Natural Sciences and Engineering Research Council of Canada | Conseil de recherches en sciences naturelles et en génie du Canada

FORM 100
Personal Data Form
PART I

Date: 2012/10/02

Family name	Given name	Initial(s) of all given names	Personal identification no. (PIN)
Müller	Martin	MF	**Valid** 242322

☐ 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: Professor

Department: Computing Science

Campus: Alberta

Canadian postsecondary institution: Alberta

Tenured or tenure-track academic appointment — Yes [X] No [ ]

Part-time appointment [ ] Full-time appointment [X]

- For all non-tenured or non tenure-track academic appointment and Emeritus Professors, complete Appendices B & C
- For life-time Emeritus Professor and part-time positions, complete Appendix C

ACADEMIC BACKGROUND

Degree	Name of discipline	Institution	Country	Date yyyy/mm
Master's	Technical Mathematics	Technische Universität Graz	AUSTRIA	1989 / 06
Doctorate	Computer Science	Swiss Federal Inst of Technology Zurich	SWITZERLAND	1995 / 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)		
	Supervised	**Co-supervised**	**Supervised**	**Co-supervised**	**Total**
Undergraduate			3	1	4
Master's	1		2		3
Doctoral	2		2	1	5
Postdoctoral			1	1	2
Others	1		2	1	4
Total	4		10	4	18

Personal information collected on this form and appendices will be stored in the Personal Information Bank for the appropriate program.

PROTECTED WHEN COMPLETED

Version française disponible

Not Completed

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	Alberta	Computing Science	2009/07
Postdoc	NTT Communication Science Laboratories	Media Information Lab	2000/04 to 2000/08
Associate Professor	University of Alberta	Computing Science	2000/09 to 2009/06
Researcher	Electrotechnical Laboratory (ETL)	Computer Science	1999/10 to 2000/03
University Assistant	ETH Zurich	Theoretical Computer Science	1997/04 to 1997/09
STA Fellow	Electrotechnical Laboratory (ETL)	Computer Science	1997/10 to 1999/09
Postdoc	UC Berkeley	Mathematics (CPAM)	1996/09 to 1996/12
Postdoc	ICSI Berkeley	Theory	1995/09 to 1996/08
University Assistant	ETH Zurich	Theoretical Computer Science	1989/09 to 1995/04

Personal identification no. (PIN)	Family name
Valid 242322	Müller

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.			
a) Support held in the past 4 years			
Müller, M.	Search and evaluation in single-agent and two-player domains NSERC Discovery	25,000 25,000 25,000 25,000 25,000	2005 2006 2007 2008 2009
Tesauro, G. and Müller, M.	Automatic Complexity Reduction of Monte Carlo Tree Search Methods by Exploiting Problem Structure DARPA, via IBM subcontract DARPA Seedling program	203,356 (39%) 101,677 (39%)	2008 2009
Tesauro, G. et al	Automated Complexity Reduction of Monte Carlo Tree Search: Phase 2 DARPA, via IBM subcontract (US$ funds) DARPA Seedling program	868,942 (20%)	2010
b) Support currently held			
Booth, K.	GRAND - Graphics, Animation and new Media Canadian Networks of Centres of Excellence (NCE) Canadian Networks of Centres of Excellence (NCE)	4,650,000 (0%) 4,650,000 (0%) 4,650,000 (0%) 4,650,000 (0%) 4,650,000 (0%)	2010 2011 2012 2013 2014

Personal identification no. (PIN)	Family name
Valid 242322	Müller

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) Support currently held			
Müller, M.	Search and simulation in games and planning NSERC Discovery Accelerator Supplement	40,000 40,000 40,000	2010 2011 2012
Müller, M.	Search and simulation in games and planning NSERC Discovery	34,000 34,000 34,000 34,000 34,000	2010 2011 2012 2013 2014

PROTECTED WHEN COMPLETED

Highly Qualified Personnel (HQP)

Provide personal data about the HQP that you currently, or over the past six years, have supervised or co-supervised.

