Mark Law | Curriculum Vitae

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Research Interests

I am a Research Associate in the Department of Computing at Imperial College London. I have a keen interest in computational logic, specifically both applied and fundamental research in logic-based machine learning and knowledge representation.

Education

Imperial College London
PhD Computer Science (Teaching Scholarship) *2013–2018*

Title: *Inductive Learning of Answer Set Programs*

Supervisors: Professor Alessandra Russo and Dr Krysia Broda

Imperial College London
PG Certificate in University Teaching and Learning *2015–2017*

Imperial College London
MSci Mathematics and Computer Science, First Class Honours *2009-2013*

Final Year Project: *General Card Game Playing* (85%)

Employment

ILASP Limited **London**
Director *June 2019 – present*

Imperial College London **London**
Research Associate *November 2018 – present*

Imperial College London **London**
Research Assistant *March 2018 – November 2018*

Formicary **London**
Summer Internship *July 2013 – September 2013*

Qualcomm Research **Cambridge**
Summer Internship *June 2012 – September 2012*

Membership of Professional Bodies

Fellow of the Higher Education Academy (FHEA) *2016 – present*

Prizes & Awards

IBM PhD Fellowship *2016*

This prestigious fellowship was awarded to 52 PhD students worldwide in 2016. I was the only student in the UK to receive the fellowship in 2016.

Department of Computing Graduate Teaching Assistant award *2015*

Runner up: Faculty of Engineering Graduate Teaching Assistant award *2015*

Donald Davies Memorial Prize *2013*

Best final year individual project in Joint Mathematics and Computing, Imperial College London

Research Experience

TODO *2021 – present*

For this project, I will be applying Logic-based learning methods on data from the Office for National Statistics COVID-19 Survey.

EU Horizon 2020 – RADON *2019 – present*

I have been developing a constraint specification language and an ASP-based verification tool for a new serverless computing framework.

DAIS-ITA *2018 – present*

For this project, I have created a new type of context-sensitive ASP-based grammar, which can be learned using ILASP. This work has enabled the learning of "generative policies". I have also developed the FastLAS system for logic-based machine learning.

EU FP7 Project – Allow Ensembles *2015 – 2016*

This project explored various aspects of cognitive computing within the area of collective adaptive systems for smart city environments. I applied ILASP to learning human readable journey preferences from examples of journeys users preferred over other journeys.

EPSRC Project – Privacy Dynamics *2015 – 2016*

One of the aims of this project was to develop computational techniques for privacy management in social networks. I used ILASP to learn declarative privacy preferences in social networks from observations of sharing behaviours.

Software

ILASP `http://www.ilasp.com/`

ILASP (Inductive Learning of Answer Set Programs) is the first system capable of learning ASP (Answer Set Programming) programs from examples. It can learn declarative, human readable, representations of knowledge, including hard and soft constraints from partial information.

FastLAS `https://github.com/spike-imperial/FastLAS`

FastLAS is a highly scalable approach to Logic-based Learning. It (currently) less expressive than ILASP, but is able to solve learning tasks with search spaces that are many orders of magnitude larger.

ASG `https://github.com/spike-imperial/ASG`

Answer Set Grammars (ASGs) are a new approach to representing context-sensitive grammars by using ASP to annotate a context-free grammar with semantic constraints. The ASG solver is able to generate the language of a given ASG, or learn (using ILASP) an ASG from examples.

Lecturing

Logic-based Learning *2015-2020*

From 2015 to 2018, I taught 25% of the course, on non-monotonic logic-based learning frameworks, including one lecture on my own PhD research. From 2019, I expanded my part of the course to 40%, including new lectures on more recent approaches to logic-based learning.

Introduction to Model-based Artificial Intelligence *2018-2020*

I taught 20% of the course, covering Answer Set Programming (ASP).

PhD Co-supervision

Daniel Cunnington *2020–present*

Daniel Furelos Blanco *2018–present*

Supervision and Co-supervision

I have supervised many Msc and undergraduate projects in the areas of program synthesis, general game playing and logic-based learning, which are detailed below.

Elliot Greenwood *2018*

Title: Learning Player Strategies Using Weak Constraints

Award: The Corporate Partnership Programme Award

Ivan Procaccini *2018*

Title: Learning Socially-Compliant Navigation Policies for Mobile Robot Navigation in Human Environments

Damiaan Twelker *2017*

Title: Inductive Inference from Latent Generative Factors

Kevin Tsui *2017*

Title: Learning Scheduling Preferences using Inductive Logic Programming

Flaviu Miron *2017*

Title: Learning how to manipulate blocks using Inductive Logic Learning

Piotr Chabierski *2017*

Title: Logic-based Approach to Machine Comprehension of Text

Award: Winton Capital Applied Undergraduate Project Prize

Shuang Xia *2017*

Title: Extracting Symbolic Knowledge from Neural Networks

Sean Dewhurst Naderi *2016*

Title: Genetic approach to Inductive Logic Programming under the Answer Set Semantics

