Plan Overview

A Data Management Plan created using UCT DMP

Title: Predictive Control of BDD Growth: Reinforcement Learning for Dynamic Variable Reordering

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Template: UCT Student Generic DMP

Project abstract:

This project studies how learning can improve symbolic methods for Boolean reasoning when computational cost is driven by representation size. I study this question through Binary Decision Diagrams, a canonical representation of Boolean functions in which tasks such as satisfiability, model counting, and equivalence checking are polynomial-time in the size of the diagram, and composing diagrams under Boolean operations is likewise polynomial in the sizes of the inputs. The central challenge is therefore to keep representations compact as large Boolean functions are built compositionally from smaller ones over time. In BDDs, this challenge is governed by variable ordering, which determines diagram size and therefore the cost of reasoning and composition. I formulate dynamic variable reordering as a predictive control problem and develop a neurosymbolic reinforcement learning framework in which neural models guide reordering decisions from diagram structure, while the symbolic system provides canonical states, deterministic transitions, and lookahead. The goal is to improve the scalability of BDD-based Boolean reasoning and to provide a concrete example of neural and symbolic methods working together on a fundamental computational bottleneck.

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Copyright information:

Predictive Control of BDD Growth: Reinforcement Learning for Dynamic Variable Reordering - Student Outline DMP

1. General guidelines

PURPOSE OF THIS TEMPLATE

The purpose of the Outline DMP is to indicate your initial plans for how your data will be collected, shared and stored, and to give you a chance to think about these data-focused aspects of the research process. As your begin doing your research, your data process may change, and it is perfectly acceptable to change your data management plan to accommodate the changes in your research process.

Indicate below that you understand the purpose of completing this Outline DMP template.

- I understand the Outline DMP template is a projection of my anticipated data management planning requirements and should be updated as my project develops.

2. Authors and supervisors

PROJECT NAME

Replicate the title of your project, dissertation or thesis exactly as it appears in your proposal document.

Predictive Control of BDD Growth: Reinforcement Learning for Dynamic Variable Ordering

PERSONAL DETAILS

Indicate the name(s) and student number(s) of the student(s) who will be involved in this project, dissertation or thesis.

Luke Slater, SLTLUK001

SUPERVISOR(S) DETAILS

Indicate who will supervise this project, dissertation or thesis. If you do not yet have a supervisor, leave this section blank.

Primary Supervisor: Thomas Meyer
Co-Supervisor: Deshendran Moodley

3. Data Collection/Generation

ORIGINAL DATA

Indicate whether you will collect or produce original data for your study. If yes, briefly describe the type of data and how you plan to manage it.
If you are unsure at this time, indicate what you think you are most likely to collect. If you are not intending to gather or collect your own data, declare that here.

- I do not intend to collect original data

DATA RE-USE

Indicate if you intend to re-use existing data, either from online searches or from datasets provided by your supervisor, lab, or funder.
If you are not intending to re-use existing data, declare that here. Also note any restrictions that apply to the re-use of data.

- I intend to reuse existing data in my study (described below).

This project does not involve the collection of personal, sensitive, or human-subject data. Instead, it uses Boolean functions drawn from publicly available datasets that have been created specifically for this research purpose. The project may also generate derived data through preprocessing, standardisation, dataset splitting, and model evaluation.

DATA SENSITIVITY & SECURITY

Indicate whether your research data may contain sensitive, personal, disclosive, or otherwise at-risk information.

If yes, briefly describe the type of sensitivity involved and the steps you will take to secure and control access to your data.
If you are unsure at this stage, indicate what you think is most likely. If your data is not sensitive, declare that here and state how you will still ensure responsible storage.

- My data is not sensitive or at-risk.

4. Data Storage

DATA SIZE ESTIMATE

Indicate the estimated size of your completed dataset, and indicate whether or not you will need to access additional data storage facilities. If such storage is not provided by your unit or department, you may need to factor in the cost of purchasing additional storage space.

- 20GB or less

DATA BACKUPS

Indicate how you plan to ensure your data is secure and retrievable in case of errors or hardware failure. Describe what procedures you will put in place to back-up copies of your data and where they will be stored.

- I intend to backup my data using a service provided by UCT (UCT GoogleDrive, UCT OneDrive, Netstorage, ZivaHub etc.).

5. Data Sharing/Publication

DATA SHARING

According to UCT's Research Data Management policy, research data should be made open by default, with provisions for making it closed in specific cases (such as ethical considerations or potential commercialisation).

Indicate whether you plan to publish your research data.
• If yes: say where you will publish it and what licence (e.g., Creative Commons) you will use.
• If no: explain why, and refer to any ethical issues, commercial or patent intentions, or data-use agreements that prevent publication.

- I intend to share my data (details below).

DATA DESCRIPTION

What information will you include to help others understand and use your dataset?
(For example: a short description of your study, explanations of variables, survey questions, or keywords. These are known as metadata.)

I am using existing datasets.

6. Budget

BUDGET

Indicate any costs specifically relating to the management and curation of your data, such as purchasing additional storage space, digitisation of physical media, data storage or curation charges, and data audits. Most student research will be able to make use of free options provided by UCT and will not have to budget for data costs.

- I do not anticipate any data costs as my data is less than 10GB, and I will be using a storage system provided by UCT (UCT GoogleDrive, UCT OneDrive, Netstorage, ZivaHub, etc.) to curate my data.