Web Application Teaching Tools Using Shiny and R

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Background

* 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.

Bridging the gap

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

Shiny Project GOALS

* Create a gallery of web-based apps for statistical educators to use: http://statistics.calpoly.edu/shiny

* Provide links to source code.

* Write paper illustrating the utility of Shiny for statistical education (now under revision).

Intro to Shiny

* 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

Robustness of ANOVA F-test

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

Multiple Regression Visualization

GOAL: Display visualizations of various multiple regression prediction surfaces.

Demonstration:
Multiple Regression Visualization

Created by Irvin Alcaraz

Maximum Likelihood Estimation

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