



**FORM 100**  
**Personal Data Form**  
**PART I**

Date  
2010/10/21

|                      |                     |                                     |  |
|----------------------|---------------------|-------------------------------------|--|
| Family name<br>Poole | Given name<br>David | Initial(s) of all given names<br>DL | Personal identification no. (PIN)<br>16877 |
|----------------------|---------------------|-------------------------------------|--|

I hold a faculty position at an eligible Canadian college (complete Appendices B1 and C)

I do not or will not hold an academic appointment at a Canadian postsecondary institution

Place of employment other than a Canadian postsecondary Institution (give address in Appendix A)

**APPOINTMENT AT A POSTSECONDARY INSTITUTION**

|  |  |
|--|--|
| Title of position<br>Professor                         | Tenured or tenure-track academic appointment<br>Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>  |
| Department<br>Computer Science                         | Part-time appointment <input type="checkbox"/> Full-time appointment <input checked="" type="checkbox"/>   |
| Campus<br>Vancouver                                    | <ul style="list-style-type: none"> <li>For all non-tenured or non tenure-track academic appointment and Emeritus Professors, complete Appendices B &amp; C</li> <li>For life-time Emeritus Professor and part-time positions, complete Appendix C</li> </ul> |
| Canadian postsecondary institution<br>British Columbia |  |

**ACADEMIC BACKGROUND**

| Degree     | Name of discipline | Institution                    | Country   | Date<br>yyyy/mm |
|------------|--------------------|--------------------------------|-----------|-----------------|
| Bachelor's | Mathematics        | Flinders University            | Australia | 1979 / 05       |
| Doctorate  | Computer Science   | Australian National University | Australia | 1984 / 05       |
|            |                    |                                |           |                 |
|            |                    |                                |           |                 |

**TRAINING OF HIGHLY QUALIFIED PERSONNEL**

Indicate the number of students, fellows and other research personnel that you:

|               | Currently  |               | Over the past six years (excluding the current year) |               | Total |
|---------------|------------|---------------|--|---------------|-------|
|               | Supervised | Co-supervised | Supervised   | Co-supervised |       |
| Undergraduate |            |               |  | 7             | 7     |
| Master's      |            |               | 3  | 1             | 4     |
| Doctoral      | 2          | 1             | 2  |               | 5     |
| Postdoctoral  |            | 1             |  | 1             | 2     |
| Others        |            |               |  |               |       |
| Total         | 2          | 2             | 5  | 9             | 18    |

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Family name

Poole

**ACADEMIC, RESEARCH AND INDUSTRIAL EXPERIENCE (use one additional page if necessary)**

| Position held (begin with current) | Organization                   | Department       | Period (yyyy/mm to yyyy/mm) |
|------------------------------------|--------------------------------|------------------|-----------------------------|
| Professor                          | British Columbia               | Computer Science | 1998/07                     |
| Associate Professor                | University of British Columbia | Computer Science | 1993/07<br>to 1998/06       |
| Assistant Professor                | University of British Columbia | Computer Science | 1988/07<br>to 1993/06       |
| Assistant Professor                | University of Waterloo         | Computer Science | 1985/07<br>to 1988/06       |
| Postdoctoral Fellow                | University of Waterloo         | Computer Science | 1983/12<br>to 1985/06       |

