Streamlit vs. Dash vs. Shiny vs. Voila vs. Flask vs. Jupyter

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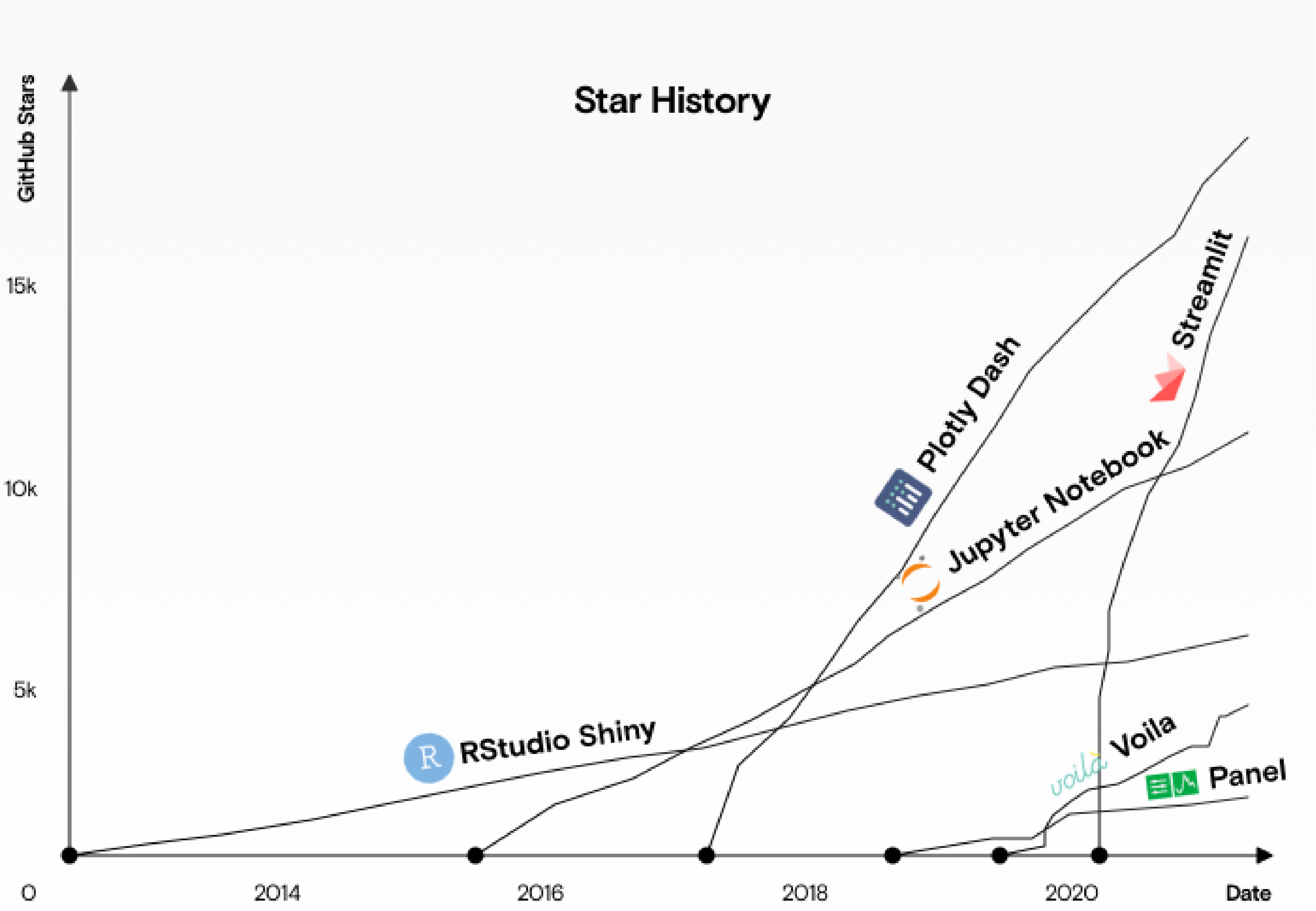
Comparing data dashboarding tools and frameworks

Nearly every company is sitting on valuable data that internal teams need to access and analyze. Non-technical teams often request tooling to make this easier.

Instead of having to poke a data scientist for every request, these teams want dynamic dashboards where they can easily run queries and see custom, interactive visualizations.



