Author Name(s) Biography

Dr. Danni Yu is a Sr. Research Scientist in Oncology at Eli Lilly and Company. She received her doctoral degree in Statistics from Purdue University, where she worked with several multidisciplinary experts to develop statistical methods for multi-omic datasets. After joining Lilly in 2013, Dr. Yu focused her research on statistical methodology and software implementation of biomarker-driven clinical trial analysis for target therapy development. She developed a shiny app named BEACH that provides a table/figure/listing (TFL) automation platform for R users. The package was published in GitHub and R CRAN in October 2016.

Michael Man received his doctorate in biochemistry and molecular biology from University of Minnesota. He completed postdoctoral training in biostatistics at University of North Carolina in 1998. Before joining Lilly in 2007, Dr. Man was a statistician at Pfizer Ann Arbor site. At Lilly, he has made significant contribution to PGx and biomarker area. He provided technical leadership in genomic submission and post marketing support for Prasugrel. More recently, his work has been focused on tailoring in oncology, covering early phase compounds. He has contributed to the scientific community with more than 20 publications.

BEACH: an open platform for building interactive and automated analysis powered by R/Shiny

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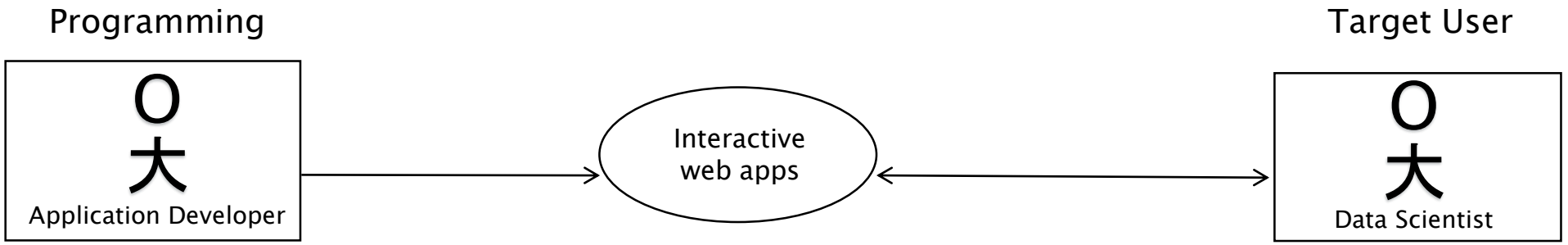
Outline

- Motivation
  - Typical use case of automated analysis
  - Introduction to R/Shiny
  - The challenge of managing code
- BEACH features
  - Built-in capability to import multiple types of datasets
  - Flexible in running different analysis
  - Easy to save output, LoA and code for traceability
  - Capable for generating animation file
  - Adjustable graph quality and table layout
- New BEACH analysis creation
- Summary and conclusion