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16877

Family name

Poole

**RESEARCH SUPPORT**

| Family name and initial(s) of applicant  | Title of proposal, funding source and program, and time commitment (hours/month)   | Amount per year                                | Years of tenure (yyyy)               |
|--|--|--|--------------------------------------|
| List all sources of support (including NSERC grants and university start-up funds) held as an applicant or a co-applicant: a) support held in the past four (4) years but now completed; b) support currently held, and c) support applied for. For group grants, indicate the percentage of the funding directly applicable to your research. Use additional pages as required. |  |  |                                      |
| <b>a) Support held in the past 4 years</b>   |  |  |                                      |
| David Poole  | Interaction of Log-Probabilities and Taxonomic Hierarchies<br>MITACS<br>MITACS Internship<br><br>6 hours/month   | 15,000(100%)                                   | 2006                                 |
| D. Poole and G. Carenini   | Applying prior probabilities and aristotelian class definitions to improving for metallurgical study purposes, the quality of computer-derived similarity rankings between descriptions of mineral depos<br>MITACS<br>MITACS-Accelerate<br><br>6 hours/month | 15,000(100%)                                   | 2010                                 |
| <b>b) Support currently held</b>   |  |  |                                      |
| David Poole  | Probabilistic Reasoning With Rich Representations<br>NSERC<br>Discovery Grant<br><br>40 hours/month  | 57,000<br>57,000<br>57,000<br>57,000<br>57,000 | 2006<br>2007<br>2008<br>2009<br>2010 |

# 1 Most Significant Contributions to Research

**Semantic Science:** I anticipate that a major impact of AI on society will be for automating decision making on both personal and societal levels, e.g., in diagnosis or public policy. Most people currently find information using search engines that give results based on popularity and appeal to authority. Scientists know that these are not the best way to determine truth. The alternative is to believe the prediction that best fits all of the evidence. We have been developing the theory and applications of what we call “semantic science” where predictions are evaluated on all of the data available, and where the data and the predictions inter-operate with rich ontologies. I have been working with Clinton Smyth, a practicing geologist, Rita Sharma and Jacek Kisyński (recent Ph.D. graduates), on developing the vision, while keeping it grounded in real applications. We have outlined the vision of semantic science (items #32, #23, #21, #27). We have also been working on applying the vision to landslide susceptibility and minerals exploration, first using qualitative probabilities (items #17, #20) and later with numerical probabilities (items #26, #2). Part of the problem is designing ontologies that are both natural to practitioners and facilitate probabilistic modelling. We have developed a design methodology for ontologies based on Aristotelian definitions that we believe fits both goals (item #3). A Ph.D. student, Mark Crowley, is developing and applying AI techniques to spatial-temporal decision making, applied to forestry (item #11).

**Combining Probability and Logic** The Independent Choice Logic (ICL) and its predecessor, Probabilistic Horn Abduction, was one of the first combinations of logic and probability, that included independence assumptions as in belief (Bayesian) networks, and also included logical variables, context-specific independence and tools for multi-agent decisions. There has been recent interest in this area (e.g., a European project to build a robust implementation of a relational probabilistic model, chose ICL as the basis for their system, which they called ProbLog). See items #33 and #31. I have also been working on the (considerably more difficult) problem of the probabilities of existence and identity; see item #12.

**Efficient probabilistic inference:** Nevin Zhang and I have been attributed with inventing Variable Elimination for probabilistic inference (Canadian AI conference 1994, JAIR 1996), which is now regarded as the most basic exact inference method in Bayesian networks that exploits conditional independencies. Work with Rita Sharma (item #15) has shown how to do probabilistic inference with large structured domains. Jacek Kisyński and I have been working on the problem of lifted probabilistic inference, where the idea is to carry out inference in relational probabilistic models without grounding. This was based on my IJCAI-03 paper that first proposed the idea, and has resulted in items #9, and #10.

**Preference elicitation:** Craig Boutilier, Ronen Brafman, Carmel Domshlak, Holger Hoos and I developed a representation for qualitative preferences that exploits conditional ceteris paribus preferences (item #6). This paper won the 2009 IJCAI-JAIR Best Paper Prize. This is the basis for algorithms that combine preferences (to determine what is desirable) and constraints (to specify what is possible) to find most desirable possible configurations (item #5).

**Design Space of AI** Alan Mackworth and I have completed a new AI textbook (item #29). Part

of writing such a book is to tell a coherent story of the whole field. We have developed a design space of AI to explain current research and how little of the space of possible designs researchers have explored (see item #14). As part of developing a coherent view of the field, we have developed a number of teaching tools that let students explore basic AI techniques, called AIspace (formerly CIspace). See items #18, #4 and #23. These tools have been built by undergraduate summer students, and provide a way for students to explore the potential and limits of AI algorithms in a low cost way.

