“You again?”: PD that makes teachers come back for more

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Ji Y. Son, Cal State LA
Overview

1. What is CourseKata Statistics and Data Science?
2. What are its key features?
3. What is our teacher learning strategy?
1. What is CourseKata?
1. What is CourseKata?

Complete curriculum for teaching statistics and data science, intro through multivariate modeling

- Interactive online textbook
- 1500+ questions
- Embedded R coding exercises
- Teacher dashboard
- Integrated into local LMS

would be equal to 0, so you wouldn't add the second parameter estimate ($b_1 \times 0 = 0$).

For females, $X_1$ would be equal to 1, which means $b_1$ would be added on to 65 to get the model prediction for females. Notice, however, that now the parameter estimate for $b_1$ would be negative. 65 plus (-6) would yield the mean for females, which is 59.

As long as R knows that a variable is categorical (e.g., a Factor), it doesn't really care how you code it. You can code Sex with any numbers you choose (e.g., 1 and 2 or 0 and 100), or with any words you choose (e.g, male and female). However you code it, internally R will recode the variable as 0 and 1.

**Fitting the Sex Model to the Complete Data Set**

Now that you have looked in detail at the tiny set of data, find the best estimates for our bigger set of data (found in the data frame called `fingers`) by modifying the code below.

```r
# store the model where Sex predicts Thumb
Sex_model <-

# this prints out the model estimates
Sex_model
```

[Code snippet from an interactive coding environment]
1. What is CourseKata?

Integrated Jupyter Notebooks platform

- Complete library of notebooks for in-class implementation
- Student project templates
2. What are the key features of CourseKata?
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- Coherent
- Computational
- Continuously Improving
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<table>
<thead>
<tr>
<th>Coherent</th>
<th>Computational</th>
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**Practicing Connections Hypothesis:**
- Coherent knowledge is transferable
- Build coherence by practicing connections
2. What are the key features of CourseKata?

- Coherent
- Computational
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Statistical Model

**DATA = MODEL + ERROR**

\[ Y_i = \beta_0 + \beta_1 X_i + \epsilon_i \]

\[ Y_i = \beta_0 + \epsilon_i \]
2. What are the key features of CourseKata?

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<thead>
<tr>
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</thead>
<tbody>
<tr>
<td><strong>A gentle introduction to R</strong></td>
<td></td>
<td></td>
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<tr>
<td>● Simulation</td>
<td></td>
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<td>● Randomization</td>
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<td>● Bootstrapping</td>
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<tr>
<td><strong>Seamless integration of cloud-hosted Jupyter notebooks</strong></td>
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<tr>
<td>● Authentic tool</td>
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<td>● In-class interactive lessons</td>
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<td>● Supports student projects</td>
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<tr>
<td><strong>Modern statistics and data science are increasingly computational, less mathematical.</strong></td>
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<td></td>
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<tr>
<td><strong>Algebra is highly relevant, but not necessarily a prerequisite for modern approach to Stats &amp; DataSci.</strong></td>
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</tr>
</tbody>
</table>
2. What are the key features of CourseKata?

| Coherent | Computational | Continuously Improving |

Developing a new approach to education R&D in which researchers, designers/developers, and teachers work together to improve materials + implementation based on student data.

Using Data to Improve Learning for All Students
3. Teacher Learning Program
3. Teacher Learning Program

Our Needs:

- Platform
- Content
- Pedagogy
- Community
3. Teacher Learning Program

<table>
<thead>
<tr>
<th>Our Needs:</th>
<th>How We Planned to Meet Those Needs:</th>
</tr>
</thead>
<tbody>
<tr>
<td>● Platform</td>
<td>“To insure the program’s success, we are developing a six-week (3 days/week) onboarding course that teachers will participate in the summer prior to their first time teaching the course....”</td>
</tr>
<tr>
<td>● Content</td>
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<td>● Pedagogy</td>
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<tr>
<td>● Community</td>
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*May 2019*
3. Teacher Learning Program

Our Needs:

- Platform
- Content
- Pedagogy
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How We Planned to Meet Those Needs:

“To insure the program’s success, we are developing a six-week (3 days/week) onboarding course that teachers will participate in the summer prior to their first time teaching the course....”

May 2019

What kind of experiences:
(1) are possible by Zoom?
(2) would make instructors want to invest their time?
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**Unappealing Experiences**

- Being talked at
- Being told what to do
- Learning things that have little relation to daily teaching
- Feeling isolated
- Hearing of good teaching described in the abstract
- Front-loaded, “one and done”
### 3. Teacher Learning Program

<table>
<thead>
<tr>
<th>Unappealing Experiences</th>
<th>Appealing Experiences</th>
</tr>
</thead>
<tbody>
<tr>
<td>● Being talked at</td>
<td>● Being a participant</td>
</tr>
<tr>
<td>● Being told what to do</td>
<td>● Re-discovering how it feels to be student</td>
</tr>
<tr>
<td>● Learning things that have little relation to daily teaching</td>
<td>● Learning things immediately relevant to daily teaching</td>
</tr>
<tr>
<td>● Feeling isolated</td>
<td>● Building camaraderie among fellow teachers</td>
</tr>
<tr>
<td>● Hearing of good teaching described in the abstract</td>
<td>● Watching a model of good teaching</td>
</tr>
<tr>
<td>● Front-loaded, “one and done”</td>
<td>● Continued, need-based support</td>
</tr>
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</table>
3. Teacher Learning Program