Typical use case for automated analyses

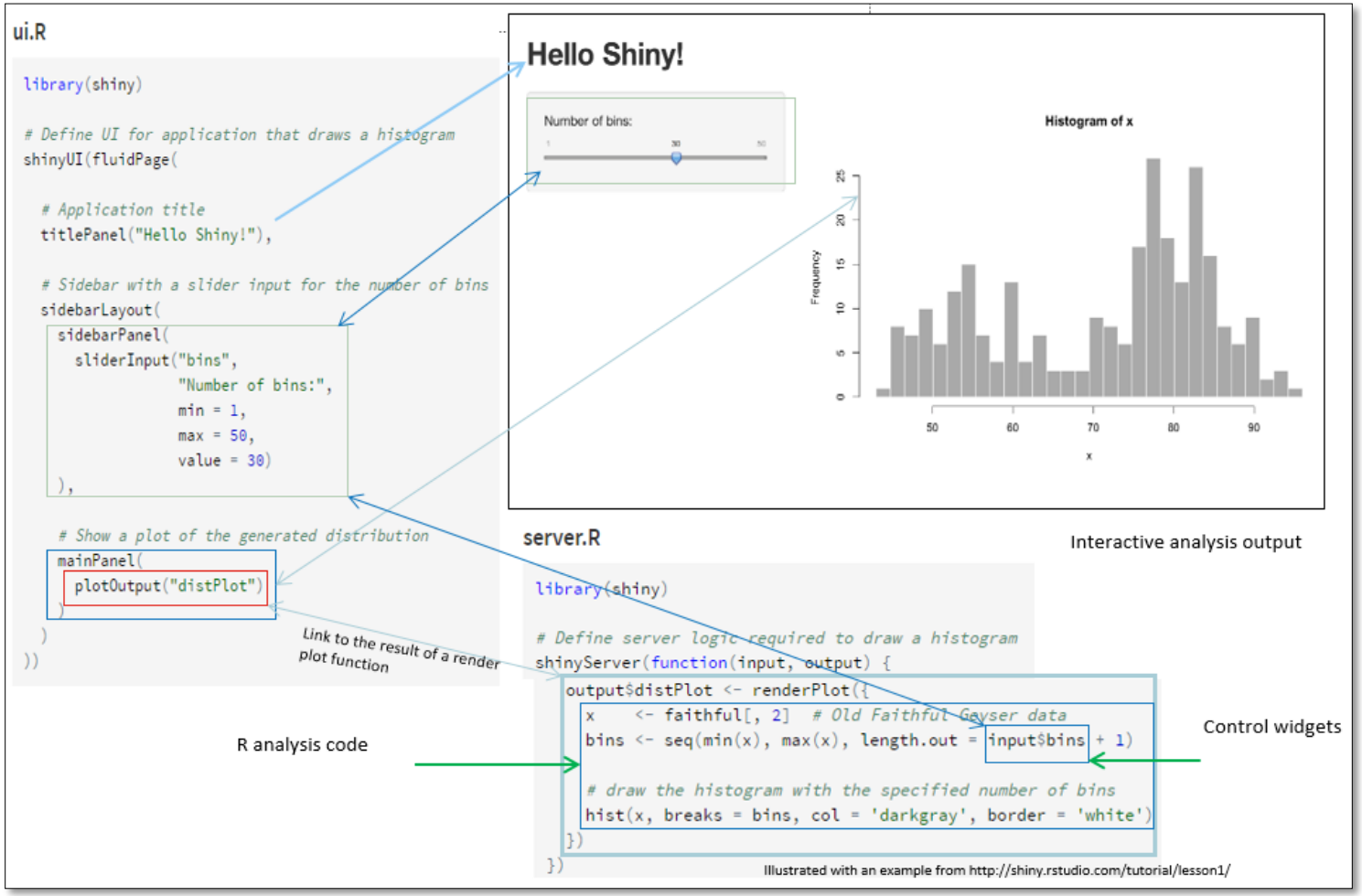


R/Shiny developed by RStudio

- is a powerful tool to build interactive web applications
- works in R environment
- enables web app development in R

Introduction to R/Shiny

- A Shiny app requires two parts: UI and server.
  - UI has the dynamic HTLM code for user interface passed through the 'shinyUI' function.
  - Server has the R analysis function sent to the backend JavaScript through the 'shinyServer' function.



The challenge of managing code

- Users has to ***repeatedly*** embed R analysis code as an element of the 'output' object in the server file.
- Users has to define the widgets ***redundantly*** and ***separately*** in the ui file.
- Ok for simple analysis, but ***headache for large numbers of analyses*** with large numbers of widgets
- Time-consuming and difficult experience for code management and debugging

