Support Vector Machines: Example

Mining of Massive Datasets
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Online Learning

- **New setting: Online Learning**
  - Allows for modeling problems where we have a continuous stream of data
  - We want an algorithm to learn from it and slowly adapt to the changes in data
- **Idea: Do slow updates to the model**
  - All our SVM makes updates if they misclassify an example
  - **So:** First train the classifier on training data. Then for every example from the stream, if we misclassify, update the model (using small learning rate)

Example: Shipping Service

- **Protocol:**
  - User comes and tell us origin and destination
  - We offer to ship the package for some money ($10 - $50)
  - Based on the price we offer, sometimes the user uses our service (**y = 1**), sometimes they don't (**y = -1**)
- **Task:** Build an algorithm to optimize what price we offer to the users
- **Features *x* capture:**
  - Information about user
  - Origin and destination
- **Problem: Will user accept the price?**

Example: Shipping Service

- **Model whether user will accept our price:**
  y = f(x; w)
  - **Accept: y =1, Not accept: y=-1**
  - Build this model with say Perceptron or Winnow
- **The website that runs continuously**
- **Online learning algorithm would do something like**
  - User comes
  - User is represented as an **(x,y)** pair where
    - **x:** Feature vector including price we offer, origin, destination
    - **y:** If they chose to use our service or not
  - The algorithm updates **w** using just the **(x,y)** pair
  - Basically, we update the **w** parameters every time we get some new data

Example: Shipping Service

- We discard this idea of a data "set"
- Instead we have a continuous stream of data
- **Further comments:**
  - For a major website where you have a massive stream of data then this kind of algorithm is pretty reasonable
  - Don't need to deal with all the training data
  - If you had a small number of users you could save their data and then run a normal algorithm on the full dataset
    - Doing multiple passes over the data

Online Algorithms

- An online algorithm can adapt to changing user preferences
- For example, over time users may become more price sensitive
- **The algorithm adapts and learns this**
- So the system is dynamic