Over the last three years, **Dash** and **Streamlit** have surged in popularity as all-in-one dashboarding solutions.

https://www.datarevenue.com/en-blog/data-dashboarding-streamlit-vs-dash-vs-shiny-vs-voila

Streamlit vs. Dash vs. Shiny vs. Voila vs. Flask vs. Jupyter

Comparing data dashboarding tools and frameworks

A data dashboard consists of many different components. It needs to:

- **Analyze: Manipulate and summarize data using a backend library such as Pandas.**
- **Visualize: Create plots and graphs of the data using a graphing library such as Bokeh.**
- **Interact: Accept user input using a frontend library such as React.**
- **Serve: Listen for user requests and return webpages using a web server such as Flask.**

In the past, you'd have had to **waste a significant amount of time writing all the "glue" code to join these components together**. But with newer libraries like Streamlit and Dash, these components come in a single package.

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Just tell me which one to use

As always, “it depends” – but if you’re looking for a quick answer, you should probably use:

- **Dash** if you already use Python for your analytics and you want to build **production-ready data dashboards for a larger company**.
- **Streamlit** if you already use Python for your analytics and you want to get **a prototype of your dashboard up and running as quickly as possible.**
- **Shiny** if you already use R for your analytics and you want to make the results more accessible to non-technical teams.
- **Jupyter** if **your team is very technical** and doesn’t mind installing and running developer tools to view analytics.
- **Voila** if you already have Jupyter Notebooks and you want to make them accessible to non-technical teams.
- **Flask** if you want to build your own solution **from the ground up**.

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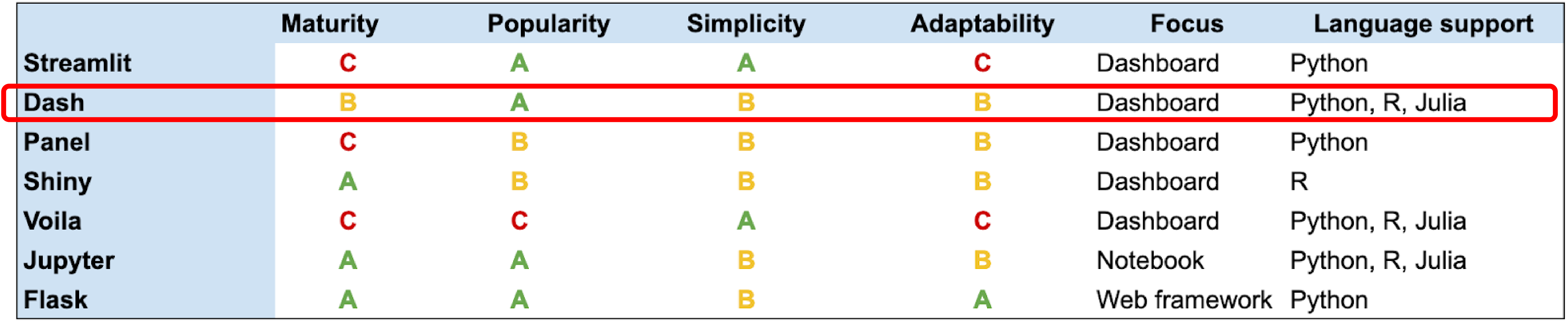

	Maturity	Popularity	Simplicity	Adaptability	Focus	Language support
Streamlit	C	A	A	C	Dashboard	Python
Dash	B	A	B	B	Dashboard	Python, R, Julia
Panel	C	B	B	B	Dashboard	Python
Shiny	A	B	B	B	Dashboard	R
Voila	C	C	A	C	Dashboard	Python, R, Julia
Jupyter	A	A	B	B	Notebook	Python, R, Julia
Flask	A	A	B	A	Web framework	Python

We've compared these libraries on:

Maturity: Based on the age of the project and how stable it is.

Popularity: Based on adoption and GitHub stars.

Simplicity: Based on how easy it is to get started using the library.

Adaptability: Based on how flexible and opinionated the library is.

Focus: Based on what problem the library solves.

Language support: The main languages the library supports.

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Streamlit vs. Dash

Streamlit and Dash are the two most similar libraries in this set. They are both full dashboarding solutions built with Python, and both include components for data analysis, visualization, user interaction, and serving.

Although they're both open source, **Dash is more focused on the enterprise market** and doesn't include all the features (such as job queues) in the open source version. By contrast, **Streamlit is fully open source.**

Streamlit is more structured and focused more on simplicity. It only supports Python-based data analysis and has a limited set of widgets (for example, sliders) to choose from.

