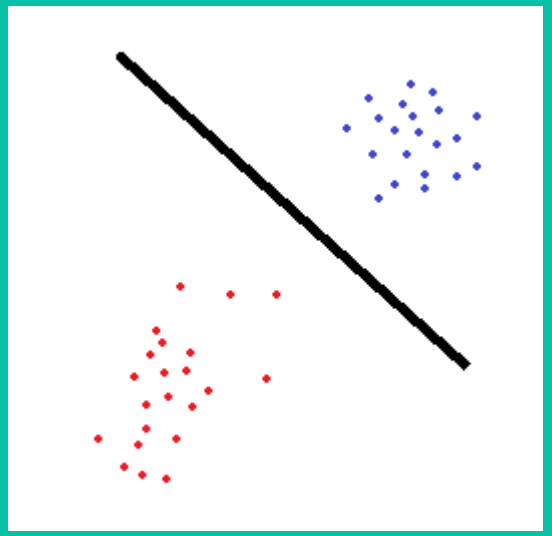
Support Vector Regression and Its Application in Trading

info@tworoads.co.in

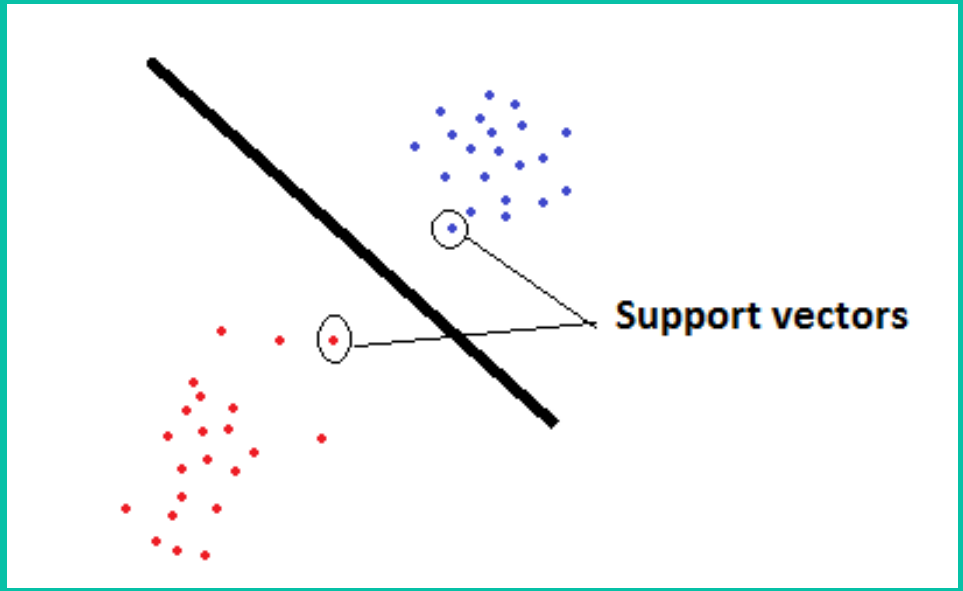
Support Vector Machine

- Red and Blue points belongs to two different class.
- SVM finds a hyperplane that separates these two classes.
- It maximizes the minimum distance of given data points from hyperplane.



