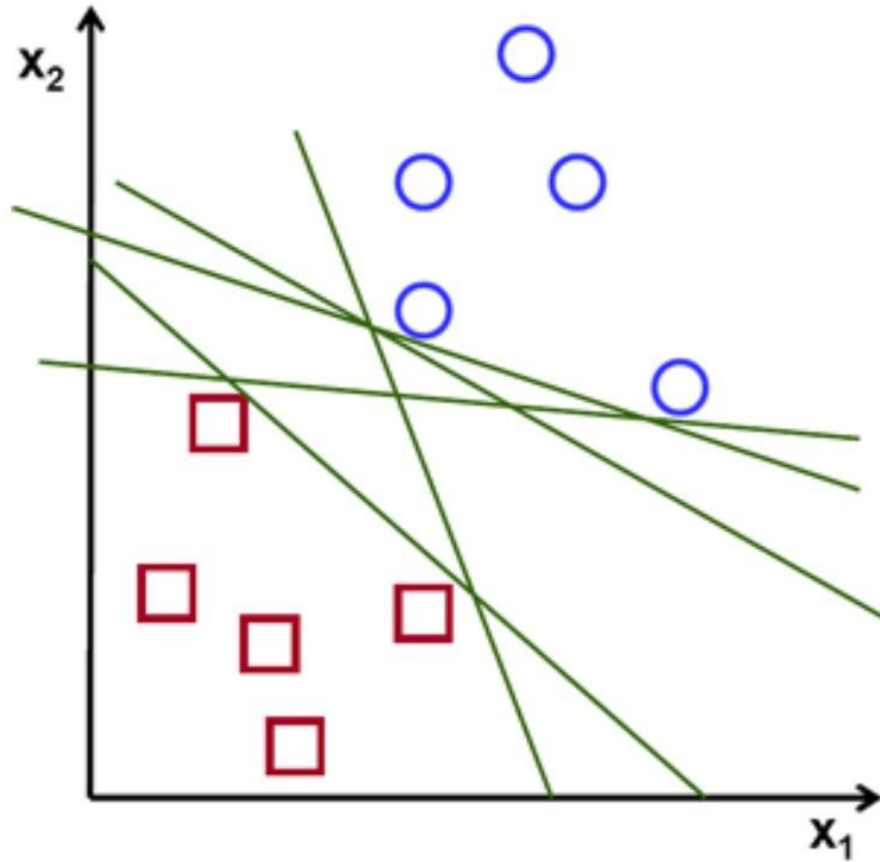
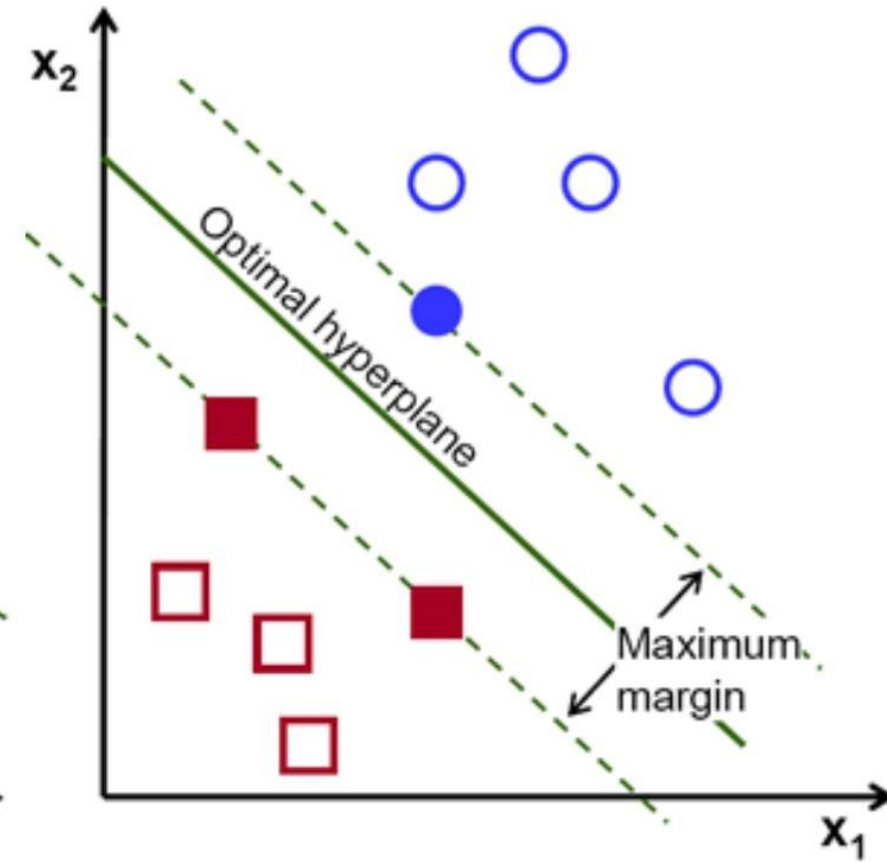


Support Vector Machine Classifier (SVM)

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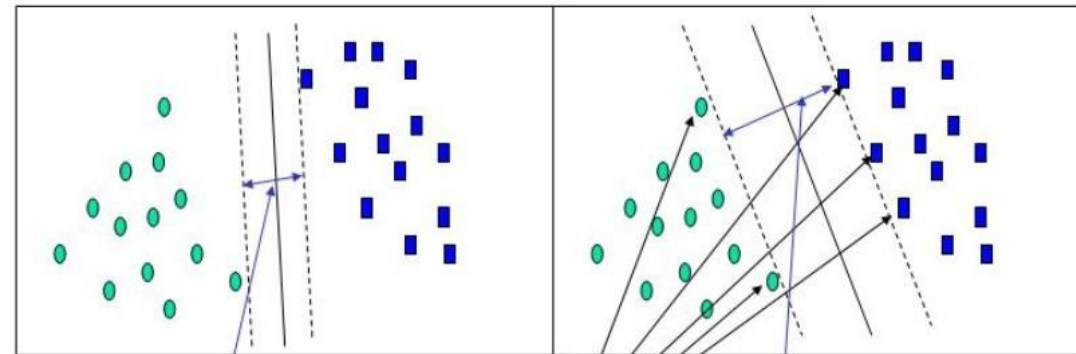
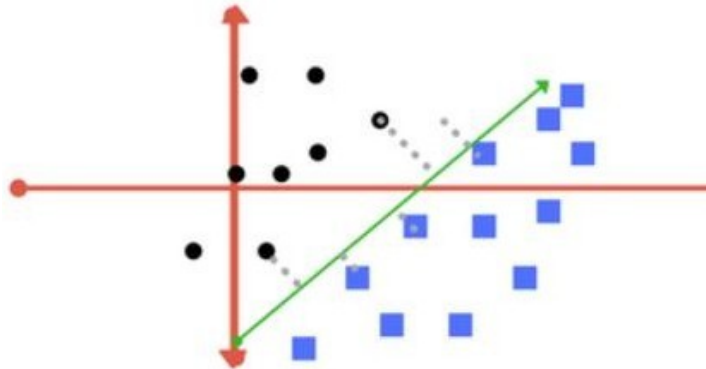
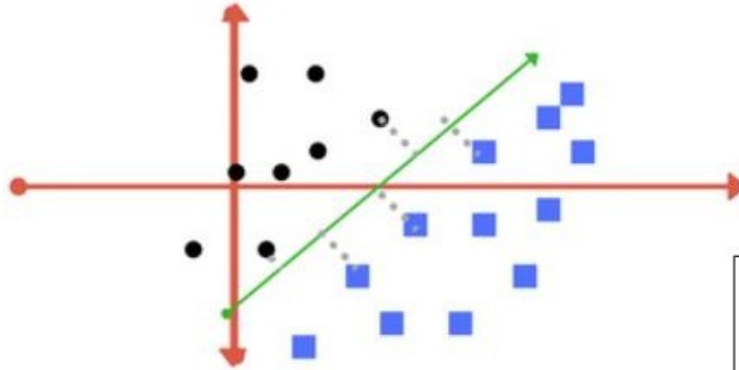


