Reproducibility and Open Integration with SAS Using Jupyter Notebooks

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July 24, 2019

Aims/Themes of This Talk

Reproducibility

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Reproducibility
and
Integration of SAS with open source tools like Jupyter

Historical Collaboration on Projects

- Organized, but fragmented...

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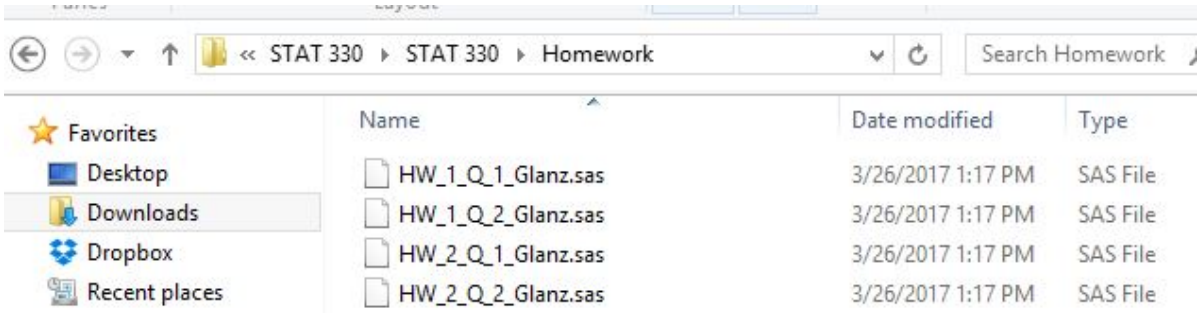
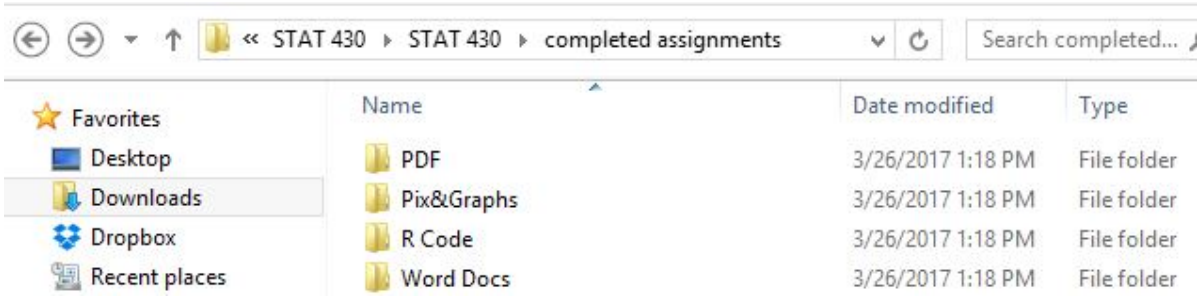
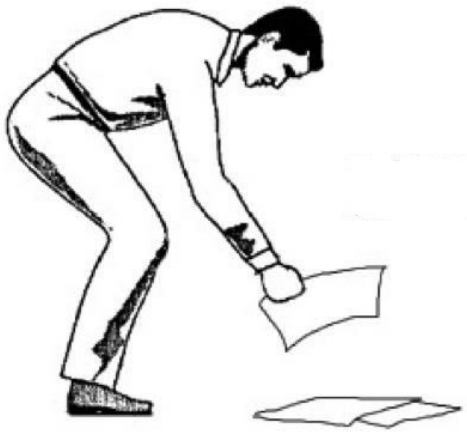




Story is Similar between Academia and Industry

- Clean, wrangle, manage data
- Summarize and visualize data
- Analyze and model
- Synthesize and report

"Some" assembly required



Historical Deficiencies

- Fragmented collection of files:
  - Code, text, images, data...
- Communication, readability, reproducibility suffer
- Unnecessarily large distance between data and story

Does Anything Out There Work?

- Make computing easier:
  - IDEs and editors (Emacs, Notebook++, Vim, SAS Studio, RStudio, etc.)
- Make report-writing easier:
  - SAS*, RStudio, LaTeX

```
5  /* Question 2*/
6
7  data increment;
8
9
10 do i = 0 to 15000 by 1000;
11 /* saving the dates for ecah increment*/
12 caldate = i;
13 /* finding the day of the week*/
14 dayofweek = weekday(i);
15 output;
16 end;
17
18
19 run;
20
21 proc print data = increment;
22 title "Dates";
23 /*formatting the SAS date to a readable date*/
24 format caldate mmddyy10. ;
25 run;
```

