# funcapprox

February 24, 2017

## 1 Function Approximation

Sciences Po, Spring 2016

### 1.1 Outline

1. Overview of Approximation Methods
    1. Interpolation
    2. Regression
2. Polynomial Interpolation
3. Spline Interpolation
4. Multidimensional Approximation

### 1.2 Approximation Methods

- Confronted with a non-analytic function $f$ (i.e. something not like $log(x)$), we need a way to numerically represent $f$ in a computer.
    - If your problem is to compute a value function in a dynamic problem, you don't have an analytic representation of $V$.
    - If you need to compute an equilibrium distribution for your model, you probably can't tell it's from one parametric family or another.
- Approximations use *data* of some kind which informs us about $f$. Most commonly, we know the function values $f(x_i)$ at a corresponding finite set of points $X = \{x_i\}_{i=1}^N$.
- The task of approximation is to take that data and tell us what the function value is at $f(y), y \notin X$.
- To an economist this should sound very familiar: take a dataset, learn it's structure, and make predictions.
- The only difference is that we can do much better here, because we have more degree's of freedom (we can choose our $X$ in $Y = \beta X + \epsilon$)

### 1.3 Some Classification

- Local Approximations: approximate function and it's derivative $f, f'$ at a *single* point $x_0$. Taylor Series:

$$f(x) = f(x_0) + (x - x_0)f'(x_0) + \frac{(x - x_0)^2}{2}f''(x_0) + \cdots + \frac{(x - x_0)^n}{n!}f^n(x_0)$$