Few possible
hyperplanes



Optimal
hyperplane

Margins



Small Margin

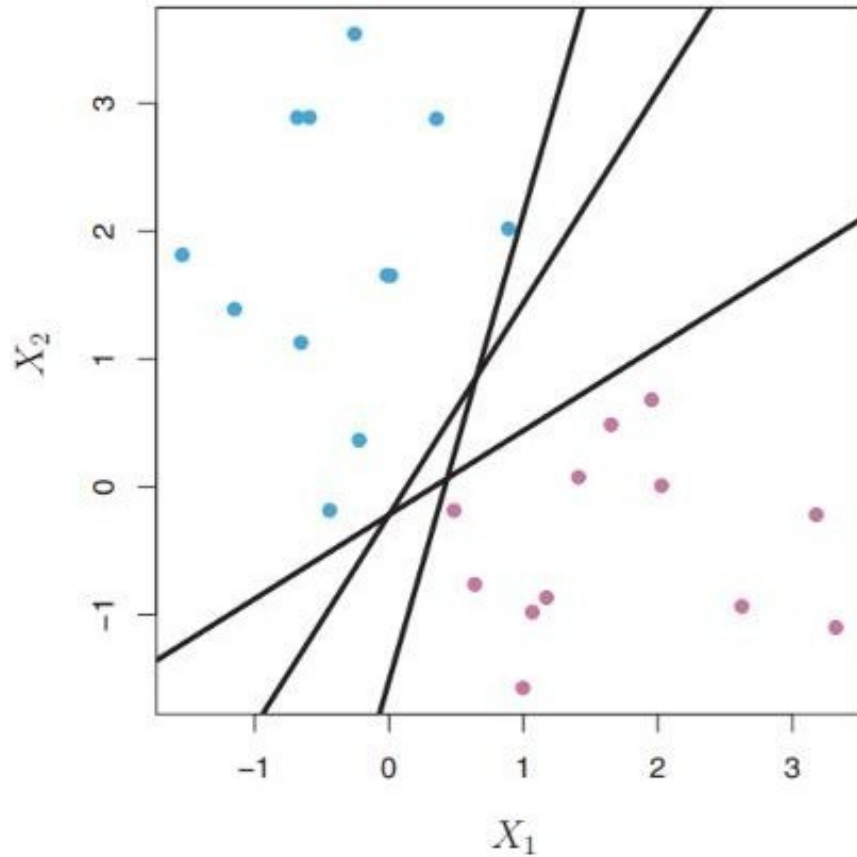
Large Margin

Support Vectors

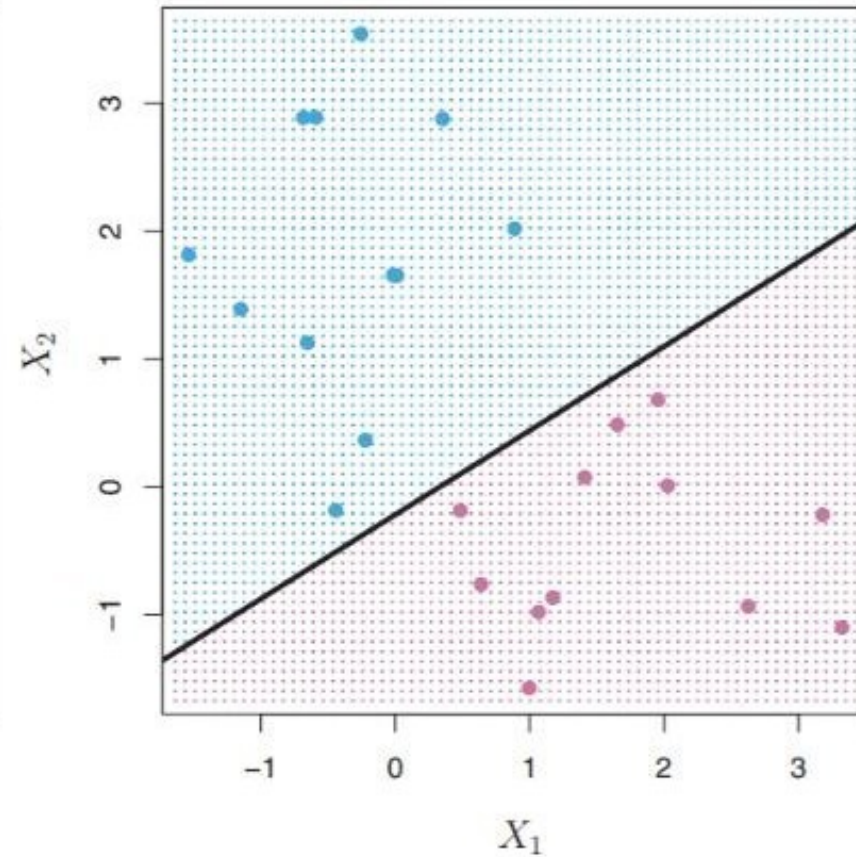
What are support vectors?

Maximal margin classifier

What is a hyperplane?

