

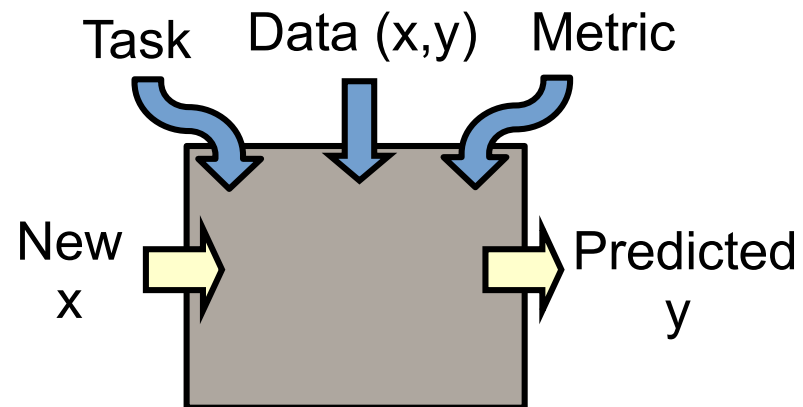
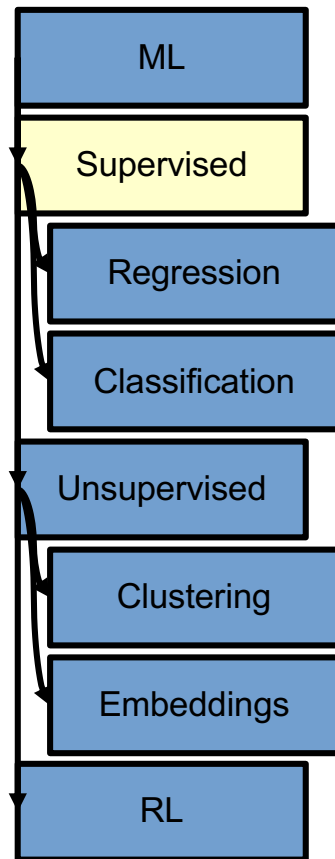
CS181: Introduction to Machine Learning

Lecture 10 (Max Margin Methods)

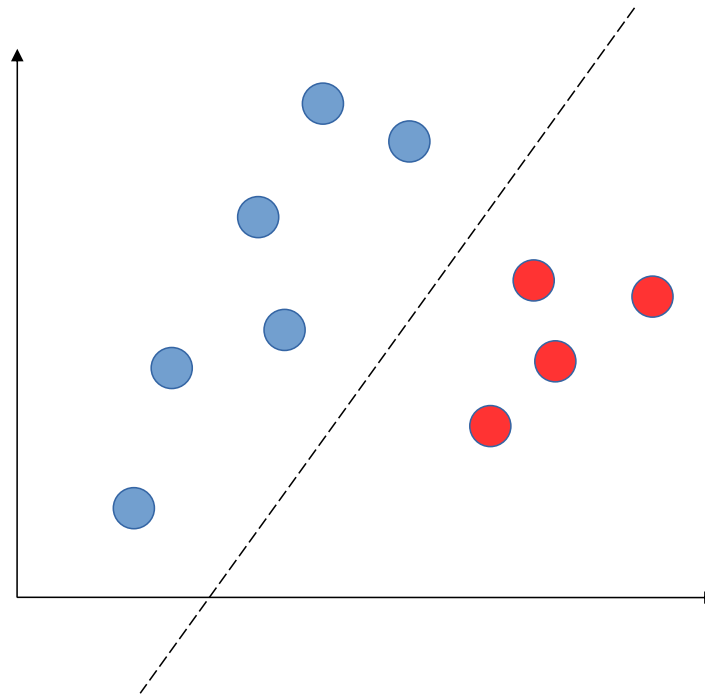
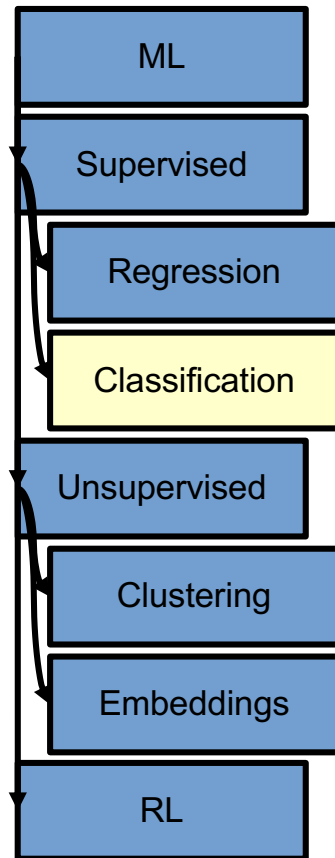
Spring 2021

