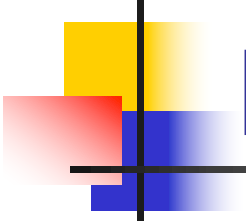
CMSC 510
Regularization Methods for Machine Learning

Instructor:
Dr. Tom Arodz

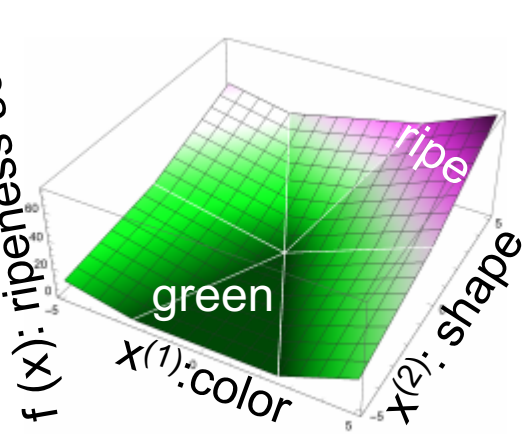


Blackboard

- You will find there:
  - Lecture slides (incl. this one)
  - Homework assignments
  - News & announcements

Topic of the course

- Supervised machine learning
  - A subcomponent of many AI systems
  - Given a vector of attributes – always in the same order – predict something
    - [color, size] -> how ripe the fruit is?
    - $x=[x^{(1)}, x^{(2)}] \rightarrow y=f(x)$



      - Find function $f: R^2 \rightarrow R$ based on
        - training data (x_i,y_i), *i from 1 to m*
        - some criterion function L (e.g. mean squared error)
      - $\min_h \sum_i L(f(x_i),y_i)$
        - e.g. $\min_h \sum_i (f(x_i)-y_i)^2$

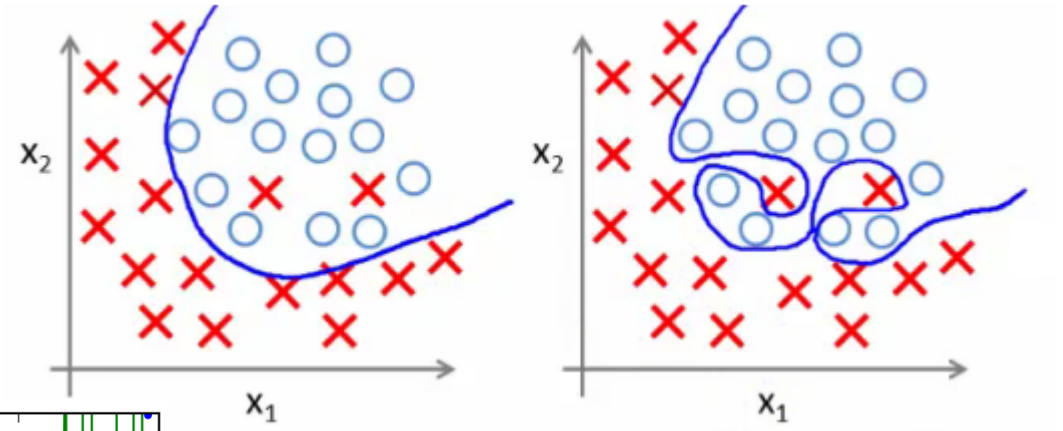
Topic of the course

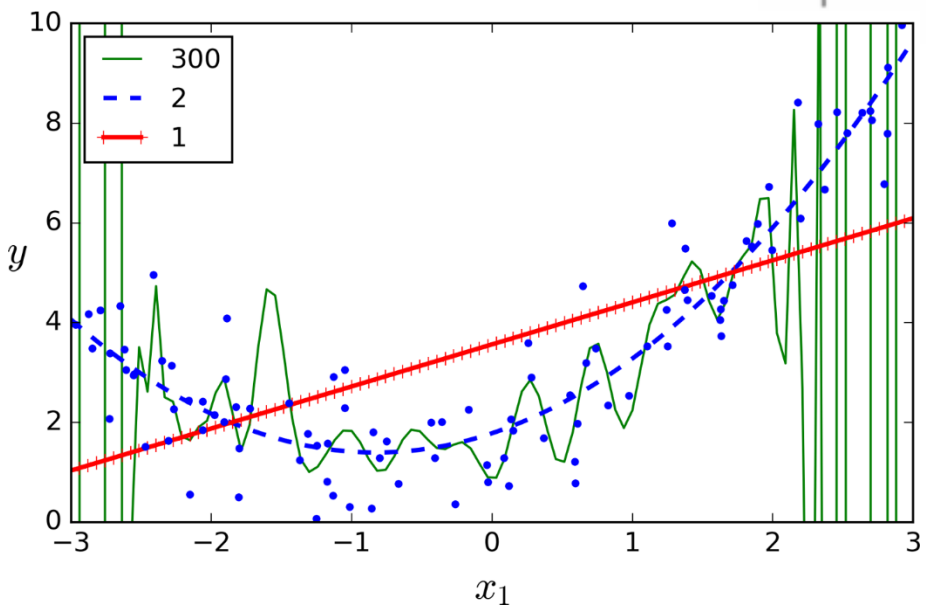
- Supervised ML
  - Classification in 2D:

    $[x^{(1)}, x^{(2)}]$ -> f(x)

    if f(x)>0: predict o
    if f(x)<0: predict x
  - Regression in 1D:

    x -> f(x)





- Goal of methods in the course:
  - Classification: draw a nice line separating points of different color
  - Regression: draw a line going close to all the points

