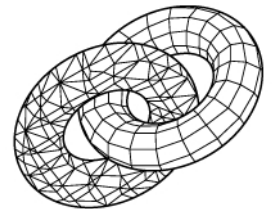
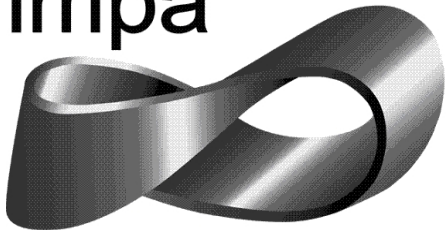


# Ciência de Dados Aplicada

## Aula 11: Máquinas de Vetores de Suporte (Support Vector Machines)

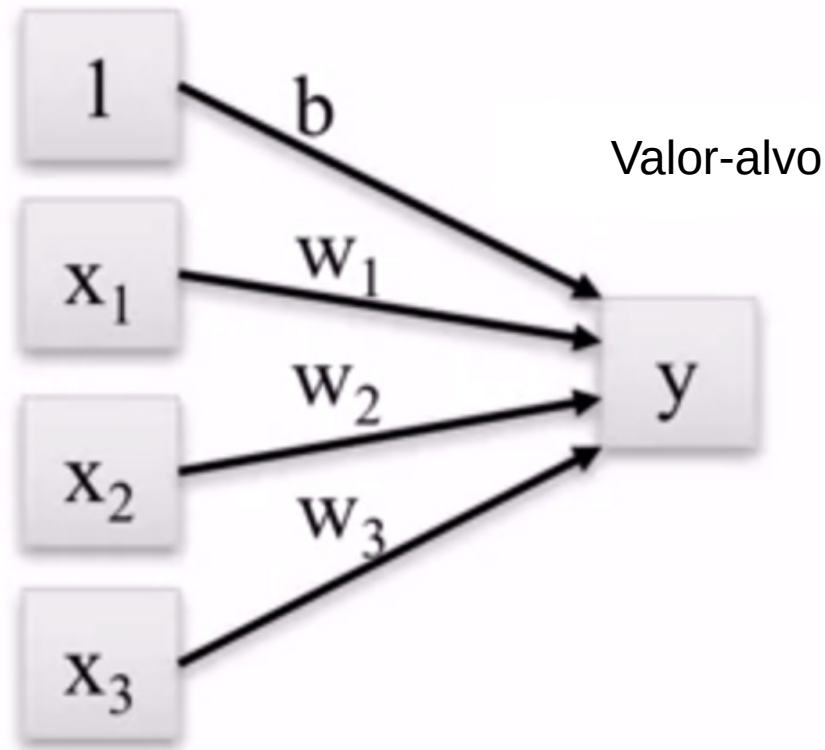
impa



VisgrafLab

# Regressão Linear

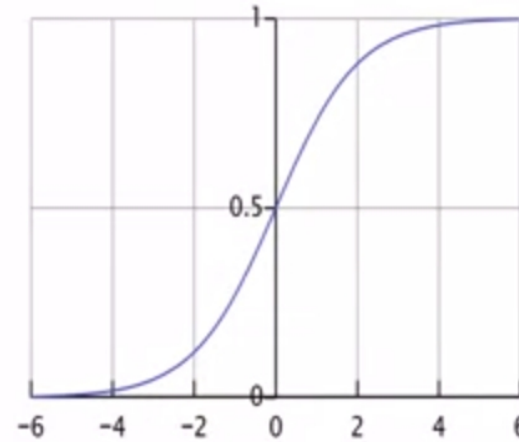
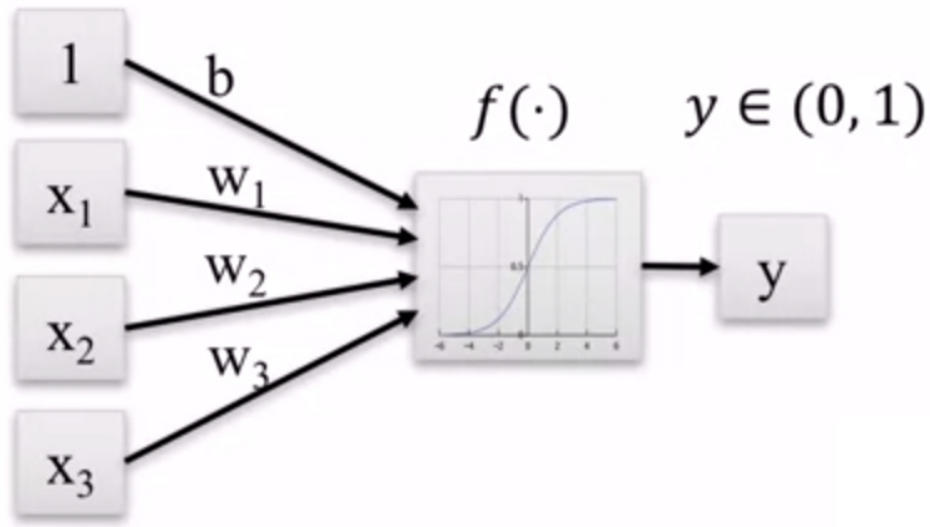
Características