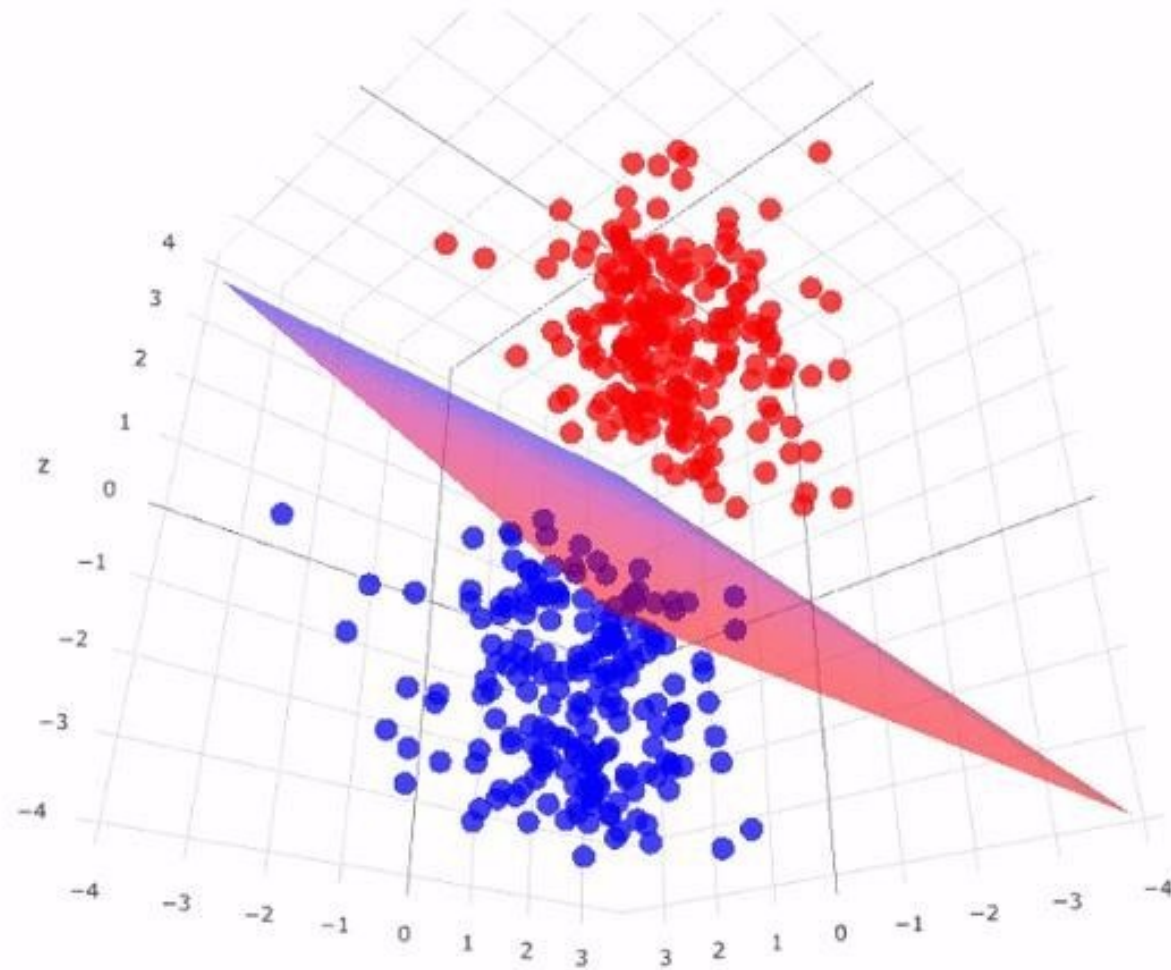


2-D

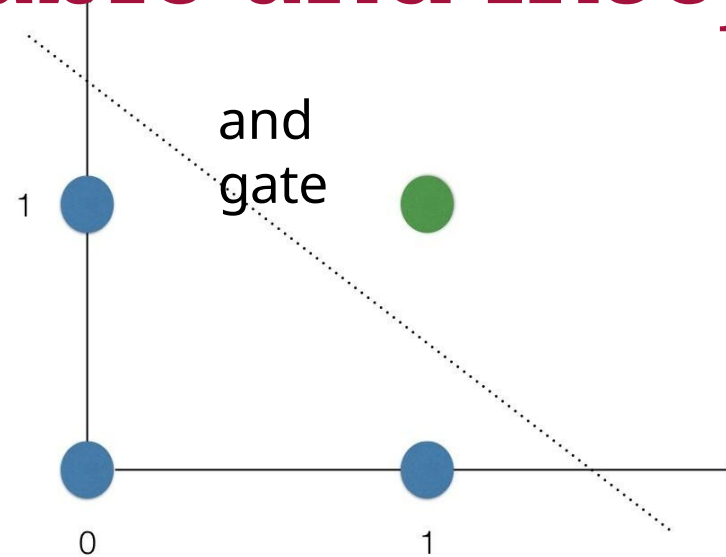


Why is it called a hyperplane?

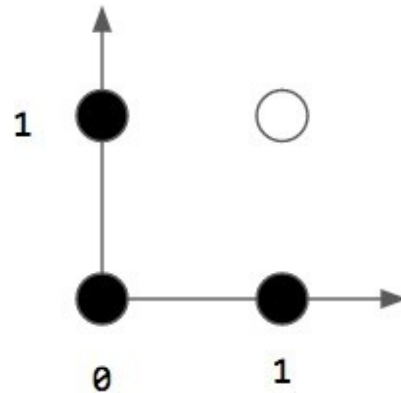
Hyperplane in 3D



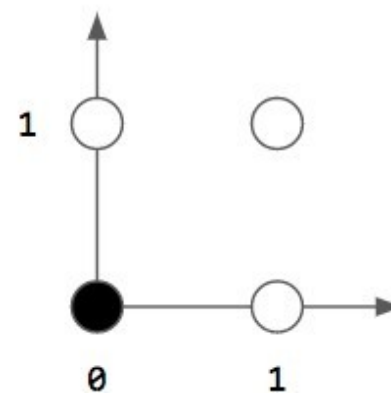
Linearly Separable and Inseparable Problems