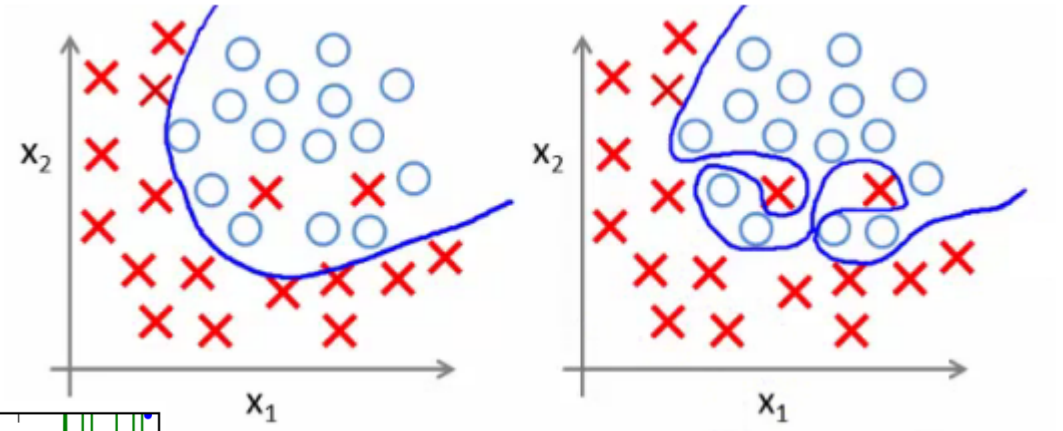
Topic of the course

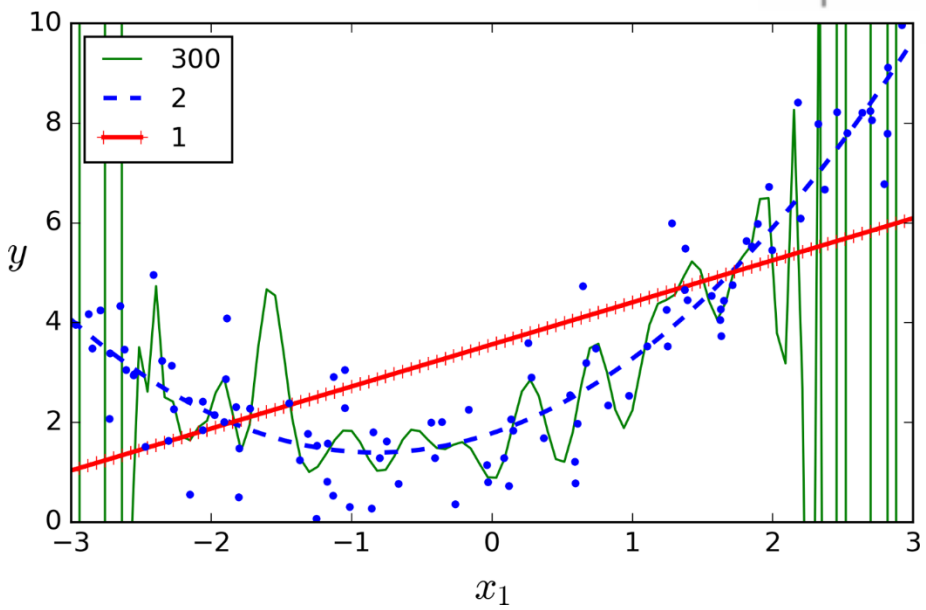
- Regularization in supervised ML
  - Classification in 2D:

    $[x^{(1)}, x^{(2)}]$ -> f(x)

    if f(x)>0: predict o
    if f(x)<0: predict x
  - Regression in 1D:

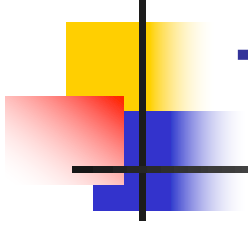
    x -> f(x)





- Regularization:
  - Mathematical methods for going "against data" to promote solution we like for some external reason
    - e.g. not too wiggly

Topic of the course



- This is NOT a broad, “intro to AI/ML”-style course
- The course goes into mathematics of one specific sub-topic of AI/ML
- Focus on depth instead of breadth

Prerequisites

- The course is open to *graduate students* and *students accepted into the five-year accelerated B.S. and M.S. program in computer science*.
- If you need an override,
  stay on zoom after we end,
  or send me an email
- The course will assume undergrad-level background in *linear algebra*, *multivariate calculus*, *statistics & probability*, and *algorithms*

Grading – components

- Projects 60%
  - 4 homework projects, 15% each
    - To be done individually, in Python
    - 1) 8/18 -> 9/15 (4 weeks, numpy) already on BB
    - 2) 9/15 -> 10/6 (3 weeks, pytorch)
    - 3) 10/6 -> 10/27 (3 weeks, tensorflow)
    - 4) 10/27 -> 11/17 (3 weeks, pytorch / tensorflow)

- Test 40%
  - Will be done remotely:
    - Nov 24th 3:30-4:45pm (last class)
    - ~~Dec 1st 4pm-5:15pm (our assigned time)~~

Grading scale

A [90% - 100%],

B [80% - 90%),

C [70% - 80%),

D [60%-70%),

F [0% - 60%)

How to reach me

- Email:
  - tarodz@vcu.edu
  - Subject line should start with: CMSC510

- Office hours:
  - When: TR 10:00am-11:00am,
    Where: zoom