$$\hat{y} = \hat{b} + \hat{w}_1 \cdot x_1 + \dots \hat{w}_n \cdot x_n$$

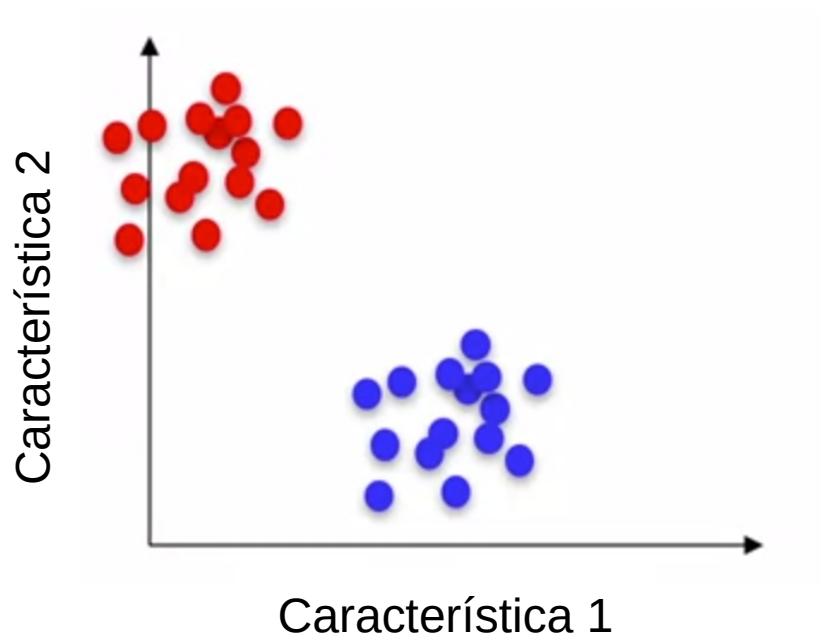
# Regressão Logística

Características

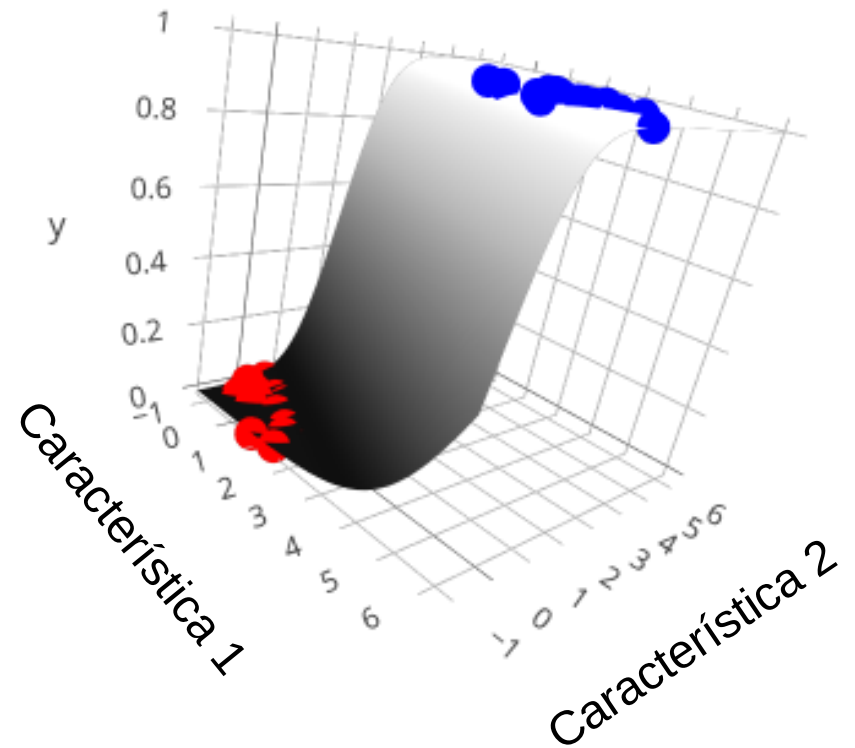
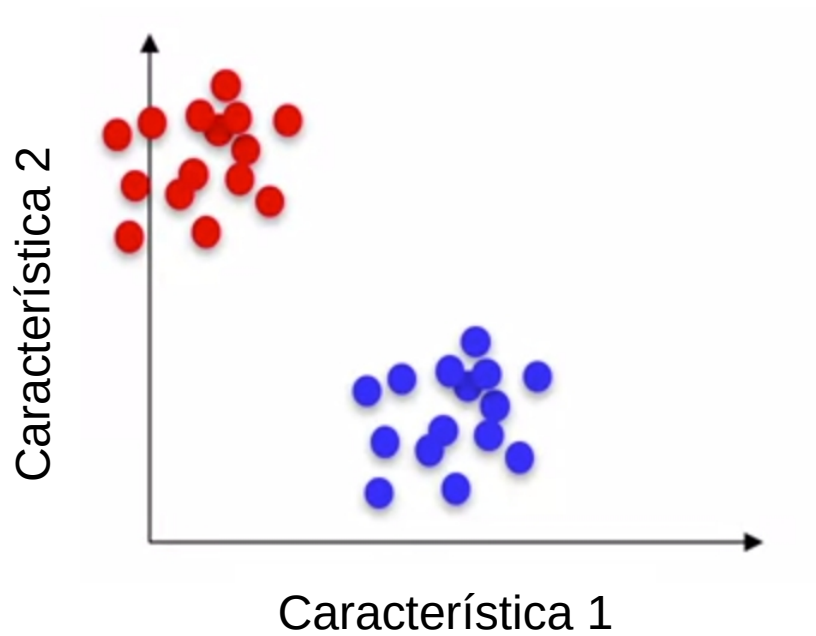


$$\hat{y} = \hat{b} + \hat{w}_1 \cdot x_1 + \dots \hat{w}_n \cdot x_n \quad \longrightarrow \quad \hat{y} = \frac{1}{1 + \exp [-(\hat{b} + \hat{w}_1 \cdot x_1 + \dots \hat{w}_n \cdot x_n)]}$$

