User Manual for the Discrimination Analysis Tool

1 Prerequisites

Before running the tool, ensure that you have installed the dependencies in Requirments.pdf.

2 File Structure and Input Files

2.1 Dataset for Discrimination Evaluation

Location: ./dataset

Format: CSV files with several columns, including a target column (e.g., "Class-label") and feature columns.

2.2 Model File

Location: ./DNN

Format: These are pre-trained deep neural network models that the tool uses for making predictions

2.3 Raw data for Mann-Whitney U Test

File name: raw data.csv

Format: The file must have exactly 10 rows (without a header). Each row represents one algorithm's results (e.g., "Random Search" or "Tabu Search") for a given sensitive feature.
Grouping: Rows are paired (row 0 and row 1 for the first group, row 2 and row 3 for the second, etc.), and there are 5 groups total.

3 How to Run the Tool

3.1 Running the Discrimination Evaluation in tabu_search.py

Fill in the paths for the dataset processed_adult.csv and the model model_processed_adult.h5 in the corresponding locations in the code.
In the code, set the list of sensitive columns (e.g., ['age']) and automatically determine non-sensitive columns from the dataset.

Execute the script and it will:

- Load and preprocess the dataset
- Load the pre-trained model
- Use tabu search to generate sample pairs and compute the Individual Discrimination Instance (IDI) ratio
- Print the computed IDI Ratio

3.2 Running the Random Search in Baseline.py

First, make sure the dataset and model files are in place. Then update the sensitive features list if necessary (e.g., ['gender']).
This script will follow similar steps as above but use random perturbations to generate sample pairs and

then compute the IDI ratio.

3.3   Running the Statistical Analysis in statistical_test.py
Ensure that raw data.csv is in the expected format (10 rows, no header).

Execute the script and it will:

- Read raw data.csv
- Validate that exactly 10 rows are present
- Perform the two-sided Mann-Whitney U test for each of the 5 groups
- Generate box plots comparing the two search methods for each group
- Print a summary table with the U statistic and p-values for each group

4   Expected outcomes

For discrimination evaluation, the calculated IDI Ratio is printed on the console, which indicates the proportion of sample pairs that exhibited discrimination according to the chosen threshold.

For Mann-Whitney U Test Analysis, a set of box plots (one per group) comparing the results of Random Search and Tabu Search.