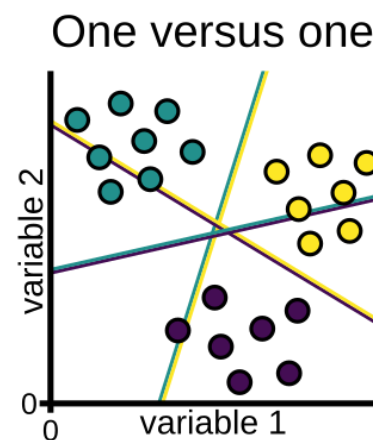
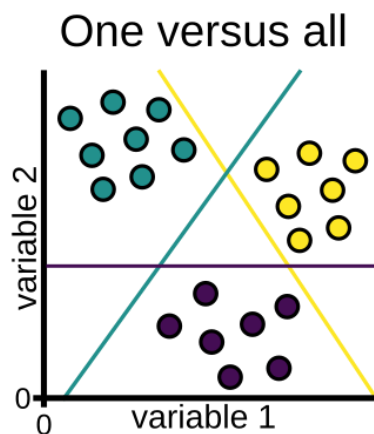
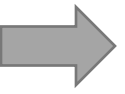




Part 27- SVM (multiple class classification) Pros and Cons + Applications

Prof. Pedram Jahangiry





Topics

Part 23

- SVM Geometry
- SVM Motivation

Part 24

- Maximum Margin Classifier (MMC)
- Support Vector Classifiers (SVC)

Part 25

- Support Vector Machines (SVM)

Part 26

- Support Vector Regressors (SVR)

