Beamer Class Demonstration[1]

## Me Myself and I

IQSS

March 26, 2018

---

[1]for beamer

Outline

What's this course about?

- Specific statistical methods for many research problems
  - How to learn (or create) new methods
  - Inference:
    Using facts you know to learn about facts you don't know

- How to write a publishable scholarly paper

- All the practical tools of research — theory, applications, simulation, programming, word processing, plumbing, whatever is useful

- ⤳ Outline and class materials:

j.mp/G2001
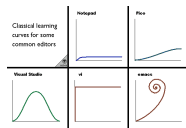
- The syllabus gives topics, not a weekly plan.
- We will go as fast as possible subject to everyone following along
- We cover different amounts of material each week

How much math will you scare us with?

- All math requires two parts: proof and concepts & intuition
- Different classes emphasize:
    - Baby Stats: dumbed down proofs, vague intuition
    - Math Stats: rigorous mathematical proofs
    - Practical Stats: deep concepts and intuition, proofs when needed
        - Goal: how to do empirical research, in depth
        - Use rigorous statistical theory — when needed
        - Insure we understand the intuition — always
        - Always traverse from theoretical foundations to practical applications
        - Includes "how to" computation
        - ⤳ Fewer proofs, more concepts, better practical knowledge
- Do you have the background for this class? A Test: What's this?

$$b = (X'X)^{-1}X'y$$

Systematic Components: Examples

- $E(Y_i) \equiv \mu_i = X_i\beta = \beta_0 + \beta_1 X_{1i} + \cdots + \beta_k X_{ki}$
- $\Pr(Y_i = 1) \equiv \pi_i = \frac{1}{1 + e^{-x_i\beta}}$
- $V(Y_i) \equiv \sigma_i^2 = e^{x_i\beta}$
- Interpretation:
  - Each is a class of functional forms
  - Set β and it picks out one member of the class
  - β in each is an "effect parameter" vector, with different meaning

Negative Binomial Derivation

Recall:

one two three

Negative Binomial Derivation

Recall:

$$\Pr(A|B) = \frac{\Pr(AB)}{\Pr(B)} \implies \Pr(AB) = \Pr(A|B)\Pr(B)$$

one two three

Negative Binomial Derivation

Recall:

$$\Pr(A|B) = \frac{\Pr(AB)}{\Pr(B)} \implies \Pr(AB) = \Pr(A|B)\Pr(B)$$

one two three

$$\text{NegBin}(y|\phi, \sigma^2) = \int_0^\infty \text{Poisson}(y|\lambda) \times \text{gamma}(\lambda|\phi, \sigma^2)d\lambda$$

Negative Binomial Derivation

Recall:

$$\Pr(A|B) = \frac{\Pr(AB)}{\Pr(B)} \implies \Pr(AB) = \Pr(A|B)\,\Pr(B)$$

one two three

$$\text{NegBin}(y|\phi, \sigma^2) = \int_0^\infty \text{Poisson}(y|\lambda) \times \text{gamma}(\lambda|\phi, \sigma^2)d\lambda$$

$$= \int_0^\infty \P(y, \lambda|\phi, \sigma^2)d\lambda$$

Negative Binomial Derivation

Recall:

$$\Pr(A|B) = \frac{\Pr(AB)}{\Pr(B)} \implies \Pr(AB) = \Pr(A|B)\,\Pr(B)$$

one two three

$$
\begin{aligned}
\text{NegBin}(y|\phi, \sigma^2) &= \int_0^\infty \text{Poisson}(y|\lambda) \times \text{gamma}(\lambda|\phi, \sigma^2)\,d\lambda \\
&= \int_0^\infty \P(y, \lambda|\phi, \sigma^2)\,d\lambda \\
&= \frac{\Gamma\left(\frac{\phi}{\sigma^2-1} + y_i\right)}{y_i!\,\Gamma\left(\frac{\phi}{\sigma^2-1}\right)} \left(\frac{\sigma^2-1}{\sigma^2}\right)^{y_i} (\sigma^2)^{\frac{-\phi}{\sigma^2-1}}
\end{aligned}
$$

Outline

Structural Features

Levels of Structure

- usual LaTeX \section, \subsection commands
- 'frame' environments provide slides
- 'block' environments divide slides into logical sections
- 'columns' environments divide slides vertically (example later)
- overlays (à la prosper) change content of slides dynamically

Example (Overlay Alerts)

On the first overlay, this text is highlighted (or *alerted*).
On the second, this text is.

Structural Features

Levels of Structure

- usual LaTeX \section, \subsection commands
- 'frame' environments provide slides
- 'block' environments divide slides into logical sections
- 'columns' environments divide slides vertically (example later)
- overlays (à la prosper) change content of slides dynamically

Example (Overlay Alerts)

On the first overlay, this text is highlighted (or *alerted*).
On the second, this text is.

Code blocks

```r
# Say hello in R
hello <- function(name) paste("hello", name)
```

Code blocks

```r
# Say hello in R
hello <- function(name) paste("hello", name)
```

```python
# Say hello in Python
def hello(name):
return("Hello" + " " + name)
```

Code blocks

```r
# Say hello in R
hello <- function(name) paste("hello", name)
```

```python
# Say hello in Python
def hello(name):
return("Hello" + " " + name)
```

```haskell
-- Say hello in Haskell
hello name = "Hello" ++ " " ++ name
```

Code blocks

```r
# Say hello in R
hello <- function(name) paste("hello", name)
```

```python
# Say hello in Python
def hello(name):
return("Hello" + " " + name)
```

```haskell
-- Say hello in Haskell
hello name = "Hello" ++ " " ++ name
```

```c
/* Say hello in C */
#include <stdio.h>
int main()
{
  char name[256];
  fgets(name, sizeof(name), stdin);
  printf("Hello %s", name);
  return(0);
}
```

Alerts

- First level alert
- Second level alert
- Third level alert
- Fourth level alert
- Fifth level alert

Outline

Other Features

Levels of Structure

- Clean, extensively customizable visual style
- Hyperlinks (click here)
- No weird scaling prosper
  - slides are 96 mm × 128 mm
  - text is 10-12pt on slide
  - slide itself magnified with Adobe Reader/xpdf/gv to fill screen
- pgf graphics framework easy to use
- include external JPEG/PNG/PDF figures
- output directly to pdf: no PostScript hurdles
- detailed User's Manual (with good presentation advice, too)

Theorems and Proofs

The proof uses *reductio ad absurdum*.

Theorem

There is no largest prime number.

Proof.

1. Suppose p were the largest prime number.

4. But $q + 1$ is greater than 1, thus divisible by some prime number not in the first p numbers. □

Theorems and Proofs

The proof uses *reductio ad absurdum*.

Theorem

There is no largest prime number.

Proof.

1. Suppose p were the largest prime number.
2. Let q be the product of the first p numbers.

4. But $q + 1$ is greater than 1, thus divisible by some prime number not in the first p numbers. □

Theorems and Proofs

The proof uses *reductio ad absurdum*.

Theorem

There is no largest prime number.

Proof.

1. Suppose p were the largest prime number.
2. Let q be the product of the first p numbers.
3. Then $q + 1$ is not divisible by any of them.
4. But $q + 1$ is greater than 1, thus divisible by some prime number not in the first p numbers. □

Blocks

Normal block

A set consists of elements.

Alert block

2 = 2.

Example block

The set $\{1, 2, 3, 5\}$ has four elements.