## 2 Research Contributions and Practical Applications

### Journals

1. **Michael Chiang** and David Poole, “Reference Classes and Relational Learning”, *International Journal of Approximate Reasoning*, accepted subject to minor revisions, July 2010.
2. **Rita Sharma**, David Poole and Clinton Smyth, “A Framework for Ontologically-Grounded Probabilistic Matching”, *International Journal of Approximate Reasoning*, 51(2), 240-262, January 2010.
3. David Poole, Clinton Smyth and **Rita Sharma**, “Ontology Design for Scientific Theories That Make Probabilistic Predictions”, *IEEE Intelligent Systems*, Special Issue on Semantic Scientific Knowledge Integration, pages 27-36. Jan/Feb 2009.
4. **Saleema Amershi**, Giuseppe Carenini, Cristina Conati, Alan K. Mackworth and David Poole, “Pedagogy and Usability in Interactive Algorithm Visualizations Designing and Evaluating CIspace”, *Interacting with Computers*, Volume 20, Issue 1, January 2008, Pages 64-96.
5. Craig Boutilier, Ronen I. Brafman, Carmel Domshlak, Holger Hoos, and David Poole, “Preference-Based Constrained Optimization with CP-nets,” *Computational Intelligence, Special Issue on Preferences in Artificial Intelligence and Constraint Processing*, 20(2), 137-157, 2004.
6. Craig Boutilier, Ronen I. Brafman, Carmel Domshlak, Holger Hoos, and David Poole “CP-nets: A Tool for Representing and Reasoning with Conditional Ceteris Paribus Preference Statements”, *Journal of AI Research*, Volume 21, pages 135-191, 2004.
7. Nando de Freitas, **Richard Dearden**, **Frank Hutter**, **Ruben Morales-Menendez**, **Jim Mutch** and David Poole. “Diagnosis by a waiter and a Mars explorer”, *Proceedings of the IEEE, special issue on Sequential State Estimation*, 94(3), 455–468, March 2004.

### Refereed Conference Proceedings

8. David Poole, Towards a Logic of Feature-Based Semantic Science Theories, in *Proceedings of the Twelfth International Conference on the Principles of Knowledge Representation and Reasoning (KR 2010)*, Toronto, May 2010, (short paper) pages 587-589.
9. **Jacek Kisyański** and David Poole, Lifted Aggregation in Directed First-order Probabilistic Models, Proc. 21st. International Joint Conference on Artificial Intelligence (IJCAI),