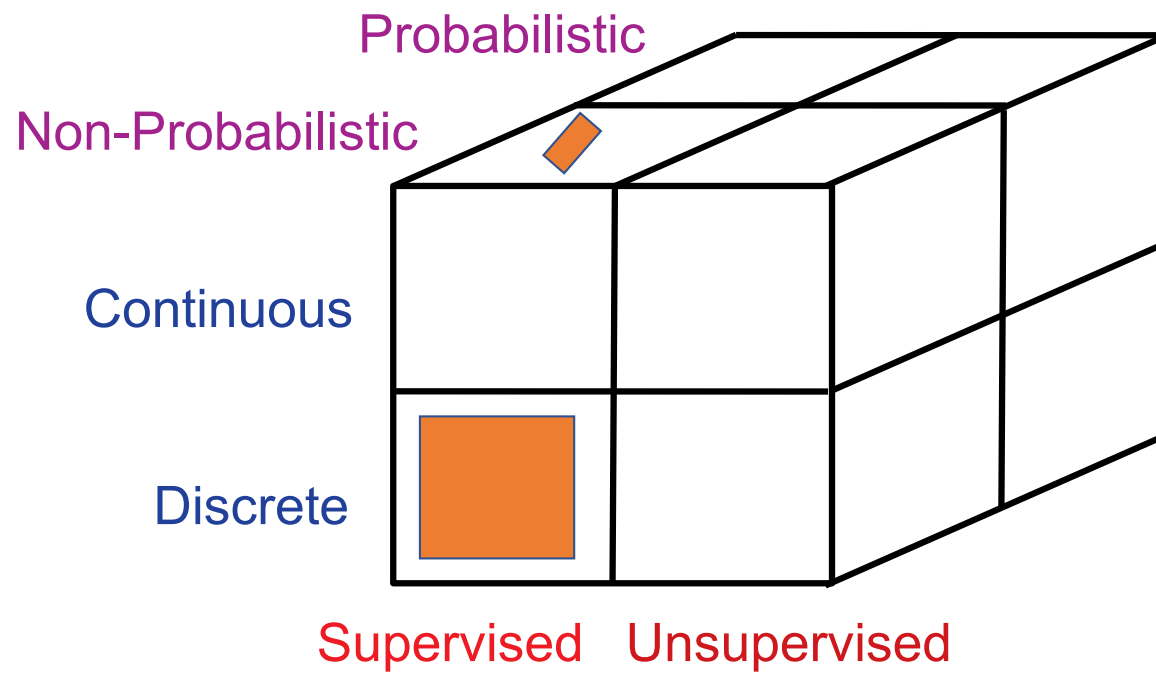
Finale Doshi-Velez and David C. Parkes
Harvard Computer Science