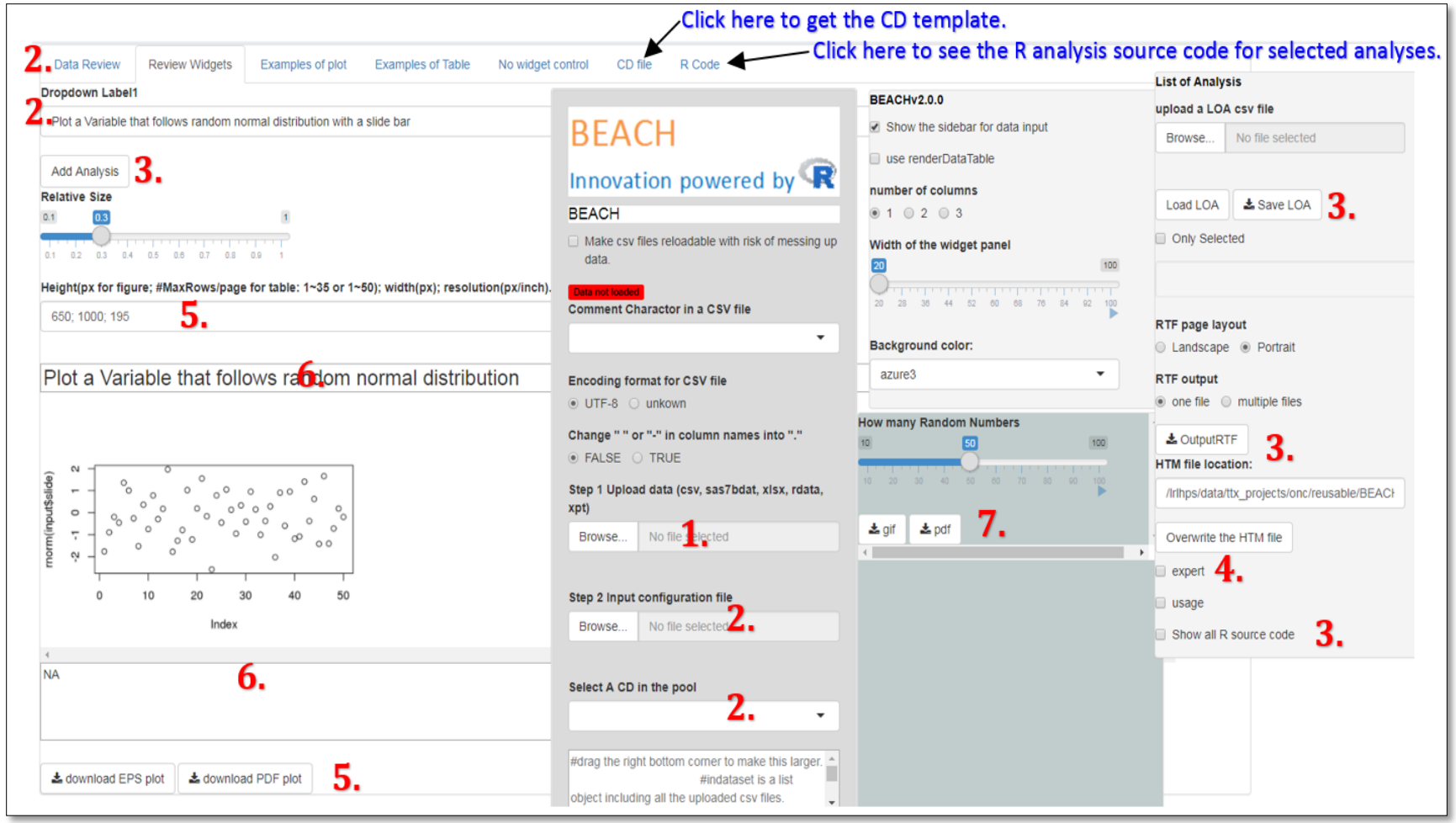
To meet the challenge

- BEACH was designed to
  - avoid of repeating blocks of shiny code
  - give up redundant programming for widget controls
  - enable app developers to focus on R coding only
  - remove the time and cost used for debugging in R/shiny code
  - manage large number of R chunk code and the interactive dashboard in only one configuration (CD) file
  - make the CD file user-friendly and editable in CSV format

