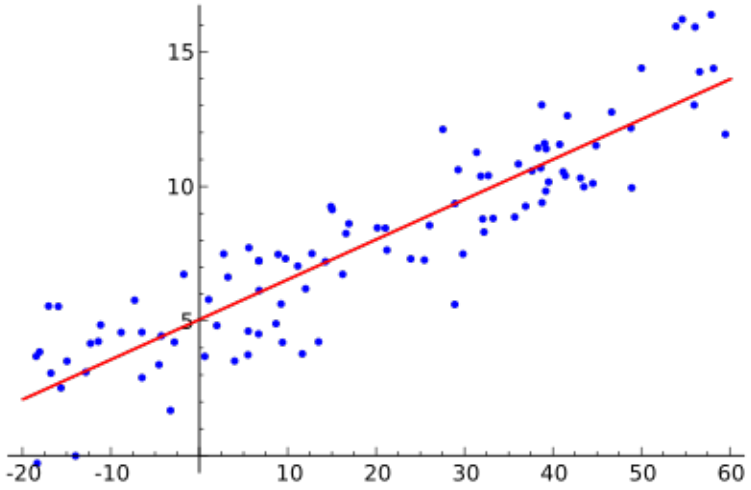
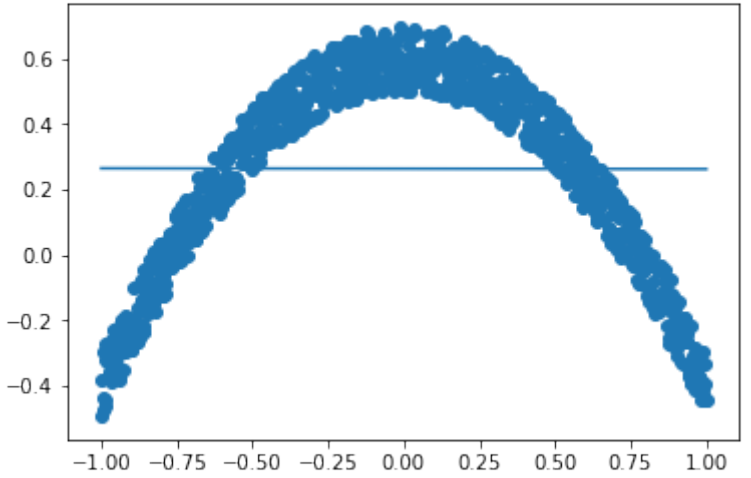
LOESS

Week 4: LOcally weighted regrESSion

Problem

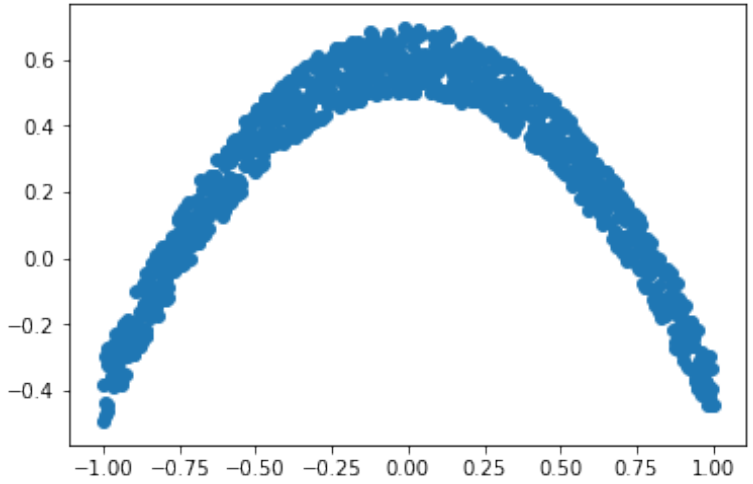
- We can fit straight lines well
- Curves—not so much