Machine Learning Taxonomy



Terminology: Classification





+ graphical models, reinforcement learning

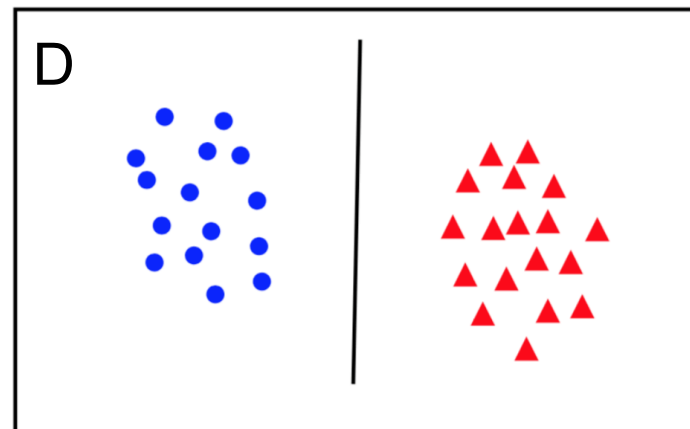
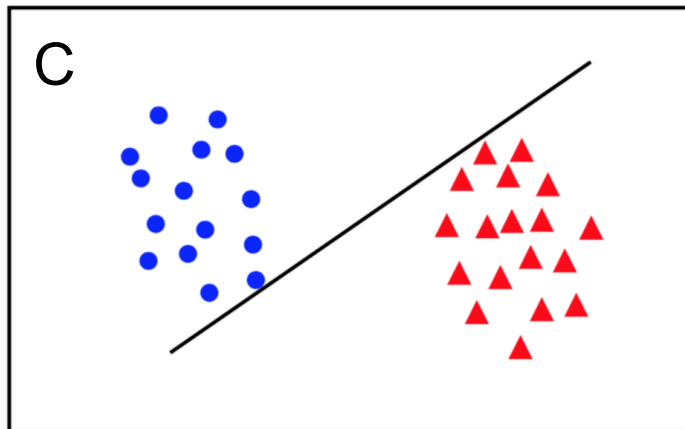
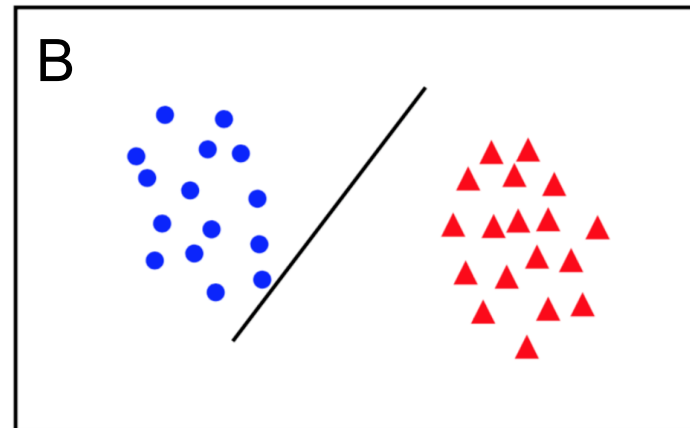
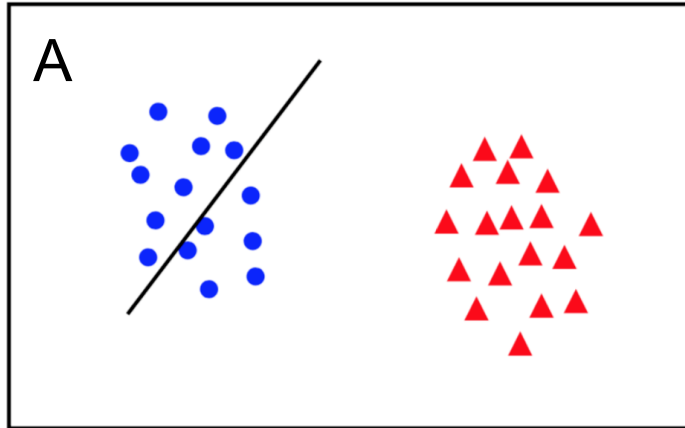
Today: Max Margin Methods

- “Max margin” is an elegant theory that takes us to the “support vector machine” model class!
- Convex training problems, coherent theory, and very good accuracy
- Leads to “**support vector machines.**” SVMs have a record of very successful application, for example:
 - Predicting a cancer type from cell samples
 - Fake news characterization
 - Predicting the function of proteins
- Especially well suited when non-linear interactions between features because handle basis functions very nicely



<https://debuggercafe.com/opencv-hog-hyperparameter-tuning-for-accurate-and-fast-person-detection/>

