 | O |

2-dimensional data

| Pattern | 1 | 2 | 3 |
|---|---|---|---|
| $Y_1$ | −0.5 | −3.0 | −1 |
| $Y_2$ | −1 | −3 | −1 |
| $Y_3$ | −0.5 | −2.5 | −1 |
| $Y_4$ | −1 | −2.5 | −1 |
| $Y_5$ | −1.5 | −2.5 | −1 |
| $Y_6$ | 4.5 | 1 | 1 |
| $Y_7$ | 5 | 1 | 1 |
| $Y_8$ | 4.5 | 0.5 | 1 |
| $Y_9$ | 5.5 | 0.5 | 1 |

3-dimensional data.
Note, class label is not needed here.

# Perceptron learning algorithm ( single sample correction algo.)

1. Start with $a_0 = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$
2. classify $Y_1 = \begin{bmatrix} -0.5 \\ -3.0 \\ -1 \end{bmatrix}$
3. $a_0 Y_1 \leq 0$, So misclassified, hence
4. $a_1 = a_0 + Y_1 = \begin{bmatrix} -0.5 \\ -3.0 \\ -1 \end{bmatrix}$

5. Now $Y_1$ is correctly classified.
6. Consider $Y_2 = \begin{bmatrix} -1 \\ -3 \\ -1 \end{bmatrix}$
7. $Y_2$ is correctly classified.
8. Similarly $Y_3, Y_4, Y_5$ are all rightly classified.
9. Now consider $Y_6$

10. $a_1 = \begin{bmatrix} -0.5 \\ -3.0 \\ -1 \end{bmatrix}$, $Y_6 = \begin{bmatrix} 4.5 \\ 1 \\ 1 \end{bmatrix}$ is wrongly classified.

11. So, $a_2 = a_1 + Y_6 = \begin{bmatrix} 4.0 \\ -2.0 \\ 0 \end{bmatrix}$

12. Now, $Y_6, Y_7, Y_8, Y_9$ are also rightly classified.

13. But we need to verify that all are rightly classified.
14. $Y_1, Y_2, Y_3, Y_4$ are also rightly classified.
15. But, $Y_5$ is not. $Y_5 = \begin{bmatrix} -1.5 \\ -2.5 \\ -1 \end{bmatrix}$
16. So, $a_3 = a_2 + Y_5 = \begin{bmatrix} 2.5 \\ -4.5 \\ -1 \end{bmatrix}$

- Now all patterns are correctly classified.
- So the discriminant is $2.5x_1 - 4.5x_2 - 1 = 0$.