CourseKata’s Multi-Faceted PD

Study Groups
Workshops
Office Hours
Slack Channel

#CourseKata on Canvas Commons
Jupyter Improvement Group
3. Teacher Learning Program

The Cornerstone: Study Groups

Six, 1-hour sessions

- Academic year: 1/week for 6 weeks
- Summer: 3/week for 2 weeks

Each meeting, a new chapter of the book

Task: complete a Jupyter notebook

Formats: facilitator-led, driver-navigator-advocate fishbowl, break-out rooms
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Example

Data frame: `world_work`

- **Country**: The name of the country
- **Code**: The country code (a three-letter abbreviation)
- **Year**: The year from which the data came (1870-2017)
- **Avg_annual_wrkhrs**: The average annual work hours for an individual for that country/year
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Context

- Session 2 – they may or may not have done any advance reading
- Volunteered to work in a fishbowl
- Clip begins after ~ 25 minutes of working together
- Thus far, they’ve
  - explored the data frame
  - proposed questions to ask of the data
  - found the mean work hours by country (annual and weekly)
  - compared weekly work hours in 1870 vs. 2017
  - arranged countries by hours worked (ascending and descending)
- “How can we figure out which countries worked more than 40 hours per week, on average, in the year 2017?”
- Roles: driver, navigator, advocate
<table>
<thead>
<tr>
<th></th>
<th>Country</th>
<th>4th of the year</th>
<th>Work in 2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>28</td>
<td>United States</td>
<td>USA</td>
<td>1757.226</td>
</tr>
<tr>
<td>29</td>
<td>Czechia</td>
<td>CZE</td>
<td>1776.162</td>
</tr>
<tr>
<td>30</td>
<td>Cyprus</td>
<td>CYP</td>
<td>1783.521</td>
</tr>
</tbody>
</table>

3g: How can we figure out which countries worked more than 40 hours per week on average in the year 2017? There are multiple strategies we could use. We've set up one possible strategy below for 1870. Feel free to modify it or come up with your own strategy.

In [ ]:

```python
# Possible Strategy

# What is this code doing?
# How can we modify this to answer our question?

Work_1870$WeeklyHrs = (Work_1870$Avg_annual_wkhrs) / 52

tally(Country ~ WeeklyHrs > 40, data = Work_1870)
```

Great job, programmers! Thank you for demonstrating our first team programming fishbowl!!
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Observations from Video

- Thinking/sense-making
- Slow
- Roles lead to productive teamwork
- Coding didn’t lead to expected outcome
- Diverse prior experience (e.g., Desmos)
- Fun, but anxiety-provoking
- Willingness to express vulnerability
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Observations from Running PD

- 14 study groups, 325+ instructors
- “You again?” – attendees sometimes came repeatedly
- Teacher in recent study group chat:
  
  “That was helpful to see -- balance of inquiry, collaboration, problem solving. This type of teaching strategy allows for divergent thinking that may create more questions than answers!”

- Attendee comments led to new workshops
What predicts how much income a YouTuber makes?

Can we use animal behavior to predict severe hurricanes?

How does the NFL treat domestic violence relative to other acts of wrongdoing by players?
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Workshops

LMS and JupyterHub Set-up
Pacing, Grading, & Syllabus
To Grade or Not to Grade
Student Projects

Why modeling?
Why R?
Panel with Experienced Instructors
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Office Hours

<table>
<thead>
<tr>
<th>Sun</th>
<th>Mon</th>
<th>Tue</th>
<th>Wed</th>
<th>Thu</th>
<th>Fri</th>
<th>Sat</th>
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<td>25</td>
<td>1p Office Hours</td>
<td>4p Office Hours</td>
<td>1p Office Hours</td>
<td>4p Office Hours</td>
<td>4p Office Hours</td>
<td>10a Office Hours</td>
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<td>26</td>
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<td>4p Office Hours</td>
<td>4p Tiger</td>
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<tr>
<td>27</td>
<td>1p Office Hours</td>
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<td>29</td>
<td>4p Office Hours</td>
<td>4p To Grade or Not to Gr</td>
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<td>4p Office Hours</td>
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Event designed for instructors of all levels
Event designed for college instructors

October 2022
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Slack Channel
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#CourseKata on Canvas
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Jupyter Improvement Group

- Monthly meetings
- "Kata" – engaging in a routine of experimentation and reflection, making continuous improvements informed by experiments
- 2021-2022 theme: data visualizations
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Recap

- Study Groups
- Workshops
- Office Hours
- Slack Channel
- #CourseKata on Canvas Commons
- Jupyter Improvement Group