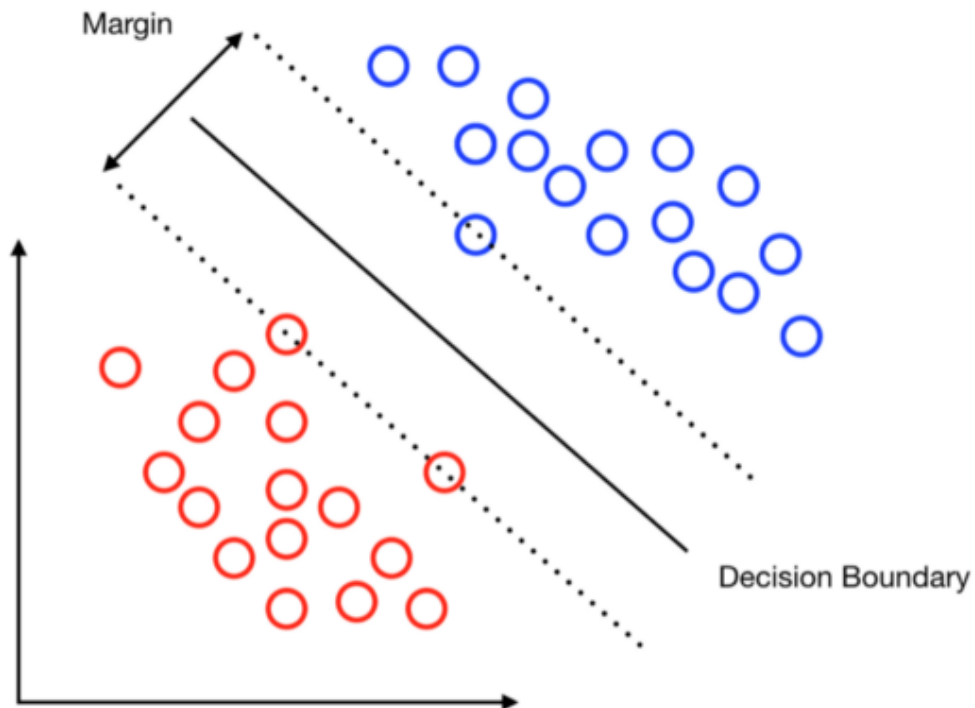
What's a good decision boundary?



← Preferred

Max-margin Decision boundary

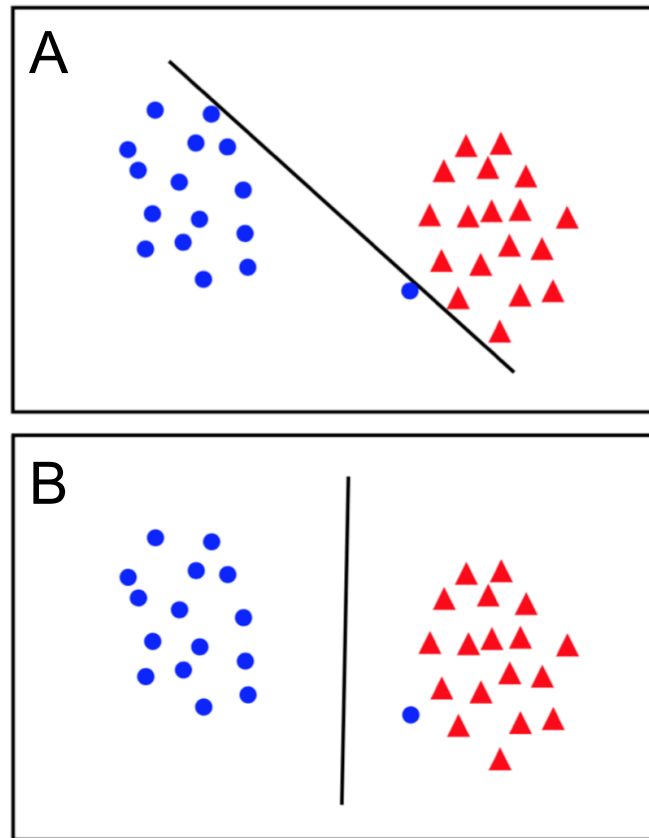
<https://medium.com/analytics-vidhya/support-vector-machines-with-amazon-food-reviews-9fe0428e09ef>