Dash is more adaptable. Although it's built with Python and pushes users towards its own plotting library (Plotly), it's also compatible with other plotting libraries and even other languages, such as R or Julia.

- **Use Streamlit** if you want to get going as quickly possible and don't have strong opinions or many custom requirements.
- **Use Dash** if you need something more flexible and mature, and you don't mind spending the extra engineering time.

> "While using the wrong tools can definitely hinder your analysis, it's more common for teams to get bogged down by so-called **Bikeshedding**: spending too much time debating details that aren't very important."

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Streamlit vs. Jupyter Notebooks

Streamlit is a full data dashboarding solution, while Jupyter Notebooks are primarily useful to engineers who want to develop software and visualizations. Engineers use Streamlit to build dashboards for non-technical users, and they use Jupyter Notebooks to develop code and share it with other engineers.

Combined with add-ons such as Voila, Jupyter Notebooks can be used similarly to Streamlit, but data dashboarding is not their core goal.

- Use Streamlit if you need dashboards that **non-technical people can use.**
- Jupyter Notebooks are best if your team is **mainly technical** and you care more about functionality than aesthetics.

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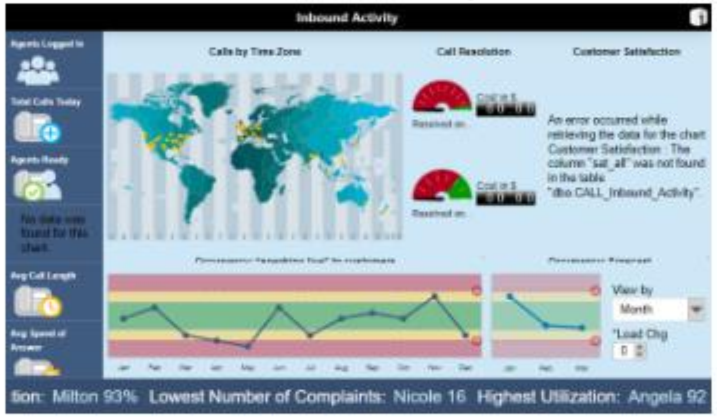
LIVE DASHBOARD EXAMPLES

Experience interactive dashboards

Call Center Dashboard Example



An error occurred while retrieving the data for the chart Customer Satisfaction : The column "sat_all" was not found in the table "dbo.CALL_Inbound_Activity".

tion: Milton 93% Lowest Number of Complaints: Nicole 16 Highest Utilization: Angela 92