Part 27

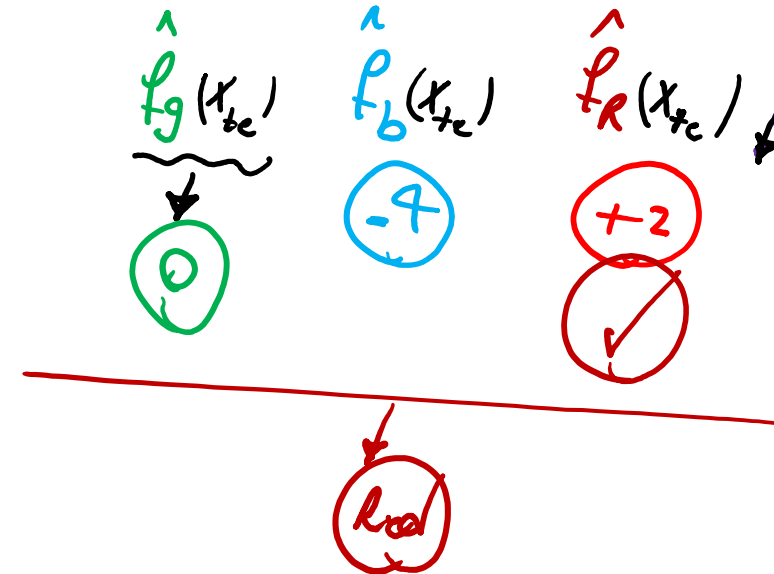
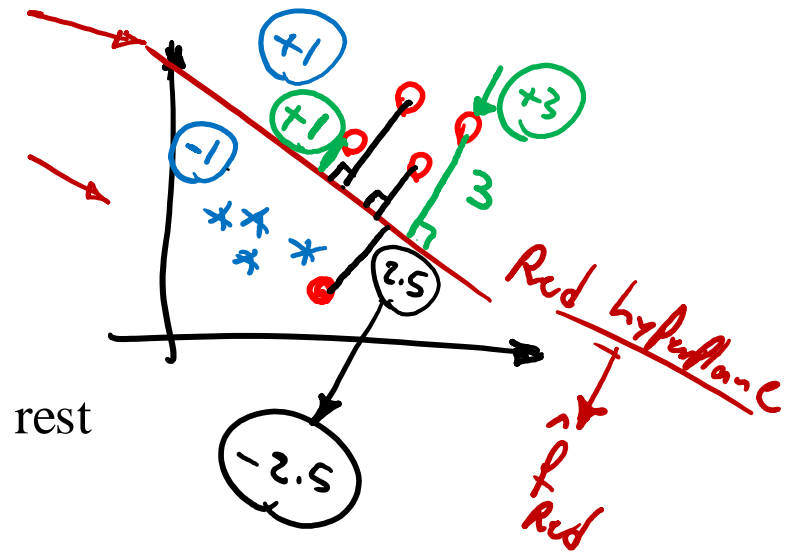
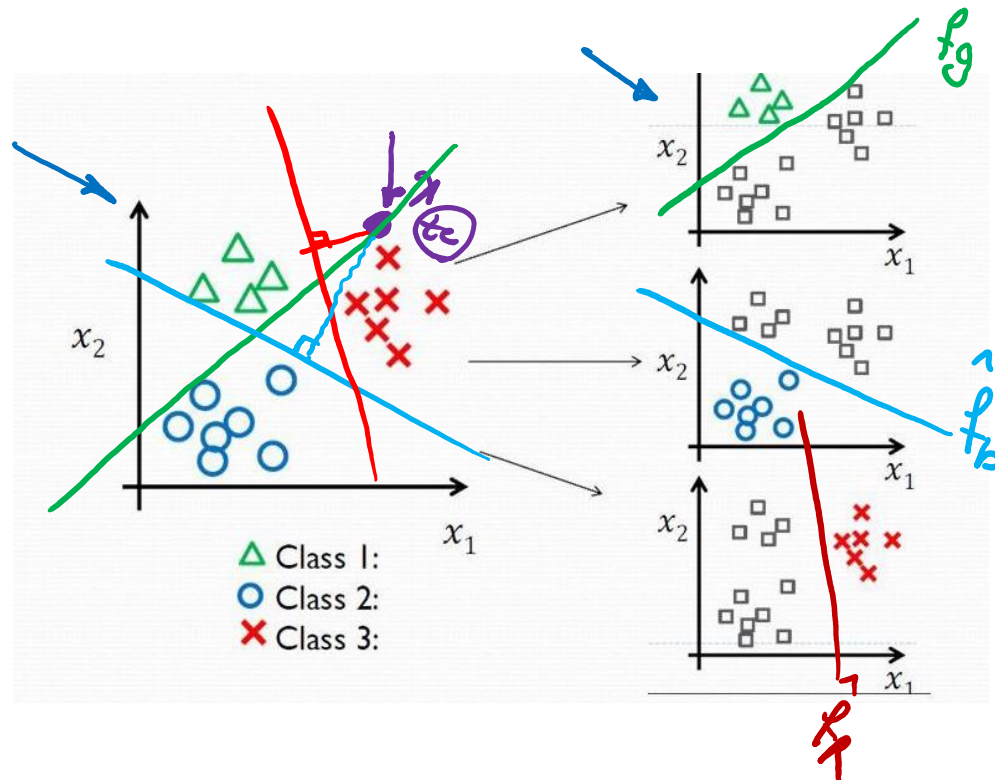
- Multiple class classification
- SVM pros and cons
- SVM applications in Finance



K-Multiple class SVM

- One-VS-All (OVA)

1. Fit ³ K different 2-class SVM classifiers $\hat{f}_k(x)$, each class versus the rest
2. Classify x_{te} to the class for which $\hat{f}_k(x_{te})$ is largest.

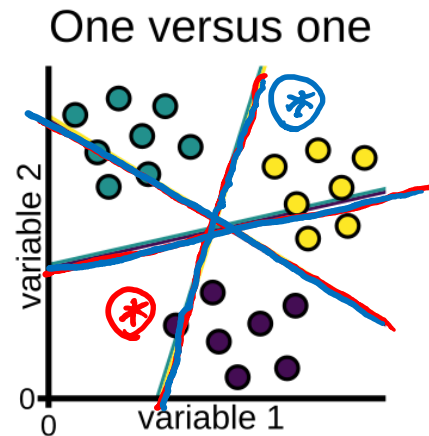
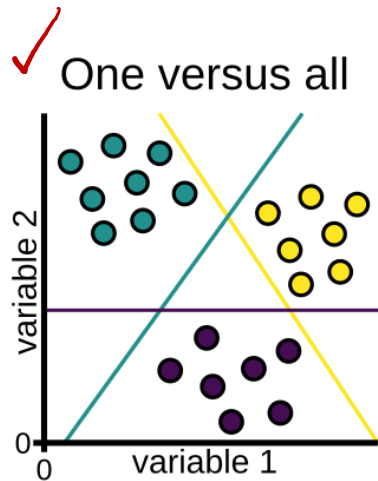