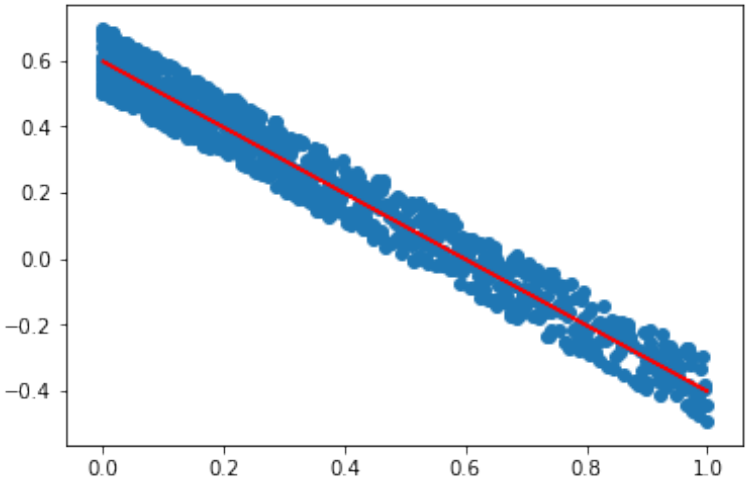


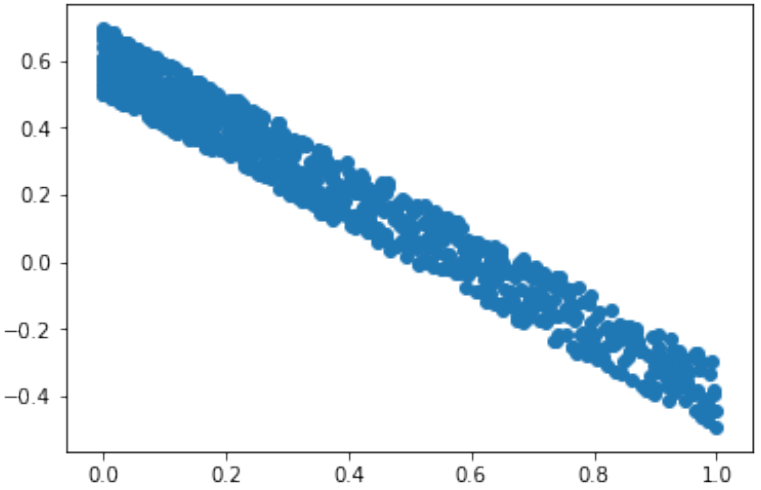


What to do

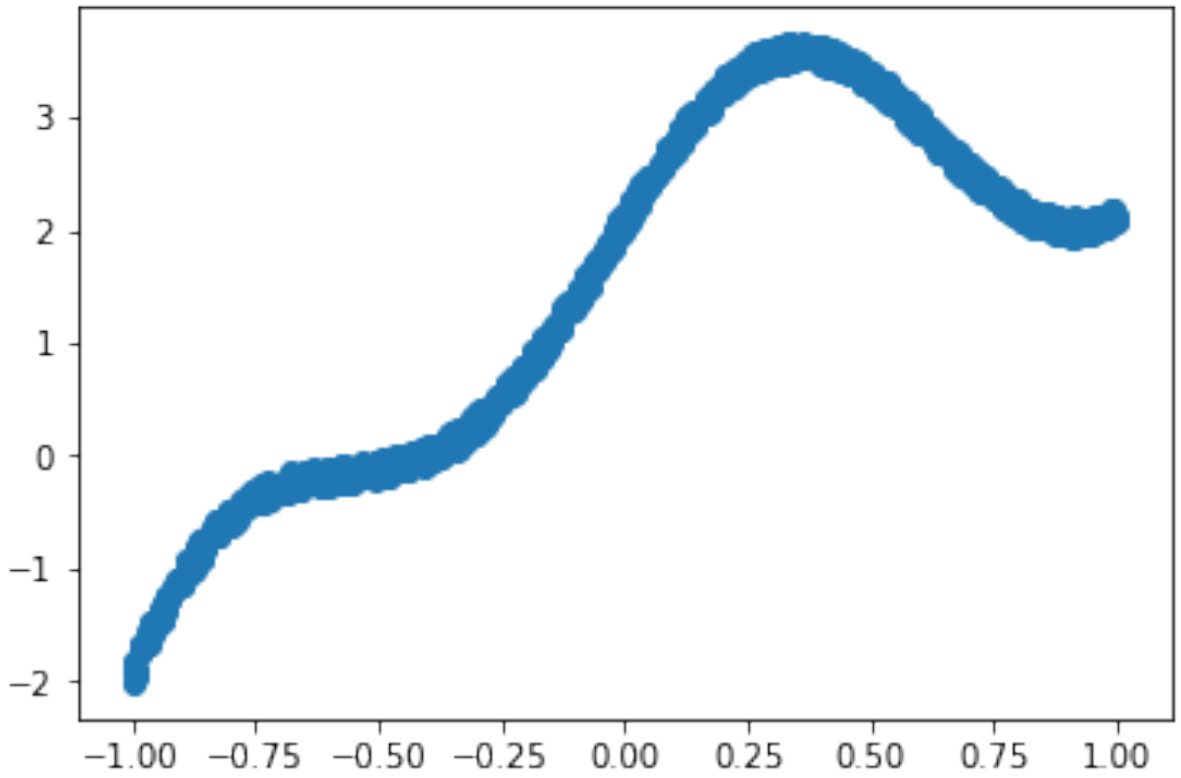
- Variable change
  - x -> x^2







Go ahead: transform this one



- If we cannot transform, what do we do?
