CS181: Introduction to Machine Learning

Lecture 10 (Max Margin Methods)

Spring 2021

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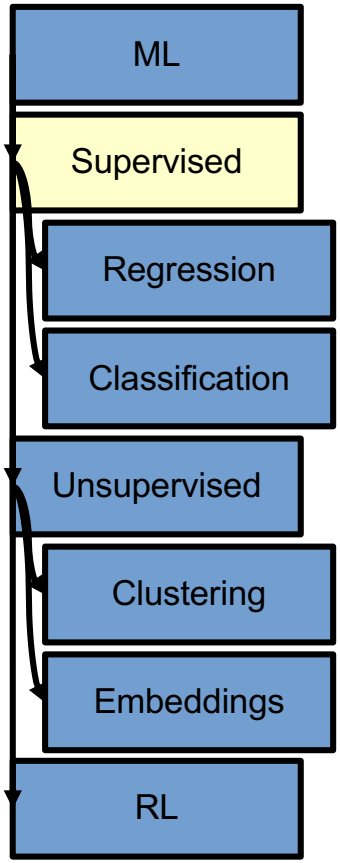
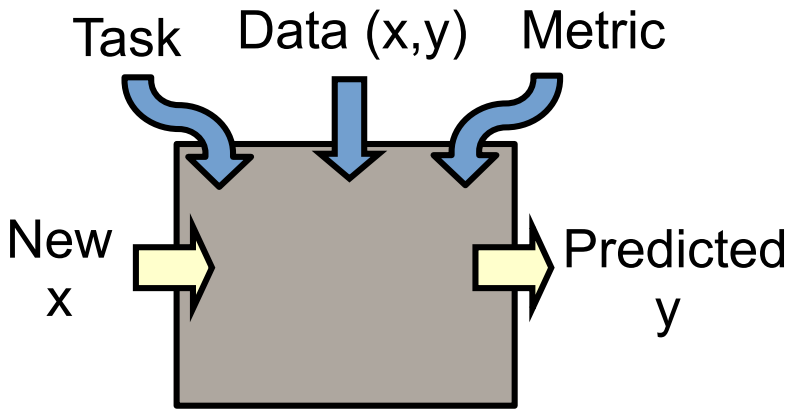
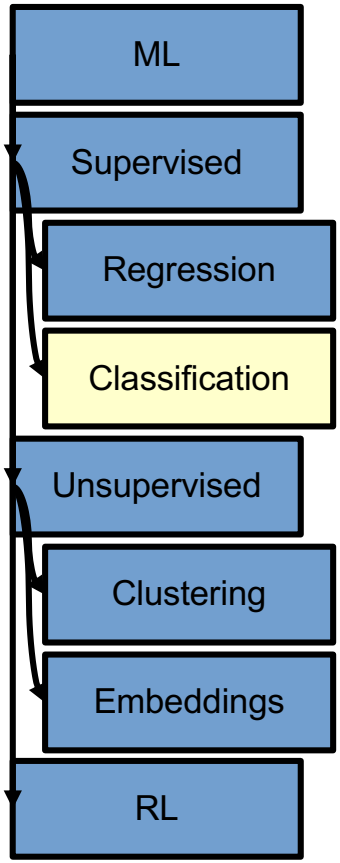
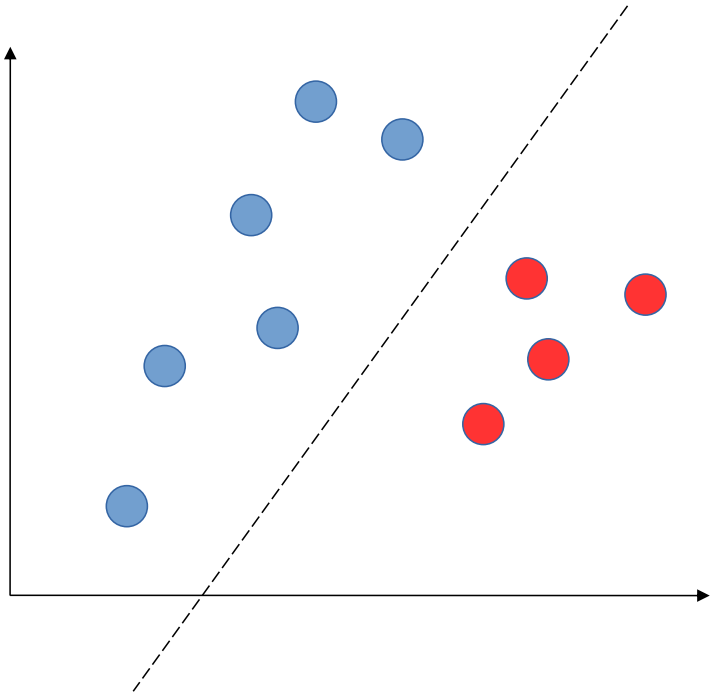
Machine Learning Taxonomy

