Usage-Based Auto Insurance Solutions

Nonparametric GLM

CAS RPM 2017
San Diego

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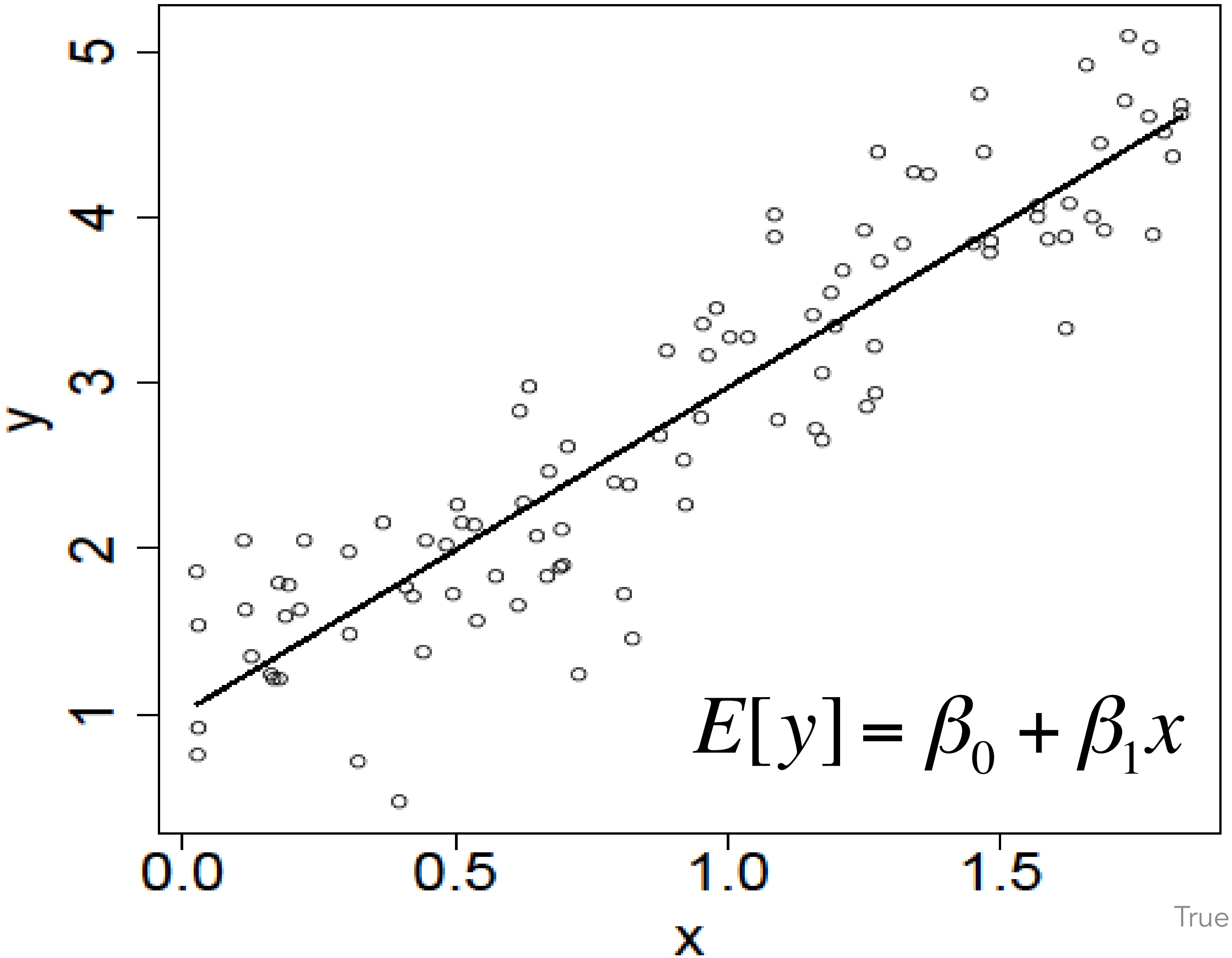
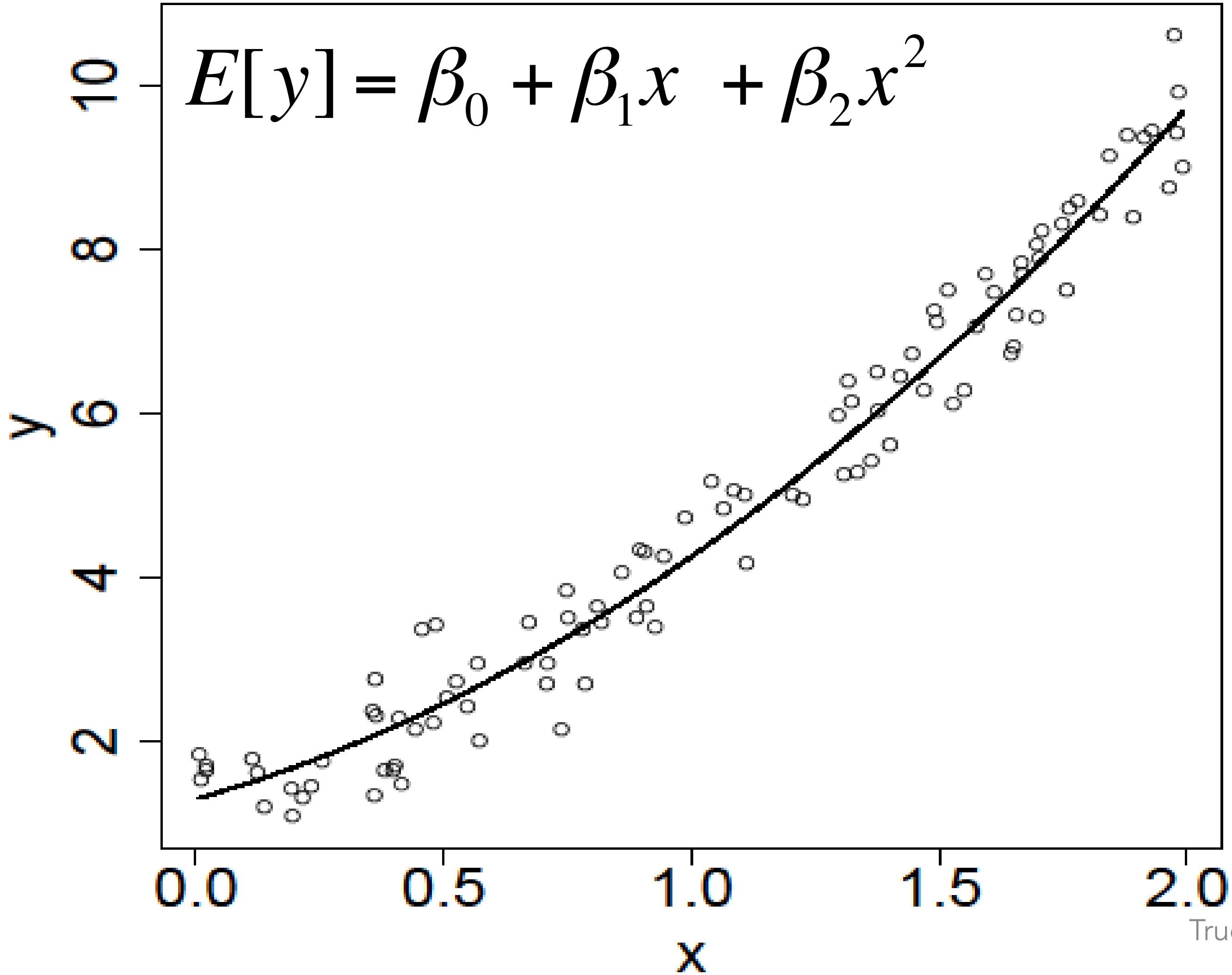
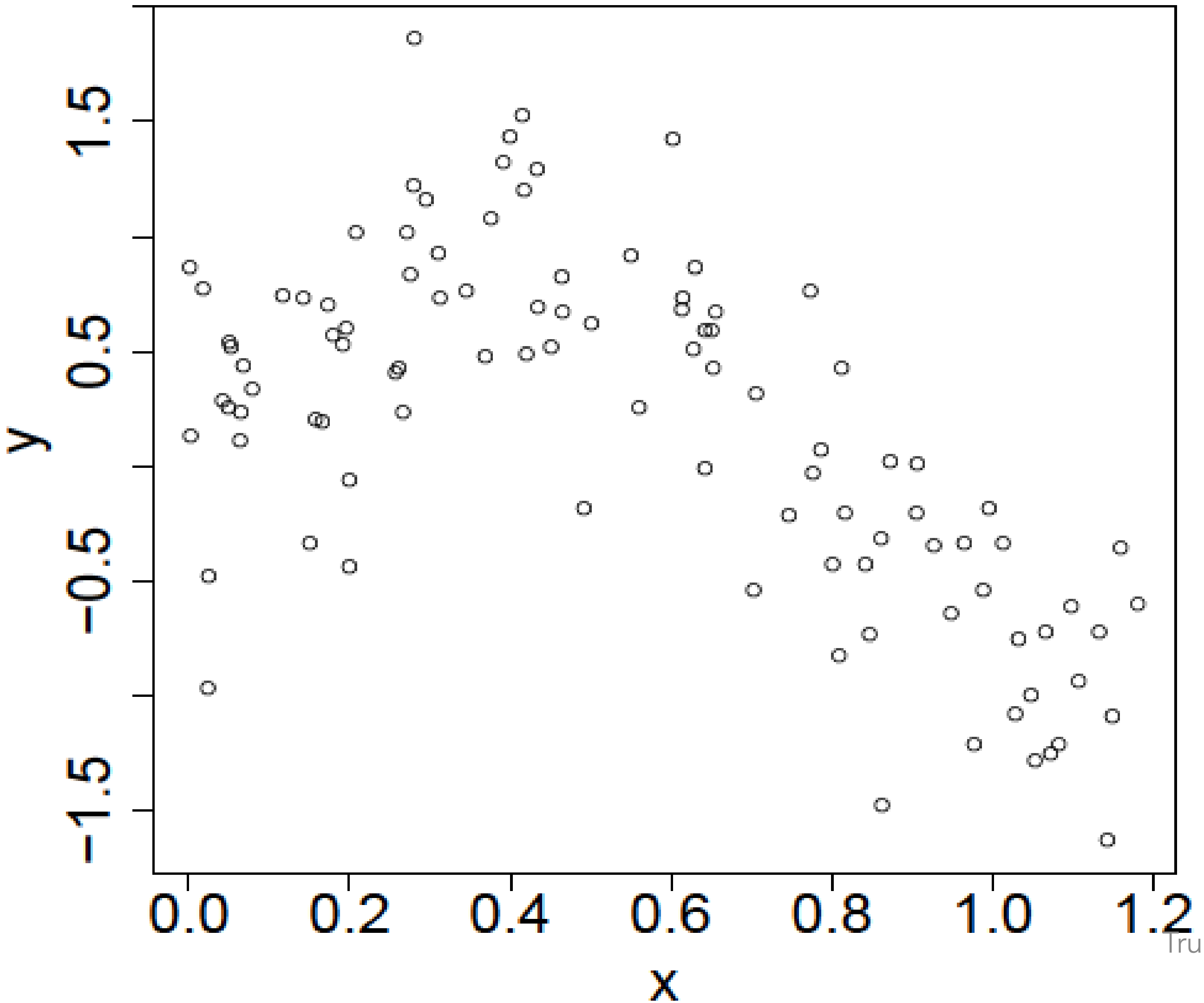
Linear Regression