- Pasadena, CA, July 2009, pages 1922-1929. Also presented at Workshop on Statistical Relational Learning, Belgium, July 2009.
10. **Jacek Kisyński** and David Poole, Constraint Processing in Lifted Probabilistic Inference, Proc. 25th Conference on Uncertainty in AI, (UAI-2009), Montreal, Canada, June 2009, pages 293-302.
  11. **Mark Crowley**, John Nelson and David Poole, Seeing the Forest Despite the Trees: Large Scale Spatial-Temporal Decision Making, Proc. 25th Conference on Uncertainty in AI, (UAI-2009), Montreal, Canada, June 2009, pages 126-134.
  12. David Poole, “Logical Generative Models for Probabilistic Reasoning about Existence, Roles and Identity”, *Proc. Twenty Second AAAI Conference on AI (AAAI-07)*, July 2007, pages 1271-1277.
  13. **Mark Crowley**, Brent Boerlage, David Poole, “Adding Local Constraints to Bayesian Networks”, *Canadian AI Conference*, May 2007.
  14. David Poole and Alan Mackworth, “Dimensions of Complexity of Intelligent Agents”, *International Symposium on Practical Cognitive Agents and Robots*, Perth, November 2006.
  15. **Rita Sharma** and David Poole, “Probabilistic Reasoning with Hierarchically Structured Variables”, *Proc. Nineteenth International Joint Conference on Artificial Intelligence (IJCAI-05)*, Edinburgh, August 2005.
  16. **Peter Carbonetto**, **Jacek Kisyński**, Nando de Freitas, David Poole, “Nonparametric Bayesian Logic”, Proc. 21st Conference on Uncertainty in Artificial Intelligence (UAI 2005), Edinburgh July 2005.
  17. David Poole and Clinton Smyth, “Type Uncertainty in Ontologically-Grounded Qualitative Probabilistic Matching”, *Eighth European Conference on Symbolic and Quantitative Approaches to Reasoning with Uncertainty (ECSQARU-2005)*, Barcelona, July 2005.
  18. **S. Amershi**, **N. Arksey**, G. Carenini, C. Conati, A. Mackworth, H. Maclaren, D. Poole, “Designing CIspace: Pedagogy and Usability in a Learning Environment for AI”, *The 10th Annual Conference on Innovation and Technology in Computer Science Education*, Lisbon, Portugal, June 27-29, 2005.
  19. **Rita Sharma** and David Poole, “Probability and Equality: A Probabilistic Model of Identity Uncertainty”, *Eighteenth Canadian Conference on Artificial Intelligence*, Victoria, May 2005.
  20. Clinton Smyth and David Poole, “Qualitative Probabilistic Matching with Hierarchical Descriptions”, *Ninth International Conference on Principles of Knowledge Representation and Reasoning (KR-2004)*, Whistler, June, 2004.

## Refereed Workshop Proceedings

21. David Poole, Toward an abductive foundation of semantic science, *IJCAI'09 Workshop on Abductive and Inductive Knowledge Development*, Pasadena, CA, July 2009.
22. **Michael Chiang** and David Poole, Incremental EM for Latent-class Relational Models, *Workshop on Statistical Relational Learning, Belgium, July 2009*.

23. **B. Knoll, J. Kisyński**, G. Carenini, C. Conati, A. Mackworth and D. Poole, “AIspace: Interactive Tools for Learning Artificial Intelligence”. In *Proceedings of the AAAI 2008 AI Education Colloquium*. July 2008.
24. David Poole, Clinton Smyth and **Rita Sharma**, “Semantic Science and Machine-Accessible Scientific Theories”, *AAAI Spring Symposium on Semantic Science Knowledge Integration*, Stanford, March 2008.
25. Lionel E. Jackson, Jr., Clinton P. Smyth and David Poole, “HazardMatch: An application of artificial intelligence to landslide susceptibility mapping, Howe Sound area, British Columbia”, *Proc. 4th Canadian Conference on Geohazards: From Causes to Management*. Presse de L’Université Laval, Quebec, 2008.
26. **Rita Sharma**, David Poole and Clinton Smyth, “A System of Ontologically-Grounded Probabilistic Matching”, Uncertainty in AI Applications Workshop, July 2007.
27. Clinton Smyth, David Poole and **Rita Sharma**, Semantic e-Science and Geology, AAAI Workshop on Semantic e-Science, July 2007.
28. **Michael Chiang** and David Poole, “Dynamic Predicate Construction for Learning Relational Concepts”, *Work-in-Progress Proceedings of the 2007 International Conference on Inductive Logic Programming*, June 2007.