Overview of BEACH

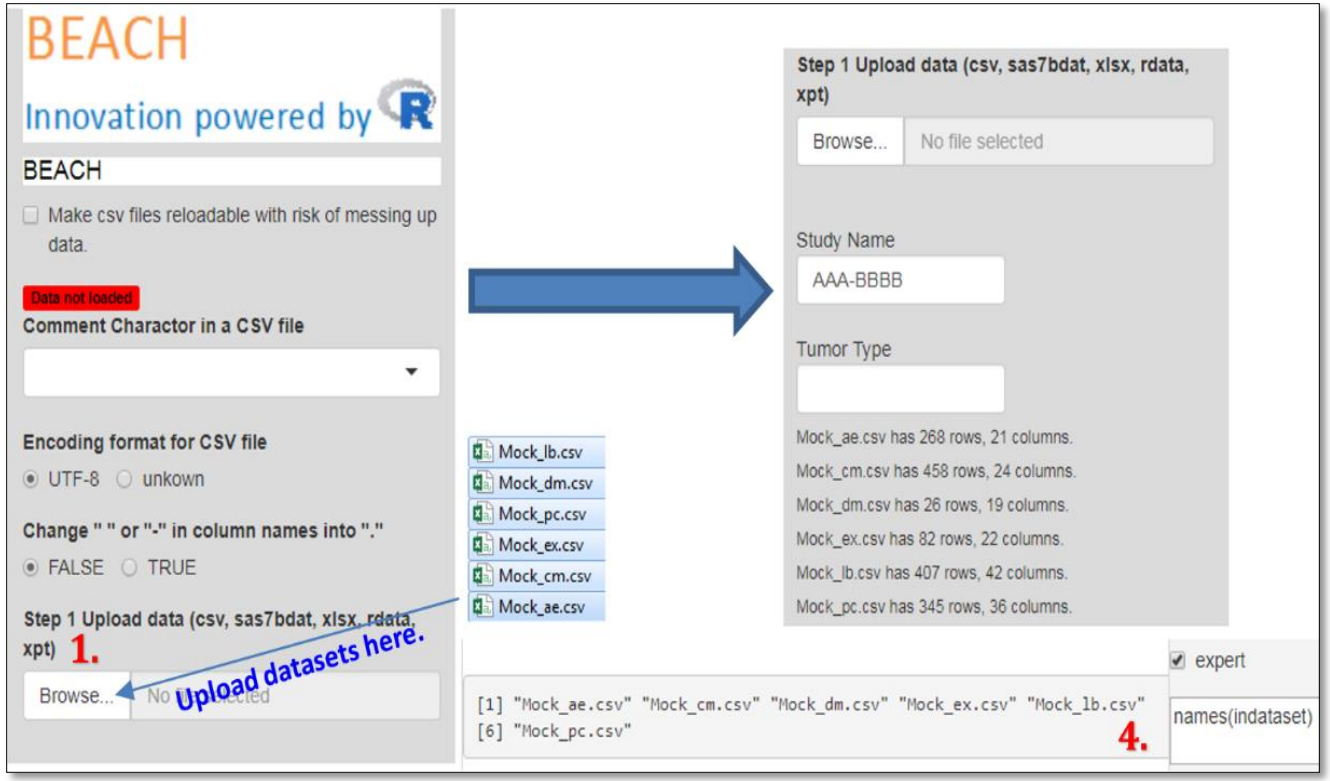
- Biometrics Exploratory Analysis Creation House.