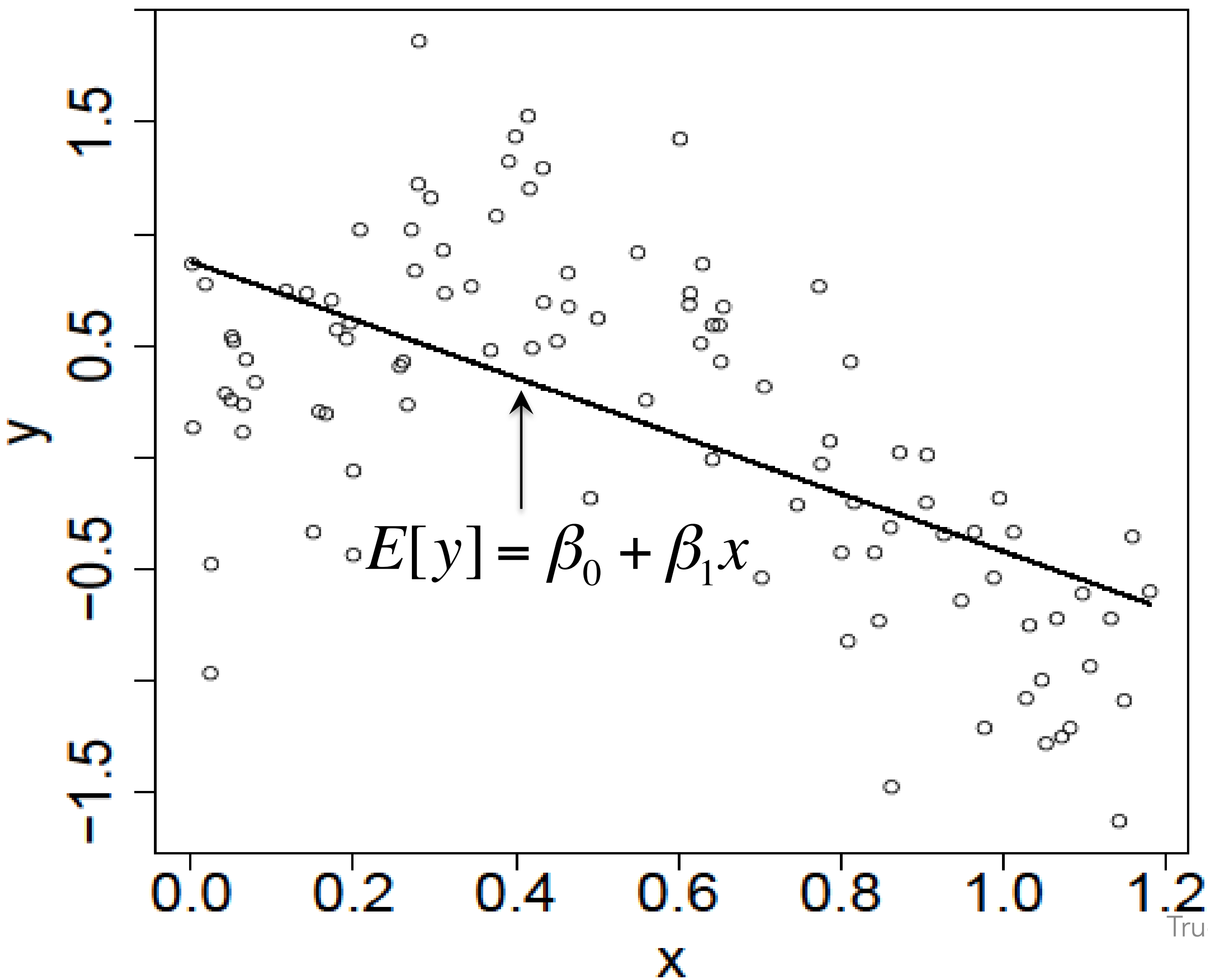
Polynomial Regression



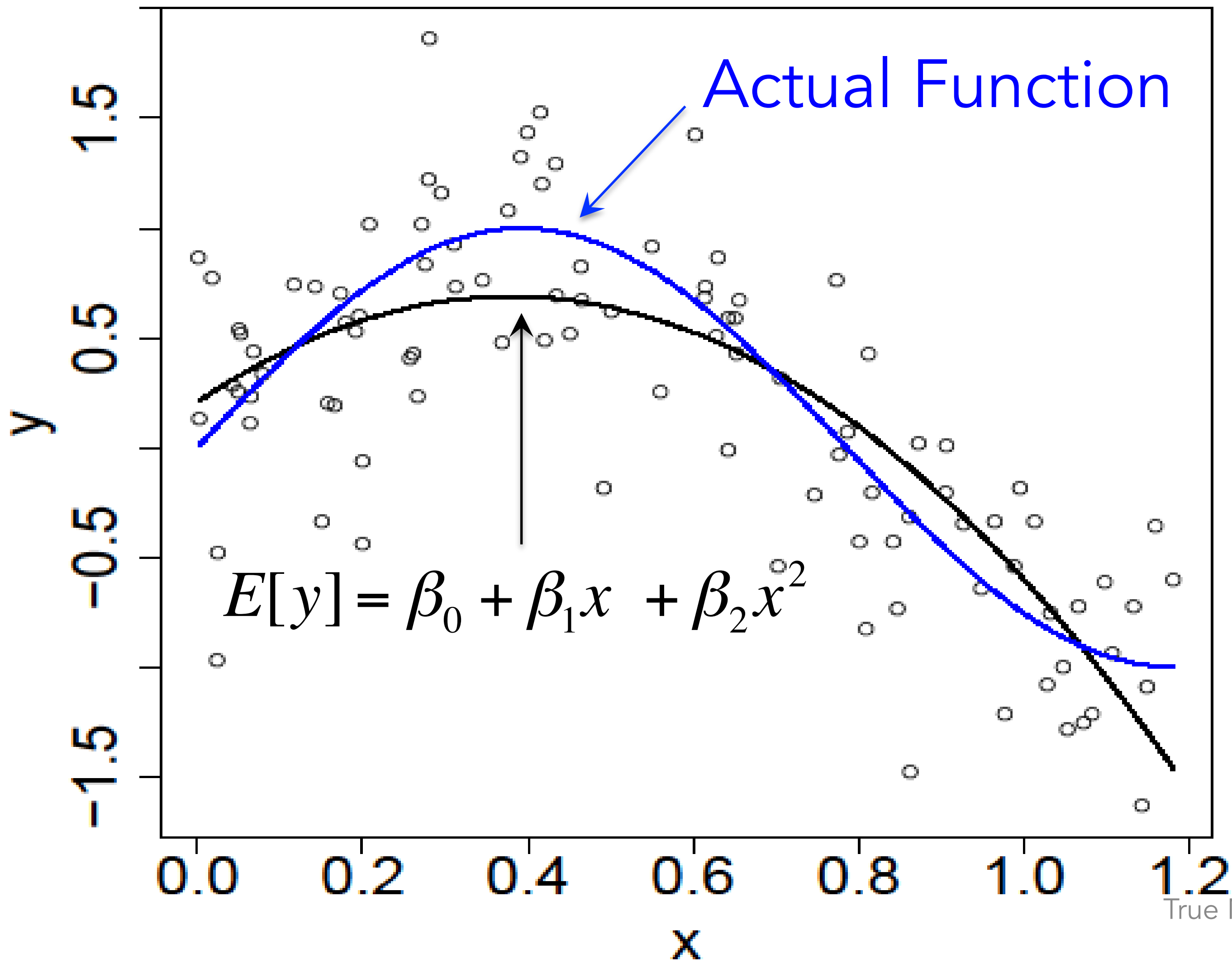
Data



Linear Regression



Polynomial Regression



Nonparametric Regression

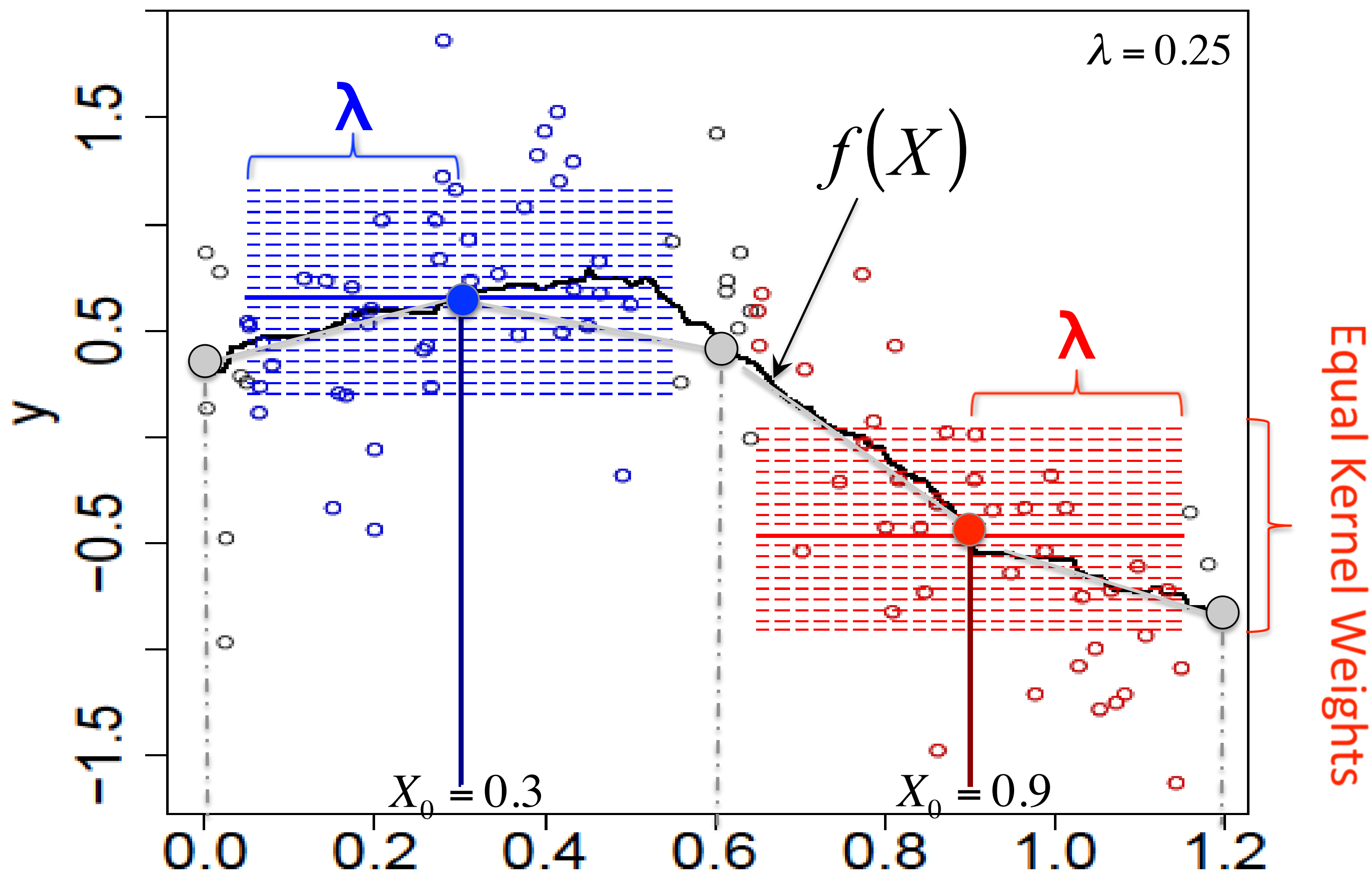
Goal

- Given a scatterplot;
- We want to find a function $f(\mathbf{x})$ that best predicts the dependent variable y

Nonparametric Regression

- Only use data in the neighborhood of X_0
- The neighborhood is set by bandwidth λ
- The regression weights are determined by a kernel function $K_\lambda(X_0, X_i)$
- Unique regression $f(X_0)$ at every X_0