- Piece wise regression

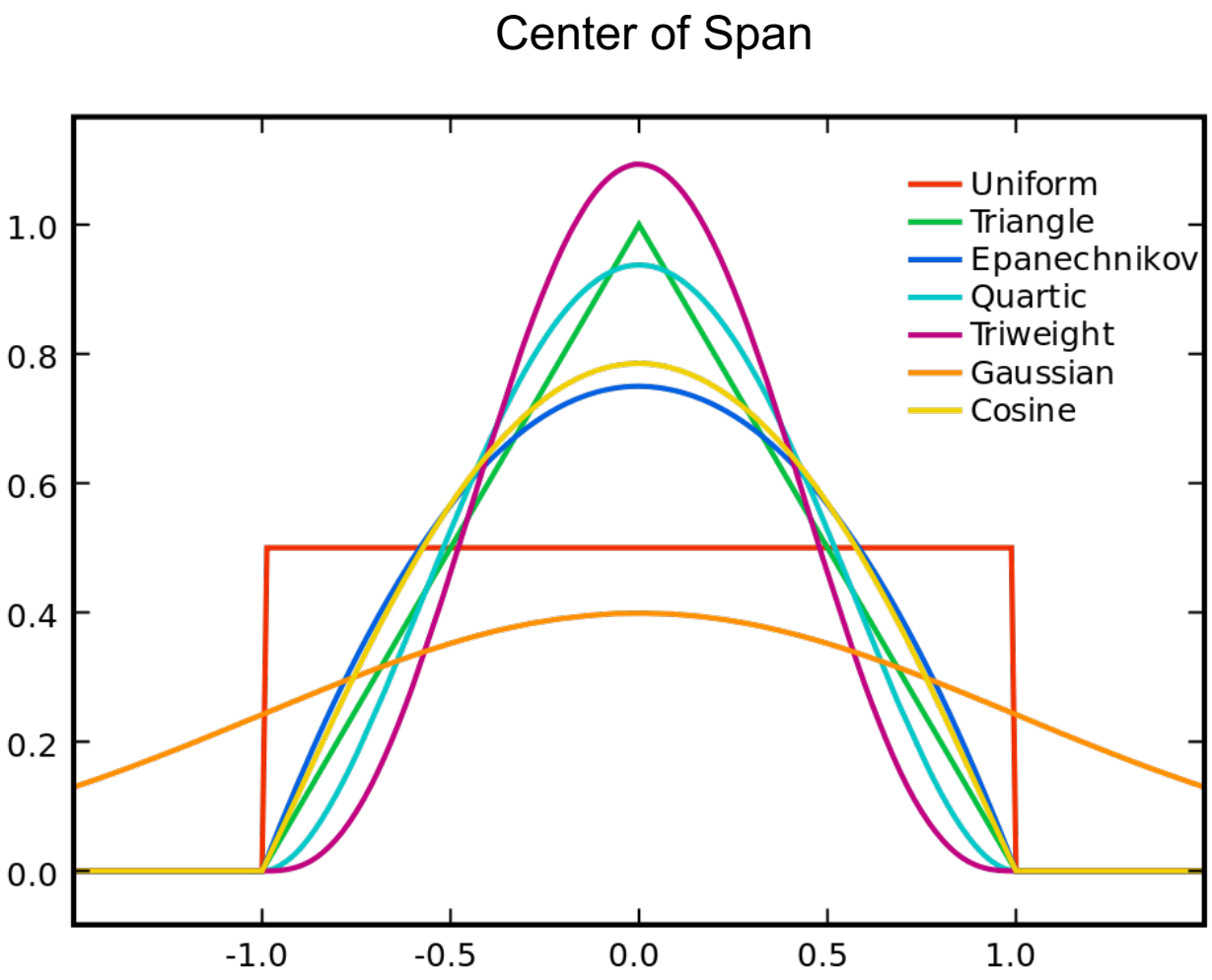
LOESS

- Essentially a spline fit
- Fit local data
- Use a polynomial (essentially variable transforms)
  - DO NOT USE HIGH ORDER POLYNOMIALS
    - Overfit
- Using distance weighting
  - kNN

