

Kernel SVM

Definition - Support Vector Machine (SVM) with a kernel trick is an extension of the basic SVM that enables the algorithm to **handle nonlinear classification problems**. The kernel trick allows SVMs to find a decision boundary that can separate data that is not linearly separable by mapping the data into a higher-dimensional space where a linear separator can be applied.

How It Works

1 - **Nonlinear Classification Problem**: In many real-world scenarios, data cannot be separated by a straight line (or hyperplane) in its original feature space. For instance, imagine data that forms concentric circles or spirals. Linear SVM would struggle with such data because it assumes linear separability.

2 - **Mapping to Higher Dimensions**: To handle nonlinear data, the kernel trick involves mapping the original feature space to a higher-dimensional space where the data might become linearly separable. This is achieved through a kernel function.

3 - **Kernel Functions**: A kernel function computes the inner product of two vectors in a higher-dimensional space without explicitly performing the mapping.

4 - **Optimization Problem**: Maximizing the margin between classes.

5 - **Classification**: Once the optimal hyperplane is found in the higher-dimensional space (implicitly through the kernel function), it can be used to classify a new data point.