K-Multiple class SVM

$$\binom{3}{2} = 3$$

- One-VS-One (OVO)

- ✓ 1. Fit all $\binom{K}{2}$ pairwise classifiers $\widehat{f}_{kl}(x)$, each class versus the rest
- ✓ 2. Classify x_{te} to the class that wins the most pairwise competitions.



	\hat{f}_{gy}	\hat{f}_{gp}	\hat{f}_{yp}	
\otimes	<u>g</u>	<u>p</u>	<u>p</u>	$\rightarrow \textcircled{p}$
\otimes	<u>y</u>	<u>g</u>	<u>y</u>	$\rightarrow \textcircled{y}$

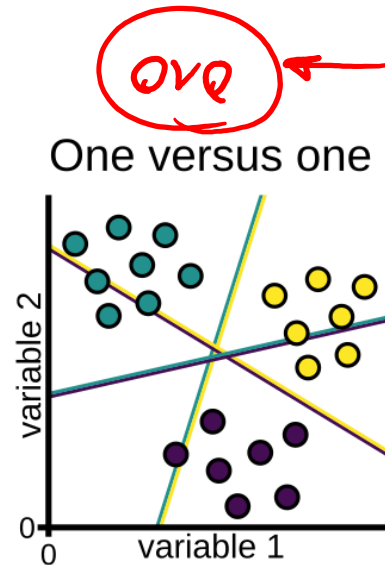
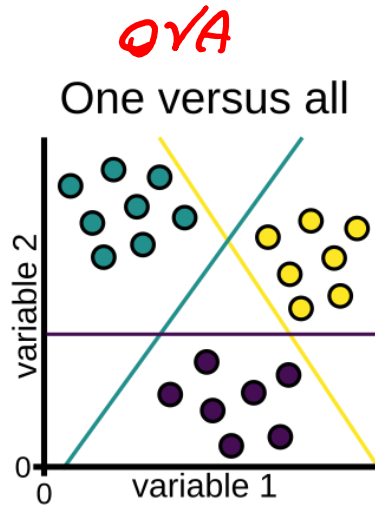
K-Multiple class SVM

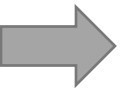
- One-VS-One (OVO)

1. Fit all $\binom{K}{2}$ pairwise classifiers $\widehat{f}_{kl}(x)$, each class versus the rest
2. Classify x_{te} to the class that wins the most pairwise competitions.

$K=3 \rightarrow$ OVA $\textcircled{3}$ OVO $\binom{3}{2} = \textcircled{3}$

$K=10 \rightarrow$ $\textcircled{10}$ $\binom{10}{2} = \frac{10 \times 9}{2} = \textcircled{45}$





SVM's Pros and Cons

Pros:

- SVM can be memory efficient! uses only a subset of the training data (support vectors)
- Can handle non-linear data sets → Kernel
- Can handle high dimensional spaces (even when $D > N$) RBF
- Used both for classification and regression
- SVM are not very sensitive to overfitting (soft margin; regularization)
- Can have high accuracy (even compared to NN)

Cons:

- * No probability outcome!
- Long training time when we have large data sets.
- Limited interpretability (specially for Kernel SVM)
- Does not perform well with noisy data
- Suited for small to medium size data



→ SVM's Applications in finance

- Corporate financial statements and bankruptcy (high dimensional)
- Identifying stressed companies to short sell (using many fundamental and technical features)
- Sentiment analysis (classify text from documents e.g., news articles, company announcements, and company annual reports into useful categories for investors)
- Money laundering analysis and spam detection
- Loan management