Support Vectors

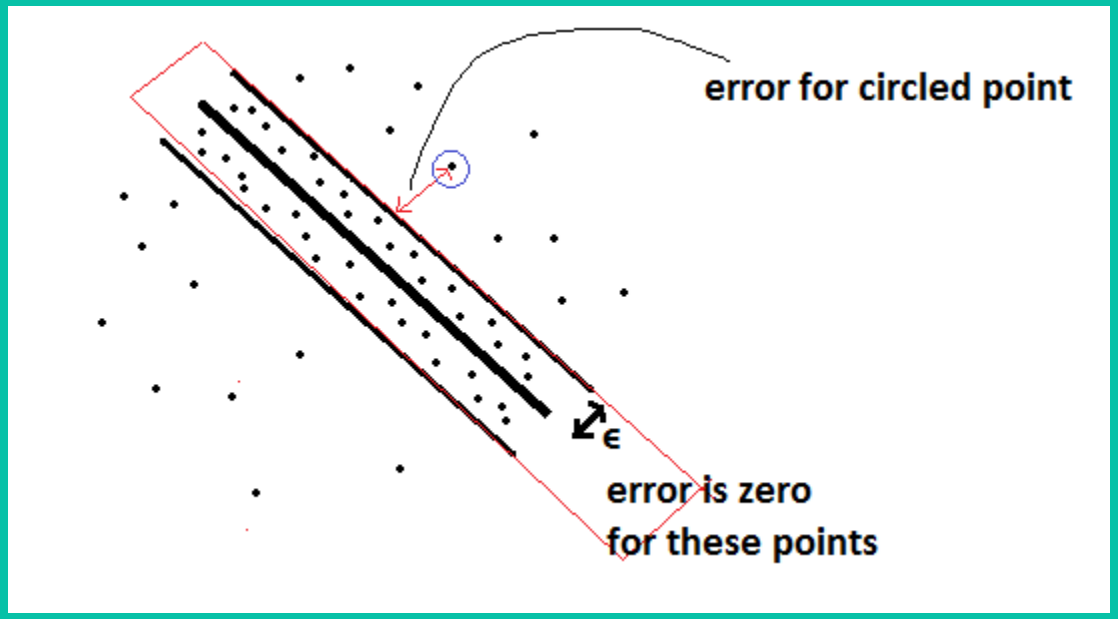
Hyperplane obtained depends only on few data points (not on all points) known as support vectors



Support vector Regression

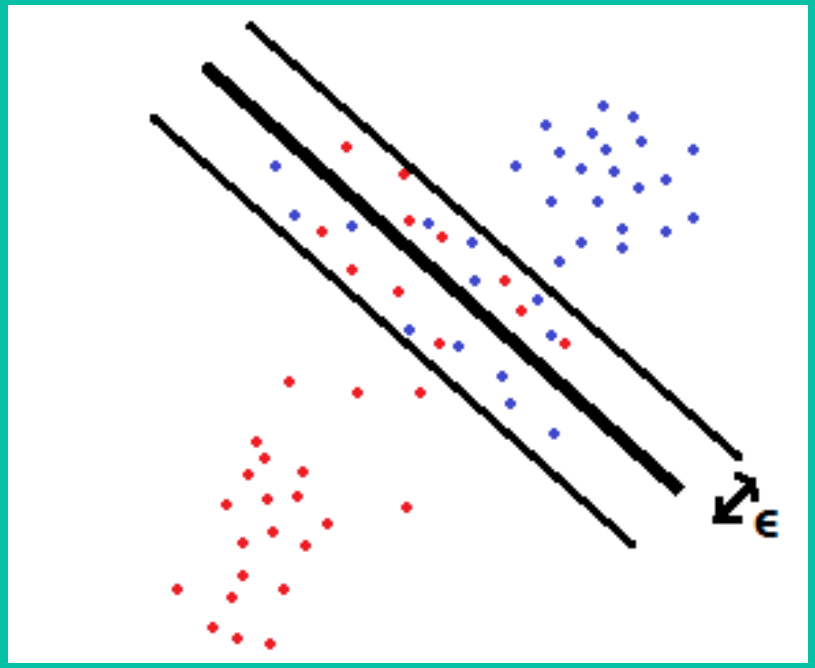
It finds a hyperplane such that Loss is minimized. Loss is taken to be zero within small deviation (ϵ) from hyperplane. Here the hyperplane depends on