Idea: find the linear separator that maximizes the **minimum distance from correctly classified examples to the boundary**

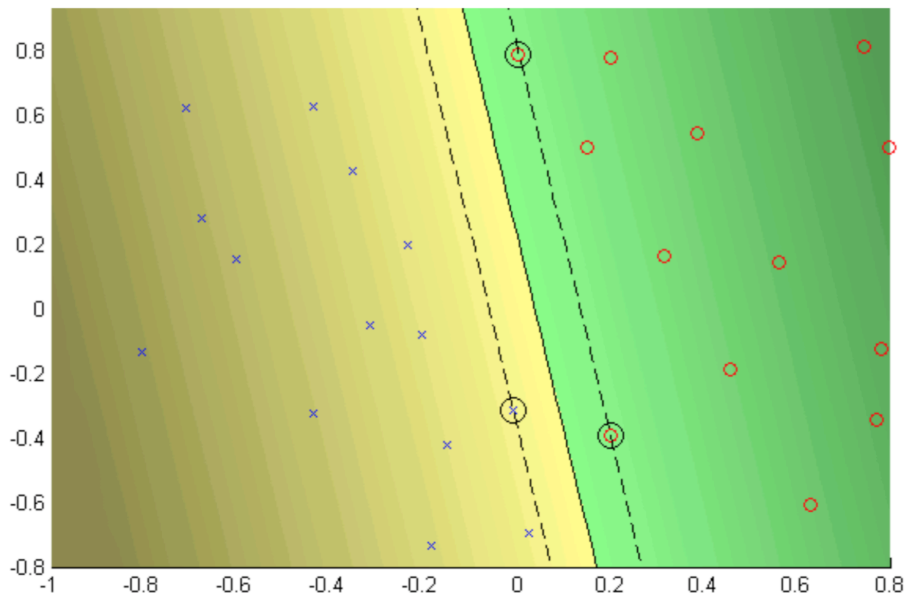
(maximize **“the margin on the data”**)

What's a good decision boundary?

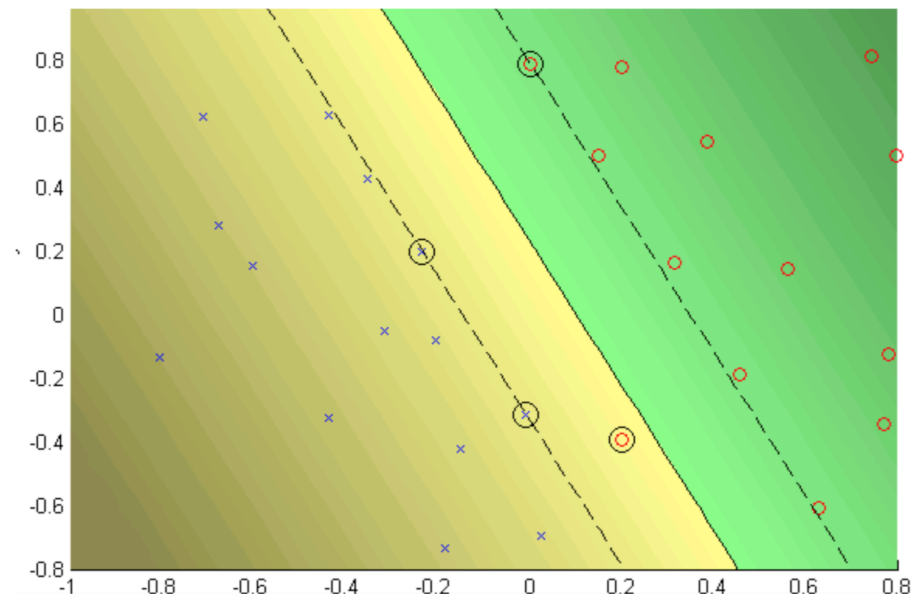


← May be preferred

Trading off the “margin” for the number of mistakes



“Hard margin”
Require a separator



“Soft margin”
Tolerate some mistakes

From linear to non-linear (next lecture)

