Experiment 1

Stability.ipynb is used to generate the robustness (stability) plot given in Figures 1c and 4a. The file **TX.mat** generated by the code will need to be loaded to the matlab codes of KLIEP and uLSIF for obtaining the importance weights for KLIEP and uLSIF methods. **X (training data)** and **T (testing data)** are the variables stored by **TX.mat.** Once the importance weights are obtained for KLIEP and uLSIF, they can be loaded back into Stability.ipynb and be used to obtain predictions for diagonal V matrices corresponding to KLIEP and uLSIF methods by running the **test_methods_review()** function.

Experiment 2

We provide **figure4b.ipynb** and **figure4c.ipynb** to generate Figures 4b and 4c. In order to run these files for KLIEP and uLSIF methods (which are implemented in MATLAB), we store the synthetic data in **data.mat** and **data_2.mat** for Figures 4b and 4c respectively. These files are then used to generate importance weights for KLIEP and uLSIF methods using **KLIEP.m** and **uLSIF.m.** The importance weights are stored in **data_final.mat** and **data_final_2.mat** for Figures 4b and 4c respectively. For convenience, we have provided all these files in the folder **dataset_files(mat,pickle).** Further, we have also provided the matlab functions **test.m** and **test_2.m** used to generate **data_final.mat** and **data_final_2.mat** respectively.

Experiment 3

Experiment_3_ringnorm.ipynb and **Experiment_3_twonorm.ipynb** are used in this experiment. The necessary mat and pickle files with datasets obtained by the biasing scheme described in experiment 3 are provided in the folder **dataset_files(mat,pickle).** We have also provided the python notebook **Dataset_Generator_Experiment_3.ipynb** which was used to bias these datasets. We also include the **GetVmatrices_ringnorm.m** and **GetVmatrices_twonorm.m** used to generate **matlab_ringnorm.mat** and **matlab_twonorm.mat** that have importance weights for KLIEP and uLSIF methods for ringnorm and twonorm datasets respectively.

Experiments 4 and 5

Generating Datasets

Running these files requires access to the datasets. You will need to update the paths for your setup, but these datasets are given in the supplementary material.

Dataset_Generator_SingleFeature.ipynb generates training/testing splits by selecting training datapoints based on one feature as described in the paper. It outputs the files **single_datasets.mat** and **single_datasets.p** which contain the preprocessed data as well as lists of indices for training and testing.

Dataset_Generator_Norm.ipynb generates training/testing splits by selecting training datapoints based on their norm as described in the paper. It outputs the files

multi_datasets.mat and **multi_datasets.p** which contain the preprocessed data as well as lists of indices for training and testing.

The outputs from these dataset generators are in the **MultiFeatureBias** and **SingleFeatureBias** folders.

Running KLIEP and uLSIF in Matlab

These algorithms are run using their original code in MATLAB. We provide the original implementations in our folder.

Get_V_Matrices.m is run to generate the weightings for each trial. To run this, you must load **single_datasets.mat** or **multi_datasets.mat** into your environment. The code to do this is in the file, but the path may need to be updated depending on your setup. The code must also have access to the matlab implementation of the KLIEP and uLSIF method, provided in the folder. The environment should be saved in **matlab_single.mat** or **matlab_multifeature.mat** depending on whether we are doing the single-feature biasing or the norm-biasing.

Running the Experiment

CovariateShiftExperiments.ipynb runs the experiment. To run this you must have the necessary .p and .mat files for the experiment.

For the single feature experiment you must have **single_datasets.p**, which contains the datasets and train-test splits. You must also have **matlab_single.mat** which contains the weightings for KLIEP and uLSIF. Both of these are in the **SingeFeatureBias** folder.

For the norm experiment you must have **multi_datasets.p**, which contains the datasets and train-test splits. You must also have **matlab_multifieature.mat** which contains the weightings for KLIEP and uLSIF. Both of these are in the **MultiFeatureBias** folder. Again, the paths may need to be updated based on your setup.

To choose the norm-biased or feature-biased experiment, uncomment the code that loads the appropriate files. The comments label each section of code.

To run the experiment for a specific dataset, modify the line:

```
dataset = 'ringnorm'
```

To be `'cancer', 'ringnorm', 'twonorm', 'diabetes', 'banknote'.`

Note: The parameters for Makoto and Huang's methods are not tuned in these files so you will need to tune those parameters yourself to verify their performance.

The order of the output performance is:

1. Unweighted

2. Proposed
3. V (Multiplicative)
4. Proposed V (Additive)
5. Makoto
6. Huang
7. uLSIF

The running totals are printed after each train-test split.