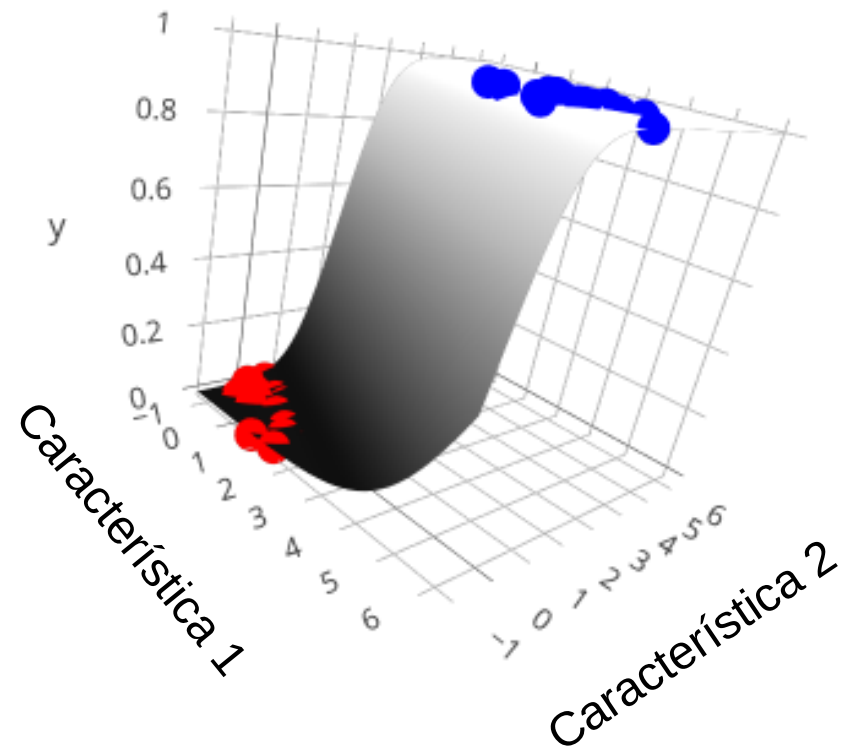
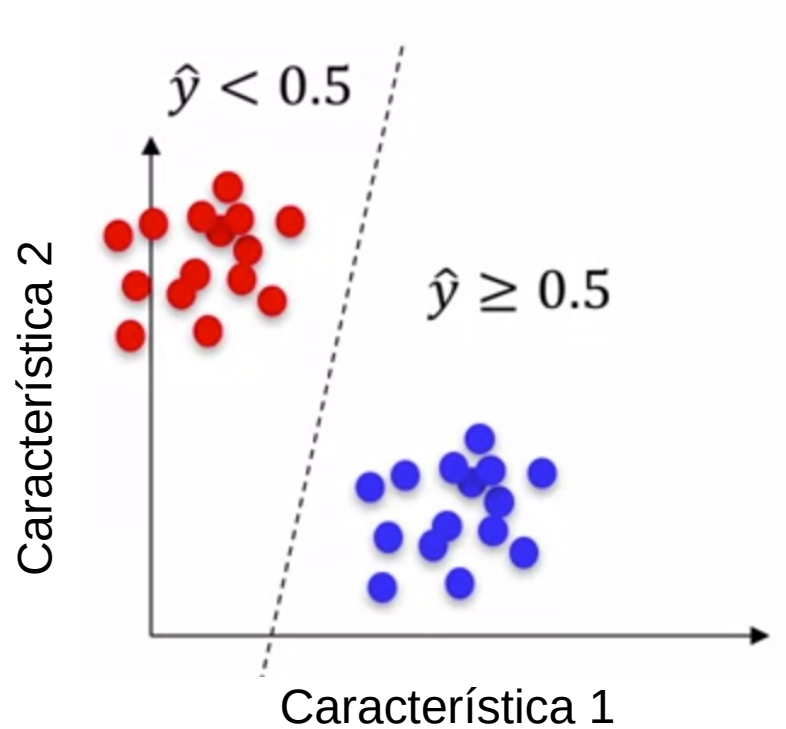
# Regressão Logística