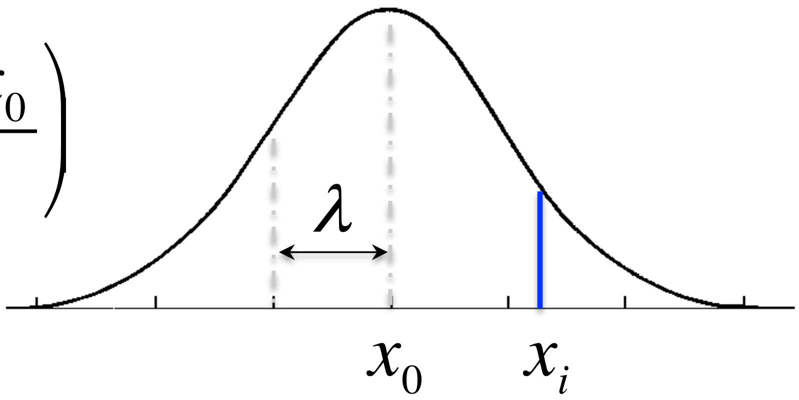
Local Average : Box Kernel



Nonparametric Regression

- The normal density is a popular kernel

$$K_\lambda(x_0, x_i) = \phi\left(\frac{x_i - x_0}{\lambda}\right)$$

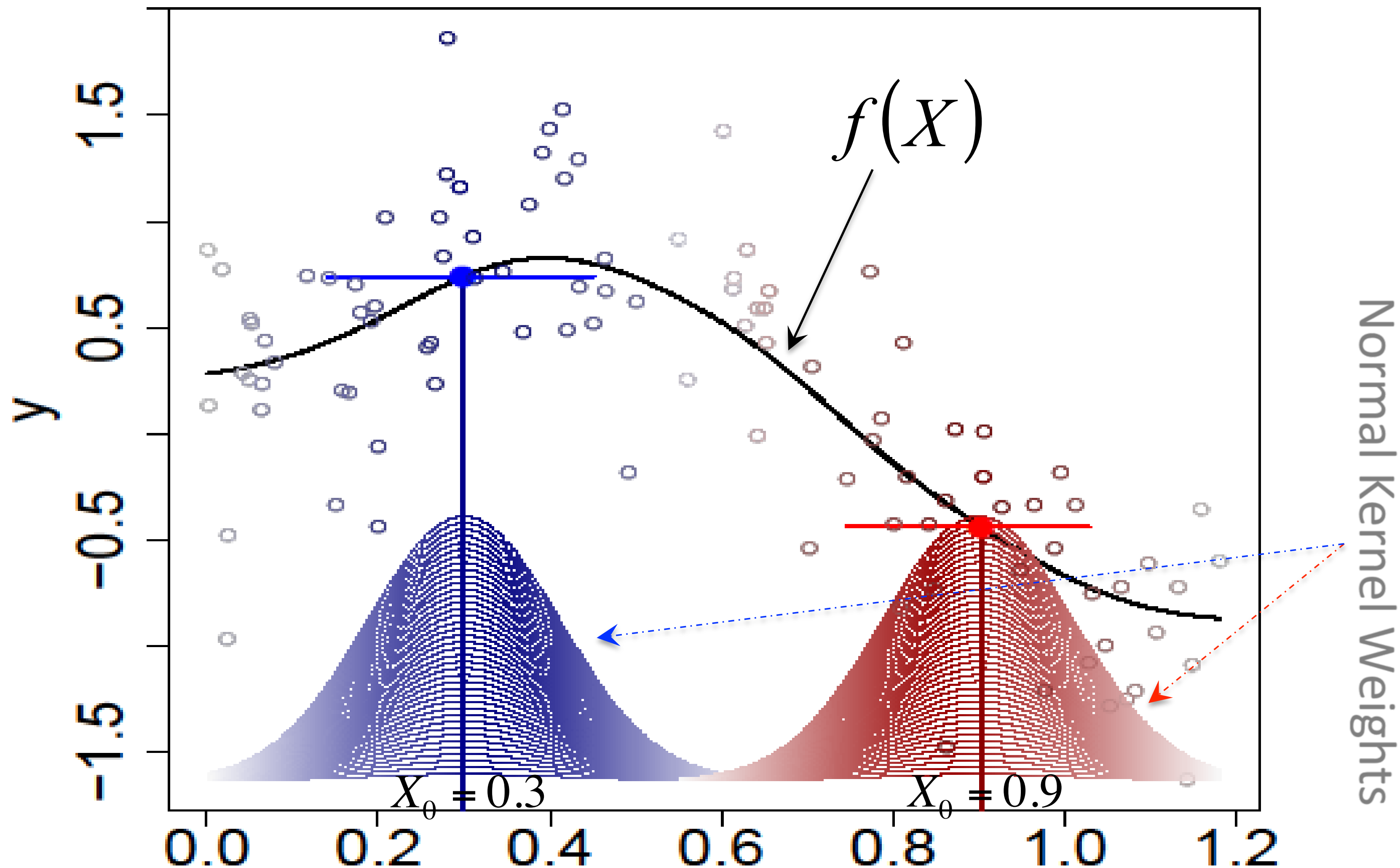


- Nadaraya-Watson kernel-weighted estimate is

$$\hat{f}(x_0) = \sum_{i=1}^{n} \left(\frac{K_\lambda(x_0, x_i)}{\sum_{i=1}^{n} K_\lambda(x_0, x_i)} \right) y_i$$

