Code for Reproducing the Experiments in “PARAMETER IDENTIFICATION IN LINEAR NON-GAUSSIAN CAUSAL MODELS UNDER GENERAL CONFOUNDING”

Overview

This repository contains the code for reproducing the experiments presented in the paper “PARAMETER IDENTIFICATION IN LINEAR NON-GAUSSIAN CAUSAL MODELS UNDER GENERAL CONFOUNDING”.

The code is organized into three main parts:

1. **Causal Effect Identification (Python)**
2. **Causal Effect Estimation (R)**
3. **Model Equivalence (Macaulay2)**

1. Causal Effect Identification (Python)

This folder contains the Python code and necessary resources to certify the criterion of Theorems 4.2 -4.3, and to reproduce the experiments of Section 8.1.

Contents:

- **requirements.yml**: YML file for installing the required Python libraries.
- **example_notebook_identification.ipynb**: Jupyter notebook demonstrating how to use the algorithms on a simple example.
- **identification.py**: Python script that contains the functions to implement the algorithms.
- **experiment_code.py**: Python script to fully reproduce the experiments from the paper.
- **Data/**: Directory containing the output data of the experiments.

Instructions:

1. **Setup Environment**:
   - Install Anaconda or Miniconda.
   - Navigate to the folder and create the environment using the YML file:

   ```
   conda env create -f requirements.yml
   conda activate causal_effect_identification
   ```

2. **Run Example Notebook**:
   - Open `example_notebook.ipynb` in Jupyter Notebook or JupyterLab to see a step-by-step guide on using the algorithms.
3. **Reproduce Experiments**:
   - Execute `experiment_code.py` to reproduce the experiments and generate output data.

2. Causal Effect Estimation (R)

This folder contains the R code and necessary resources to execute the optimization described in Lemma 8.1, and to reproduce the experiments of Section 8.2.

Contents:

- **install_packages.R**: R script for installing the required R packages.
- **example_notebook.Rmd**: R Markdown notebook demonstrating how to use the algorithms on a simple example.
- **experiment_code.R**: R script to fully reproduce the experiments from the paper.
- **output_data/**: Directory containing the output data of the experiments.

Instructions:

1. **Setup Environment**:
    - Ensure you have R and RStudio installed.
    - Install the required packages by running:

    ```
    source("install_packages.R")
    ```

2. **Run Example Notebook**:
    - Open `example_notebook.Rmd` in RStudio to see a step-by-step guide on using the algorithms.
3. **Reproduce Experiments**:
    - Execute `iv_simulations.R` to reproduce the experiments and generate output data for the IV graph.
    - Execute `dc_simulations.R` to reproduce the experiments and generate output data for the graph in Fig. 11.
    - Execute `cycle_simulations_laplace.R` to reproduce the experiments and generate output data for the *3-cycle* of Fig. 9, and the error terms samples from a Laplace distribution.
    - Execute `cycle_simulations_uniform.R` to reproduce the experiments and generate output data for the *3-cycle* of Fig. 9, and the error terms samples from an Uniform distribution.
    - Execute `plots.R` to reproduce Fig. 12 from the main paper, and Fig.1-2 from the supplement.

3. Model Equivalence (Macaulay2)

This folder contains the Macaulay2 code for the model identification algorithm described in Theorem 6.2, and to reproduce the experiments from Example 6.1.

Contents:

- **model_identification.m2**: Macaulay2 script containing the code for the algorithm described in Theorem 6.2.
- **example_script.m2**: Macaulay2 script to with a simple example of how to use the algorithm.
- **experiment_from_the_paper.m2**: Macaulay2 script to replicate the reproduce the experiments from Example 6.1.

Instructions:

1. **Setup Environment**:
   - Ensure you have Macaulay2 installed. Download it from Macaulay2 official website.
2. **Run the Script**:
   - Open Macaulay2 and load the script:

     ```
     load "model_identification.m2"
     ```

   - Follow the instructions within the script to replicate the experiments.