

Research School of Computer Science

Intelligence

Systems

Theory



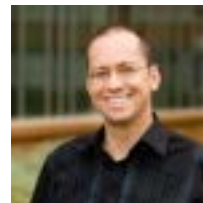
Christen Wang Hutter Lloyd Xie Renz Gould Reid Williamson Haslum Hijazi Thieboux

- Artificial Intelligence (AI) is the scientific discipline that will likely have the greatest impact on our society over the next 50 years, with a wide range of applications in all areas.
- Our theoretical and applied AI research has repeatedly been ranked the best in Australia.
- We cover a wide range of subfields within AI.
- Our members are international leaders in their fields and hold prestigious fellowships.
- We intensely collaborate with academia, government and industry
- We have strong ties with NICTA/Data61, with adjuncts and secondments in both directions
- We have a large number of excellent PhD students

Problem Domain

We develop techniques for discovering novel and useful knowledge in large databases, with a focus on integrating data from diverse sources by linking records across different databases that correspond to the same entities. Our work addresses computational and privacy aspects of data integration.

Data linkage / entity resolution
Active learning for data linkage
Population informatics
Privacy technologies
Advanced data integration



Christen



Wang



Vatsalan

Impact & Recognition

- Standard reference book 'Data Matching' (Springer) by P Christen
- Widely used open source software 'Febrl' (Freely Extensible Biomedical Record Linkage)
- Research collaborations with 'Digitising Scotland' and 'Minnesota Population Center'
- Industry collaborations with NSW Health, Veda, Fujitsu Laboratories

Problem Domain

We are working on the theory and applications of spatial and temporal reasoning. This includes areas such as navigation, GIS, sensor networks, video games, calendar management. We have a particular interest in predicting consequences of physical actions and selecting actions that have no undesired consequences

Spatial Reasoning

Intelligent Navigation

Change and Trend Prediction

Physical Reasoning

Robust and Beneficial AI



Renz

Impact & Recognition

- Collaborative research with domestic and international partners
- ARC Future Fellowship and competitive grants
- International research leadership

Angry Birds AI Competition

Spatial Information Systems

Problem Domain

We develop algorithms that help us make sense of data. This is useful for making predictions based on uncertain or incomplete information.

We are advancing machine learning to help making better decisions.

Social Media Analysis

Visual Intelligence

Recommender Systems

Biomedical Applications

Trend Prediction

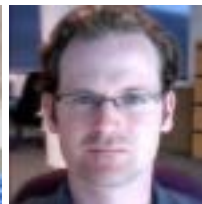
Economic Modeling



Xie



Gould



Reid



Williamson



Rizoiu

Impact & Recognition

- Collaborative research with academia and industry, both domestic and overseas
- Award winning and highly cited research
- Prestigious fellowships and memberships in learned societies

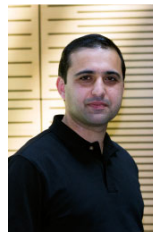
Problem Domain

Conceive **model-based autonomous or decision-support systems** which diagnose, plan, schedule, coordinate and optimise their actions to achieve complex objectives at least cost.

Automated planning
Diagnosis & diagnosability
Nonlinear optimisation
Discrete-continuous systems
Uncertainty, robustness & risk
Future energy applications



Haslum



Hijazi



Thiébaux



Gordon



Scott



Scala

Impact & Recognition

International Standing

“World’s top 1 in Automated Planning” [reviewers]

Award-Winning Research

20+ paper/thesis/excellence awards [past 5 years]

International & Multi-Disciplinary Collaborations

MIT (AFOSR), KCL (ARC), UMichigan, LANL, CNRS, Tasnetworks & Reposit (ARENA), Hivery spinout

Open Source Software

HSP, Powertools, SmartgridToolbox

Problem Domain

While specialised intelligent systems are meanwhile pervasive, we develop rigorous foundations for **General Intelligent Agents**. This is a prerequisite for the development of more flexible, adaptive, robust, reliable, and secure software that our modern society needs.

Robots and Agents

Active Learning

Adaptive Control

Philosophy of Mind

AI Safety



Hutter



Lloyd

Impact & Recognition

- We developed the theory of Universal AI, which provides a unified foundation for intelligent agents
- We provide information-theoretic, statistical, and philosophical foundations of AI
- Interdisciplinary theoretical research
- Widely used theory, particularly in Philosophy

General Artificial Intelligence

Problem

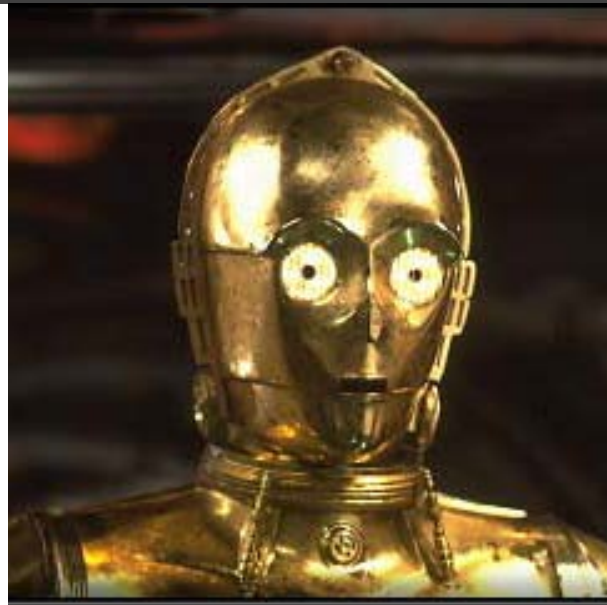
Specialised intelligent systems are already pervasive, but *general* ones are still out of reach.

Insight

We have developed *unified* information-theoretic foundations for intelligent agents

Impact

The developed theory is a prerequisite for the development of *more flexible, adaptive, robust, reliable, and secure software that our modern society needs*, and provides a gold standard and valuable guidance for researchers working on smart software.



Marcus Hutter

Collaborators

DeepMind

Resources

<http://www.hutter1.net/>

Universal Artificial Intelligence

$$\begin{aligned} &= \\ \text{Decision Theory} &= \text{Probability} + \text{Utility Theory} \\ &+ \\ \text{Universal Induction} &= \text{Ockham} + \text{Bayes} + \text{Turing} \end{aligned}$$

Information-theoretic, Statistical, and Philosophical Foundations of AI