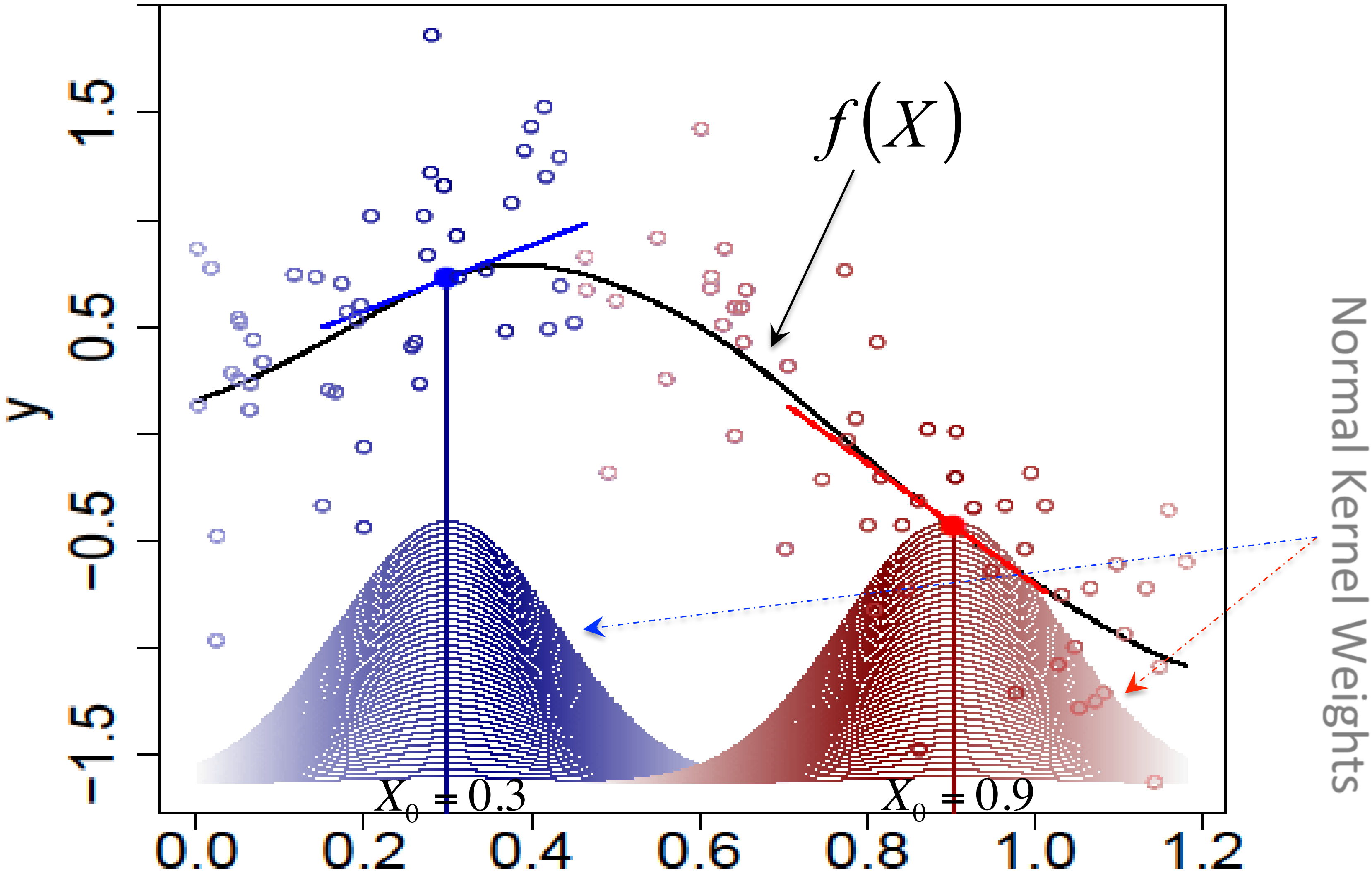
Local Average : Normal Kernel

$$E[y] = \beta_0 \qquad K_\lambda(x_0, x_i) = \phi\left(\frac{x_i - x_0}{\lambda}\right)$$



Local Linear : Normal Kernel

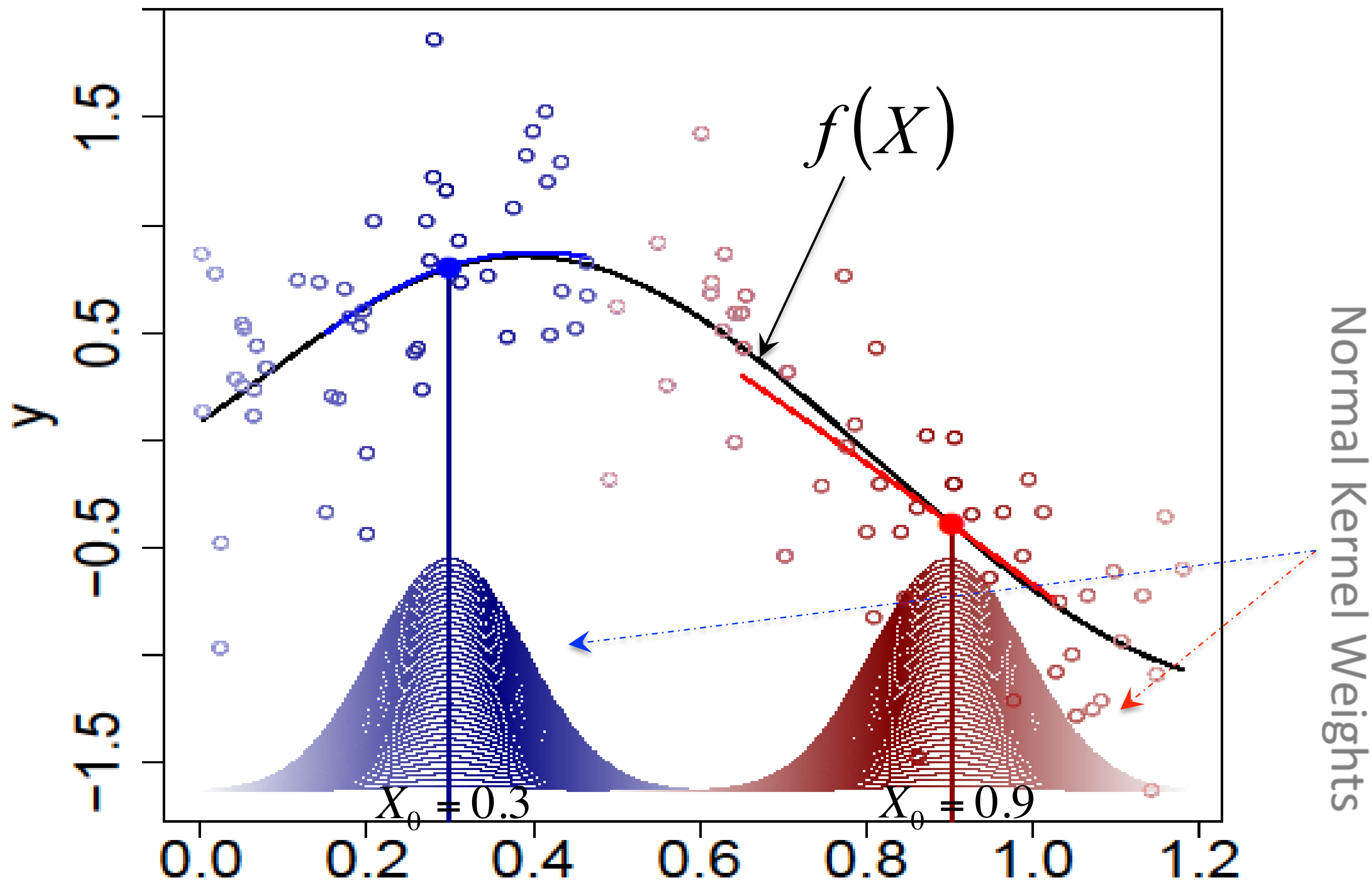
$$E[y] = \beta_0 + \beta_1 x \qquad K_\lambda(x_0, x_i) = \phi\left(\frac{x_i - x_0}{\lambda}\right)$$