Inbound Calls

Finance Dashboard Example

CFO Scorecard

Project Management Dashboard Example

Project Tracker & Resource Allocation

Healthcare Dashboard Example

Doctor's Scorecard

Government Dashboard Example

Parks and Recreation

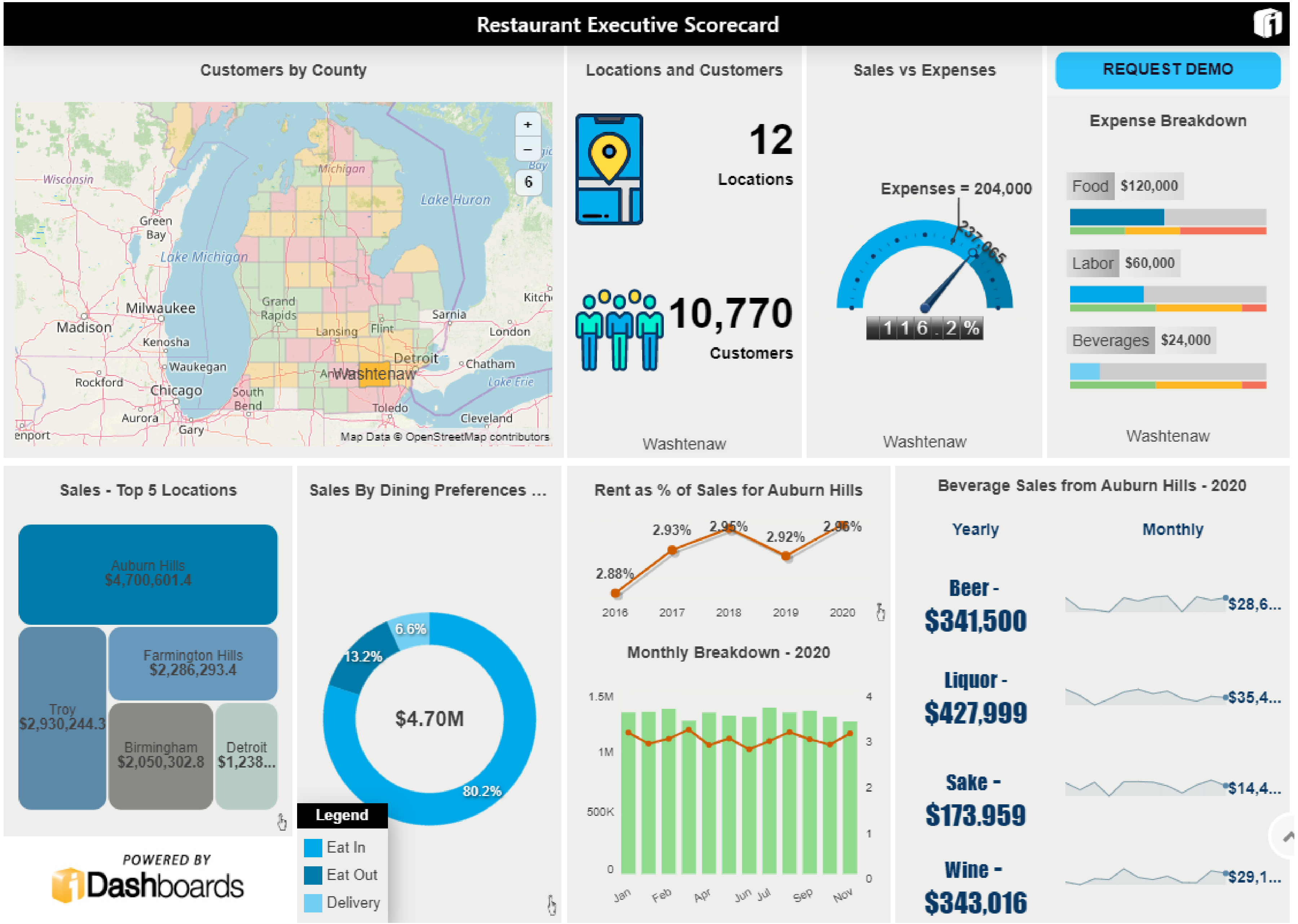
Food & Beverage Dashboard Example

Restaurant Executive Scorecard

https://www.idashboards.com/dashboard-examples/

Food & Beverage - Restaurant Executive Scorecard -- Washtenaw County Michigan

a dynamic
SVG map

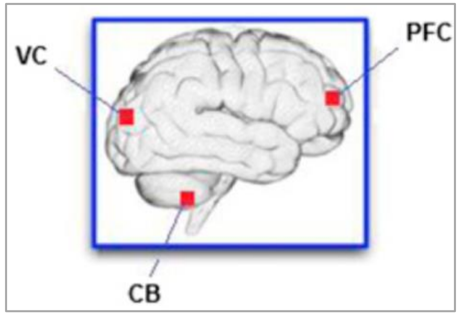


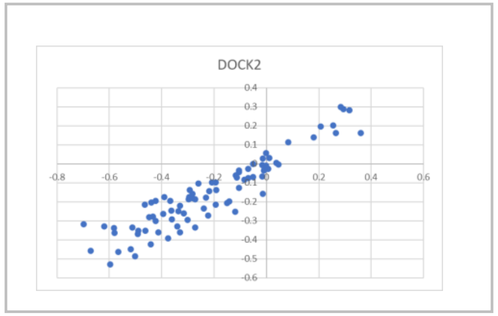
https://www.idashboards.com/dashboard-examples/food-beverage-restaurant-executive-scorecard/

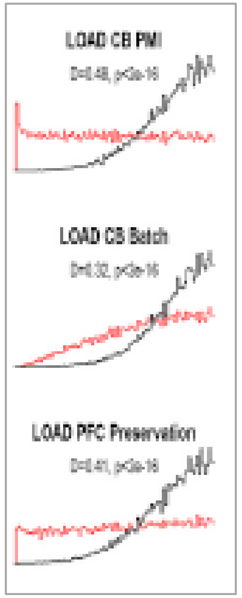
Late-Onset Alzheimer's Disease (LOAD) Dashboard

