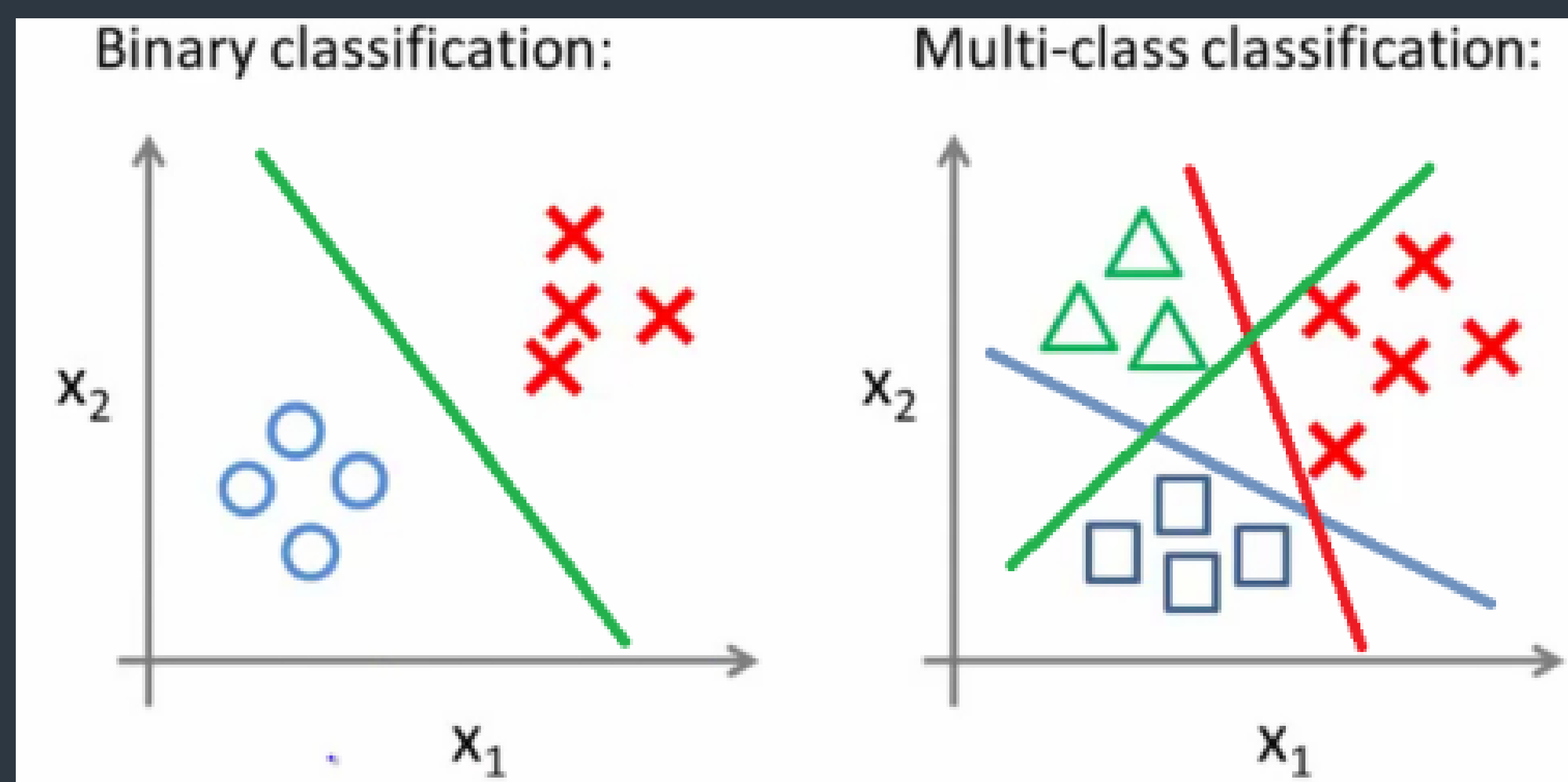


# Multiclass classification



→ One vs One  
→ One vs Rest

Image classifier (😊)