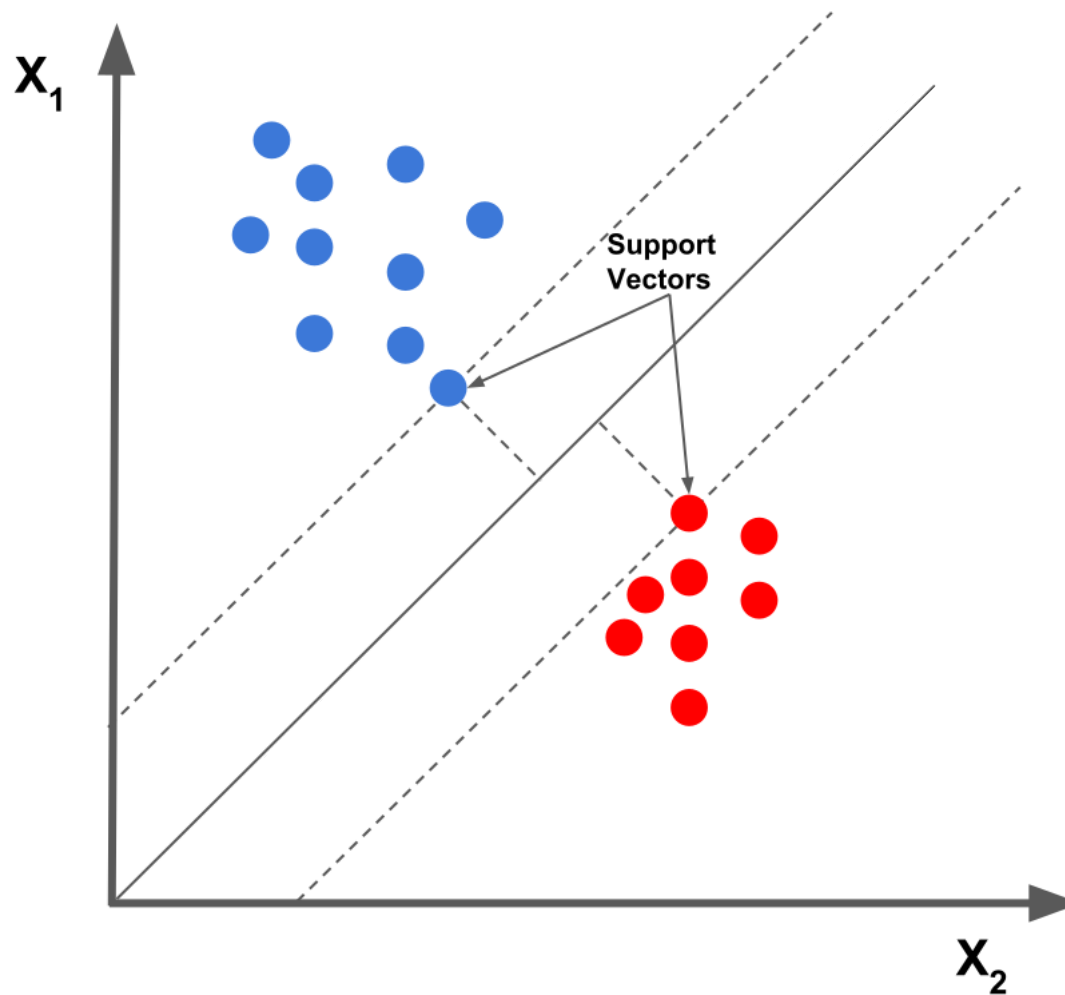
# Regressão Logística



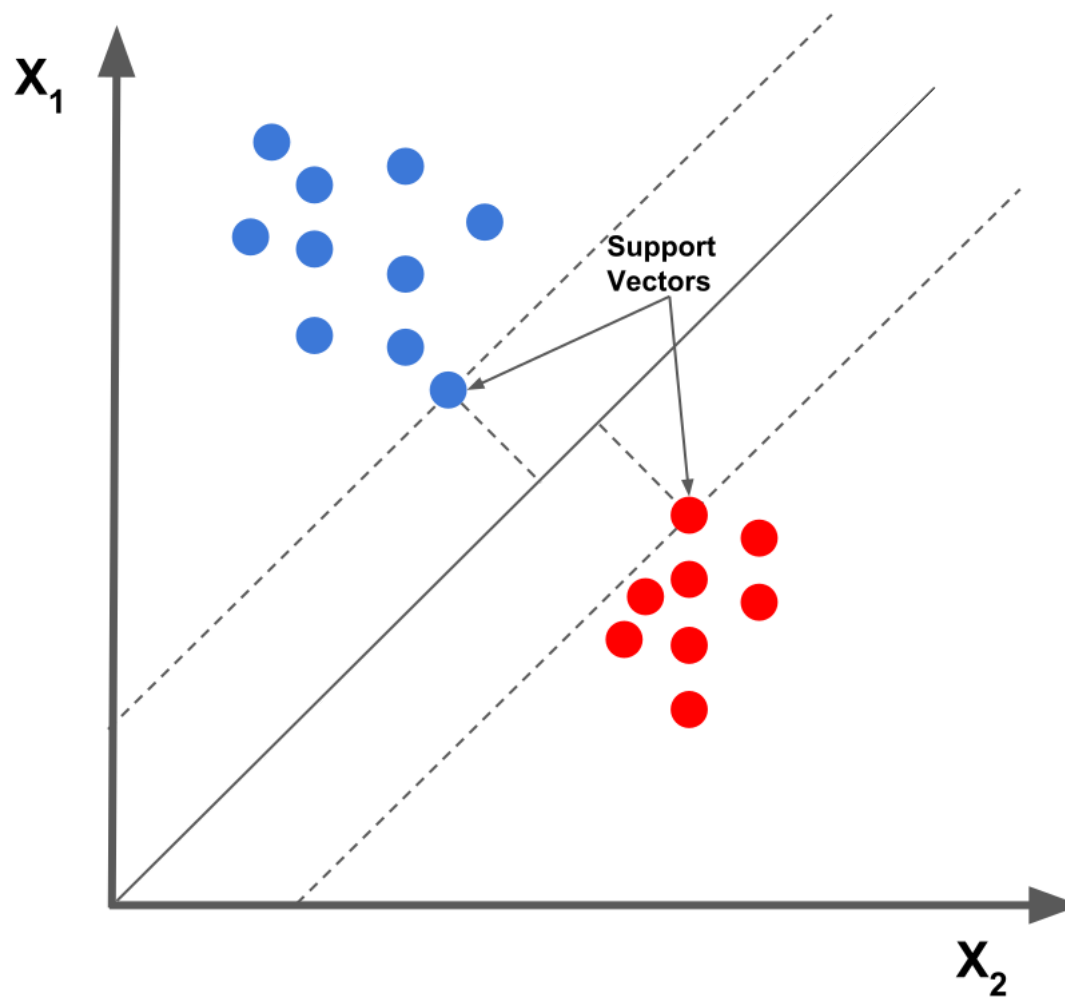
# Regressão Logística



# Vetores de Suporte

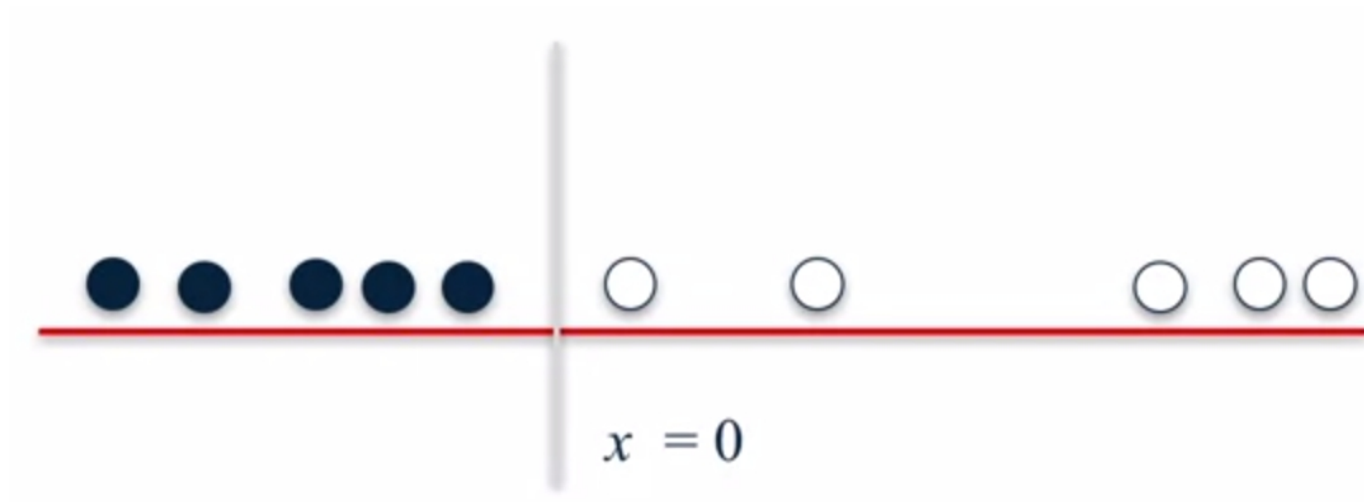


# Vetores de Suporte





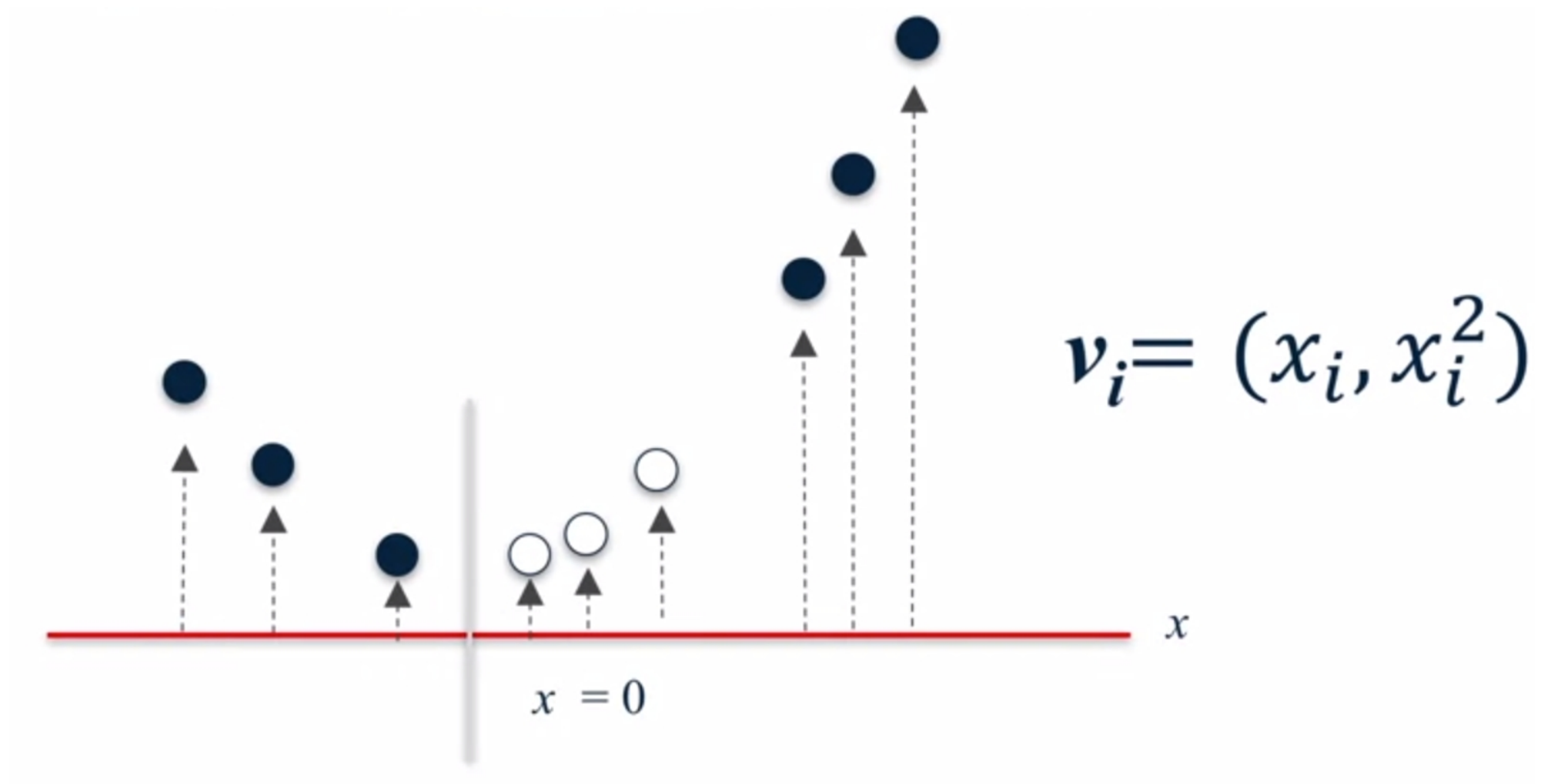