- Key features are illustrated in the following 7 slides



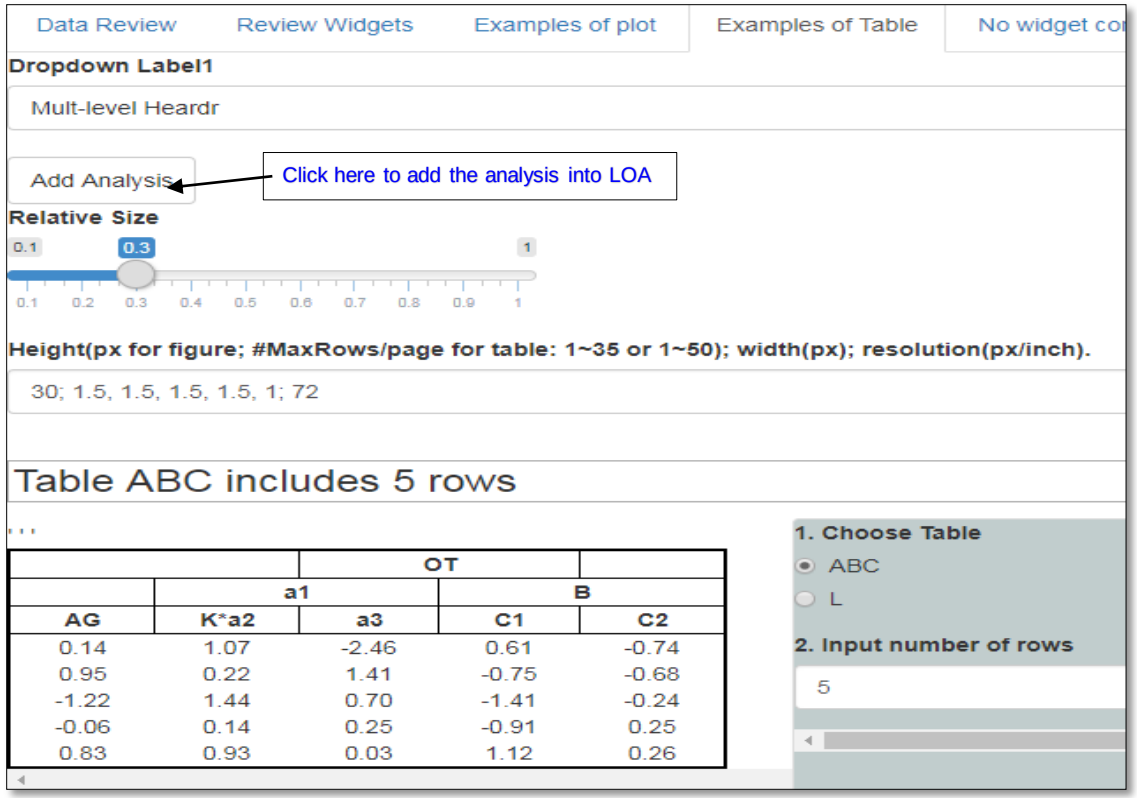
Built-in capability to import data

- BEACH is flexible in reading different types of datasets directly, such as SDTM or ADaM SAS datasets, or data in the format of SAS7BDAT, XPT, CSV, EXCEL, and Rdata.



Flexible in running different analyses

- Incorporating both source and self-replication analysis codes
- Three hierarchical layers for users to change or switch analysis

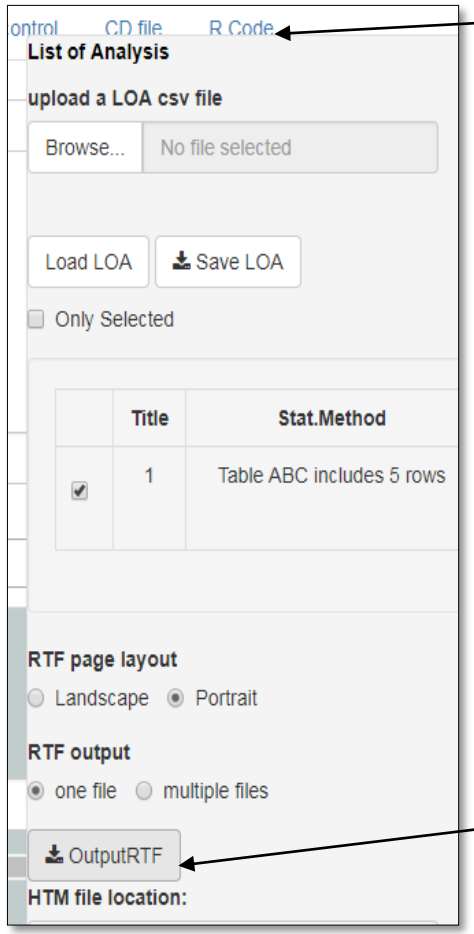


		OT		
	a1		B	
AG	K*a2	a3	C1	C2
0.14	1.07	-2.46	0.61	-0.74
0.95	0.22	1.41	-0.75	-0.68
-1.22	1.44	0.70	-1.41	-0.24
-0.06	0.14	0.25	-0.91	0.25
0.83	0.93	0.03	1.12	0.26

Easy to save output, LoA and code

- On the list-of-Analyses (LoA) panel, users can add analysis into the table, select or deselect the analysis, and then output the table or figure result into one or multiple RTF files.

- Under the 'Rcode' session, users can review or download the main R scripts and source functions of the selected analysis.



