Goal: practice the basic visualization tools used in visual analytics

- use data from mini project #1 (or other)
- client-server system: python for processing (server), D3 for VIS (client)
- non-CS students can use plotly Dash for VIS & python or R to compute

Task 1: basic dimension reduction and data visualization with PCA

- use PCA to compute the Eigenvectors of the data and visualize the Eigenvalues as a scree plot
- add an interaction element into the scree plot that allows the user to mark and select the intrinsic dimensionality index ($d_i$)
- plot the data into a PCA-based biplot

Task 2: visualize the data with a scatterplot matrix

- use the PCA components $\leq d_i$ to obtain the 4 attributes with the highest squared sum of PCA loadings and list them in a table on the webpage
- use these four attributes and construct a scatterplot matrix

Task 3: use k-means to find clusters and color the points by cluster ID

- use the elbow method to find the best k (visualize the function on k)
What's a Scatterplot Matrix?

All possible bivariate scatterplots arranged into a matrix.
Upon loading of the dataset, using all numerical attributes

- Compute PCA and obtain Eigenvectors and Eigenvalues
- Compute clusters for \( k=1\ldots10 \), and for each \( k \) (1) keep the MSE score and (2) store each point’s cluster ID into a dedicated column

Construct initial displays

- Display PCA scree plot as a bar chart and set the initial intrinsic dimensionality as the elbow of the plot; color the respective bar
- Display \( k \)-means MSE plot as a bar chart; set the initial \( k \) as the elbow point and color the respective bar
- Display biplot and color the points by the set initial \( k \)
- Display scatterplot matrix where the attributes are chosen using the initial intrinsic dimensionality and color the points according to the initial \( k \)
Support user interactions

- User can choose a different intrinsic dimensionality in the scree plot by coloring the respective bar.
- User can choose a different k in the k-means MSE plot, again by coloring the respective bar.

Make observations

- Observe what happens when you make these changes.

Additional optional observations

- Observe what happens in the biplot when different PCA vectors are chosen as the projection basis.
- You could choose them in the scree plot by coloring the respective two bars or choosing a different visual marking (bold bar outline).
- It will have an effect on the quality of the display (you can keep the k as chosen).
Each (task) bullet item carries 10 points
  - an extra 10 pts for overall elegant implementation and function

Don’t forget to
  - label the axes and tick marks where appropriate
  - show color legends where appropriate
  - provide a meaningful header on each plot

Due date
  - due March 7, end of day
  - no group project, single only
Submit on Brightspace

- voice-narrated video file to show all features of your software in action
- in the video discuss any interesting observations you were able to make in the data
- 2-3 page report
  - describe interesting observations (beyond the video)
  - mention anything noteworthy about implementation (beyond the video)
- zip file with complete source code as well as the data
- submit video as an extra file
Grading

- TA will pick students at random for thorough code review sessions
- you better know your code !!!
- so, please do not just copy code beyond the D3 templates
- or even worse, videotape someone else’s program