Nikolay Paleshnikov *2016*

Title: Parallelizing Inductive Logic Programming in ASP

Lukas Majercak *2016*

Title: Synthesis and Revision of Imperative Programs

James Rodden *2016*

Title: Synthesis of Functional Programs using Answer Set Programming

Stanislav Dragiev *2016*

Title: An Abductive-Inductive Algorithm for Probabilistic Inductive Logic Programming

Award: The Corporate Partnership Programme Award

Joseph Crowe *2015*

Title: Synthesis of Simple While Programs Using Answer Set Programming

Timothy van Bremen *2015*

Title: PASPAL: A parallel logic-based learning system

Other Teaching

As a teaching scholar I was involved with various aspects of teaching in the department. My main responsibilities were:

- **Small group tutorials:** I ran logic tutorials for groups of first year undergraduates. I started this teaching activity initially as undergraduate teaching assistant in the third and fourth years of my undergraduate degree.
- **Lab Exercises:** I developed lab material and exercises for first year programming courses.
- **LabTS:** I implemented a web application called LabTS, which allowed students to run their programming courseworks before submission, against some sample tests in our departmental auto testing environment. This system was required to interface with many of the other department services such as the department teaching database and GitLab. It made use of frameworks such as AngularJS, Ruby on Rails and Docker. The system is being used extensively within the department.

Invited Talks

Logic-based Machine Learning of Answer Set Programs
IBM TJ Watson Research Center, New York, USA *September 20th 2016*

Inductive Learning of Answer Set Programs
University of Sussex *March 6th 2019*

Inductive Learning of Answer Set Programs
Schloss Dagstuhl *May 14th 2019*
Dagstuhl Seminar: Approaches and Applications of Inductive Programming

Representing and Learning Grammars in Answer Set Programming
Schloss Dagstuhl *May 16th 2019*
Dagstuhl Seminar: Approaches and Applications of Inductive Programming

Inductive Learning of Answer Set Programs
University of Oxford *June 11th 2019*

Logic-based Learning of Answer Set Programs
New Mexico, USA *September 21st 2019*
Autumn School on Logic Programming

Logic-based Learning of Answer Set Programs
Bolzano, Italy *September 24th 2019*
The 15th Reasoning Web Summer School

Inductive Learning of ASP and Answer Set Grammars
Imperial College London *October 24th 2019*
Language and Communication Intelligence (LaCI) Seminar

Inductive Learning of Answer Set Programs
University of Milan *April 8th 2021*

Service

IJCAI — *Program Committee Member*

RuleML — *Program Committee Member*

StaRAI — *Program Committee Member*

ILP — *Program Committee Member*

ILP — *Competition Chair and Webmaster (2016)*

Designed and ran the first international competition on ILP, which included creating a new dataset for the competition.

Annals of Mathematics and Artificial Intelligence (special issue on Commonsense) — *Reviewer*

Machine Learning Journal (special issue on Inductive Logic Programming) — *Reviewer*

Journal Submissions Under Review

[1] Mark Law. Conflict-driven inductive logic programming. *Theory and Practice of Logic Programming (Under Review)*, 2021.

[2] Daniel Furelos-Blanco, Mark Law, Alessandra Russo, Krysia Broda, and Anders Jonsson. Induction and exploitation of subgoal automata for reinforcement learning. *Journal of Artificial Intelligence Research (Under Review)*, 2021.

Journal Publications

[3] Andrew Cropper, Richard Evans, and Mark Law. Inductive general game playing. *Machine Learning*, 2019.

[4] Mark Law, Alessandra Russo, and Krysia Broda. Inductive Learning of Answer Set Programs from Noisy Examples. *Advances in Cognitive Systems*, 2018.

[5] Mark Law, Alessandra Russo, and Krysia Broda. The complexity and generality of learning answer set programs. *Artificial Intelligence*, 2018.

[6] Mark Law, Alessandra Russo, and Krysia Broda. Iterative Learning of Answer Set Programs from Context Dependent Examples. *Theory and Practice of Logic Programming*, 16(5-6):834–848, 2016.

[7] Mark Law, Alessandra Russo, and Krysia Broda. Learning weak constraints in answer set programming. *Theory and Practice of Logic Programming*, 15(4-5):511–525, 2015.

Conference Publications

[8] Mark Law, Alessandra Russo, and Krysia Broda. The ILASP System for Inductive Learning of Answer Set Programs. *The Association for Logic Programming Newsletter*, 2020.

[9] Mark Law, Alessandra Russo, Bertino Elisa, Broda Krysia, and Lobo Jorge. FastLAS: Scalable Inductive Logic Programming Incorporating Domain-specific Optimisation Criteria. In *AAAI*, 2020.

[10] Daniel Furelos-Blanco, Mark Law, Alessandra Russo, Krysia Broda, and Anders Jonsson. Induction of subgoal automata for reinforcement learning. In *AAAI*, 2020.