Personal identification no. (PIN)	Family name
Valid 242322	Müller

Name	Type of HQP Training and Status	Years Supervised or Co-supervised	Title of Project or Thesis	Present Position
Fernando, Sumudu	Programmer (In Progress)	Supervised 2012 -	Investigating Simulations in Monte Carlo Tree Search	PhD student, Alberta
Rimmel, Arpad	Postdoctoral (Completed)	Supervised 2010 -	Monte Carlo Tree Search; Computer Go.	Postdoc, Paris, France
Song, Jiaxing	Master's (In Progress)	Supervised 2010 -	Improving Solvers for the Game of Amazons	MSc student, Alberta
Xie, Fan	Doctoral (In Progress)	Supervised 2010 -	Combining Search and Random Walks in Planning	PhD student
Nakhost, Hootan	Doctoral (In Progress)	Supervised 2007 -	Planning in AI	PhD student
Hunt, Colin	Undergraduate (In Progress)	Supervised 2012 - 2012	Fuegito - simple framework for game tree search	Undergraduate Alberta
Huang, Shih-chie	Postdoctoral (Completed)	Co-supervised 2011 - 2012	Computer Go and computer Hex	Researcher, startup company, London, England
Sankaran, Saradha	programmer (Completed)	Supervised 2011 - 2012	games research	In Switzerland with husband, looking for job there
Van Eyck, Gabriel	Master's (Completed)	Supervised 2010 - 2012	Move groups in Monte Carlo Tree Search	Programmer, games company, California
Brausen, Henry	Undergraduate (In Progress)	Co-supervised 2011 - 2011	Blunder analysis in Go and Hex	Undergraduate, Alberta
Drummond, Teri	Undergraduate (In Progress)	Supervised 2010 - 2010	Fuego open source code library	Undergraduate, Alberta
Arneson, Broderick	Programmer (In Progress)	Supervised 2008 - 2010	Computer Go; Computer Hex	Programmer
Tom, David	Master's (In Progress)	Supervised 2008 - 2010	Monte Carlo tree search	unknown
Niu, Xiaozhen	Doctoral (Not Completed)	Supervised 2004 - 2010	Flexible goal-oriented search	programmer
Dick, Travis	Undergraduate (Completed)	Supervised 2008 - 2009	supervised learning of preferences	Graduate student, Alberta
Silver, David	Doctoral (Completed)	Co-supervised 2004 - 2009	Reinforcement Learning and Simulation-Based Search in	Royal Society Research Fellow, University College London
Enzenberger, Markus	Res. Associate (Completed)	Co-supervised 2002 - 2009	Computer Go; planning; Monte-Carlo Tree Search;	Freelance programmer, Munich, Germany
Zhao, Ling	Doctoral (Not Completed)	Supervised 2002 - 2009	Planning in Go	unknown

Research Contributions

Refereed Journal Articles

[1] **D. Silver**, R. Sutton, and M. Müller. Temporal-difference search in computer Go. *Machine Learning*, 87(2):183–219, 2012.

[2] **M. Enzenberger**, M. Müller, **B. Arneson**, and R. Segal. Fuego - an open-source framework for board games and Go engine based on Monte-Carlo tree search. *IEEE Transactions on Computational Intelligence and AI in Games*, 2(4):259–270, 2010. Special issue on Monte-Carlo Techniques and Computer Go.

[3] J. Schaeffer, N. Burch, Y. Björnsson, **A. Kishimoto**, M. Müller, R. Lake, P. Lu, and S. Sutphen. Checkers is solved. *Science*, 317(5844):1518–1522, 2007. Originally published in Science Express on 19 July 2007.

[4] S. Soeda, K. Yoshizoe, A. Kishimoto, T. Kaneko, T. Tanaka, and M. Müller. λ search based on proof and disproof numbers. *Information Processing Society of Japan (IPSJ) Journal*, 48(11):3455–3462, 2007. In Japanese.

Refereed Conference Papers

[5] J. Styles, H. Hoos, and M. Müller. Automatically configuring algorithms for scaling performance, 2012. Presented at Learning and Intelligent OptimizatioN conference (LION) 6, Paris, January 2012. To appear.

[6] **H. Brausen**, R. Hayward, M. Müller, A. Qadir, and D. Spies. Blunder cost in Go and Hex. In H. van den Herik and A. Plaat, editors, *Advances in Computer Games*, volume 7168 of *Lecture Notes in Computer Science*, pages 220–229. Springer Berlin / Heidelberg, 2012.

[7] L. McCluskey, B. Williams, J. Reinaldo Silva, and B. Bonet, editors. *Proceedings of the Twenty-Second International Conference on Automated Planning and Scheduling, ICAPS 2012, Atibaia, São Paulo, Brazil, June 25-19, 2012*. AAAI, 2012.

[8] **H. Nakhost**, J. Hoffmann, and M. Müller. Resource-constrained planning: A Monte Carlo random walk approach. In McCluskey et al. [7], pages 181–189. **Top tier**.

[9] **F. Xie**, **H. Nakhost**, and M. Müller. Planning via random walk-driven local search. In McCluskey et al. [7], pages 315–322. **Top tier**.