Local Quadratic : Normal Kernel

$$E[y] = \beta_0 + \beta_1 x + \beta_2 x^2$$

$$K_\lambda(x_0, x_i) = \phi\left(\frac{x_i - x_0}{\lambda}\right)$$



Nonparametric Regression

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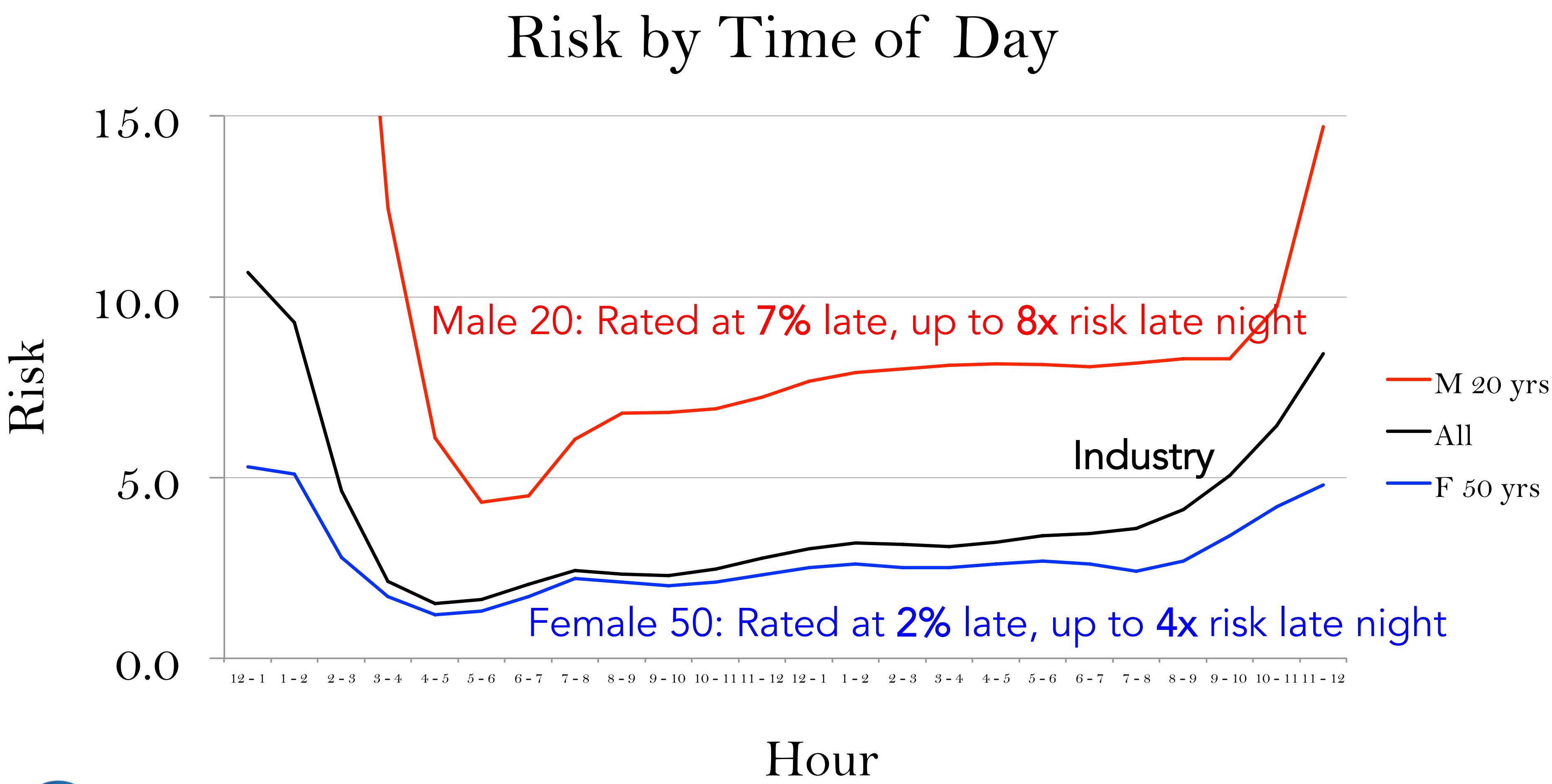
Daytime Discount Analytics™



Mileage Discounts

Typical on-going verified mileage discounts today:

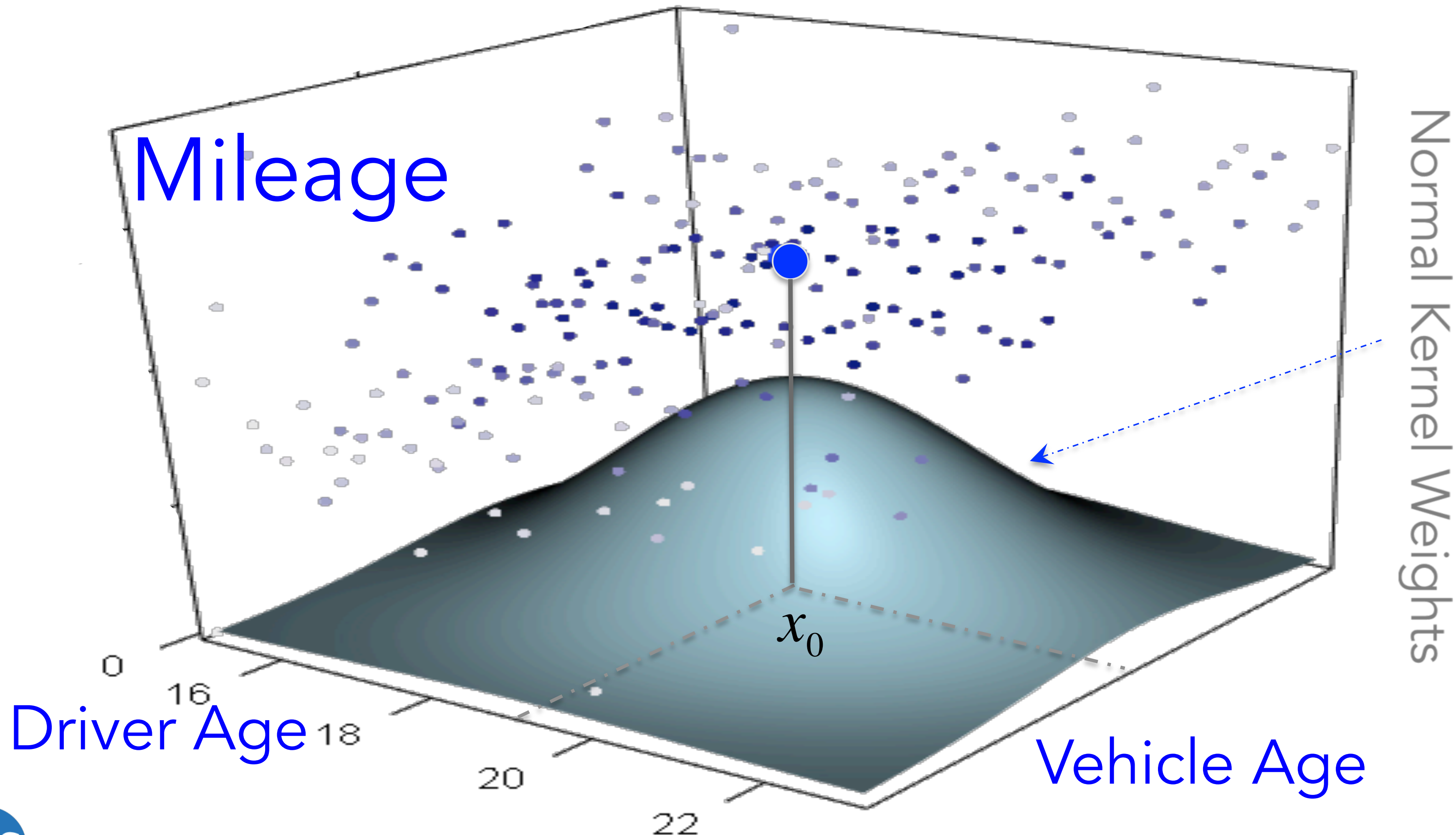
Mileage Up To	Discount
2,500	54%
5,000	39%
7,500	34%
10,000	26%
12,500	18%
15,000	13%
15,000 +	7%

