Web Application Teaching Tools Using Shiny and R

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Joint work with Jimmy Doi, Peter Chi, Jimmy Wong, Irvin Alcaraz
Computer simulations with visualizations improve student comprehension in intro statistics courses.

Ideally, students themselves experiment with the simulations.

Need an accessible software interface.
Existing tools

* Web-based Java & JS applets
* Demonstration scripts in JMP or other software
  * Accessible to students
  * Hard for instructor to tailor them
  * Have to pay for software

* Write your own in R
  * Hard for intro-level students to use on their own.
THE PROBLEM:
Want to use R to create applets which are accessible to non-R users.
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THE SOLUTION:
The Shiny package created by RStudio.
Outline

- The Cal Poly Shiny Project
- Introduction to Shiny
- Demonstration of 3 apps
- Discussion & Conclusion
The Cal Poly Shiny Project

Group project at Cal Poly State University

- Faculty members:
  - Jimmy Doi
  - Gail Potter
  - Peter Chi

- Statistics graduates:
  - Jimmy Wong
  - Irvin Alcaraz
Create a gallery of web-based apps for statistical educators to use: [http://statistics.calpoly.edu/shiny](http://statistics.calpoly.edu/shiny)

Provide links to source code.

Write paper illustrating the utility of Shiny for statistical education (now under revision).
Web application framework for R created by RStudio

Helpful tutorials at http://shiny.rstudio.com/tutorial/

Two scripts:
- ui.R – Creates user interface
- server.R – Processes inputs, creates objects for output

Some free web-hosting (up to 5 apps, 25 active hours/month)
Demonstration of 3 apps

* Robustness of the ANOVA F-test
* Multiple regression visualizer
* Maximum likelihood estimation
GOAL: Assess the impact of unequal variances on Type I error rate and power of the ANOVA F-test
Demonstration:
Robustness of ANOVA F-test

Created by Gail Potter
GOAL: Display visualizations of various multiple regression prediction surfaces.
Demonstration:
Multiple Regression Visualization

Created by Irvin Alcaraz
GOAL: Visualize the likelihood function and compare/contrast it to the probability mass function.
Demonstration: Maximum Likelihood Estimation

Created by Gail Potter
Challenges

- Reliance on cutting-edge packages – updates may remove or change features
- Changing pricing scheme for web-hosting
Tips

* Work through RStudio’s Shiny tutorials.

* Save working versions of app when modifying code.

* Ask for support (Google groups, RStudio, etc.).
Conclusions

* Shiny is a helpful tool for statistics educators who want to produce accessible software tools.

* We created a total of 20 apps on a variety of topics, found at http://statistics.calpoly.edu/shiny

* Our source code is also available so you may tailor apps to your own purposes.
Thank you!

* Jimmy Doi
* Peter Chi
* Jimmy Wong
* Irvin Alcaraz
* RStudio
* Cal Poly Computing Support