CSC4009: FIP-ML – Assignment 1

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I have chosen to analyse the bias within a **Classification** task using a simple 3 layer neural network based off [1].

Firstly, I evaluated the amount of data points within the dataset that contained missing values and this totalled to 3620 rows (7.41% of the original total). This is a significant portion of the full dataset. Complete case analysis is useful in settings where insignificant amounts data, however this is above 5% which is above a threshold recommended by a 2017 paper on missing data within clinical trials [1]. If the data qualified as MCAR (Missing Completely at Random), I would have opted for complete case analysis as well. However, I could not verify if there was no relationship between the missingness of the data and any values observed or missing [2] thus I did not want risk biased results based on incomplete data. I came to the conclusion that between MAR (missing at random) vs MCAR, the data was more likely to have a systemic relationship to the observed data as the most common fields missing were workclass & occupation which directly relate to the measured attribute, whether a person makes above 50k. The next most common was country of origin which is a sensitive attribute, while there would a relationship to race. Unfortunately it is difficult to work whether or not the values are MNAR (Missing Not at Random) as we cannot determine the propensity of a value to missing based of its value, i.e. someone in lower education leaving an education field blank. Thus I have made the assumption that the values missing are MAR, this will be considered when evaluating the model.

At the risk of including bias within the dataset, I have decided to make use of Imputation using mode for missing values, while there is a risk of introducing bias, it is easier and computationally much less expensive than other methods such imputation using KNN, MICE or Deep Learning [3]. To encode the categorical values (not including sensitive data) I have performed

[1] <https://bmcmedresmethodol.biomedcentral.com/articles/10.1186/s12874-017-0442-1>

[2] <https://www.theanalysisfactor.com/missing-data-mechanism/>

[3] <https://towardsdatascience.com/6-different-ways-to-compensate-for-missing-values-data-imputation-with-examples-6022d9ca0779>

<https://machinelearningmastery.com/imbalanced-classification-with-the-adult-income-dataset/>

<https://www.stxnext.com/blog/getting-started-machine-learning-python/>

<https://godatadriven.com/blog/towards-fairness-in-ml-with-adversarial-networks/>

<https://machinelearningmastery.com/evaluate-gradient-boosting-models-xgboost-python/>

<https://machinelearningmastery.com/one-hot-encoding-for-categorical-data/>

<https://www.analyticsvidhya.com/blog/2016/02/complete-guide-parameter-tuning-gradient-boosting-gbm-python/>

<https://towardsdatascience.com/hyperparameter-tuning-the-random-forest-in-python-using-scikit-learn-28d2aa77dd74>