Hyperparameters

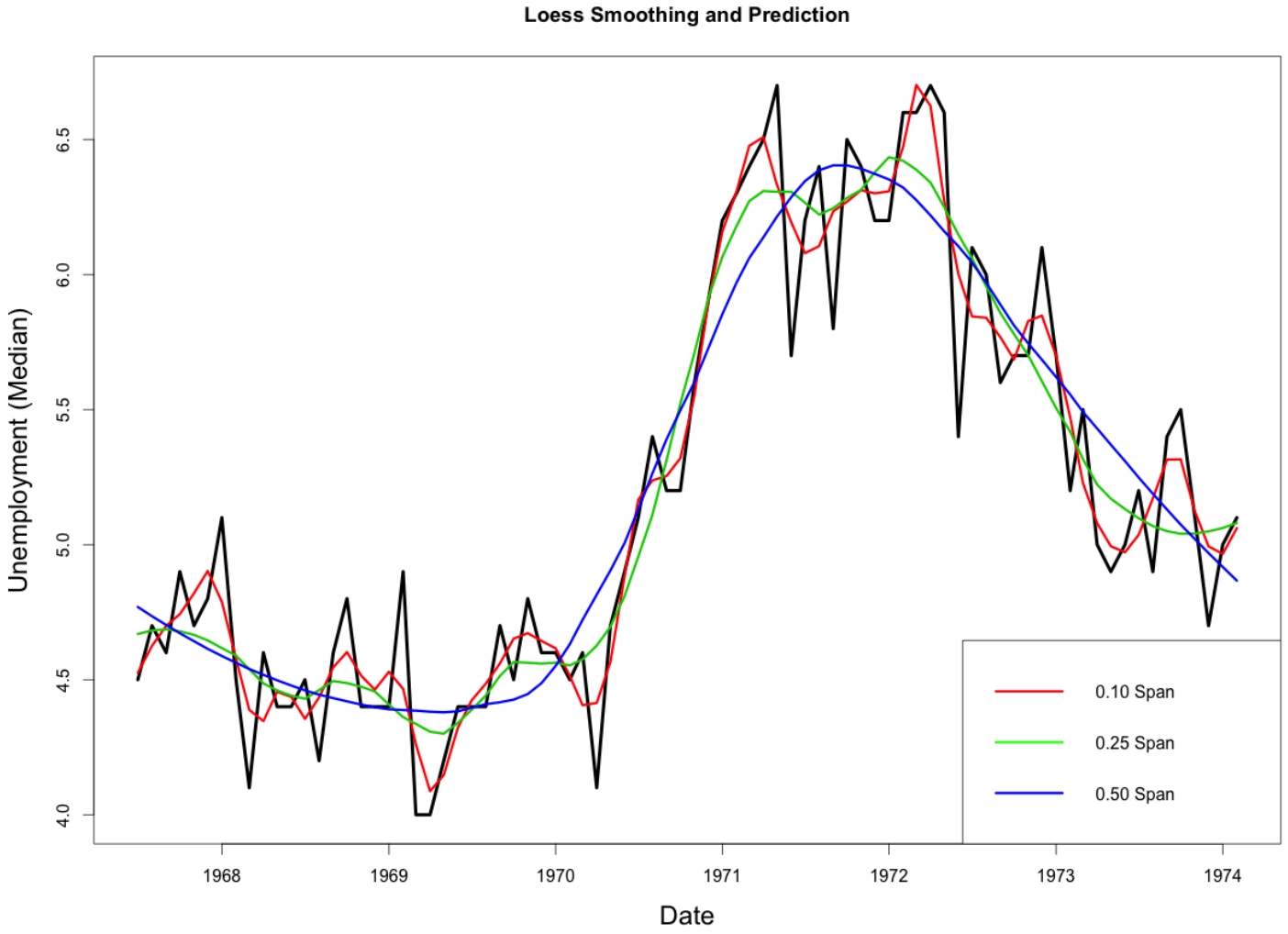
- Order
  - This is your variable transform
  - 0—weighted mean
  - 1—linear
  - 2—Quadratic
  - 3—Cubic
- Span (α)
  - How many points (fraction of total)
  - $0 < \alpha < 1$
- Weighting
  - Default: $(1 - |d|^3)^3$
  - Scaled to be between 0-1

