Objective

Learn how to use an off-the-shelf tool to explain a regression model for medical expense prediction. This lab will focus on SHAP.

Recipe Ingredients

1. NotebookDownload Notebook
2. CodebookLinks to an external site.

As before, the notebook will automatically grab the data with wget.

Your Tasks

- **(TURN THIS IN, 5 points)** First, read the assignment specification and _**estimate how long you think it will take you**_ and write it down.

1. *Task 1: Expectations before beginning*
   A. **[Each, TURN THIS IN, 5 points]** Before beginning this assignment, briefly characterize in writing your expectation of what you will find to be predictive of an individual having high medical expenses. We learned about this in the last labs, but this one will use a different model and a different explainer. So how do you think this one might be different?
   B. Run the following cells in Pre-task to set up packages and prepare the data
2. *Task 2: Investigate data*
   A. Run the following cells to investigate the data
   B. **[Team, TURN THIS IN, 5 points]** Inspect the features, description of targets, and histogram of target values. The notebook asserts that this distribution is hard for regression to accurately model. Comment on why specifically you think this might be the case from a mechanistic perspective (i.e., if data instance A is predicted to have value X, but its real value is Y, then...)
3. *Task 3: Using SHAP*
   A. **[Team, TURN THIS IN, 5 points]** Inspect the SHAP summary plot (AKA the "beeswarm plot"). Describe any interpretations you make from it, including clustering of feature values and impact on the output.
   B. **[Each, TURN THIS IN, 5 points]** Interact with the visualization in the last cell. Does it lead you to any insights? Why or why not? As you answer this question, be sure to use the drop-down menus to reorganize the data in various ways and also mouse over the visualization to see the results from the popups.

4. *Task 4: Generate different charts*
    A. [**Team, TURN THIS IN, 20 points**] Work together to generate a "dependence plot" (refer to the SHAP docs). Include a picture of your output in your submission. What do you see in it?
    B. [**Team, TURN THIS IN, 20 points**] Work together to generate a "force plot" explaining a single prediction (refer to the SHAP docs). Use that code to check out 3 the explanation for the inputs located in the dataset at indices 35, 273, and 300. Include a picture of your output in your submission. What do you see in these plots? How are they different or similar?

5. *Task 5: Big Picture*
    A. [**Each, TURN THIS IN, 10 points**] Dig around in the links provided in the first cell and learn a bit about some of the other features SHAP offers. Describe a few that look interesting to you and why.
    B. [**Each, TURN THIS IN, 15 points**] To inform your final project, see if there are any other packages besides SHAP, LIME, and AIX360 that might offer useful tools for whatever project idea you might have in mind.
    C. [**Each, TURN THIS IN, 5 points**] Having finished this lab, re-read what you wrote for task A1. How has your position changed?
    D. [**Each, TURN THIS IN, 5 points**] Upon completing the lab, determine how long you actually spent on the lab, and report that timeframe in addition to your estimate beforehand.