# Kernelização



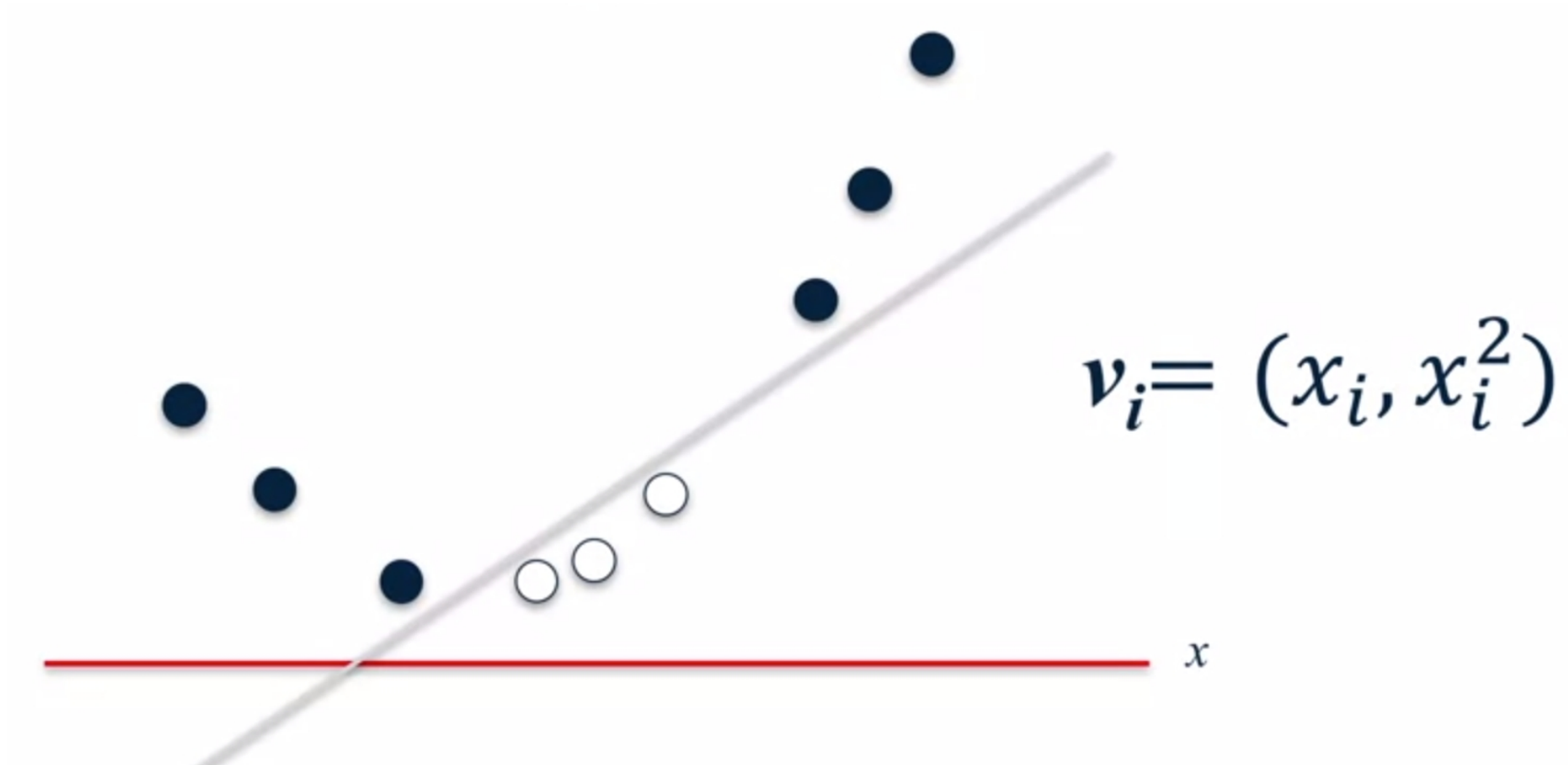
# Kernelização em 1 dimensão



# Kernelização – adicionando mais uma dimensão

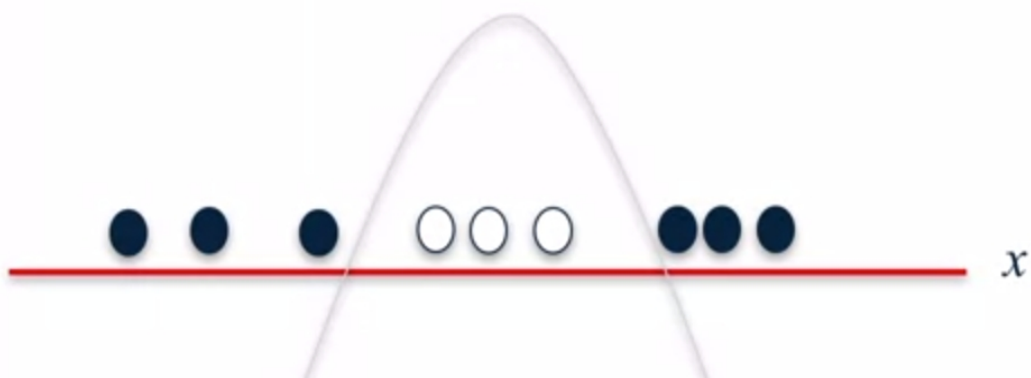


# Kernelização – adicionando mais uma dimensão

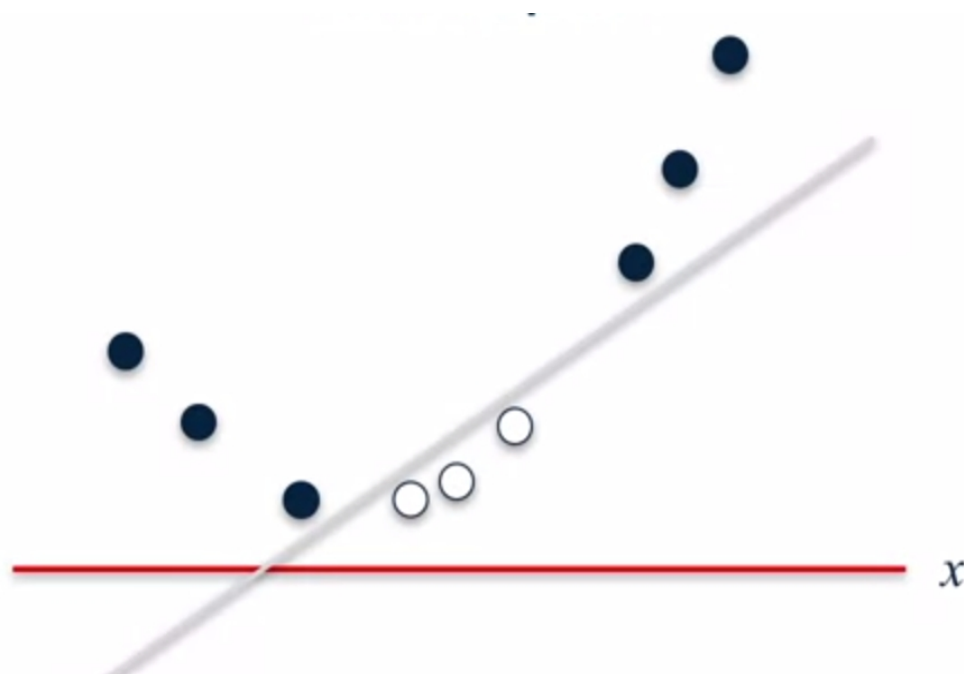