[10] **H. Nakhost** and M. Müller. A theoretical framework for studying random walk planning. In D. Borrajo, A. Felner, R. Korf, M. Likhachev, C. Linares Lopez, W. Ruml, and N. Sturtevant, editors, Symposium on Combinatorial Search (SOCS), pages 57–64. AAAI Press, 2012.

[11] R. Valenzano, **H. Nakhost**, M. Müller, N. Sturtevant, and J. Schaeffer. ArvandHerd: Parallel planning with a portfolio. In L. De Raedt, C. Bessière, D. Dubois, P. Doherty, P. Frasconi, F. Heintz, and P. Lucas, editors, European Conference on Artificial Intelligence (ECAI), volume 242 of *Frontiers in Artificial Intelligence and Applications*, pages 786–791. IOS Press, 2012.

[12] **G. Van Eyck** and M. Müller. Revisiting move groups in Monte Carlo Tree Search. In H. van den Herik and A. Plaat, editors, *Advances in Computer Games*, volume 7168 of *Lecture Notes in Computer Science*, pages 13–23. Springer Berlin / Heidelberg, 2012.

[13] **D. Tom** and M. Müller. Computational experiments with the RAVE heuristic. In J. van den Herik, H. Iida, and A. Plaat, editors, *Computers and Games*, volume 6515 of *Lecture Notes in Computer Science*, pages 69–80. Springer Berlin / Heidelberg, 2011.

[14] N. Burch, R. Holte, M. Müller, D. O'Connell, and J. Schaeffer. Automating layouts of sewers in subdivisions. In H. Coelho, R. Studer, and M. Wooldridge, editors, European Conference on Artificial Intelligence (ECAI), volume 215 of *Frontiers in Artificial Intelligence and Applications*, pages 655–660. IOS Press, 2010. Acceptance rate: 135/607 = 22%.

[15] **H. Nakhost** and M. Müller. Action elimination and plan neighborhood graph search: Two algorithms for plan improvement, 2010. In R. Brafman, H. Geffner, J. Hoffmann, and H. Kautz, editors, *International Conference on Automated Planning and Scheduling (ICAPS-2010)*, pages 121–128, Toronto, Canada, 2010. AAAI Press. **Top tier**. Acceptance rate: 37/108 = 34%.

[16] **H. Nakhost** and M. Müller. Monte-Carlo exploration for deterministic planning. In *Twenty-first International Joint Conference on Artificial Intelligence*

(IJCAI-09), pages 1766–1771, Pasadena, California, USA, 2009. **Top tier**. Acceptance rate (oral presentation): 331/1291 = 26%.

[17] **M. Enzenberger** and M. Müller. A lock-free multithreaded Monte-Carlo tree search algorithm. In van den Herik and Spronck [19], pages 14–20. Acceptance rate: 20/35 = 57%.

[18] **D. Tom** and M. Müller. A study of UCT and its enhancements in an artificial game. In van den Herik and Spronck [19], pages 55–64. Acceptance rate: 20/35 = 57%.

[19] J. van den Herik and P. Spronck, editors. *Advances in Computer Games. 12th International Conference, volume 6048 of Lecture Notes in Computer Science*. Springer, 2010.

[20] A. Kishimoto and M. Müller. About the completeness of depth-first proof-number search. In J. van den Herik, X. Xu, Z. Ma, and M. Winands, editors, *Computer and Games. 6th International Conference*, volume 5131 of *Lecture Notes in Computer Science*, pages 146–156, Beijing, China, 2008. Springer. http://dx.doi.org/10.1007/978-3-540-87608-3_14. Acceptance rate: 24/40 = 60%.

[21] **X. Niu** and M. Müller. An improved safety solver in Go using partial regions. In J. van den Herik, X. Xu, Z. Ma, and M. Winands, editors, *Computer and Games. 6th International Conference*, volume 5131 of *Lecture Notes in Computer Science*, pages 102–112, Beijing, China, 2008. Springer. http://dx.doi.org/10.1007/978-3-540-87608-3_10. Acceptance rate: 24/40 = 60%.

[22] **D. Silver**, R. Sutton, and M. Müller. Sample-based learning and search with permanent and transient memories. In W. Cohen, A. McCallum, and S. Roweis, editors, *Machine Learning, Proceedings of the Twenty-Fifth International Conference (ICML 2008)*, volume 307 of *ACM International Conference Proceeding Series*, pages 968–975, Helsinki, Finland, 2008. ACM. **Top tier**. Acceptance rate: 158/583 = 27%.