Weights


Center of Span
Uniform
Triangle
Epanechnikov
Quartic
Triweight
Gaussian
Cosine
1.0
0.8
0.6
0.4
0.2
0.0
-1.0
-0.5
0.0
0.5
1.0

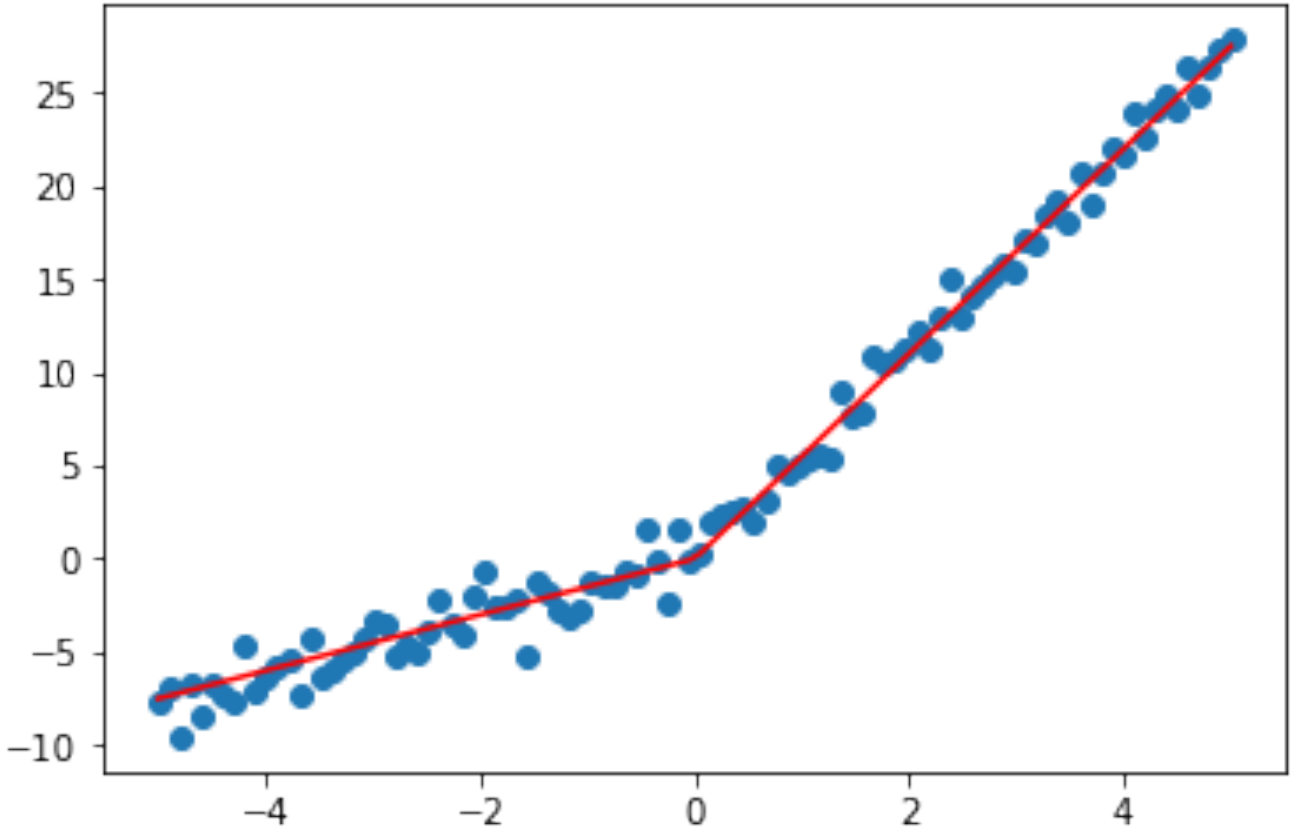
α

- Small α increases time/complexities overfit
- Large α increases lag/decreases locality



I tire of your differentiable functions (Change Points)

- What if slope changes at a certain point?



Discussion

- Have you been doing the Videos?
- How do we detect a change point
- How do we detect more than one change point?
- What methods are used?
- What R packages are used?

This is a reminder

- Value in the Videos
- I do check to see who has viewed them
  - I’m also smarter than an automated system

Homework Example

- Getting the men’s data
- How to solve issues