# Kernelização

Espaço Original



Espaço de Características



# Kernelização em 2 dimensões

Espaço Original

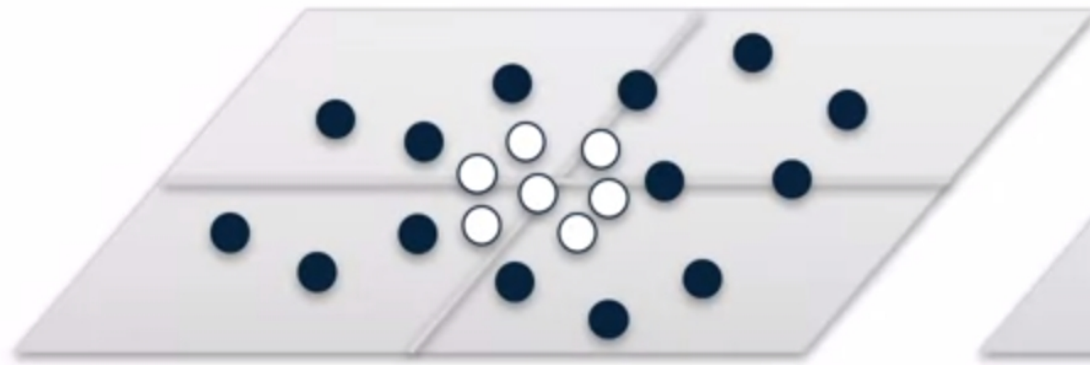


$$\mathbf{x}_i = (x_0, x_1)$$

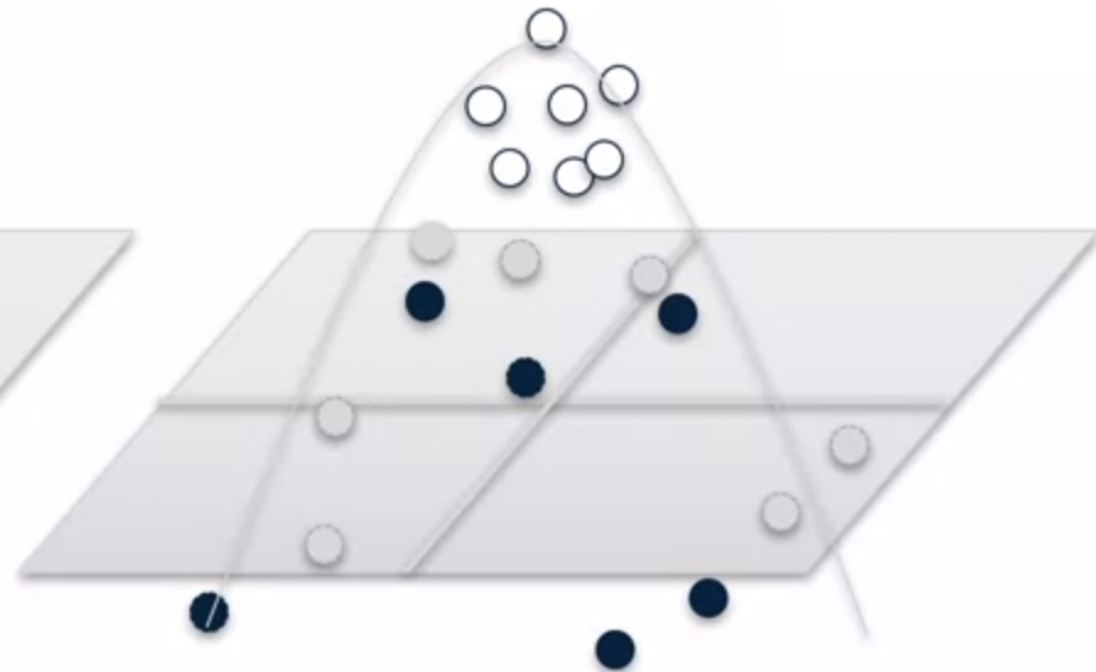
# Kernelização – adicionando mais uma dimensão