### Books and Chapters in Books

29. David Poole and Alan Mackworth, *Artificial Intelligence: Foundations of Computational Agents*, Cambridge University Press, 2010 (680 pages).
30. Maria Fox and David Poole (Eds), *Proceedings of the Twenty-Fourth AAAI Conference on Artificial Intelligence (AAAI-10)*, AAAI Press, July 2010.
31. David Poole, Probabilistic Programming Languages: Independent Choices and Deterministic Systems, in *Heuristics, Probability and Causality: A Tribute to Judea Pearl*, edited by R. Dechter, H. Geffner and J.Y. Halpern, College Publications, 2010, pages 253-269.
32. David Poole, Clinton Smyth, **Rita Sharma** “Semantic Science: Ontologies, Data and Probabilistic Theories” in Paulo C.G. da Costa, Claudia d’Amato, Nicola Fanizzi, Kathryn B. Laskey, Ken Laskey, Thomas Lukasiewicz, Matthias Nickles, and Mike Pool (Eds.), *Uncertainty Reasoning for the Semantic Web I*, Springer LNAI/LNCS, 2008.
33. David Poole, “The Independent Choice Logic and Beyond”, in Luc De Raedt, Paolo Frasconi, Kristian Kersting, and Stephen Muggleton (eds), *Probabilistic Inductive Logic Programming: Theory and Application* LNAI 4911, 2008.

### 3 Other Evidence of Impact and Contributions

34. Program co-chair, *Twenty-Fourth AAAI Conference on Artificial Intelligence AAAI-10* Atlanta, Georgia, USA, July, 2010.
35. 2009 IJCAI-JAIR Best Paper Prize awarded to an outstanding paper published in Journal of AI Research in the preceding five calendar years (for paper #6 above).

36. Elected secretary, *Association for Uncertainty in AI*, (2004–2010).
37. Associate editor, *Artificial Intelligence Journal* (2007-2011).
38. Associate Editor, *International Journal of Approximate Reasoning* (2005–)
39. Invited Speaker, “Probabilistic Relational Learning and Inductive Logic Programming at a Global Scale”, *20th International Conference on Inductive Logic Programming (ILP 2010)*, June 2010.
40. Invited Speaker, “What Should the World-Wide Mind Believe? Knowledge and Uncertainty at a Global Scale”, *23rd International FLAIRS Conference*, May 2010.
41. Invited Tutorial, “Uncertainty with logical, procedural and relational languages”, 22nd Conference on Uncertainty in AI, MIT, Cambridge, MA, July 2006.
42. Invited opening speaker, “Combining logic and probability: a knowledge representation perspective”, Dagstuhl Seminar 05051, Probabilistic, Logical and Relational Learning — Towards a Synthesis, Dagstuhl, Germany, February 2005
43. Invited speaker, “Relations, generalizations and the reference-class problem”, International Conference on Machine Learning, Workshop on Statistical Relational Learning and its Connections to Other Fields, Banff, July 2004.
44. Member AAAI Press Editorial Board 2005–2009, AI magazine Editorial Board 2006–.
45. Senior Program committee for AAAI Annual Conference 2008 and IJCAI-2010. Area chair AAAI 2010.
46. Program Committees for Conferences: International Joint Conference on Uncertainty in AI (IJCAI) 2005, 2009; Uncertainty in AI (UAI) 2004, 2005, 2006, 2009; International Conference on Principles of Knowledge Representation and Reasoning(KR) 2004, 2008; AAAI Conference (AAAI) 2005, 2006, 2007; European Conference on Symbolic and Quantitative Approaches to Reasoning with Uncertainty (ECSQARU) 2005, 2007; European Conference on Artificial Intelligence 2005; Canadian Conference on AI, 2005, 2007; International Symposium on Artificial Intelligence and Mathematics, 2006; International Inductive Logic Programming Conference (ILP), 2009; International Workshop on Statistical Relational Learning (SRL), 2009.
47. I was elected as a Fellow of the Association for the Advancement of Artificial Intelligence (AAAI), in 2000.

## **4 Contributions to the Training of Highly Qualified Personnel (HQP)**

I have been concentrating on supervising Ph.D. students. When I get a good masters student, they want to get a Ph.D. with me (Sharma and Crowley), others come into the Ph.D. to work with me (Kisyński and Chiang), and others transfer to the Ph.D. program (Buchman). I have been supervising 3 Ph.D. students at a time, as that is all I can afford on my research grant.