[23] **L. Zhao** and M. Müller. Using artificial boundaries in the game of Go. In J. van den Herik, X. Xu, Z. Ma, and M. Winands, editors, *Computer and Games. 6th International Conference*, volume 5131 of *Lecture Notes in Computer Science*, pages 81–91, Beijing, China, 2008. Springer.

http://dx.doi.org/10.1007/978-3-540-87608-3_8. Acceptance rate: 24/40 = 60%.

[24] A. Botea, M. Müller, and J. Schaeffer. Fast planning with iterative macros. In *Twentieth International Joint Conference on Artificial Intelligence (IJCAI)*, pages 1828–1833, Hyderabad, India, 2007. **Top tier**. Acceptance rate (oral presentation): 212/1353 = 16%.

[25] **D. Silver**, R. Sutton, and M. Müller. Reinforcement learning of local shape in the game of Go. In *Twentieth International Joint Conference on Artificial Intelligence (IJCAI)*, pages 1053–1058, Hyderabad, India, 2007. **Top tier**. Acceptance rate (oral presentation): 212/1353 = 16%.

[26] K. Yoshizoe, A. Kishimoto, and M. Müller. Lambda depth-first proof number search and its application to Go. In *Twentieth International Joint Conference on Artificial Intelligence (IJCAI)*, pages 2404–2409, Hyderabad, India, 2007. **Top tier**. Acceptance rate (oral presentation): 212/1353 = 16%.

[27] **X. Niu** and M. Müller. An open boundary safety-of-territory solver for the game of Go. In J. van den Herik, P. Ciancarini, and H. Donkers, editors, *Computer and Games. 5th International Conference*, volume 4630 of *Lecture Notes in Computer Science*, pages 37 – 49, Torino, Italy, 2007. Springer. Acceptance rate: 24/45 = 53%.

Refereed Abstracts and Short Papers

[28] **F. Xie**, **H. Nakhost**, and M. Müller. A local Monte Carlo Tree Search approach in deterministic planning, 2011. 2 pages. Accepted for AAAI Conference on Artificial Intelligence Student Abstract and Poster Program (SA-11).

[29] **H. Nakhost**, J. Hoffmann, and M. Müller. Improving local search for resource-constrained planning. In *Proceedings of the Third Annual Symposium on Combinatorial Search (SOCS-10)*, pages 81–82, Stone Mountain, Atlanta, GA, USA, 2010. Accepted for full paper and oral presentation. Published as extended abstract only.

Invited Journal and Conference Proceedings Papers; Editorials

[30] **H. Nakhost**, M. Müller, R. Valenzano, and **F. Xie**. Arvand: the art of random walks, 2011. 2 pages. 2011 International Planning Competition (IPC 2011) Planner Description.

[31] R. Valenzano, **H. Nakhost**, M. Müller, J. Schaeffer, and N. Sturtevant. Arvandherd: Parallel planning with a portfolio, 2011. 4 pages. 2011 International Planning Competition (IPC 2011) Planner Description.

[32] C. Lee, M. Müller, and O. Teytaud. Special issue on Monte Carlo techniques and computer Go. *IEEE Transactions on Computational Intelligence and AI in Games*, 2(4):225 – 228, 2010. Editorial.

Software and other Scholarly Works

[33] **H. Nakhost** and M. Müller. *Arvand*, a state of the art planner based on Monte Carlo Random Walks [16]. Successfully participated in the IPC 2011 competition [30]. Extended to deal with resource-constrained planning [8].

[34] R. Valenzano, **H. Nakhost**, M. Müller, N. Sturtevant, and J. Schaeffer. *ArvandHerd*, a leading parallel planner based on Arvand and the LAMA system. Winner of the IPC 2011 parallel planning track [31, 11].

[35] **F. Xie**, **H. Nakhost**, and M. Müller. *Arvand-LS*, a state of the art planner combining Monte Carlo Random Walks with local search [9].

[36] **H. Nakhost** and M. Müller. *Aras*, the leading plan improvement postprocessor [15].

[37] **M. Enzenberger** and M. Müller. *Fuego*, Go-playing program. A top-level Go-playing program based on Monte Carlo simulations and highly selective game tree search. Fuego was the first program to beat a top human professional player in an even game in 9×9 Go. Winner of the 2009 computer Olympiad in 9×9 Go, second place in 19×19 Go. Winner of the 2010 UEC cup, the largest 19×19 computer Go competition of the year. Third place, 2011 Computer Olympiad, 9×9 Go. Available as open source under a LGPL license on `http://sourceforge.net/projects/fuego`.