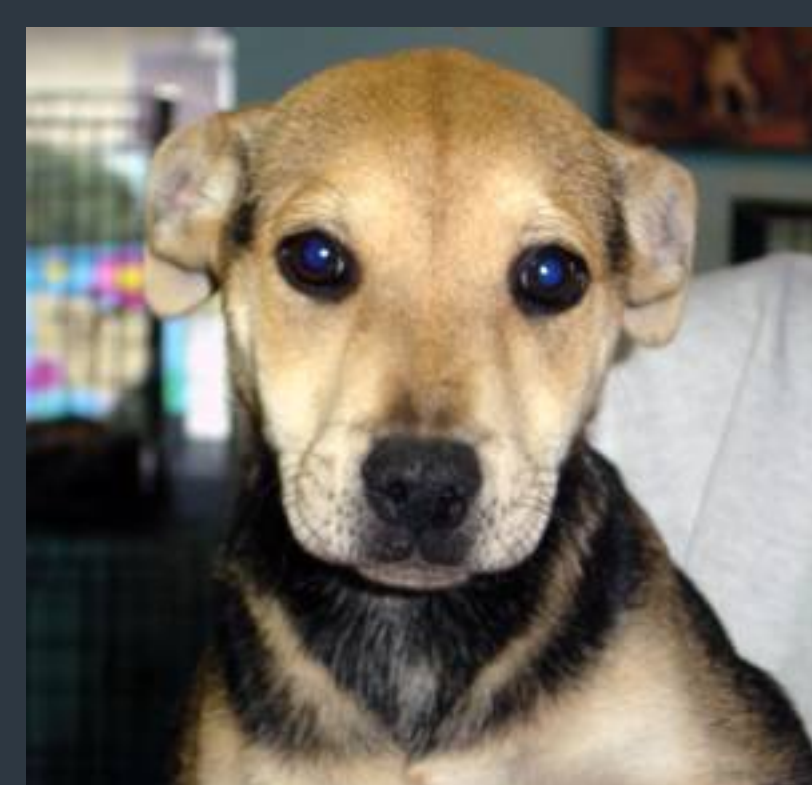
Logistic

Binary  
 $y \in \{0, 1\}$

SVM

Binary  
 $y \in \{-1, 1\}$

$y = \{0, 1, 2, 3\}$   
multiclass



↑  
dog



↑  
cat



horse

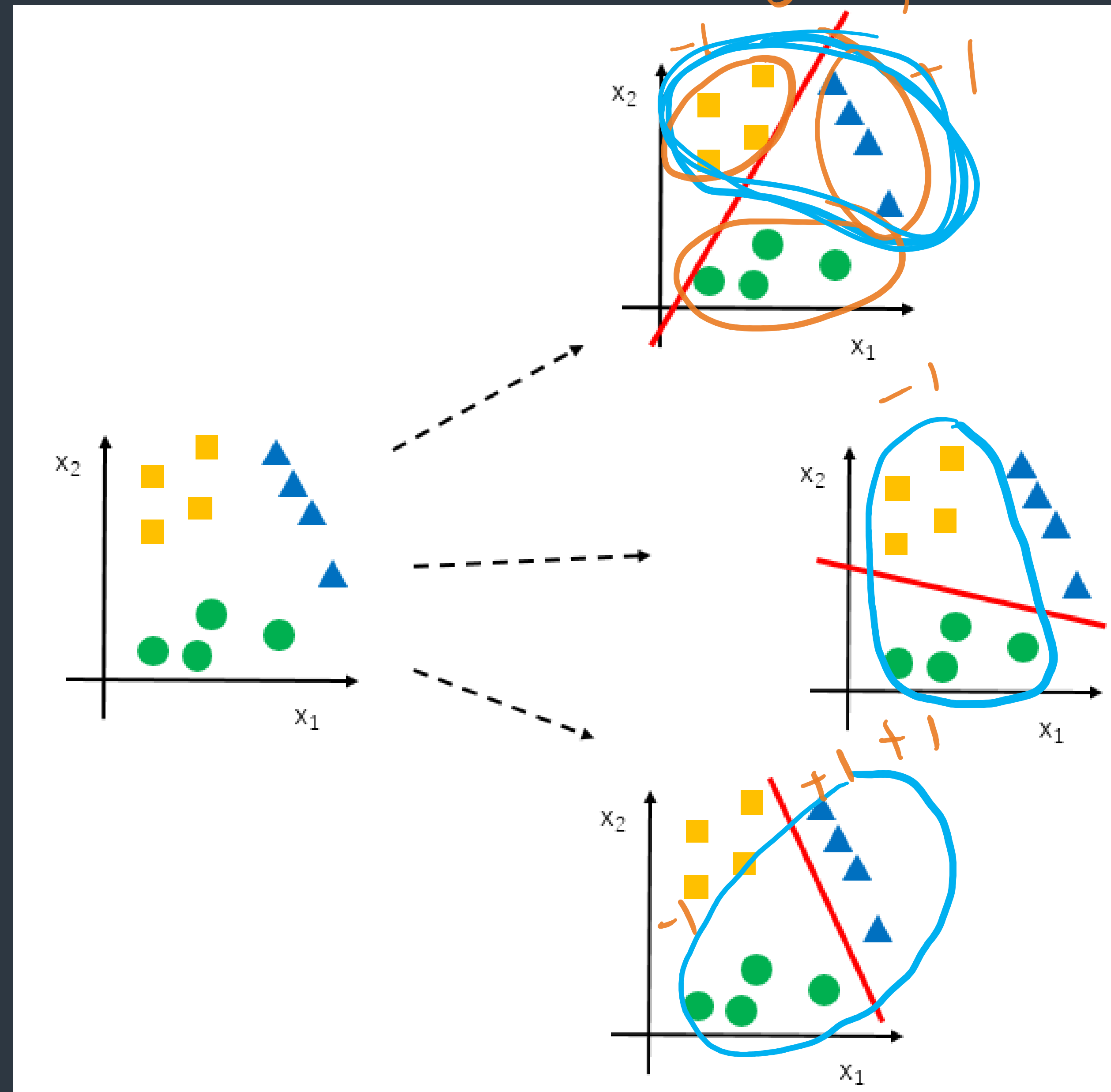
human





# One VS one

data { 0 → [ ]  
1 → [ ]  
2 → [ ]  
3 → [ ]



