Lesson Plan 3/13
Monday, March 12, 2018 3:29 PM

Admin
- Project 1 due tomorrow 3/14 24:00
- Change in grading weights

HDSC
- CBCB summer internship program: https://www.cbcb.umd.edu/summer-internships

Project 1
- Outstanding questions and comments
- Update to two table example (how to turn similarity matrix into data frame)

HW3
- Go over description
- Work on #1

Intro stats
- Random variables
- Discrete probability distributions
- Expectation

Estimation
- LLN
- CLT
- Normal distribution
- Continuous probability distributions
- CLT finalized

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Homework 3, Q2

(a) Derive $\bar{z}$

(b) Derive $S^2$
\[ \bar{z} = \frac{1}{n} \sum_{i=1}^{n} z_i \]
\[ = \frac{1}{n} \sum_{i=1}^{n} k_i \frac{x_i}{s_{x0}} \]
\[ = \frac{1}{s_x} \left[ \frac{1}{n} \sum_{i=1}^{n} k_i \right] \]
\[ = \frac{\bar{x}}{s_x} \]

\[ s^2_x = \frac{1}{n} \sum_{i=1}^{n} (z_i - \bar{z})^2 \]
\[ = \frac{1}{n} \sum_{i=1}^{n} \left( \frac{x_i}{s_x} - \frac{\bar{x}}{s_x} \right)^2 \]
\[ = \frac{1}{s_x^2} \left( \frac{1}{n} \sum_{i=1}^{n} (k_i - \bar{x})^2 \right) \]
\[ - \frac{1}{s_x^2} \times s_x^2 \]
\[ = 1 \]

\[ \rightarrow \text{Population vs. sample} \]

\[ \rightarrow \text{Notation & properties} \]
-> Distributions of discrete variables

-> Central limit theorem

-> Expectation

Data: Tweets (about a specific topic) or hashtag

-> Bot or human
Entities: tweets

Attribute: bot or not

\[ x_i \in \{0, 1\} \] observed

\[ x_i \in \{0, 1\} \] random variable

\[ P : \mathcal{D} \rightarrow \{0, 1\} \]

Density

\[ p (x_i = x_i) > 0 \] \[ x_i \in \mathcal{D} \]
\( \sum p(X_i = x_i) = 1 \) \\
\( \Rightarrow \) \text{calc} \\
\( p(X_i = 1) = 0.7 \) \\
\( \Rightarrow \) \text{Expectation} \\
\[ E X_i = \sum_{x_i \in \mathcal{D}} x_i \cdot p(X_i = x_i) \] \\
\[ E X_i = 0 \times p(X_i = 0) + 1 \times p(X_i = 1) \]
Estimation

1. Compute sample mean
2. Set equal to expected value
3. Solve!

\[ n = 100 \]
\[ X_i \in [0, 13], \ldots, X_n \in [0, 13] \]

\[ \frac{1}{n} \sum_{i} X_i \]
(2) \[ \mathbb{E} \left[ \frac{1}{n} \sum X_i \right] = \frac{1}{n} \sum \mathbb{E} X_i = \frac{1}{n} \sum \rho = \rho \]

(3) \[ \hat{\theta} = \bar{x} \]

Estimate