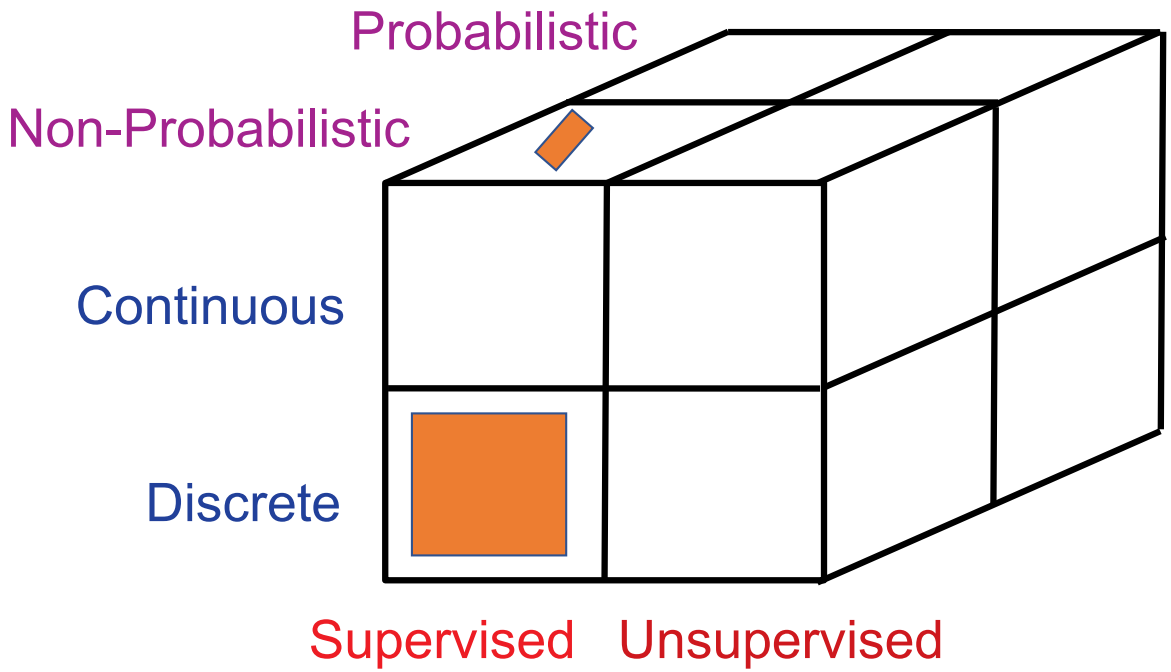




Terminology: Classification







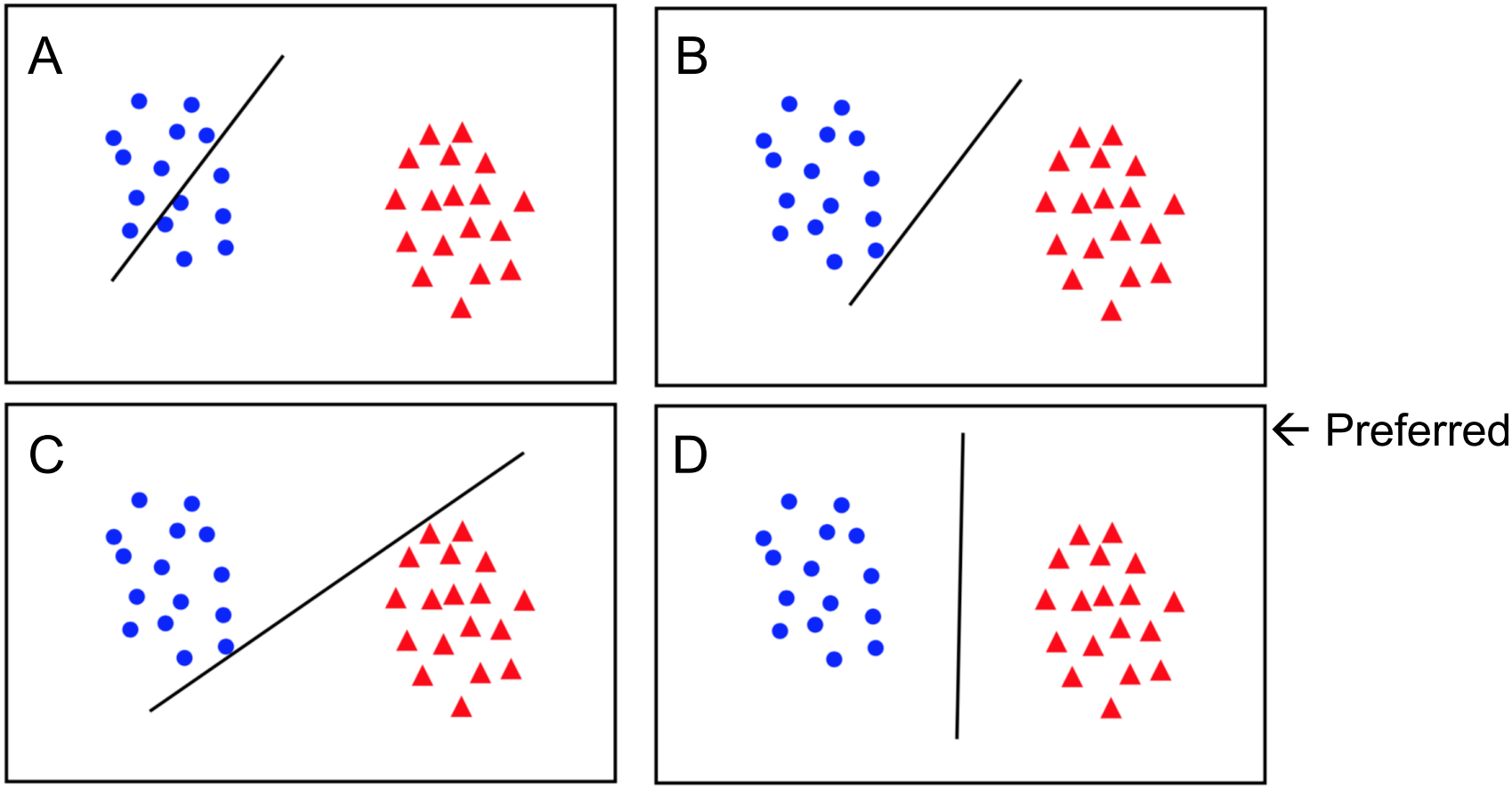
+ graphical models, reinforcement learning

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?