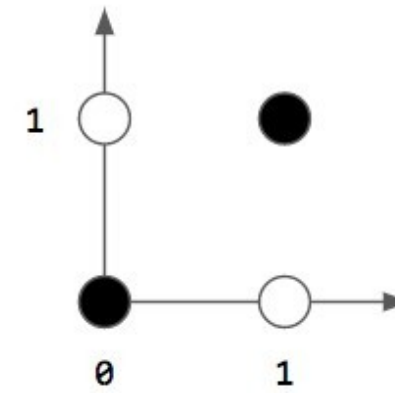
AND



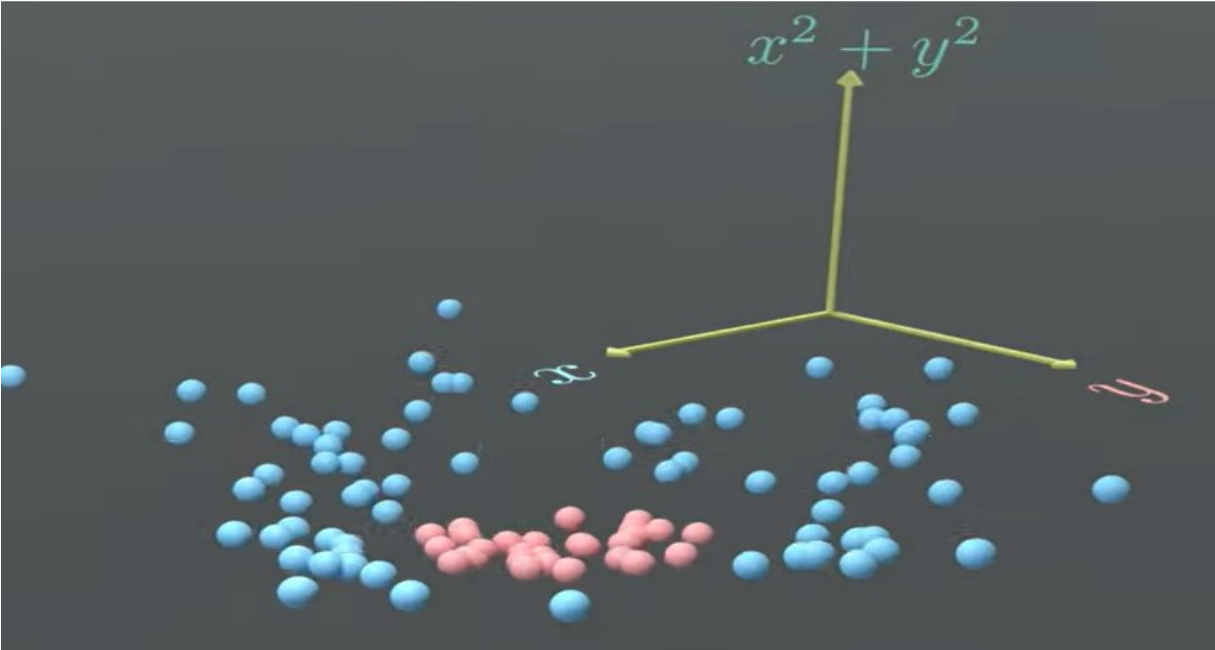
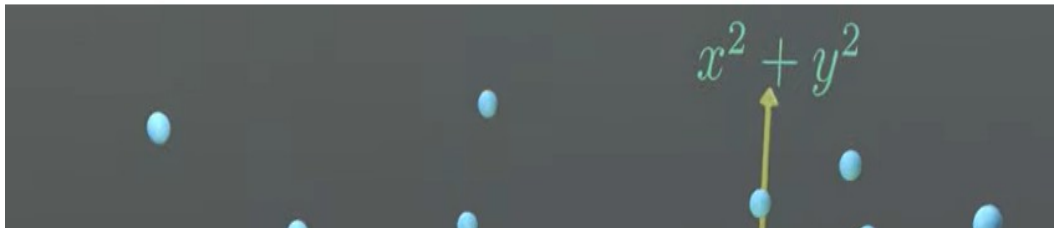
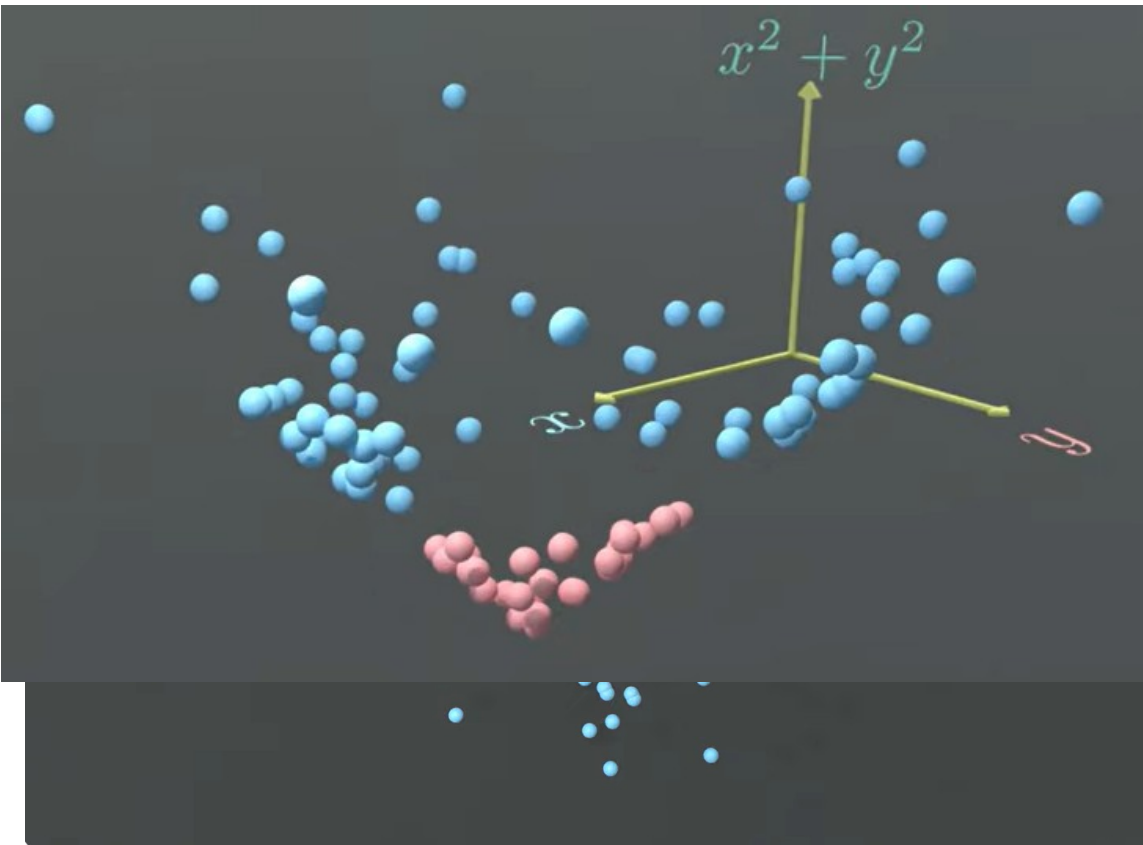
OR