N classes

$N C_2$  classifiers every pair of data

$$5 C_2 = \frac{5 \cdot 4}{2} = 10 \text{ classifiers}$$

→ Majority  
→ majority vote from  $N C_2$  classifiers

Y-B  
-G  
B-G

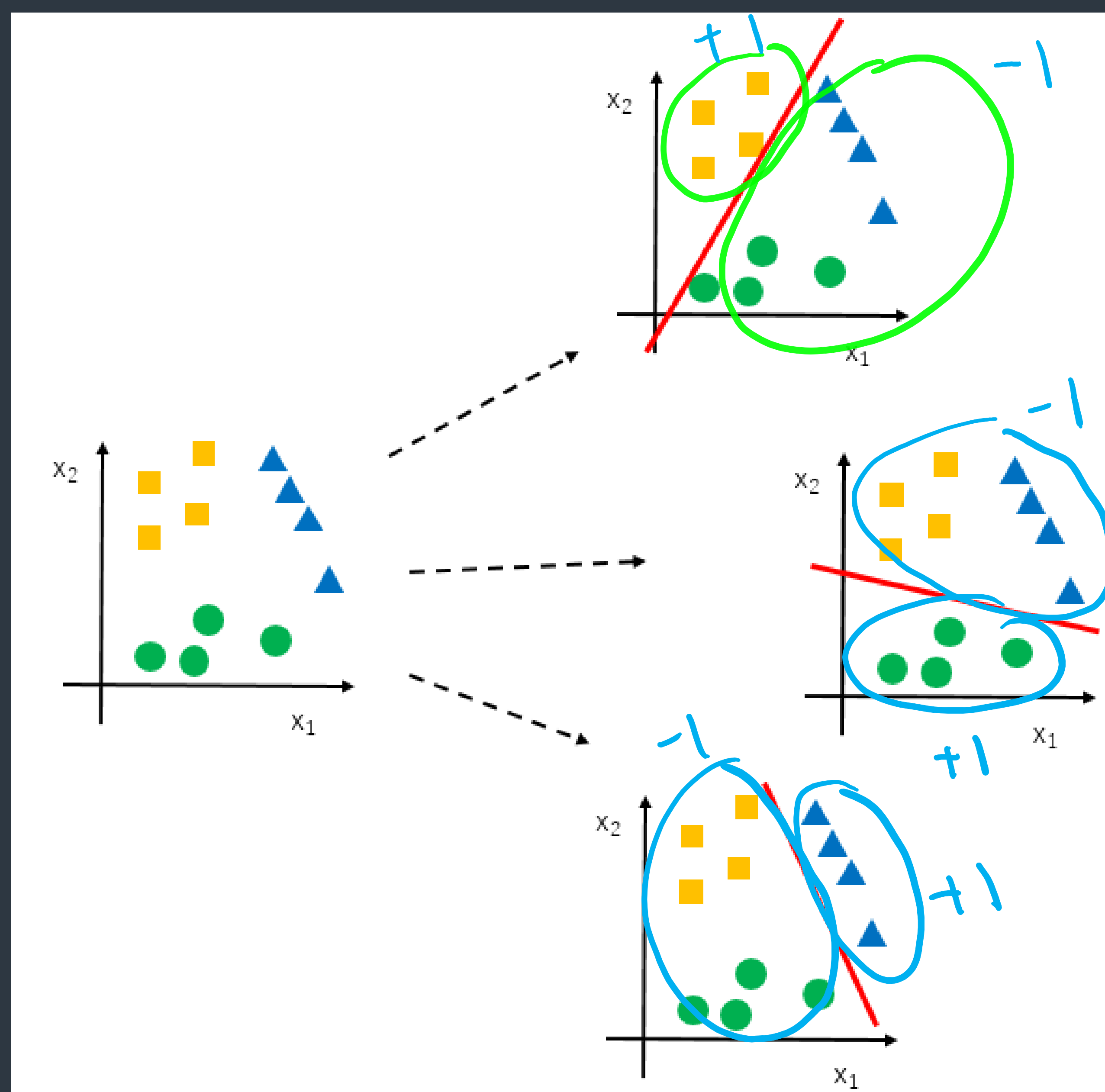
3 classifiers  
↓  
yellow

→  $O(N^2)$  time.

Useful: Large dataset One vs One scheme.

# One Vs Rest

yellow or  
↑  
not



→ More memory

→  $N$  classifiers  
↳ Yes/No  $x^{(i)} \in C$

→ Parallel.

→ less Time  $O(N)$

→ Common  $\Rightarrow$  Scikit  
Learn.

→  $\begin{bmatrix} \text{'ovr'} \\ \text{'ovo'} \end{bmatrix} \Rightarrow \uparrow \text{documentation}$