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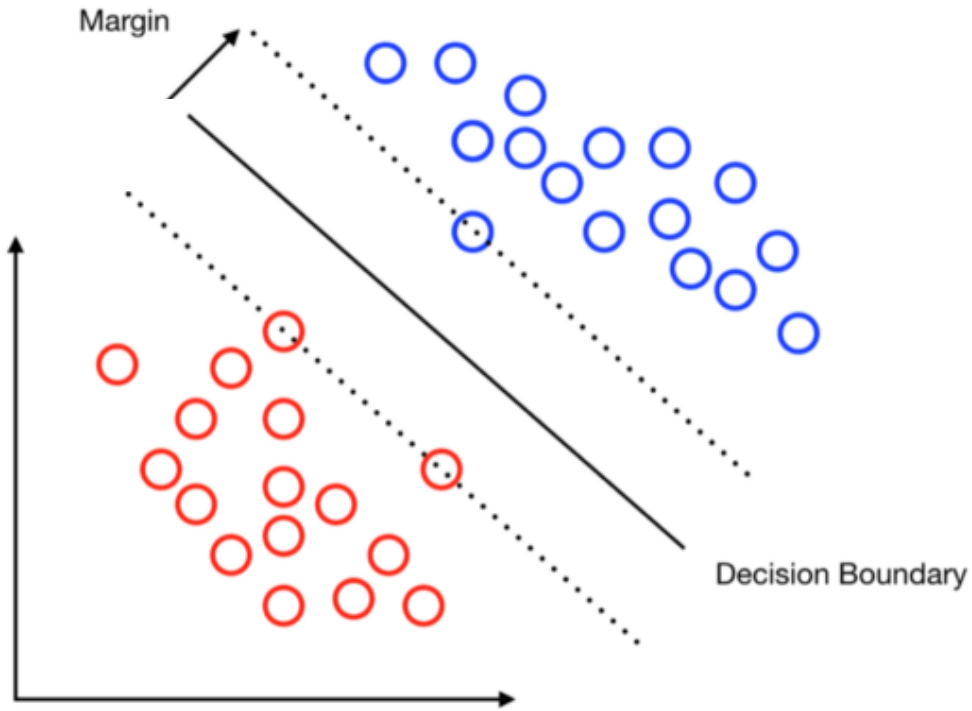
Max-margin Decision boundary

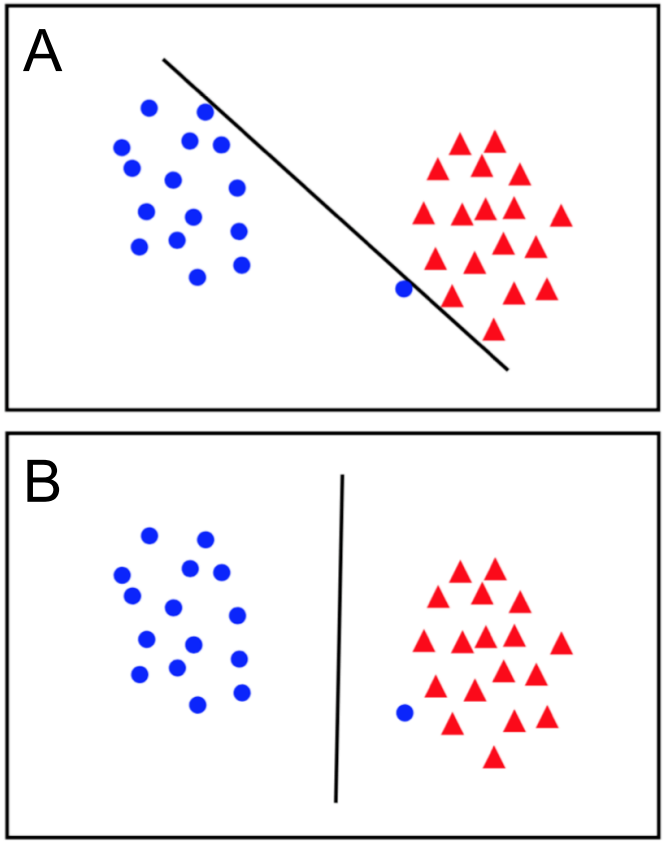
https://medium.com/analytics-vidhya/support-vector-machines-with-amazon-food-reviews-9fe0428e09ef