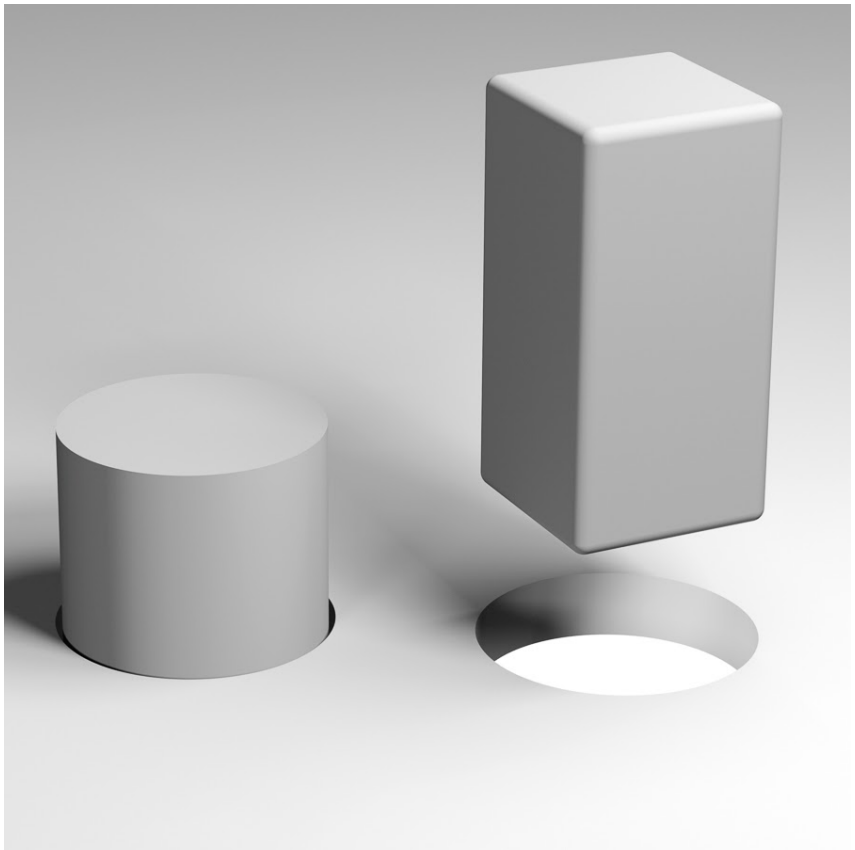
Style=Pearl and Highlight Color =Chartreuse

Country	# Medalists	Total Medals			Age (yrs)	Weight (kg)	Gender	
		Sum	Ratio	Max per Athlete	Average	Average	Female	Male
Australia	25	32	1.28	4	24.4	73.2	76.0%	24.0%
Azerbaijan	1	1	1.00	1	18.0	56.0	---	100.0%
Belarus	4	4	1.00	1	29.5	68.3	75.0%	25.0%
Belgium	2	2	1.00	1	26.0	61.0	50.0%	50.0%
Brazil	5	5	1.00	1	23.4	81.6	40.0%	60.0%
Canada	25	25	1.00	1	28.2	77.8	56.0%	44.0%

Nothing Addresses Our Needs

- IDEs/Editors
  - SAS Studio and RStudio
    - Built-in documentation
  - Color coding, formatting, etc.
- Documenting
  - RMarkdown & Report-Writing Interface
  - Highly customizable LaTeX

None of these integrate coding and documentation!



Capabilities of Ideal Tool

- Color coding, formatting, organization of existing tools
- Documentation and report writing organically coexist with coding
- Streamline the process of:
  - Exploratory data analysis
  - Data science
  - Data journalism
  - Research
  - Analytics, etc.

Cue the Jupyter Project

- Supports over 40 software languages!

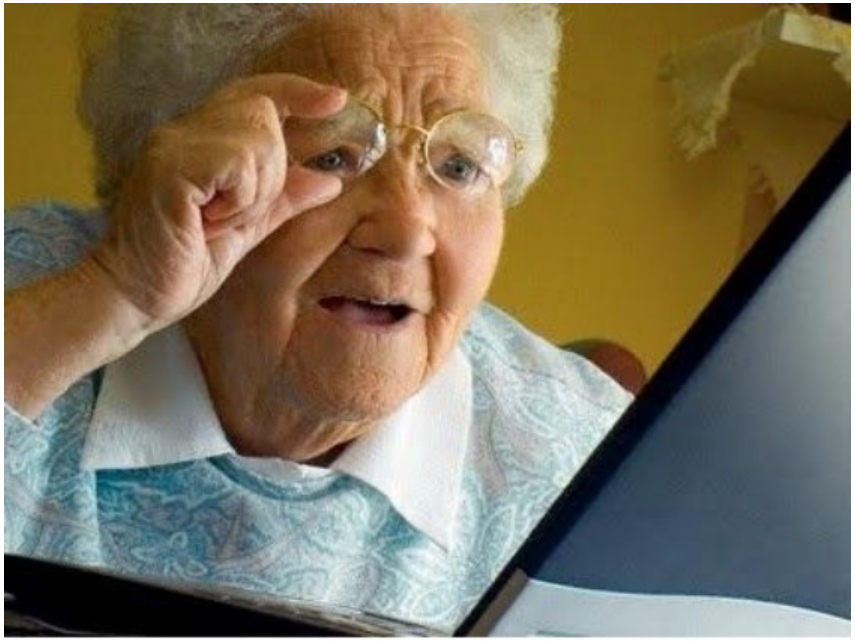
Google Microsoft IBM Bloomberg O'REILLY
CONTINUUM ANALYTICS rackspace SOUNDCLOUD Quantopian NetApp
software carpentry hhmi janelia CODE NEURO N-Site LLC SageMathCloud
BRYN MAWR COLLEGE CAL POLY SAN LUIS OBISPO Berkeley The University Of Sheffield. THE GEORGE WASHINGTON UNIVERSITY
CLEMSON UNIVERSITY MICHIGAN STATE UNIVERSITY Northwestern University NYU NASA

You May Be....