Click here to obtain the main and source code

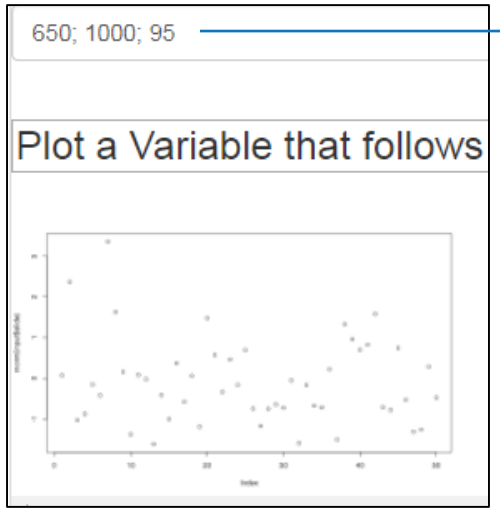
Click here to download the table in RTF

Capable for generating animation files

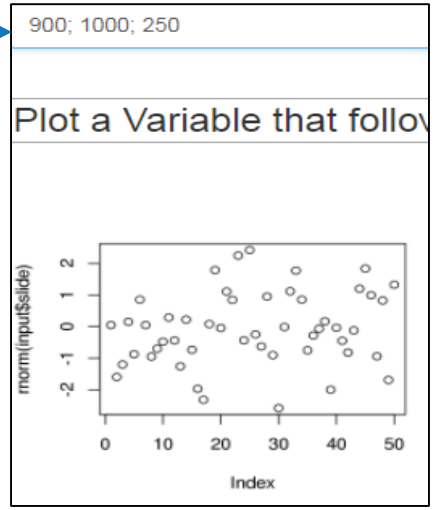
- Innovatively, BEACH provides an auto-sequent-downloading button
- It creates an animation file in a GIF file or a library file in a PDF file.

Adjustable graph quality and table layout

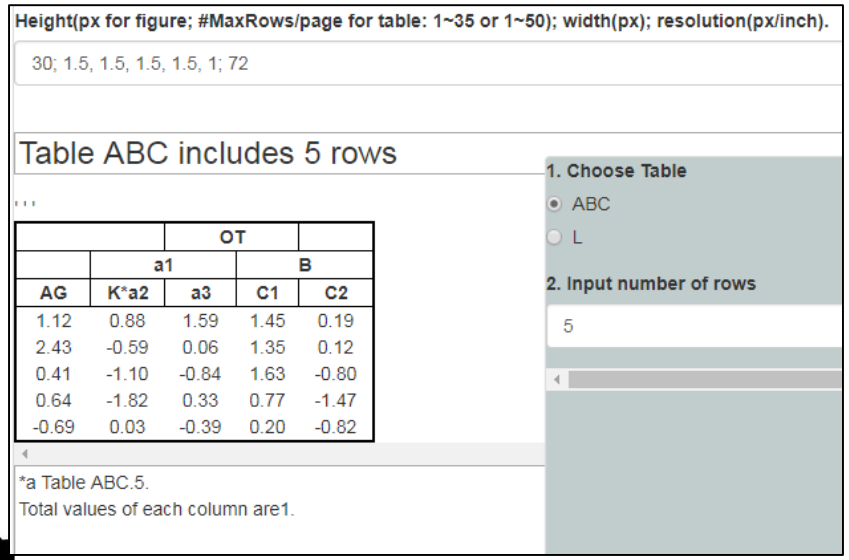
- Immediately adjusting figure resolution



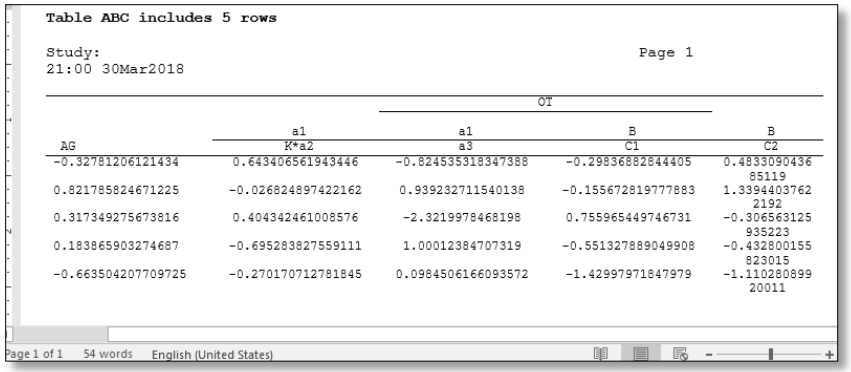
Change the height (px), width (px), resolution (px/inch) to increase the quality of figure.



- Available for creating multi-level header table



	OT			
	a1		B	
AG	K*a2	a3	C1	C2
1.12	0.88	1.59	1.45	0.19
2.43	-0.59	0.06	1.35	0.12
0.41	-1.10	-0.84	1.63	-0.80
0.64	-1.82	0.33	0.77	-1.47
-0.69	0.03	-0.39	0.20	-0.82