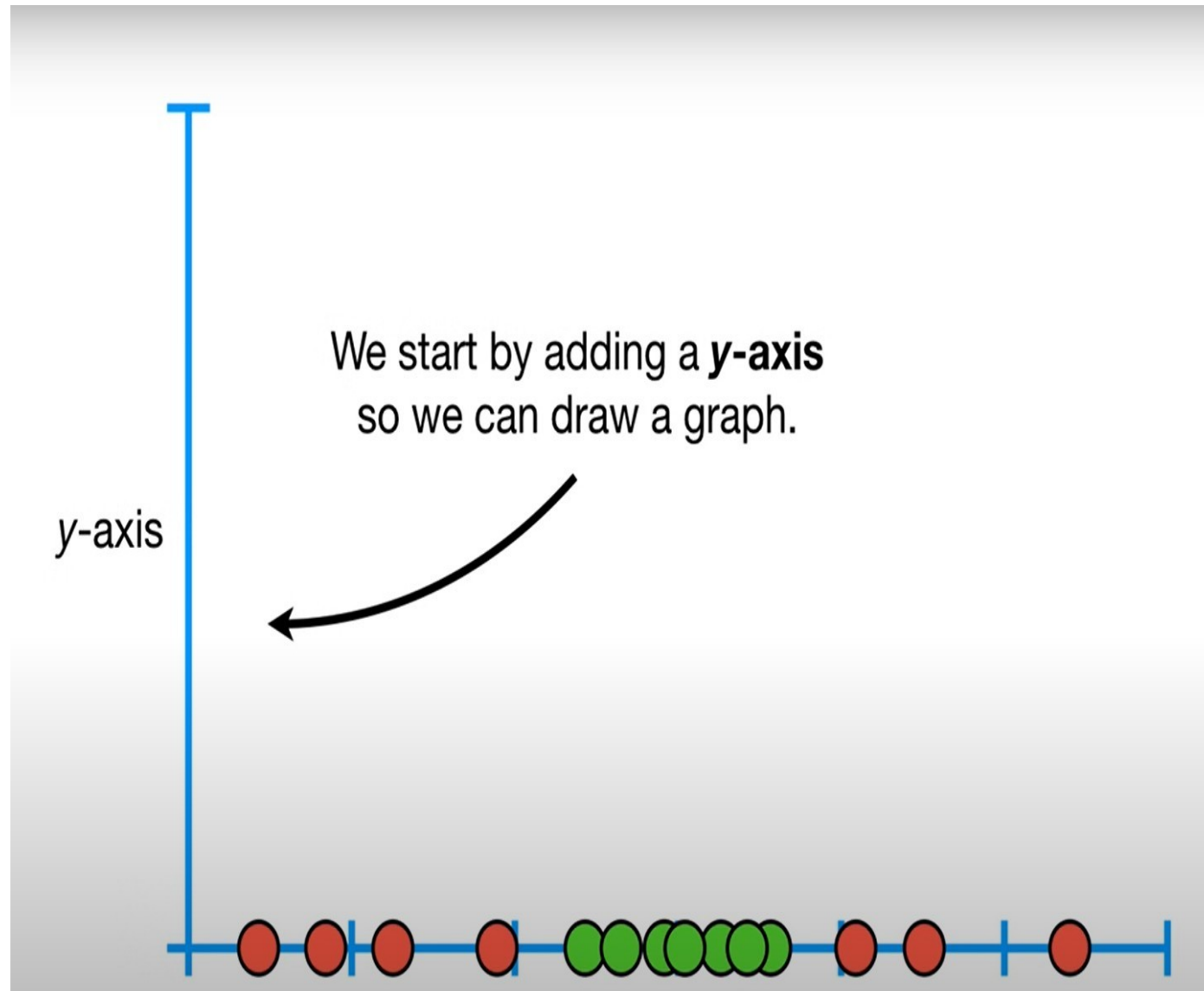


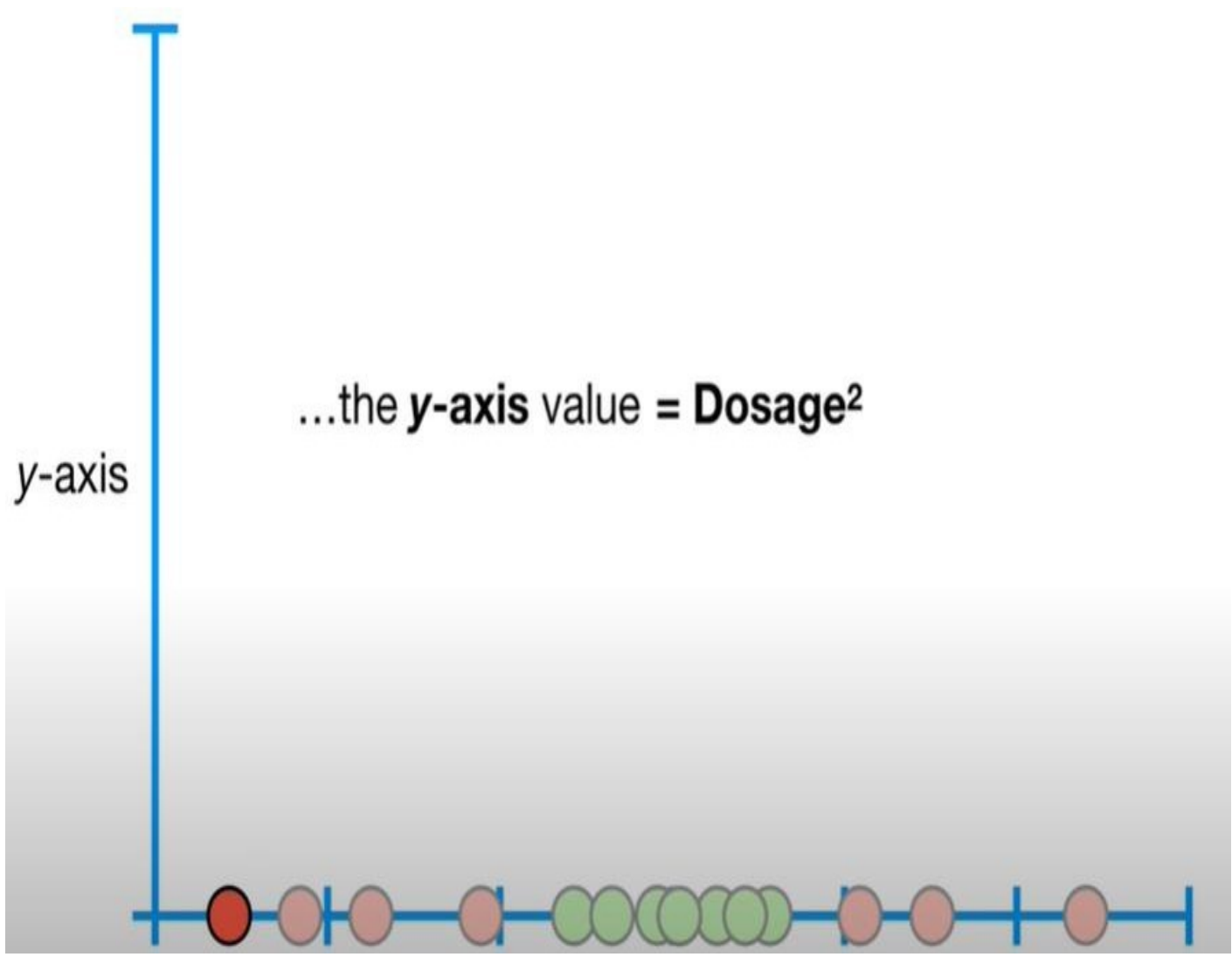
XOR

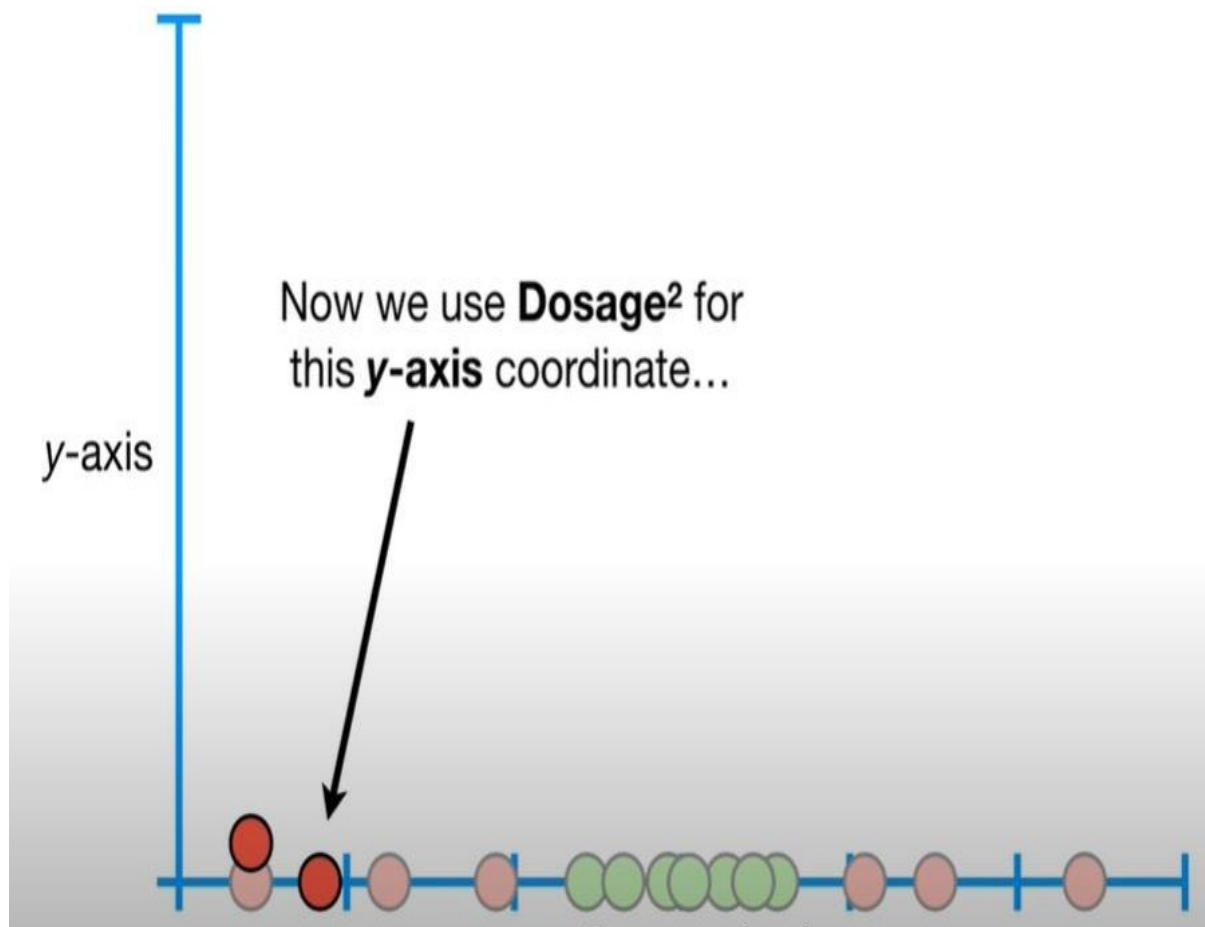


