Jinqiang Yu

PhD Candidate at Monash University

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Summary

I am passionate about machine learning and AI areas, with experience in solving real-world problems with the use of machine/deep learning and optimisation techniques. I am strongly skilled in programming languages, in particular, Python and its packages, e.g. PyTorch, Tensorflow. With the enthusiasm and experience in machine learning and AI areas, I am expecting to utilise my strong technical skills to contribute to real-world projects and gain valuable industry experience.

Education

Monash University *Melbourne, Australia*

PhD in Data Science & AI *Feb 2021 - Current*

- **Thesis Topic**: Explainable AI with the Use of Incremental Formal Reasoning
- **Supervisors**: Prof. Peter J. Stuckey, Dr. Alexey Ignatiev
- **Thesis Description**: In this PhD project, we focus on developing approaches to generating interpretable machine learning models, e.g. decision trees, decision sets and decision lists, as well as computing correct and succinct explanations for predictions in machine/deep learning models.

Monash University *Melbourne, Australia*

Master of Information Technology *Mar 2019 - Dec 2020*

- Graduated with H1
- **Core units**: Master Minor Thesis, Applied Data Analysis, Data Processing for Big Data, Statistical Data Modelling, Algorithm and Data Structure.
- **Minor Thesis Topic**: Computing optimal interpretable models.
- **Thesis Description**: The thesis focuses on the most interpretable models, e.g. decision trees/sets/lists, aiming at developing advanced approaches to computing machine learning models that are both accurate and interpretable.

Publications

Eliminating the Impossible, Whatever Remains Must Be True: On Extracting and Applying Background Knowledge in the Context of Formal Explanations
Jinqiang Yu, Alexey Ignatiev, Peter J. Stuckey, Nina Narodytska, Joao Marques-Silva
37th AAAI Conference on Artificial Intelligence (AAAI), 2023

Learning Optimal Decision Sets and Lists with SAT
Jinqiang Yu, Alexey Ignatiev, Peter J Stuckey, Pierre Le Bodic
Journal of Artificial Intelligence Research 72 (2021) pp. 1251–1279. 2021

Computing Optimal Decision Sets with SAT
Jinqiang Yu, Alexey Ignatiev, Peter J. Stuckey, Pierre Le Bodic
26th International Conference on Principles and Practice of Constraint Programming (CP), 2020

Skills

Proficient in Python, Java, R, SQL

Familiar with C/C++, Spark, MongoDB, MATLAB, MiniZinc

Experience with data analysis, machine learning and optimisation libraries such as pandas, numpy, scikit-learn, TensorFlow, PyTorch, and PySAT

Experience

Monash University *Melbourne, Australia*

Teaching Associate *Jun 2021 - Nov 2021*

- Tutoring and grading students in tutorials, assignments, and final exams.
- **Unit**: FIT5220 - Solving discrete optimisation problems.
- **Topics**: Constraint Programming, Mixed Integer Programming, Boolean Satisfiability (SAT) Solving, Local Search, Large Neighbourhood Search.

Research Projects

Learning Optimal Interpretable Machine Learning Models

- In order to make explanations easy for humans to understand the interpretable models, e.g. decision trees, lists and sets, they should be as concise as possible. In addition, such models should provide accurate predictions such that humans can make proper decisions based on the predictions. Therefore, this project focuses on devising approaches to computing interpretable ML models that are both small in size and accurate, making use of modern formal reasoning.
- **Technical Skills:** Python, XGBoost, scikit-learn, PySAT.

Computing Succinct and Accurate Explanations

- In recent years the growing practical AI and ML applications have given the rise to Explainable AI (XAI). One of the major approaches to XAI is to compute explanations to ML predictions on demand, including post-hoc (*abductive*) explanations answering a "*why?*" question and (*contrastive*) explanations targeting a "*why not?*" question. However, these approaches often check combinations of feature values that realistically can never appear in practice, leading to unnecessarily long explanations. In this project, we focus on developing the approach to computing both abductive and contrastive formal explanations making use of background knowledge, which can positively affect the quality of both kinds of explanations.
- **Technical Skills:** Python, PyTorch, XGBoost, scikit-learn, PySAT.

Explainability in Image Classification

- There has been an upsurge in interest in image classification problems in recent years. However, as most models for image classification are black-box models, users cannot understand the prediction made by the models and thus it is hard to trust the predictions. Although existing model-agnostic approaches are able to provide explainability for image predictions, these approaches are known to suffer from fundamental explanation issues. Inspired by the limitation, in this project, we target developing the approach to providing trustable explanations for image predictions in machine/deep learning models, e.g. CNNs.
- **Technical Skills:** Python, Tensorflow, XGBoost, PySAT.

Applying Trustable Explanations in Real-world Scenarios

- Due to the lack of explainability of ML and AI, humans cannot understand the reason behind the predictions made by ML models. For example, Just-In-Time defect prediction has been proposed to enable developers to enforce the priority of limited Software Quality Assurance resources on the most risky commits. Unfortunately, practitioners cannot know why a commit is predicted as defect-introducing and also cannot know how they should mitigate the risk because of the lack of explainability of defect models. Motivated by the limitation, this project aims at developing approaches to applying explainable AI in practical scenarios such that users can trust the predictions made by ML models and also find an explainable way to change the decision.
- **Technical Skills:** Python, XGBoost, scikit-learn, PySAT.

Awards and Scholarships

2021-2025	**Monash Graduate Scholarship**	Scholarship covers living expenses
2021-2025	**International Postgraduate Research Scholarship**	Scholarship covers tuition
2020	**Best Paper Award**	Our paper "Computing Optimal Decision Sets with SAT" has been selected for the Best Paper Award for the CP/ML Track of CP 2020.

References available upon request.