points lying outside ϵ margin



Loss Function

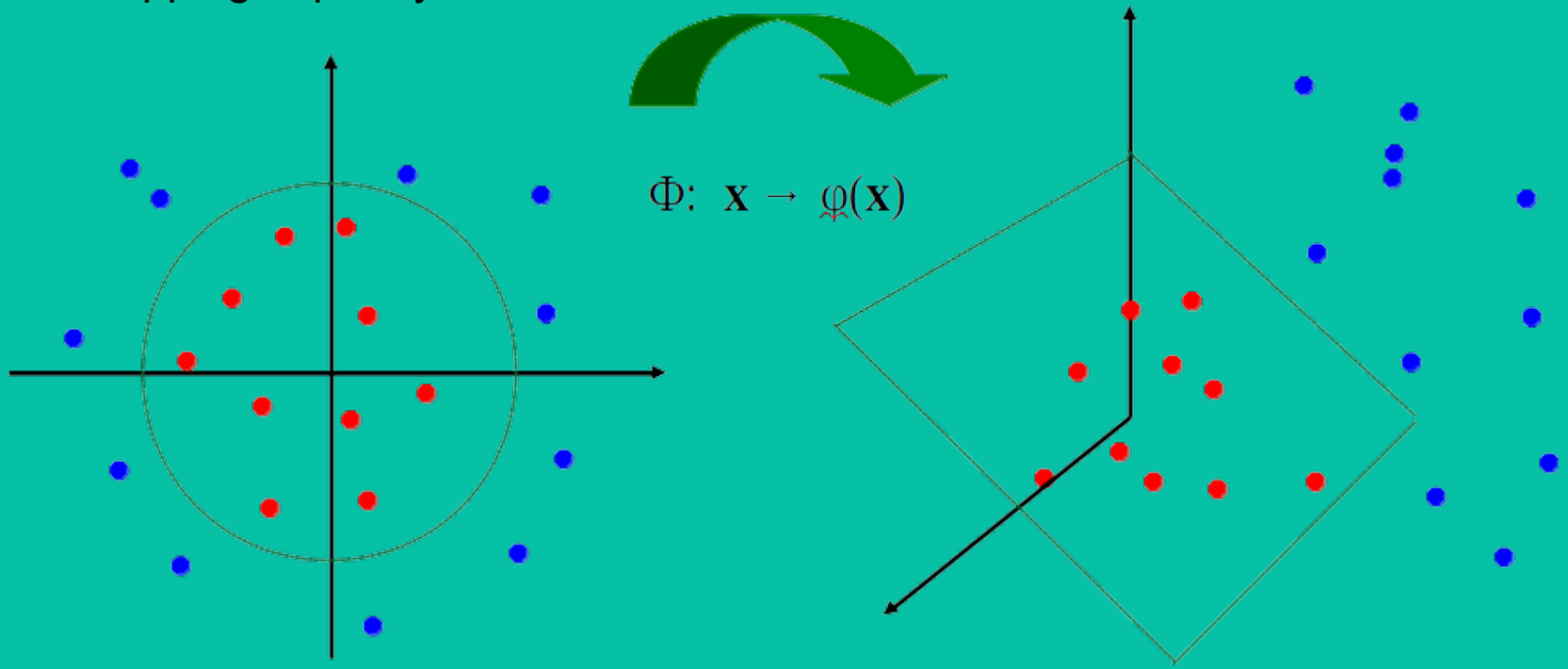
$$\text{Loss} = \begin{cases} 0 & |f(x_i) - y_i| < \epsilon \\ |f(x_i) - y_i| - \epsilon & \text{otherwise} \end{cases}$$



Kernel Trick

Map points to a higher dimensional space where data is linearly separable.

Kernel Trick is a way to map points without having to compute the mapping explicitly



RBF Kernel

$$K(x, x') = \exp(\gamma \|x - x'\|^2)$$

where $\|\ .\ \|$ is Euclidean distance and γ is negative

We can see that if the distance between 2 points is large then this function gives a very small value. Thus this function achieves small loss for far away points.

High Dimensional Space

$$\exp\left(-\frac{1}{2}||\mathbf{x}-\mathbf{x}'||_2^2\right) = \sum_{j=0}^{\infty} \frac{(\mathbf{x}^\top \mathbf{x}')^j}{j!} \exp\left(-\frac{1}{2}||\mathbf{x}||_2^2\right) \exp\left(-\frac{1}{2}||\mathbf{x}'||_2^2\right)$$

RBF basically maps the points to a Hilbert space (infinite dimensional space) and thus SVR with RBF kernel finds a hyperplane in that space.

Why SVR in Trading

Stock Market Data is very noisy. There are lots of outlier point in the data. Their loss will be large, and thus these points will change the hyperplane very much. We would like to have small error for points which are close to hyperplane, Also we would like to have small error for points which are very far from the hyperplane.

To achieve this, we use a RBF (Radial Basis Function) Kernel function.

SVR in Trading

- Outlier Detection
- Regime Prediction
- Classify News
- Identify Bad Trading Days

References

- Support Vector Regression, by Max Welling
- Support Vector Machine by C. Cortes and V. Vapnik
- Support Vector Regression by Debasish Basak, Srimanta Pal and Dipak Chandra Patranabis

Thanks for coming!

Aashay Harlalka
aashay.harlalka@tworoads.co.in

www.tworoads.co.in

info@tworoads.co.in