[38] **M. Enzenberger** and M. Müller. *Smart Game and Go Kernel*, base modules for game-playing programs. Includes game-independent and Go-specific modules. Provides the basis for Fuego and half a dozen other game-playing projects. Available as open source under a LGPL license on `http://sourceforge.net/projects/fuego`.

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SEND ONE ORIGINAL ONLY DO NOT PHOTOCOPY

APPENDIX A
Personal Data
(Form 100)

Complete this appendix (i) if you are an applicant or co-applicant applying for the first time; (ii) if you need to update information submitted with a previous application; or (iii) if you do not hold an appointment at a Canadian postsecondary institution. For updates, include only the revised information in addition to the date, your name and your PIN.

This information will be used by NSERC primarily to contact applicants and award holders. It may also be used to identify prospective reviewers and committee members, and to generate statistics. It will not be seen or used in the adjudication process.

Date: 2012/10/02

Family name	Given name	Initial(s) of all given names	Personal identification no. (PIN)
Müller	Martin	MF	**Valid** 242322

Position and complete mailing address if your primary place of employment is not a Canadian postsecondary institution or if your current mailing address is temporary

345 Athabasca
University of Alberta
Edmonton AB T6G2E8

If address is temporary, indicate:

Starting date

Leaving date

Telephone number	Facsimile number	E-mail address
(780) 4923703	(780) 4921071	mmueller@cs.ualberta.ca

Telephone number (alternate)

Give an alternate telephone number only if you can be reached at that number during business hours.

Gender (completion optional): [X] Male [ ] Female

LANGUAGE CAPABILITY

English	Read [X]	Write [X]	Speak [X]
French	Read [ ]	Write [ ]	Speak [ ]

I wish to receive my correspondence: in English [X] in French [ ]

AREA(S) OF EXPERTISE

Provide a maximum of 10 key words that describe your area(s) of expertise. Use commas to separate them. If you have expertise with particular instruments and techniques, specify which one(s).

game tree search, automated planning, computer Go, combinatorial game theory, Monte Carlo tree search

Research subject code(s)

Primary: 2800

Secondary:

Appendix D (Form 100)
Consent to Provide Limited Personal Information About Highly Qualified Personnel (HQP) to NSERC

NSERC applicants are required to describe their contributions to the training or supervision of highly qualified personnel (HQP) by providing certain details about the individuals they have trained or supervised during the six years prior to their current application. HQP information must be entered on the Personal Data Form (Form 100). This information includes the trainee's name, type of HQP training (e.g., undergraduate, master's, technical etc.) and status (completed, in-progress, incomplete), years supervised or co-supervised, title of the project or thesis, and the individual's present position.

Based on the federal *Privacy Act* rules governing the collection of personal information, applicants are asked to obtain consent from the individuals they have supervised before providing personal data about them to NSERC. In seeking this consent, the NSERC applicant must inform these individuals what data will be supplied, and assure them that it will only be used by NSERC for the purpose of assessing the applicant's contribution to HQP training. To reduce seeking consent for multiple applications, applicants will only need to seek consent one time for a six-year period. If the trainee provides consent by e-mail, the response must include confirmation that they have read and agree to the text of the consent form.

When consent cannot be obtained, applicants are asked to not provide names, or other combinations of data, that would identify those supervised. However, they may still provide the type of HQP training and status, years supervised or co-supervised, a general description of the project or thesis, and a general indication of the individual's present position if known.

An example of entering HQP information on Form 100 (with and without consent):

Name	Type of HQP Training and Status	Years Supervised or Co-supervised	Title of Project or Thesis	Present Position
Consent Received from Marie Roy				
Roy, Marie	Undergraduate (Completed)	Supervised 1994 - 1997	Isotope geochemistry in petroleum engineering	V-P (Research), Earth Analytics Inc., Calgary, Alberta
Consent Not Obtained from Marie Roy				
(name withheld)	Undergraduate (Completed)	Supervised 1994 - 1997	Isotope geochemistry	research executive in petroleum industry - western Canada

Consent Form

Name of Trainee	
Applicant Information	
Name Müller, Martin MF	
Department Computing Science	Postsecondary Institution Alberta

I hereby allow the above-named applicant to include limited personal data about me in grant applications submitted for consideration to NSERC for the next six years. This limited data will only include my name, type of HQP training and status, years supervised or co-supervised, title of the project or thesis and, to the best of the applicant's knowledge, my position title and company or organization at the time the application is submitted. I understand that NSERC will protect this data in accordance with the *Privacy Act*, and that it will only be used in processes that assess the applicant's contributions to the training of highly qualified personnel (HQP), including confidential peer review.

Trainee's signature _____ Date _____

Note: This form must be retained by the applicant and made available to NSERC upon request.