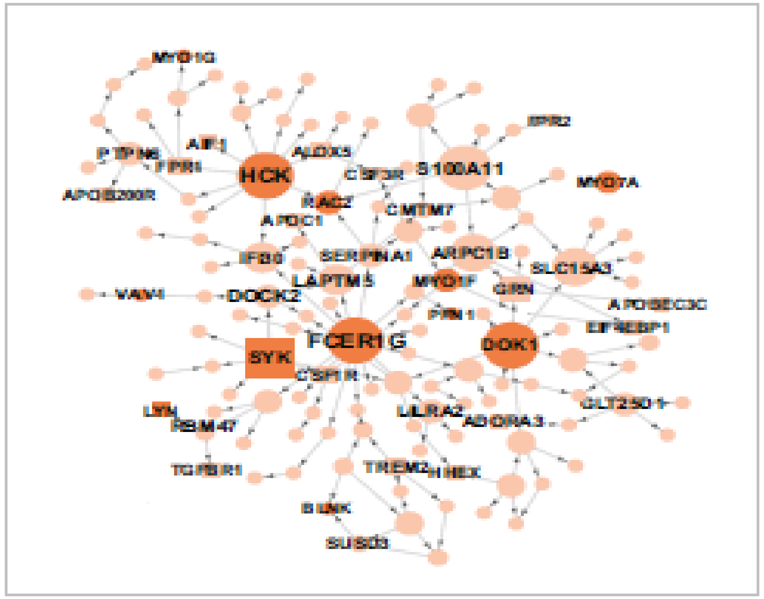
by Sue Smith, CSE5520, Fall 2021

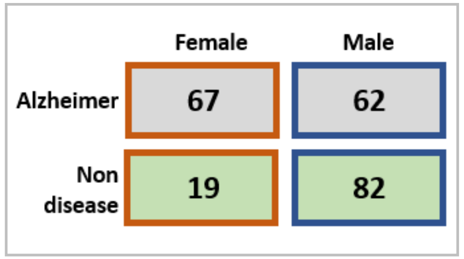
Dashboard
Example



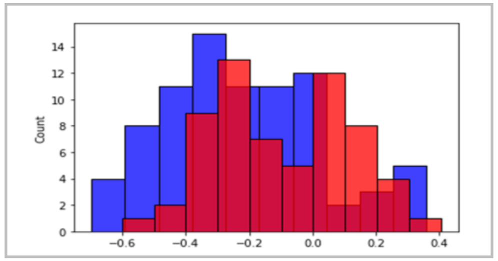


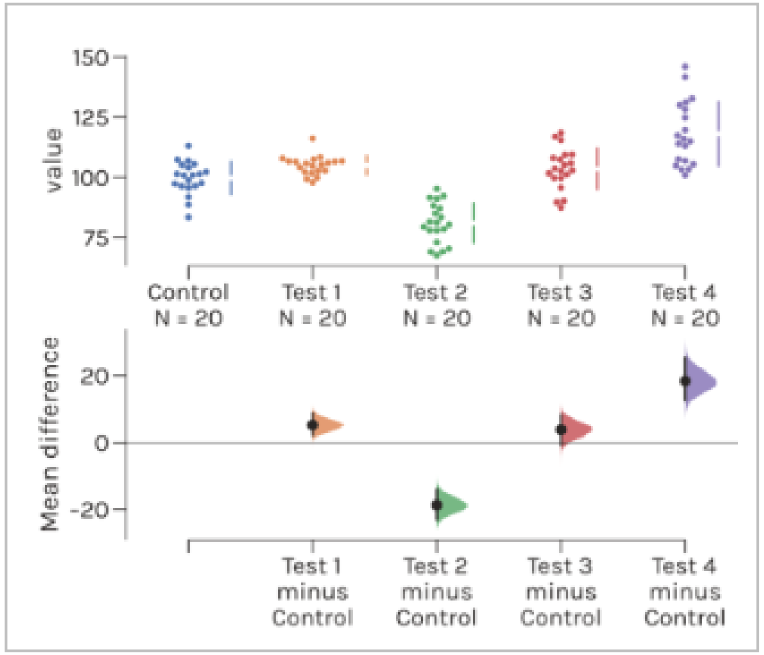


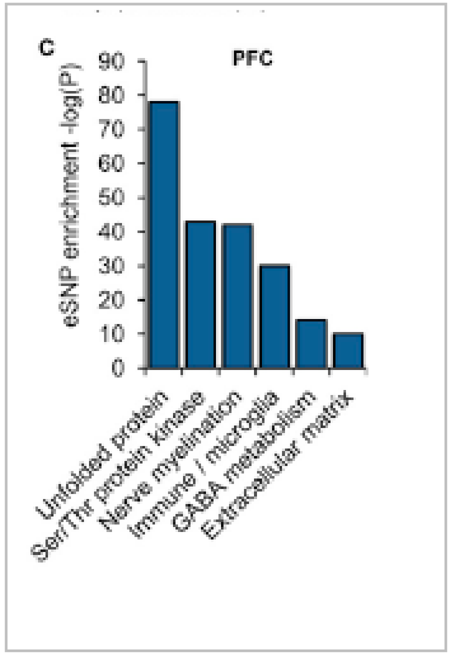


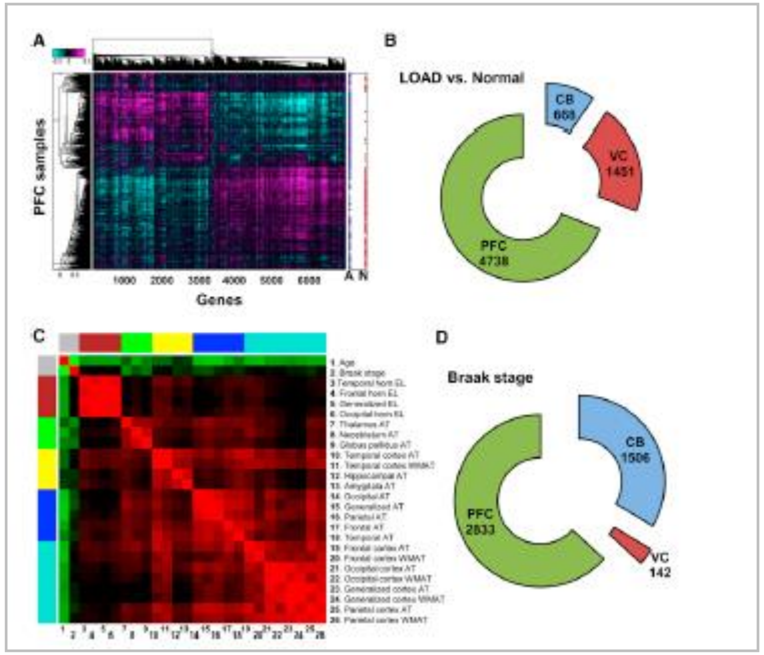


	Female	Male
Alzheimer	67	62
Non disease	19	82









Categorical variable
Discrete variable
Continuous variable

My Project

What data?

What visualization?

What analysis?

Prediction
Causality
Association

Domain: Biology, Engineering, Business, NBA/NFL/MLB, Social Science

Bayesian inference

Basic
Monte Carlo
MCMC

Sampling

Monte Carlo

Classification

Information Gain
KNN
Gaussian mixed model

Clustering

Hierarchical
K-means

Network Analysis

Directional
Non-directional

Kernel Density Estimate

Discrete to continuous

Hypothesis Testing

t- Test
p-value
ROC
FDR

χ^2 Test

$$\chi^2 = \sum \frac{(O_i - E_i)^2}{E_i}$$

Correlation Analysis

Linear regression
Pearson correlation
Non-linear regression

Scatter plot
Regression line
Correlation matrix
Heatmap

Probability Distribution

Bernoulli distribution
Poisson distribution
Gamma distribution
Beta distribution

Histogram
Boxplot
Violinplot

Data Visualization Road Map

By Oct 6, 2021

PhD students – Project should be done solo.

All the rest – Project can be done upto a 2 people team, but such formation is designed to facilitate “discussion with a partner” and requirements are same as solo, i.e., two different Dashboards and two different final term papers.

Format of Report

Name:

Team?: Yes or No

Data Choices (you are required to put two choices):

Option 1 - Describe the nature of data you would like to use and where such data could come from in 2-3 sentences.

Option 2 - Describe the nature of data you would like to use and where such data could come from in 2-3 sentences.

(Fallback option: Multiple data sets related to Alzheimer’s Disease will be provided from the class. You are welcome to choose these data sets as Option 2.)

By Oct 13, 2021

You submit:

1. Decision of data choice
2. Sources of data
3. Types of analyses you may want to perform
4. Types of visualizations you may want to generate

Nothing is written on stone at this point. This exercise is designed to help you formulate the project.