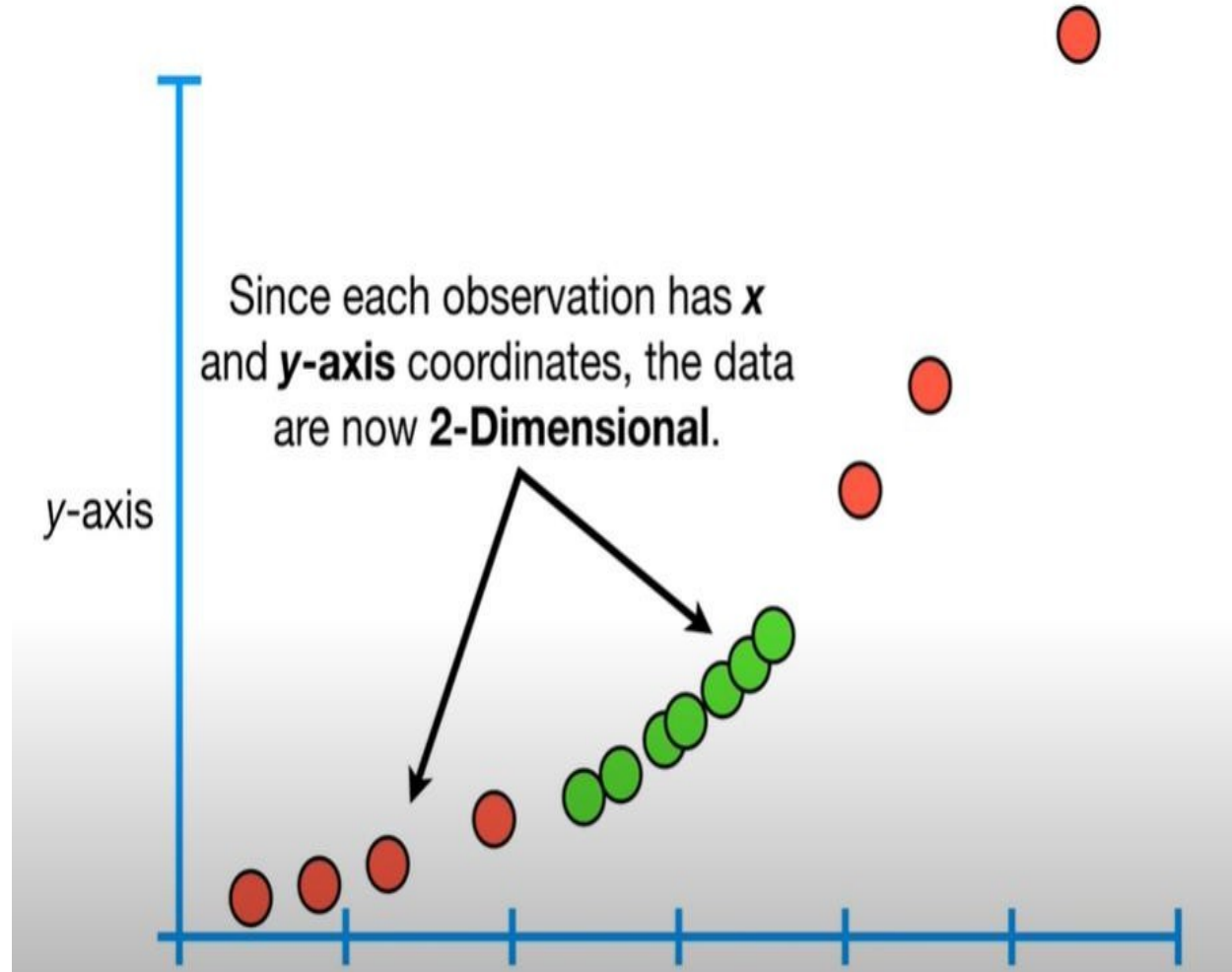
Migrating to higher dimensions for finding separability in data

