AI, Ethics, and Society

Homework Project #3

Readings:

- Dixon, Lucas & Li, John & Sorensen, Jeffrey & Thain, Nithum & Vasserman, Lucy. "Measuring and Mitigating Unintended Bias in Text Classification," AAAI/ACM Conference on AI, Ethics, and Society, pp. 67-73, 2018. https://www.aies-conference.com/2018/contents/papers/main/AIES_2018_paper_9.pdf
- Tolga Bolukbasi, Kai-Wei Chang, James Zou, Venkatesh Saligrama, and Adam Kalai, "Man is to Computer Programmer as Woman is to Homemaker? Debiasing Word Embeddings," NIPS 2016 -https://papers.nips.cc/paper/6228-man-is-to-computer-programmer-as-woman-is-to-homemaker-debiasing-word-embeddings.pdf

In this assignment, you'll continue the process of exploring relationships in data. You'll accomplish this task by computing some basic inferential statistical measures on a natural language-based dataset.

Natural language processing is concerned with the ability to process and analyze large amounts of natural language data, whether for automated sentence completion in emails, conversational agents and chatbots, or AI tools to help journalists. In this assignment, we will work with data from a classifier built to identify toxicity in comments from Wikipedia Talk Pages. The model is built from a dataset of 127,820 Talk Page comments, each labeled by human raters as toxic or non-toxic. A toxic comment is defined as a "rude, disrespectful, or unreasonable comment that is likely to make you leave a discussion."

Step 1 – *Download the modified dataset available on CANVAS – toxity_per_attribute.csv*:

- <Wiki_ID> is unique identifier associated with Wikipedia comment
- <TOXICITY> is a toxicity value from 1 if the comment was considered toxic and value 0 if the comment was considered neutral or healthy
- < subgroup > columns: One column per human attribute; True if the comment mentioned this identity.
- Due to sensitivity, comments were removed to construct the modified dataset. The original data source can be found at: https://github.com/conversationai/unintended-ml-bias-analysis/tree/master/data

Step 2: Identify the protected class categories and members associated with each protected class category.

- For each protected class category, identify its relevant protected class members (e.g. christian + muslim + X -> Religion)
- Provide the classification results (i.e. list of protected class categories and their associated protected class members)

Step 3:

- Create a *reduced data set* by deleting any rows that have all FALSE values for every column in that row. ***Note***: This is the *reduced data set* that you will use in all subsequent steps.
- Using the reduced data set, identify an ordering scheme for each protected class category by defining values for each of its protected class member. Convert FALSE to 0 and TRUE to a unique numerical value for each subgroup member based on a subjective ordering of who you believe would be least/most impacted by negative toxicity (e.g. for gender identify: FALSE = 0; male = 1; female = 2; binary = 3; etc.). You may also combine group members and assign

numerical values based on your belief about similarities among the group members (e.g. gender identify: FALSE = 0; all others = 1; female = 2).

- Using your assigned numerical values, create a compacted data set by combining the columns associated with the related protected class members into one column representing the protected class category (e.g. combine all columns related to Religion into one Religion column).
- Calculate the correlation between the protected class category and TOXICITY. Provide the correlation coefficients in table format and identify the strength of the correlation. Select the three highest correlation coefficients and plot data for the correlated variables; indicate its correlation strength [Note: there may/may not be any strong correlations in this dataset].
- As guidance, can use (Evans, J. D. (1996). Straightforward statistics for the behavioral sciences. Brooks/Cole Publishing) which suggests the following related to the absolute value of the correlation coefficient:
    - .00-.19 “very weak” correlation
    - .20-.39 “weak” correlation
    - .40-.59 “moderate” correlation
    - .60-.79 “strong” correlation
    - .80-1.0 “very strong” correlation

Example Output (for illustrative purposes only):

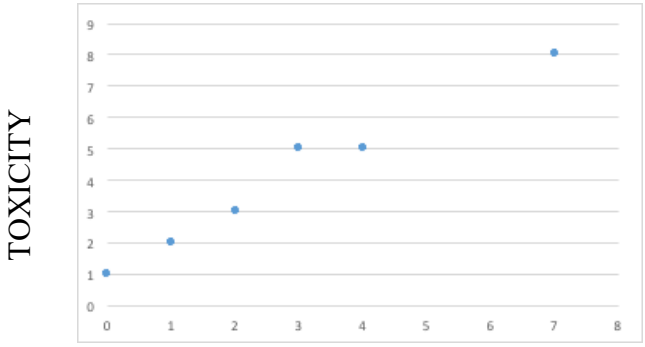
Classification Results - Protected Class Variables:

- Religion: christian, muslim
- Age: younger, older

Correlation Coefficients:

	Religion (Protected Class Variable)	Age (Protected Class Variable)
TOXICITY	0.03	0.7
CORRELATION STRENGTH	Very weak correlation	Strong correlation

TOXICITY and Age are strongly correlated.



Step 4: Using your reduced data set (from the first task in Step 3), calculate the population mean and population standard deviation of TOXICITY. What is the range of values around the mean that includes

95% of TOXICITY? Run the random sampling method using 10% and 60% of the data. For each, what is the mean, standard deviation, and margin of error? **Note:** Although, for this and the following questions, TOXICITY may/may not follow a normal distribution, feel free to use the methods discussed in the lecture (i.e. it is not expected for you to explore new methods).

For these questions, choose only one of the protected class categories.

Step 5: Using your reduced data set, calculate the mean and standard deviation of TOXICITY associated with the protected class category (***Hint:*** TOXICITY values should only be included in the calculation when the associated protected class value is not FALSE). Run the random sampling method using 10% and 60% of the data. For each, what is the mean and standard deviation? Indicate (yes/no) if the values lie within the associated population margin of error.

Step 6: Using your reduced data set, calculate the mean and standard deviation of TOXICITY associated with each subgroup that is a member of the protected class category (***Hint:*** TOXICITY values should only be included in the calculation when the associated protected class value is not FALSE). Run the random sampling method using 10% and 60% of the data. For each subgroup, what is the mean and standard deviation? Indicate (yes/no) if the values lie within the associated population margin of error.

Step 7: Plot (on one graph) - 1) the computed population mean/standard deviation (Step 4), (2) the computed mean/standard deviation for the protected class category (Step 5), and (3) the computed mean/standard deviation for each subgroup of the protected class category (Step 6). Which of the subgroups has the highest TOXICITY value? Which of the subgroups has the lowest TOXICITY value? Which of the subgroups has the largest difference in TOXICITY value when compared to the population mean? Does there seem to be any human bias in the data? Explain (in no more than 3-5 sentences).

Step 8: Turn in a report (in PDF format) documenting your outputs. **Please note that, if desired, you may submit a jupyter notebook (.ipynb) for the assignment submission.** If choosing this option, you need to make sure you have clearly printed/displayed all outputs necessary for receiving credit (as you would for a PDF submission) before submitting. This means that the jupyter notebooks must be run before your submission. Credit would not be awarded for just submitting the codes in the notebook and not displaying the output. Note that you can still submit the assignment as a PDF - jupyter notebook is optional and is intended to ease logistics. In this case, submission should be just one **.ipynb** file.