Lesson Plan 4/12

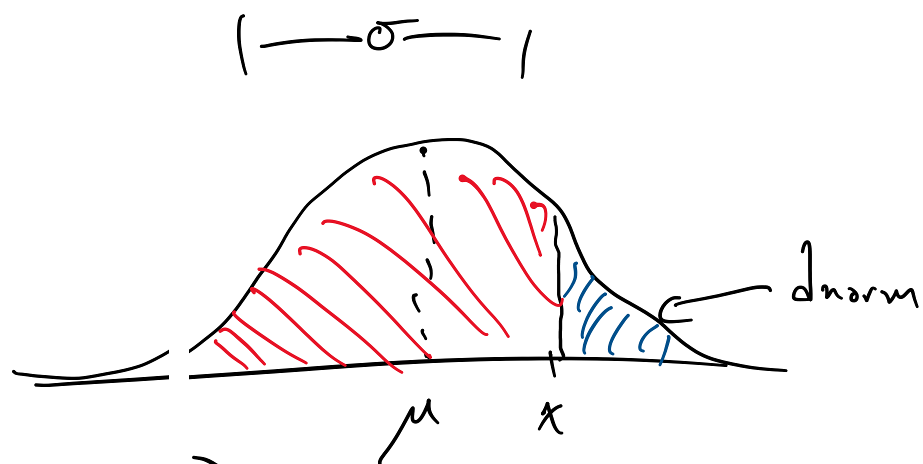
Wednesday, April 11, 2018 12:09 PM

Admin
- HW4 due tonight
- HW5 posted
- Project 3 (first part) posted

HDSC:
- The 2nd generation p-value: http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0188299

HW4
HW5
Project 3 (first part)
Logistic Regression
Solving linear ML problems

- pnorm
- dnorm
- qnorm



pnorm(x, mean = μ, sd = σ) =

(x, " " , lower.tail = FALSE) =

pnorm(x, , , lower.tail = TRUE)

probality

$$+ \quad = 1$$

$$p(\bar{X} > x) < .05$$

$$\int_{-\infty}^{\infty} dnorm = 1$$

~

$$dnorm(x, \mu, \sigma) = \frac{1}{\sqrt{2\pi}\,\sigma} \exp\left\{-\frac{1}{2}\left(\frac{x-\mu}{\sigma}\right)^2\right\}$$

density

qnorm

q

n

$$lifeExp = \beta_0 + \beta_1 \, gdpPerCap$$

Ex Classification

Logistic Regression

$$g = \begin{cases} Yes \\ No \end{cases} \implies y = \begin{cases} 1 & \text{if } Yes \\ 0 \end{cases}$$

Logistic regression

$$\log \frac{P(Y=1 \mid X_1 = x_1, \ldots, X_p = x_p)}{P(Y=0 \mid X_1 = x_1, \ldots, X_p = x_p)} = \beta_0 + \beta_1 X_1 + \cdots + \beta_p X_p$$

log odds

What does it mean if

$$\log \frac{P(Y=1 \mid x)}{P(Y=0 \mid x)} = \log 1$$

$$= 0$$

what does it mean it?

$$\log \frac{P(Y=1 \mid x)}{P(Y=0 \mid x)} <= 0 \Rightarrow \text{predict No}$$

(i.e, $Y=0$)

$$\log \frac{P(Y=1 \mid x)}{P(Y=0 \mid x)} > 0 \Rightarrow \text{predict Yes}$$

(i.e. $Y=1$)

Linear Models

Regression $\quad Y = \beta_0 + \beta_1 x_1 + \cdots + \beta_p x_p$

Class: $\quad \log \dfrac{P(Y=1|X)}{P(Y=0|X)} = \beta_0 + \beta_1 x_1 + \cdots + \beta_p x_p$

Given $\{(x_1, y_1), \ldots, (x_n, y_n)\}$,

Get estimates of $\beta_0, \beta_1, \ldots, \beta_p$

$\boxed{\text{Pop}} \xrightarrow{\text{Assumption}} \text{Data}$

$$RSS(\beta_0, \ldots, \beta_p) = \sum_{i=1}^{n} \left(y_i - (\beta_0 + \beta_1 x_1 + \cdots + \beta_p x_p)\right)^2$$

inverse

"loss function" (squared loss)

(mean squared loss) : $\frac{1}{n} \sum_{i=1}^{n} (y_i - \hat{y}_i)^2$

Find parameters that minimize loss:

$$\arg\min_{\beta} \frac{1}{n} \sum_{i=1}^{n} \left(y_i - \hat{y}_i(\beta)\right)^2$$

Find values of β where "derivative" of loss is zero

Case study:

$$y = \beta x$$