[11] Amani Abu Jabal, Elisa Bertino, Jorge Lobo, Mark Law, Alessandra Russo, Seraphin Calo, and Dinesh Verma. Polisma-a framework for learning attribute-based access control policies. In *European Symposium on Research in Computer Security*, pages 523–544. Springer, 2020.

[12] Mark Law, Alessandra Russo, Bertino Elisa, Broda Krysia, and Lobo Jorge. Representing and Learning Grammars in Answer Set Programming. In *AAAI*, 2019.

[13] Mark Law, Alessandra Russo, and Krysia Broda. Logic-based learning of answer set programs. In *Reasoning Web. Explainable Artificial Intelligence*, pages 196–231. Springer, 2019.

[14] Daniel Cunnington, Mark Law, Geeth de Mel, Irene Manotas, Elisa Bertino, Seraphin Calo, and Dinesh Verma. Towards a learning-algorithm agnostic generative policy model for coalitions. In *Artificial Intelligence and Machine Learning for Multi-Domain Operations Applications*, volume 11006, page 110060J. International Society for Optics and Photonics, 2019.

[15] Daniel Cunnington, Graham White, Mark Law, and Geeth de Mel. A demonstration of generative policy models in coalition environments. In *International Conference on Practical Applications of Agents and Multi-Agent Systems*, pages 242–245. Springer, 2019.

[16] Daniel Cunnington, Irene Manotas, Mark Law, Geeth de Mel, Seraphin Calo, Elisa Bertino, and Alessandra Russo. A generative policy model for connected and autonomous vehicles. In *2019 IEEE Intelligent Transportation Systems Conference (ITSC)*, pages 1558–1565. IEEE, 2019.

[17] Elisa Bertino, Alessandra Russo, Mark Law, Seraphin Calo, Irene Manotas, Dinesh Verma, Amani Abu Jabal, Daniel Cunnington, Geeth de Mel, Graham White, et al. Generative policies for coalition systems-a symbolic learning framework. In *2019 IEEE 39th International Conference on Distributed Computing Systems (ICDCS)*, pages 1590–1600. IEEE, 2019.

[18] Benjamin Wu, Alessandra Russo, Mark Law, and Katsumi Inoue. Learning Commonsense Knowledge Through Interactive Dialogue. In *Technical Communications of the 34th International Conference on Logic Programming (ICLP 2018)*. Schloss Dagstuhl-Leibniz-Zentrum fuer Informatik, 2018.

[19] Piotr Chabierski, Alessandra Russo, Mark Law, and Krysia Broda. Machine Comprehension of Text Using Combinatory Categorial Grammar and Answer Set Programs. In *Proceedings of the Thirteenth International Symposium on Commonsense Reasoning, COMMONSENSE 2017, London, UK, November 6-8*, 2017.

[20] Stanislav Dragiev, Alessandra Russo, Krysia Broda, Mark Law, and Calin-Rares Turliuc. An Abductive-Inductive Algorithm for Probabilistic Inductive Logic Programming. In *Proceedings of*

the 26th International Conference on Inductive Logic Programming (Short papers), London, UK, 2016., pages 20–26, 2016.

[21] Gul Calikli, Mark Law, Arosha K Bandara, Alessandra Russo, Luke Dickens, Blaine A Price, Avelie Stuart, Mark Levine, and Bashar Nuseibeh. Privacy dynamics: Learning privacy norms for social software. In *Software Engineering for Adaptive and Self-Managing Systems (SEAMS), 2016 IEEE/ACM 11th International Symposium on*, pages 47–56. IEEE, 2016.

[22] Duangtida Athakravi, Ken Satoh, Mark Law, Krysia Broda, and Alessandra Russo. Automated Inference of Rules with Exception from Past Legal Cases Using ASP. In *Logic Programming and Nonmonotonic Reasoning - 13th International Conference, LPNMR 2015, Lexington, KY, USA, September 27-30, 2015. Proceedings*, pages 83–96, 2015.

[23] Mark Law, Alessandra Russo, and Krysia Broda. Inductive Learning of Answer Set Programs. In *Logics in Artificial Intelligence - 14th European Conference, JELIA 2014, Funchal, Madeira, Portugal, September 24-26, 2014. Proceedings*, Lecture Notes in Computer Science, pages 311–325. Springer, 2014.

Newsletter Publications

[24] Mark Law, Alessandra Russo, and Krysia Broda. The ILASP System for Inductive Learning of Answer Set Programs. *The Association for Logic Programming Newsletter*, 2020.

Workshop Publications

[25] Seraphin Calo, Irene Manotas, Geeth de Mel, Daniel Cunnington, Mark Law, Dinesh Verma, Alessandra Russo, and Elisa Bertino. Agenp: An asgrammar-based generative policy framework. In *Policy-Based Autonomic Data Governance*, pages 3–20. Springer, 2019.