Espaço de Características

Espaço Original

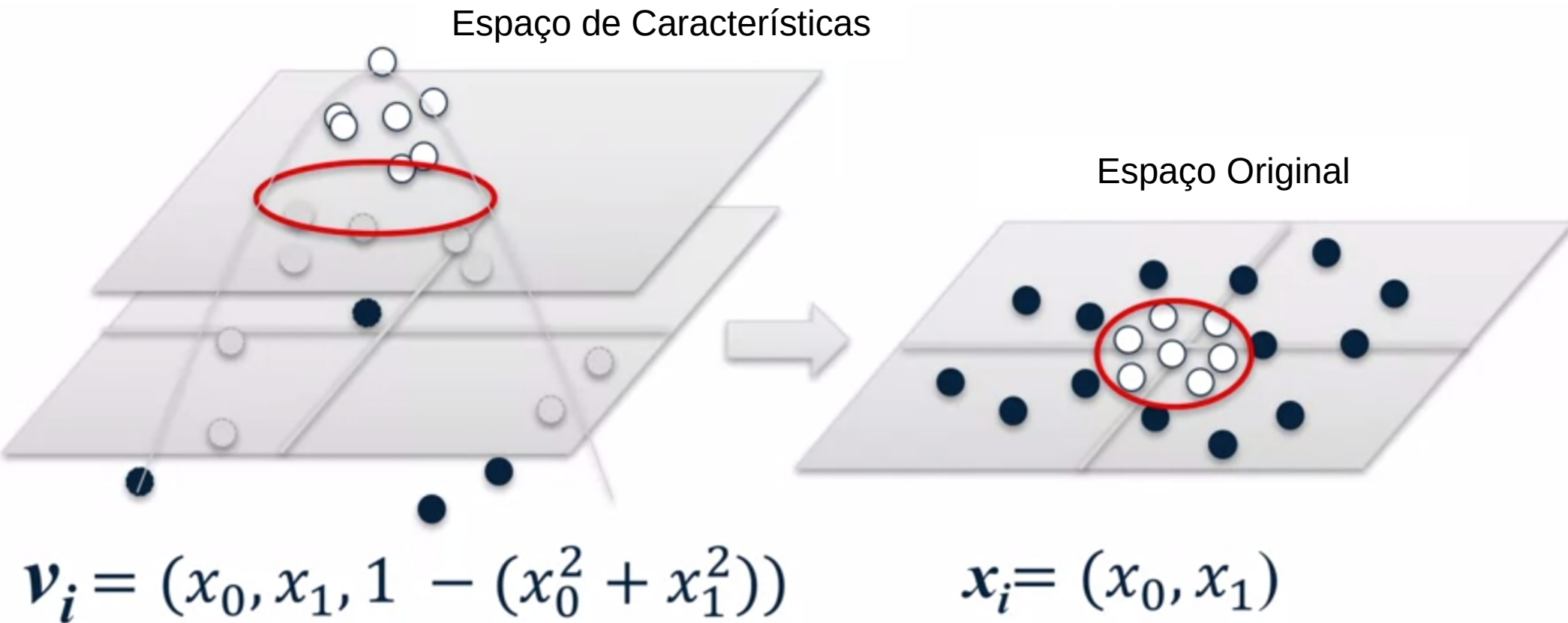


$$\mathbf{x}_i = (x_0, x_1)$$



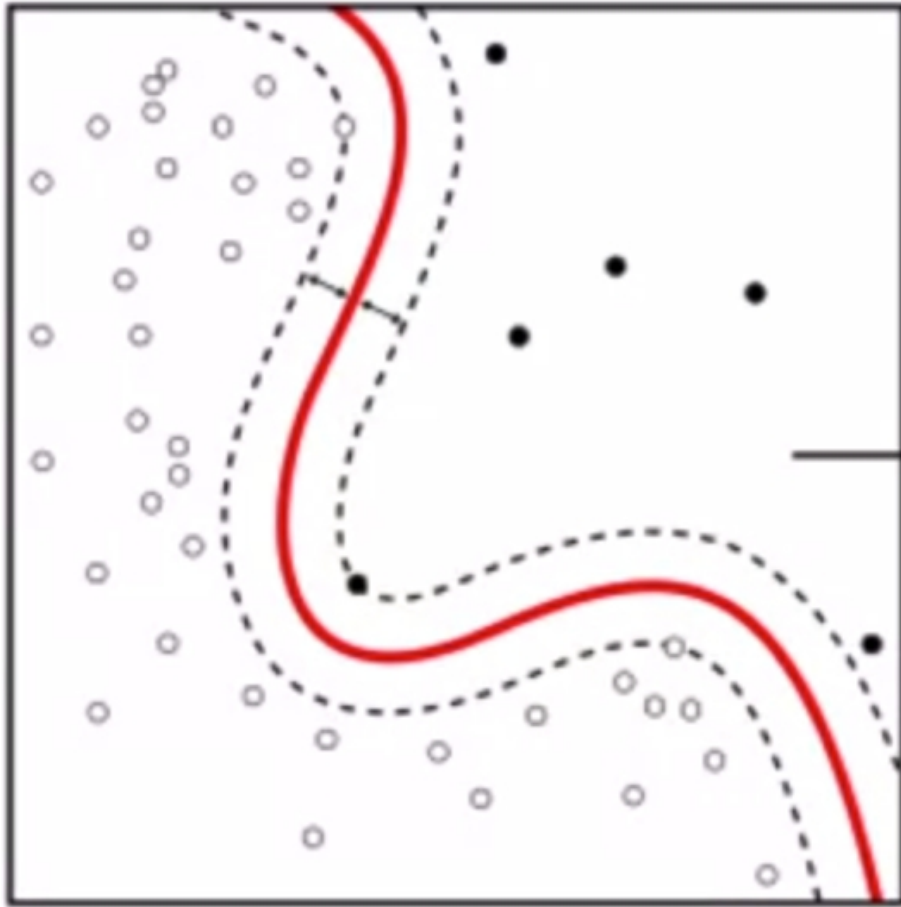
$$\mathbf{v}_i = (x_0, x_1, 1 - (x_0^2 + x_1^2))$$