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

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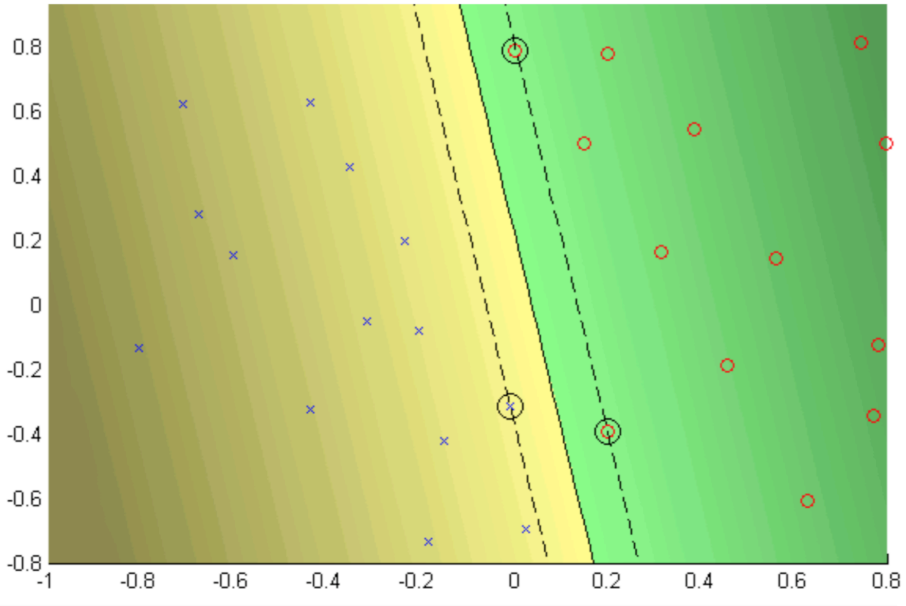
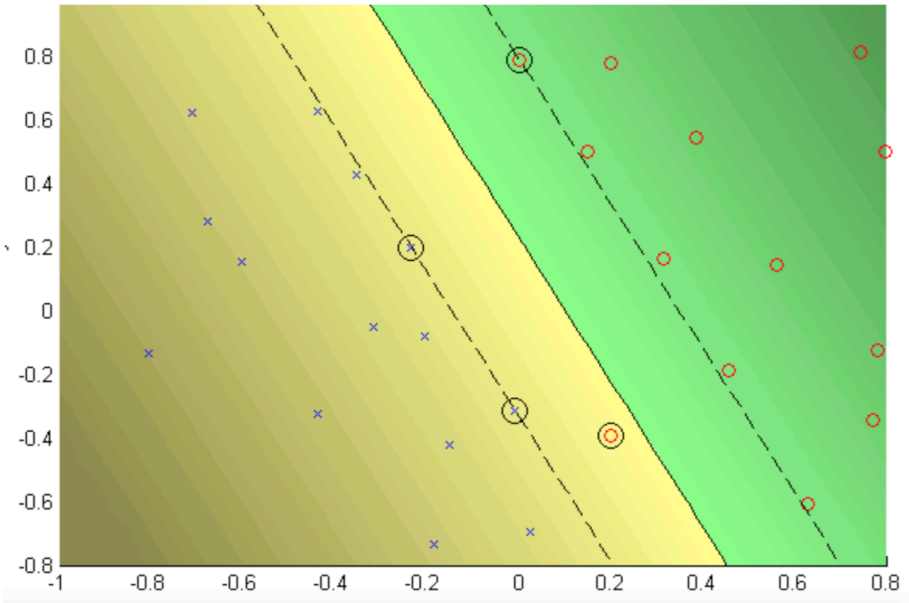
Trading off the “margin” for the number of mistakes