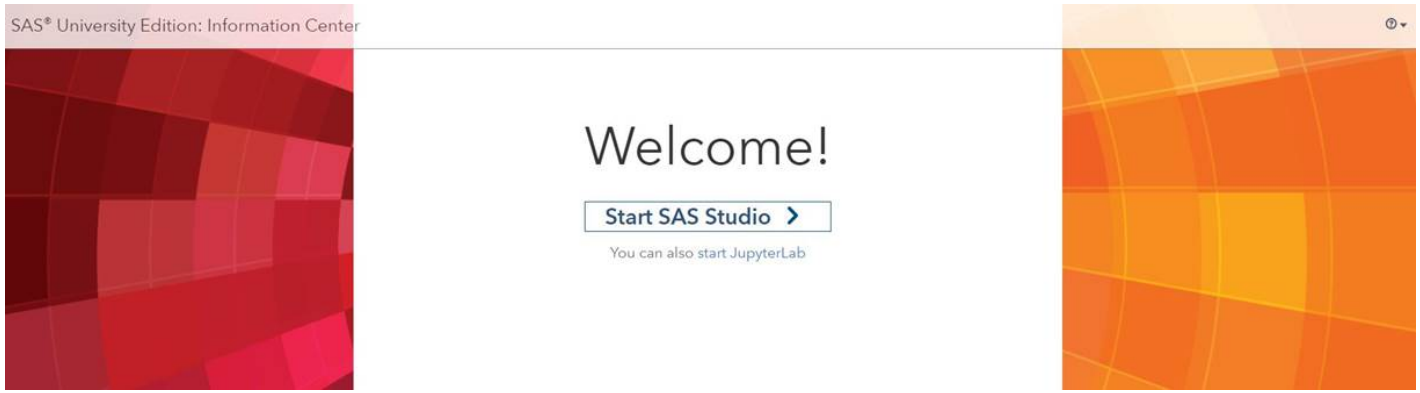

CALIFORNIA · POLYTECHNIC · STATE · UNIVERSITY · 1901 ·
DISCERE FACIENDO

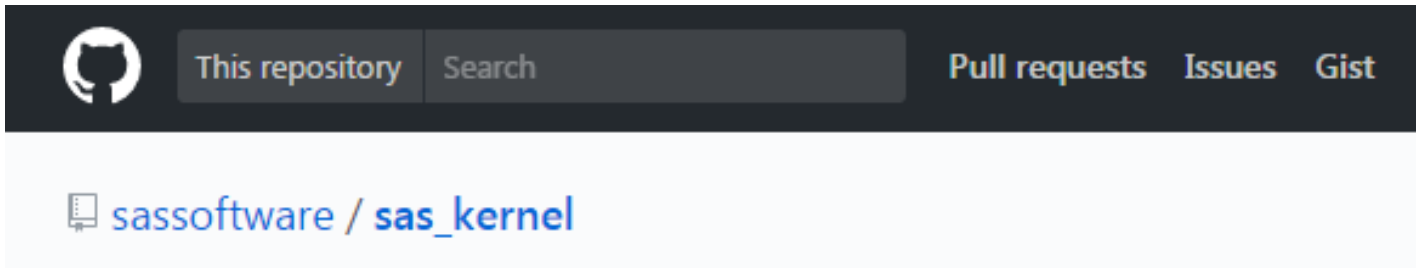
You May Be....

You May Be....



Getting Started with Jupyter Notebooks





Live Demo of Jupyter via SAS University Edition!

Live Demo!

Project Jupyter Summary Part I

- Web application enabling creation of documents that contain live code, equations, visualizations and explanatory text.
- Over 40 languages are supported, including SAS, Python, and R!
- Code within the notebook can produce rich output such as images, videos, LaTeX and JavaScript.
- Interactive widgets can be used to manipulate and visualize data in real time.

Project Jupyter Summary Part II

- Nbviewer
- GitHub
- Binder
- JupyterHub (for organizations)

Conclusions: Ease of Use

- From personal use to JupyterHub for organizations, Jupyter Notebooks make statistical computing easier to do AND share than every before!

  "The need to minimize thought-to-execution friction is probably the single biggest productivity requirement in corporate America."

- Jupyter Notebooks let us take a GIANT leap toward achieving this when it comes to data science and statistical computing.

Conclusions: The Tool We Need and Deserve

- Jupyter Notebooks
  - A single vehicle for live code, text and images.
  - Dynamic documents that enhance statistical computing and statistical communication.
  - Streamline the analytics process
    - The color coding, formatting and organization of your favorite editor
    - Report writing capabilities
    - The integration and synthesis of these things into a single environment

Thank You! Questions?

- Slides and Live Demo at
  https://github.com/hglanz/PugSUG2019-GlanzTalk