# Kernelização

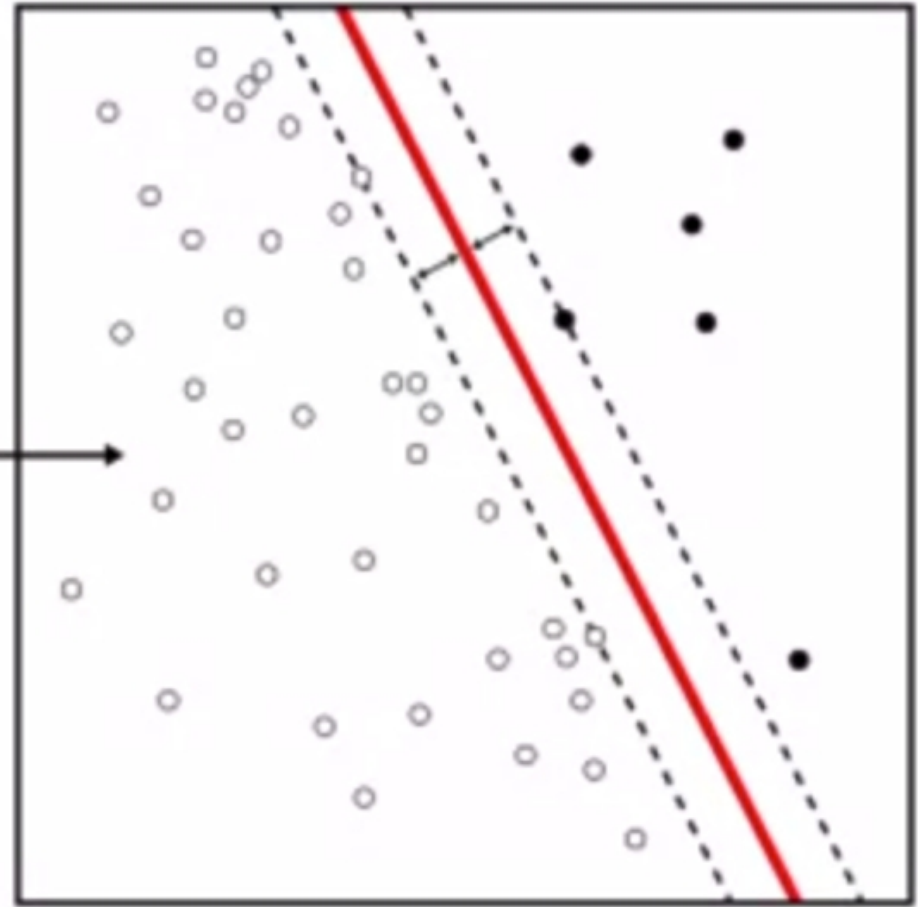
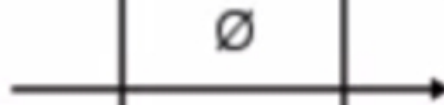




# Vetores de Suporte



Espaço Original



Espaço de Características

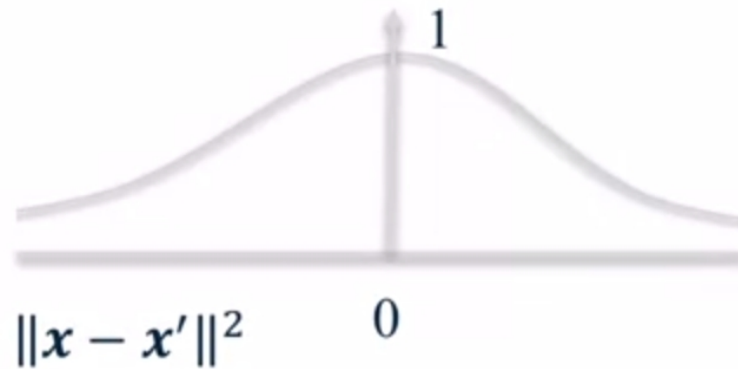
# RBF – Parâmetro gamma

$$K(\mathbf{x}, \mathbf{x}') = \exp [-\gamma \cdot \|\mathbf{x} - \mathbf{x}'\|^2]$$

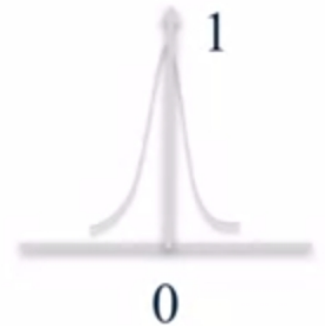


largura do kernel

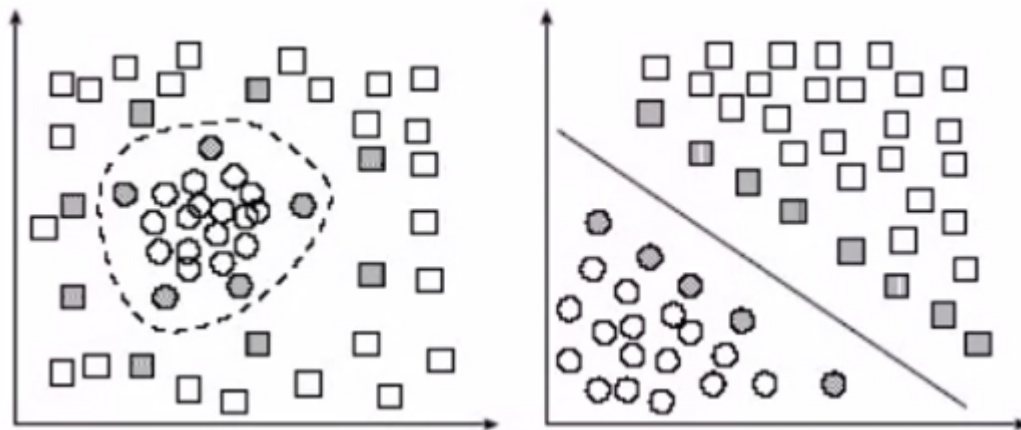
gamma (0.01)



gamma (10)



Original



Espaço de  
características

# Observações

Variedade de conjuntos de dados

Versátil: funções de kernel diferentes podem ser especificadas “RBF” e “poly”

Funciona bem para dados com baixa e alta dimensões

Velocidade de execução e uso de memória, i.e., a eficiência diminui conforme o tamanho do conjunto de treinamento aumenta

Precisa de cuidadosa normalização de dados de entrada e ajuste de parâmetros

Difícil de interpretar por que uma previsão foi feita