“Hard margin”
Require a separator



“Soft margin”
Tolerate some mistakes

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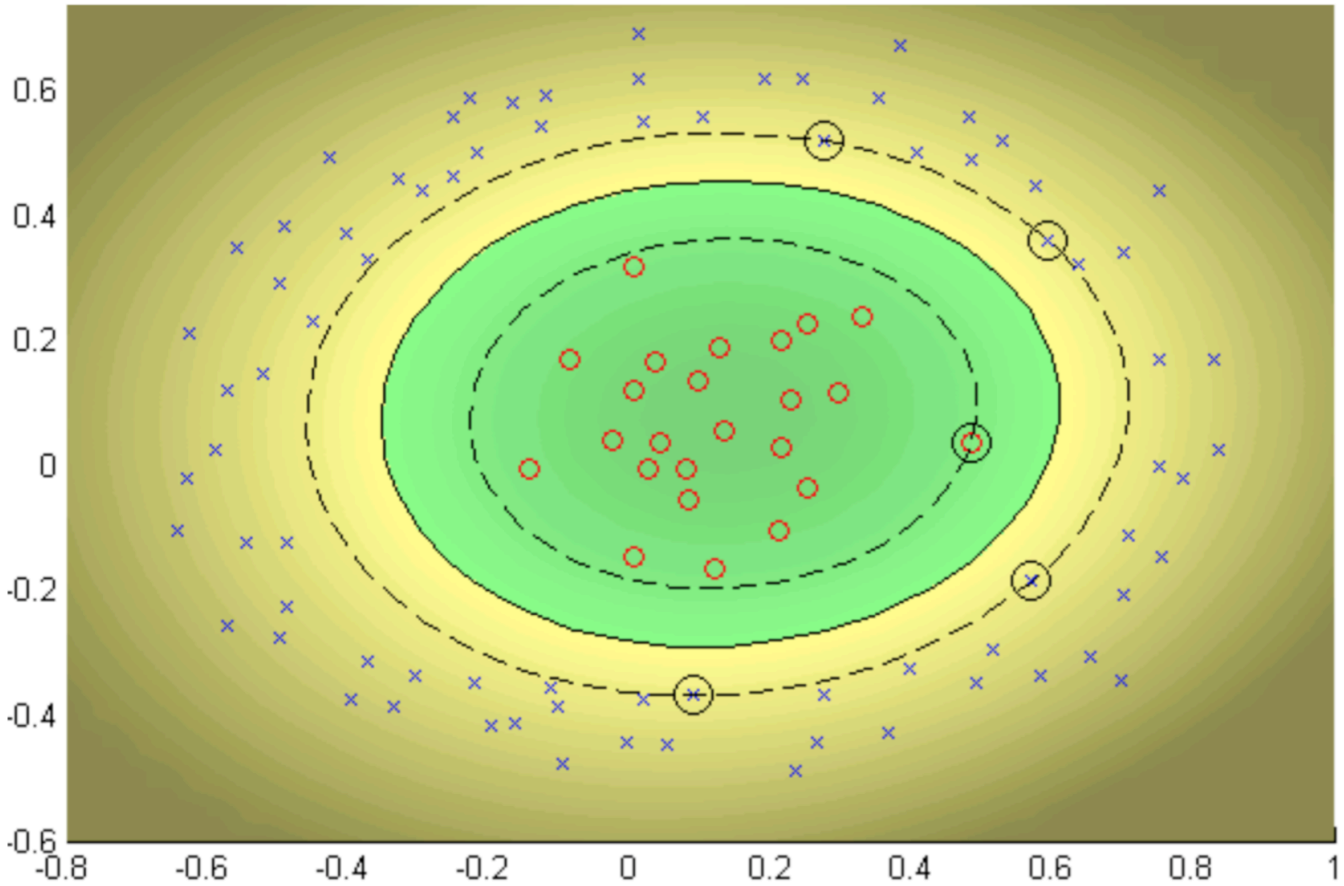
From linear to non-linear (next lecture)



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