Create new BEACH analysis in CD

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
Num	Add	Tab.value	Tab.label	select.label	Type	Source	Request.Name	Condition	Layout	Title	height	width	res	tmp	PlotCode	FootCode
0	TRUE	NA	NA	NA	title_imag	NA	NA	NA	NA	logo.png	NA	NA	NA	NA	NA	
0	TRUE	NA	NA	NA	title_text	NA	NA	NA	NA	Add my BI	NA		NA	NA		
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3	TRUE	Tab1	Review W	Dropdown Labe	Figure	NA	Plot a Variable tha	FALSE	1	Plot a Vari	650	1000	95	0	if(is.null(input$slide)){ plot.new()}else{	NA
4	TRUE	cd	CD file	Dropdown Labe	Table	NA	Show the current	FALSE	1	Configura	0	0	NA	0	Vdic0	
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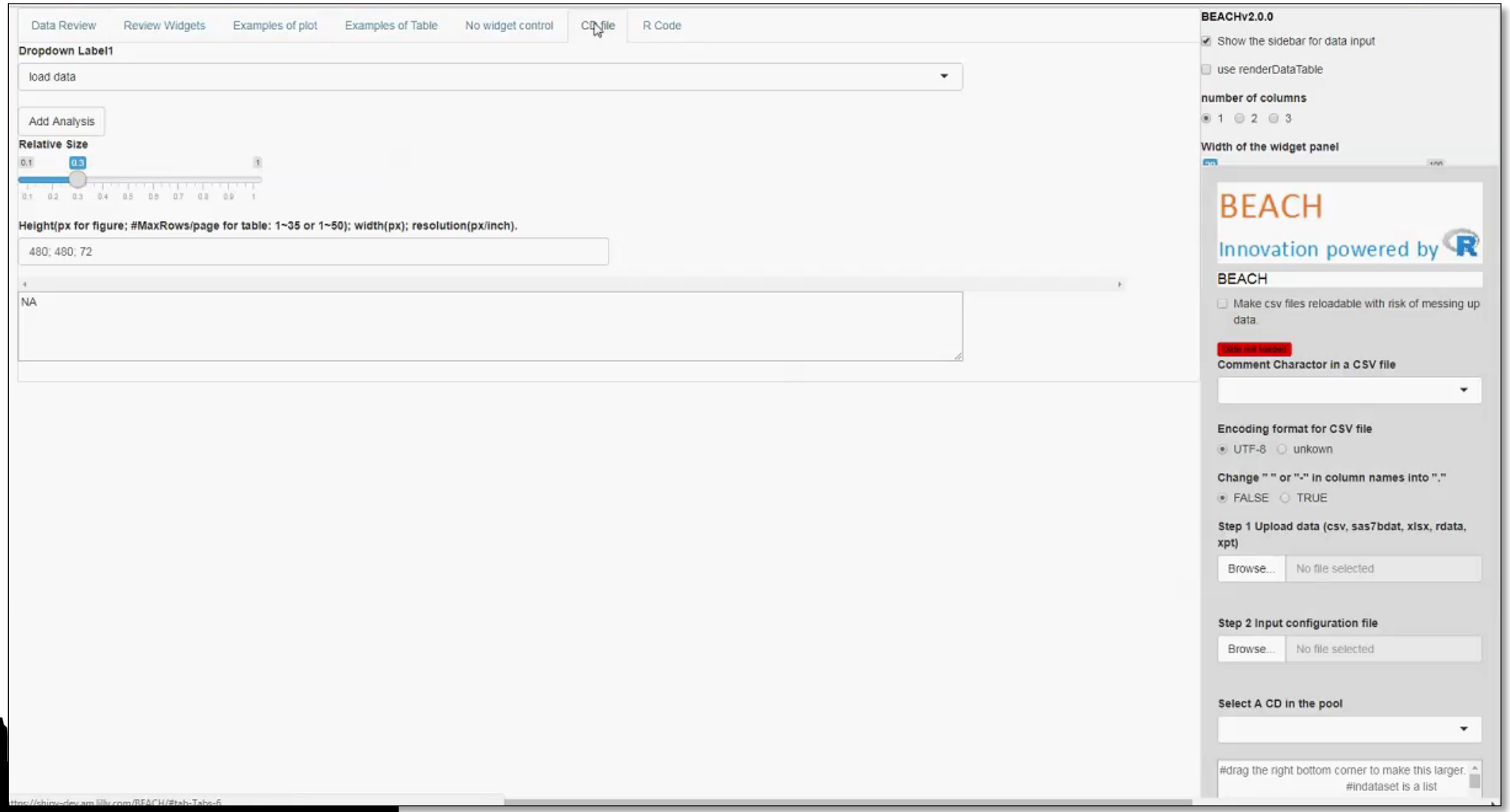
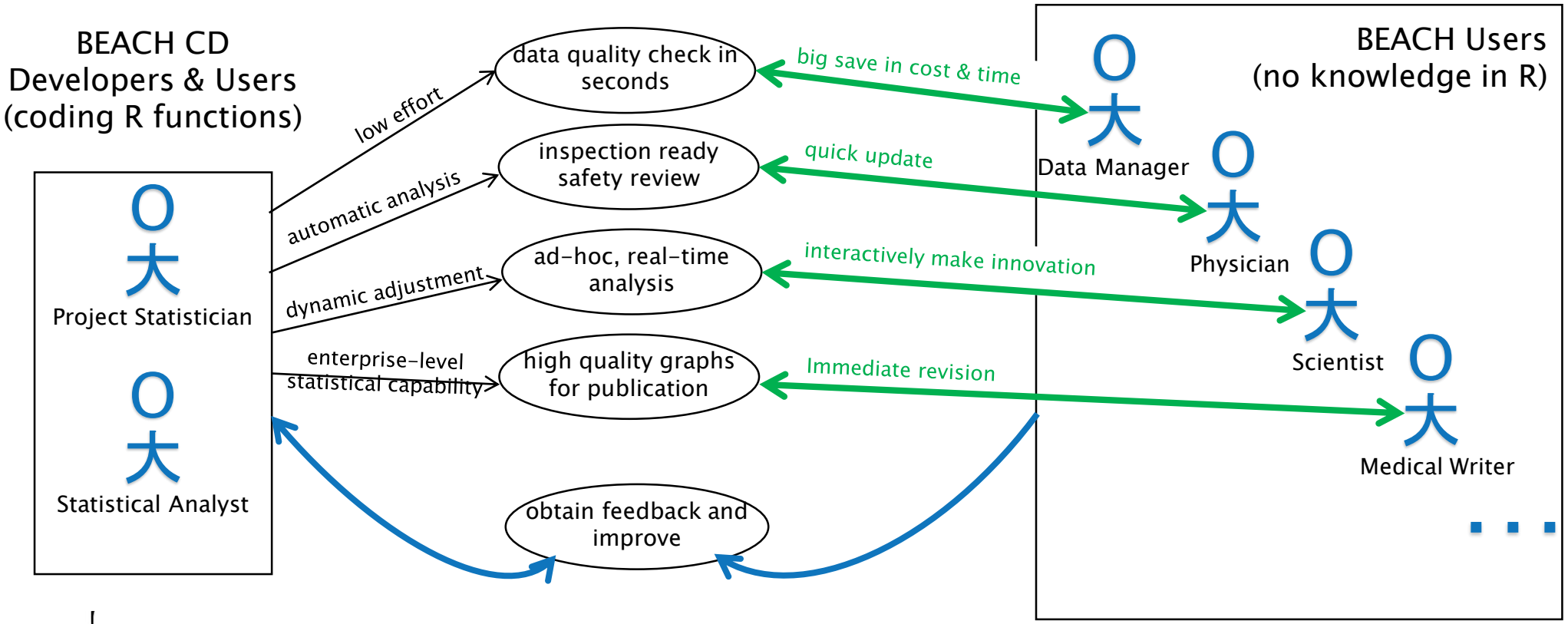
T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM
uiInput1	uilab1	uiInput2	uilab2	uiInput3	uilab3	uiInput4	uilab4	uiInput5	uilab5	uiInput6	uilab6	slide.min	slide.max	slide.by	slide.valu	slide.labe	slide.alert	radio.labe	radio.choi
						NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA		
						NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA		
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
input$slid	Random N	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	10	100	5	50	How many	NA	NA	NA
input$rad	any label	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	no widget	c('at least
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

- Managing code through configuration (CD) file
- The CD includes the layout, control widgets and R code

Live demo for adding a new analysis



Summarizing use cases of BEACH



BEACH is a systematic tool that

- helps statisticians reduce redundant work
- enhances communication efficiency
- improves cross-disciplinary collaboration

Conclusion

- R/Shiny is a powerful tool for creating interactive analysis but hard for code management with unnecessary redundancy.

- BEACH is an innovative platform that
  - enables interactive and automatic study having large numbers of analyses,
  - combines the sophisticated backend R/Shiny and HTML code,
  - helps users build web GUI quickly for comprehensive statistical analysis.

Acknowledgement

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