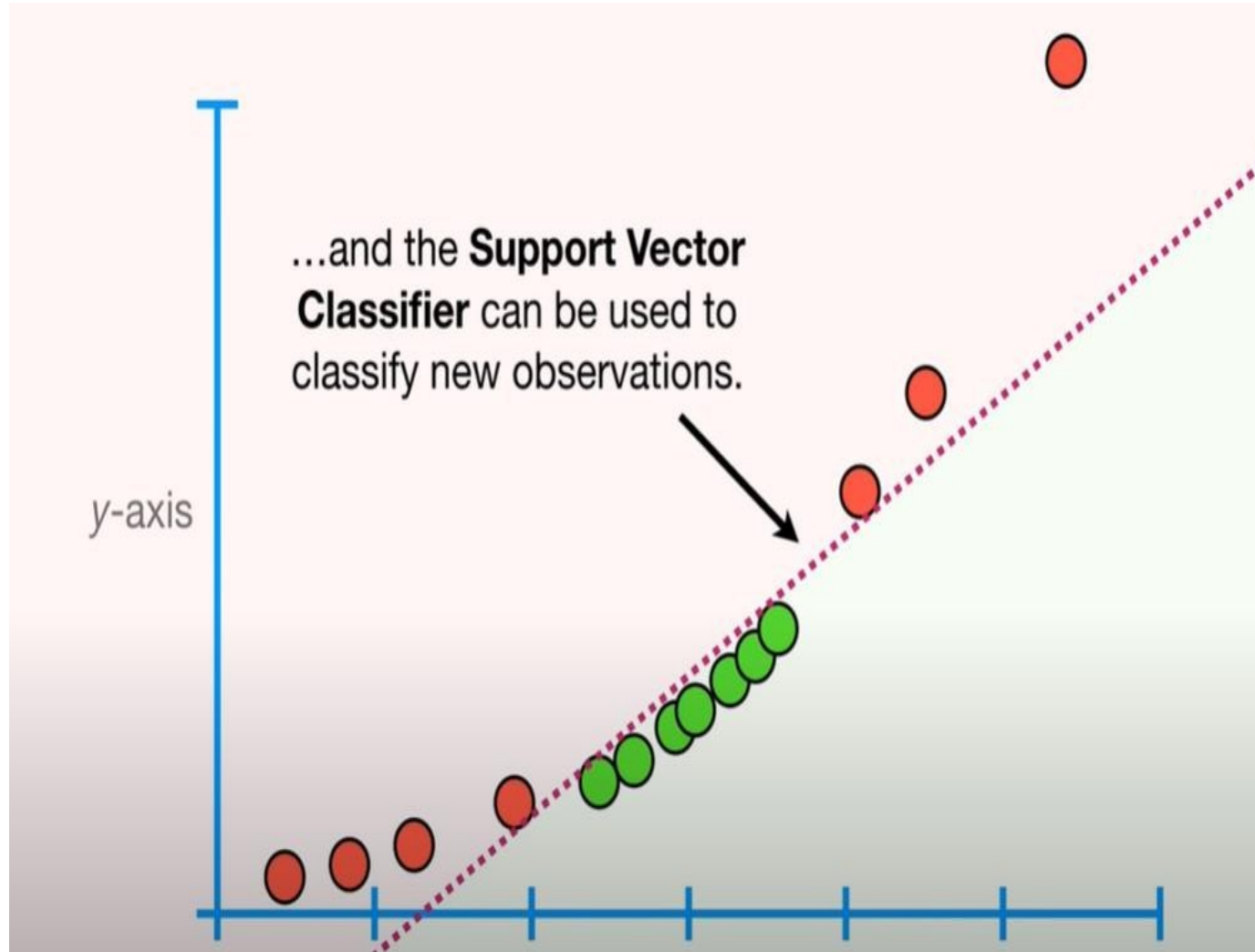


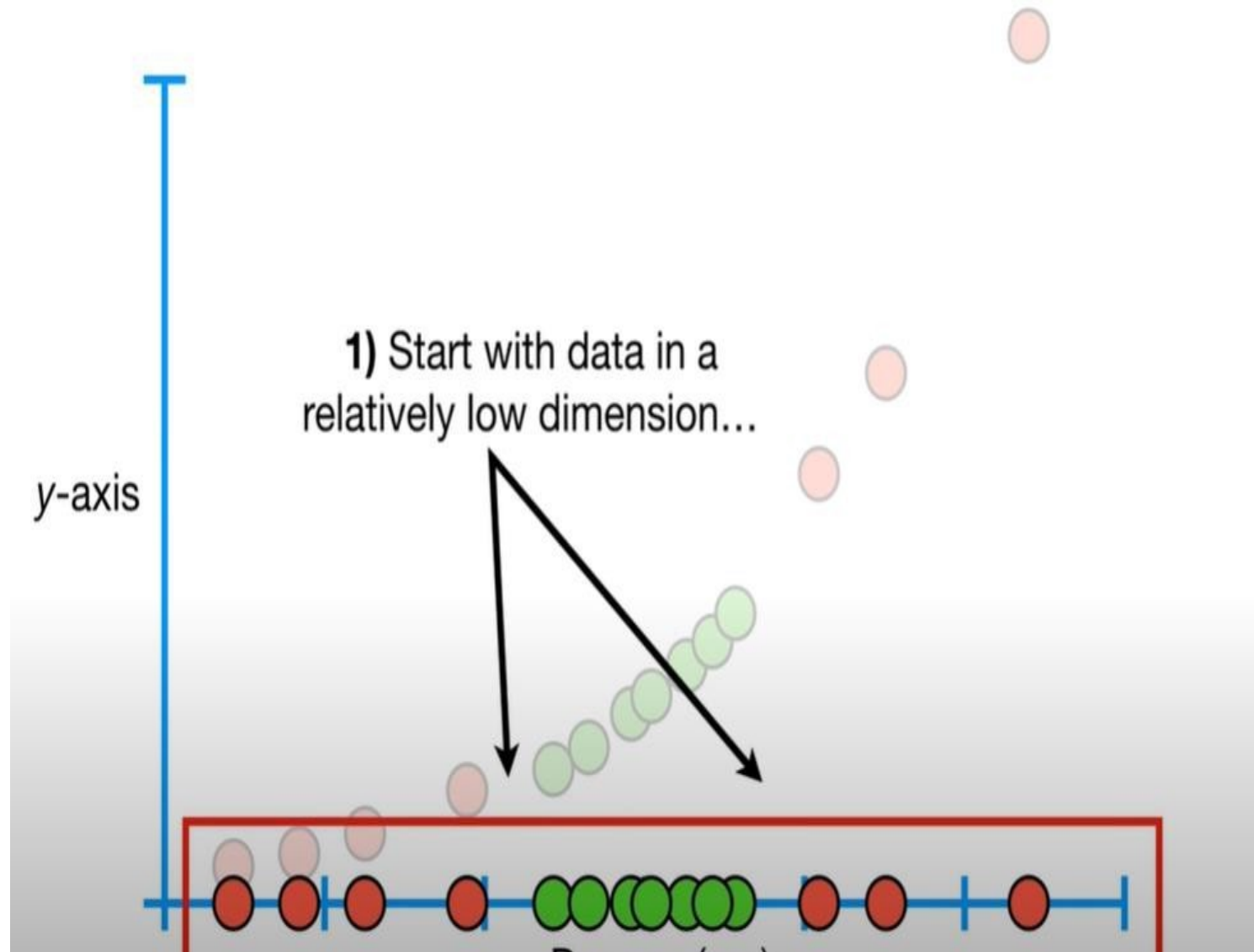


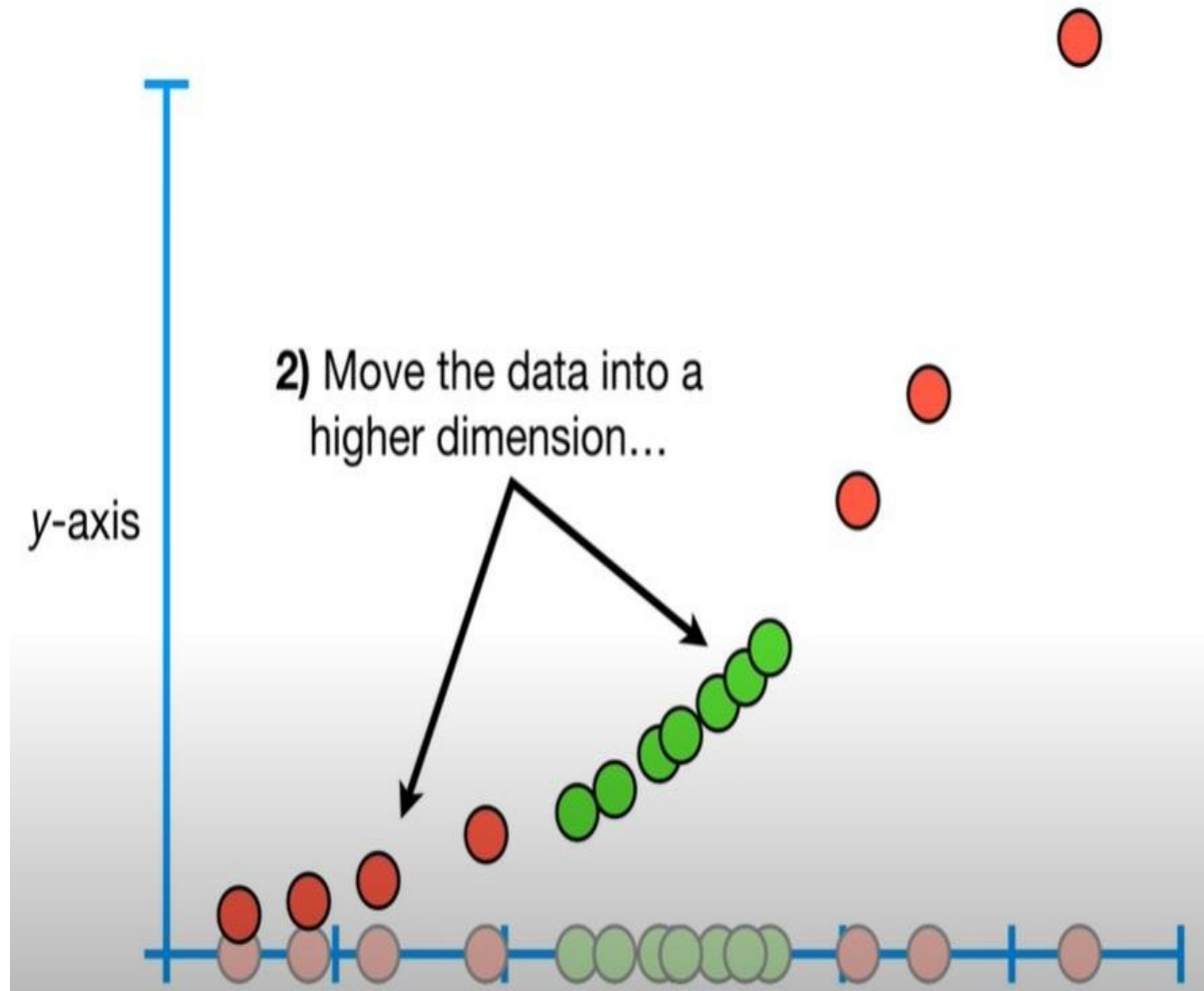






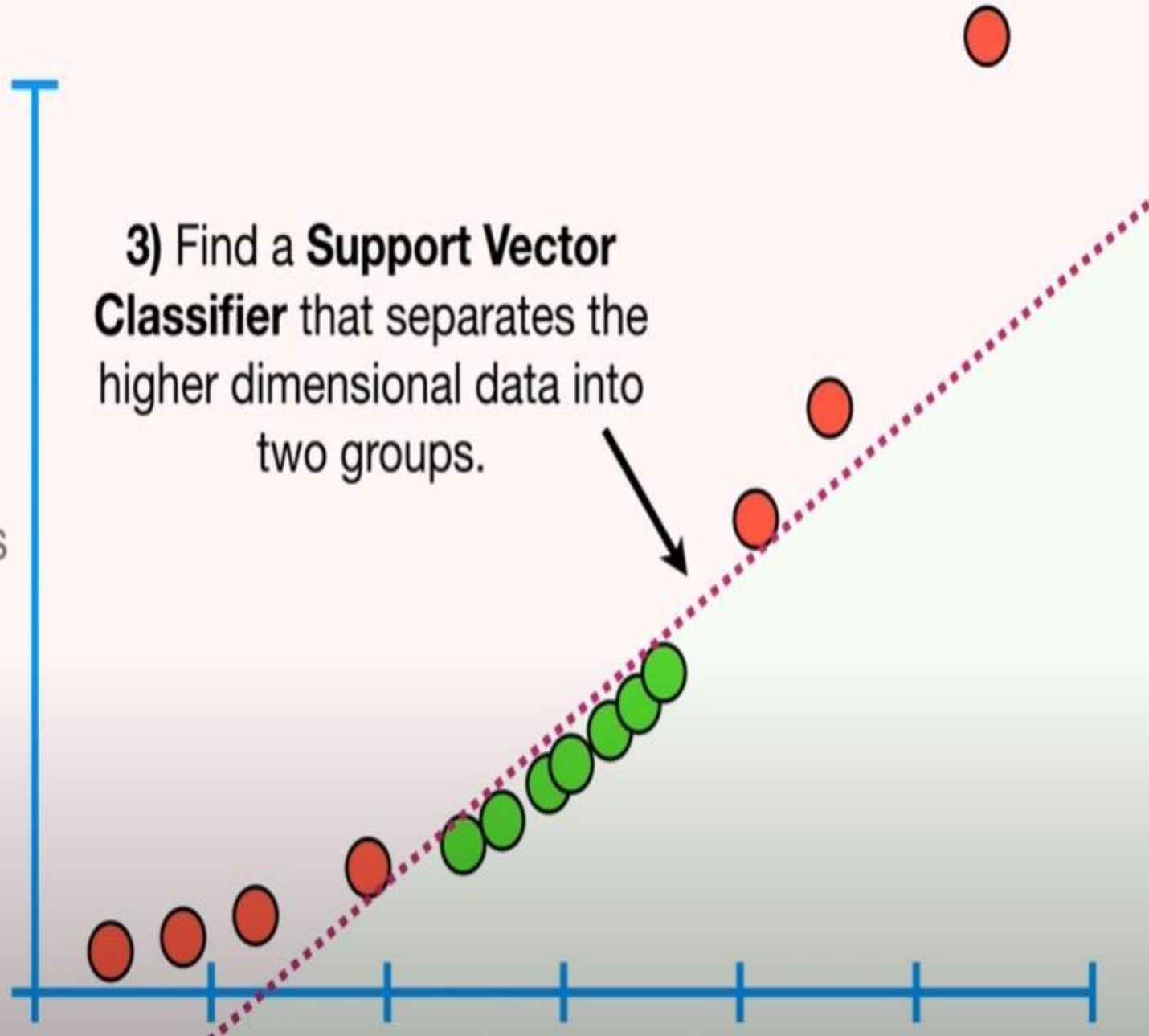






3) Find a **Support Vector Classifier** that separates the higher dimensional data into two groups.

y-axis



Kernel Function

- A **kernel** is a mathematical function that transforms the input data into a higher-dimensional space.
- This transformation allows the SVM to find a linear boundary (or hyperplane) that can separate the data points in this higher-dimensional space, even if they are not linearly separable in the original input space.

Kernel Functions

“Kernel” is a set of mathematical functions used in Support Vector Machine that provides the window to manipulate the data.

In our case we have used $y = x^2$, this is a polynomial of x and thus called a polynomial kernel.

There are several other kernels that are used by SVM, namely Radial Basis Function (RBF), Laplace RBF Kernel, Sigmoid Kernel, etc.

Strength and Weakness

Strengths of SVM

- Effective in high-dimensional spaces.
- Versatile with different kernels.
- Robust to overfitting by maximizing the margin.
- Works well with clear margin of separation.
- Handles both linearly and non-linearly separable data using the kernel trick.

Weaknesses of SVM

- Computationally expensive, especially for large datasets.
- Requires careful parameter tuning
- Not well-suited for large datasets; scales poorly with the number of samples.
- Sensitive to the choice of kernel and noisy data.

Thank you