Mileage Discount Analytics™

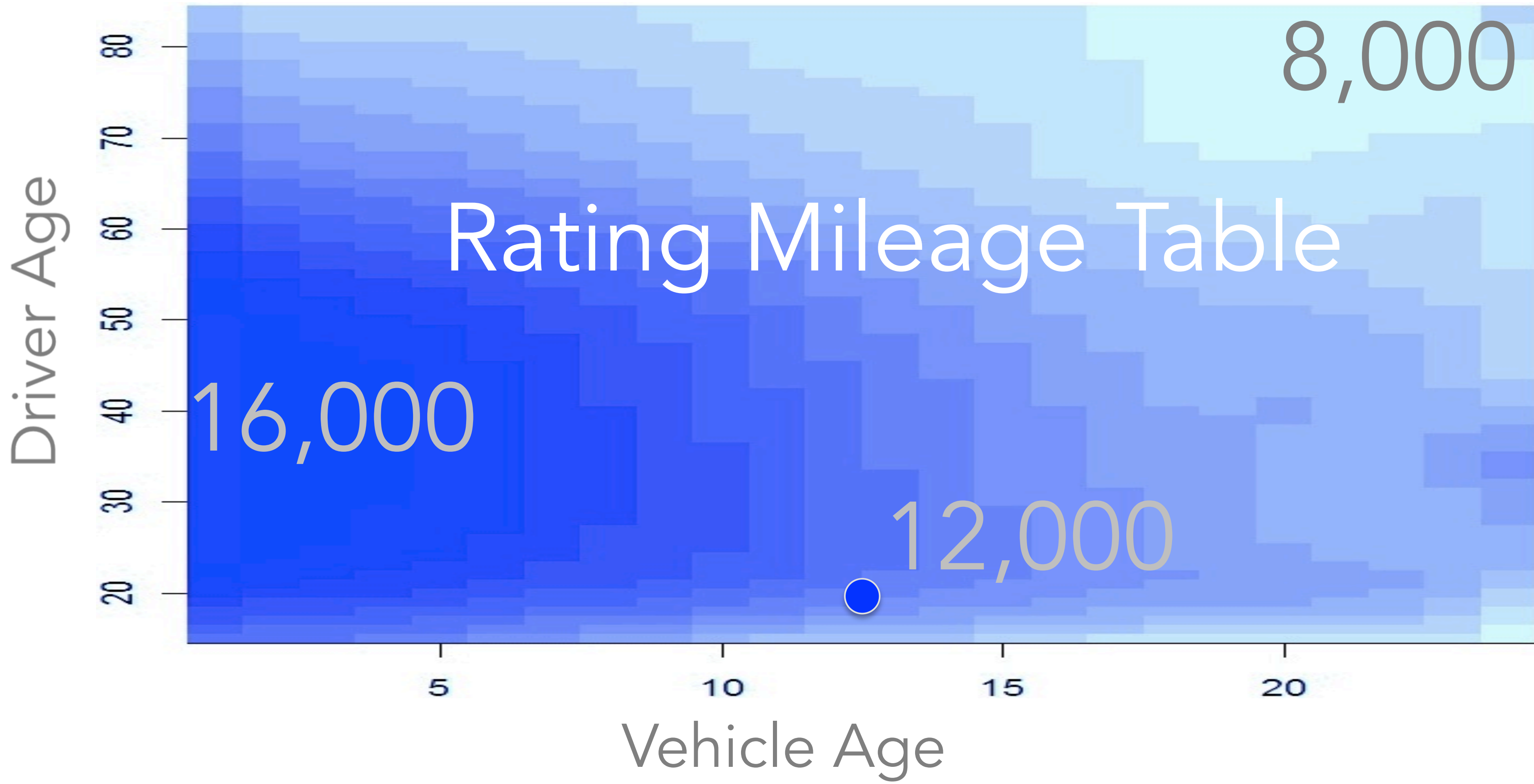
Rating variables with the strongest mileage relationship?

- Driver Age
- Urban vs. Rural
- Vehicle Type
- Driver Gender
- Drivers/Vehicles
- Vehicle Age

Mileage Discount Analytics™



Mileage Discount Analytics™



Mileage Discount Analytics™

$$Max\ Discount \cdot \left(1 - \frac{Mileage}{\mathbf{Rating\ Mileage}}\right)$$

Example 1:
(new car and mid-age driver)

$$50\% \cdot \left(1 - \frac{10{,}000}{\mathbf{16,000}}\right) = \mathbf{19\%}$$

Example 2:
(older car)

$$50\% \cdot \left(1 - \frac{10{,}000}{\mathbf{10,000}}\right) = \mathbf{0\%}$$

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Visit True Mileage
At exhibitor booth #24!

Ryan N. Morrison

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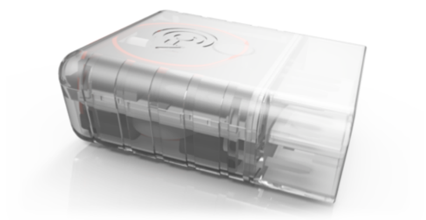
Intelligent UBI Devices

Replace your devices with our new Intelligent UBI Devices and save millions.

*** NO CELL PHONE REQUIRED ***



Key advantages:

1) 50% lower cost than traditional devices.
2) No monthly cellular data transfer fees.

Refinements & unique features:

Error codes. Disconnects. Reduced size. Accelobrakes. Return time alarm. Return envelope attached. Easy data access at return.

UBI Discount Analytics

Calculate mileage and UBI discounts accurately for data from any source.

17% 29% 13%

Key advantages:

1) Massive unbiased driving & accident data from all states & insurers.
2) Applies to data from any source.
3) Accounts for associated variables.