

# Yngvi Björnsson

Curriculum Vitae

Associate Professor  
School of Computer Science  
Reykjavik University  
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## Research Interests

- Heuristic search, learning search control, artificial intelligence in computer games and industrial optimization.

## Academic Positions

- **Associate Professor / CADIA co-director** 2004-present  
School of Computer Science, Reykjavik University
- **Acting Chair** 2005-2006  
Department of Computer Science, Reykjavik University
- **Research Associate** 2002-2003  
Department of Computing Science, University of Alberta
- **Faculty Lecturer** 2000-2001  
Department of Computing Science, University of Alberta

## Education

- **Ph.D. in Computer Science**, University of Alberta 2002  
Thesis: Selective Depth-First Game-Tree Search  
Advisor: Professor Tony Marsland
- **B.S. Computer Science**, University of Iceland 1988

## Awards and Honors

- **International General Game Playing Competition** 2007-2008, 2012  
GGP World Champion (software)
- **Solving Checkers** 2007  
Named by Science magazine as one of the top ten scientific achievements of the year.
- **IJCAI Distinguished Paper Prize** 2005  
For co-authored conference paper "Solving Checkers"
- **Computer Olympiad** 2000-2002  
Gold-medal winner in Lines-of-Action competition (software)
- **Andrew Steward Memorial Graduate Award** 1999  
University of Alberta, for doctoral research.

## Publications

### Journal Articles

- Mandy J. W. Tak, Mark H. M. Winands, and Yngvi Björnsson (2012). N-Grams and the Last-Good-Reply Policy Applied in General Game Playing. *IEEE Transactions on Computational Intelligence and AI in Games*, 4(2):73–83.
- Hilmar Finnsson and Yngvi Björnsson (2011). CadiaPlayer: Search Control Techniques. *KI Journal*, 25(1), pp. 9–16.
- Mark H.M. Winands, Yngvi Björnsson, and Jahn-Takeshi Saito (2010). Monte-Carlo Tree Search in Lines of Action. *IEEE Transactions on Computational Intelligence and AI in Games*, 2(4), pp. 239-250.
- Vadim Bulitko, Yngvi Björnsson, and Ramon Lawrence (2010). Case-Based Subgoaling in Real-Time Heuristic Search for Video Game Pathfinding. *Journal of Artificial Intelligence Research (JAIR)*, 39, pp. 269-300.
- Yngvi Björnsson and Hilmar Finnsson (2009). CadiaPlayer: A Simulation-Based General Game Player. *IEEE Transactions on Computational Intelligence and AI in Games*, 1(1), pp.4-15.
- Vadim Bulitko, Mitja Luvstrek, Jonathan Schaeffer, Yngvi Björnsson, Sverrir Sigmundarson (2008). Dynamic Control in Real-Time Heuristic Search. *Journal of Artificial Intelligence Research*, 32, pp. 419–452.
- Mark Winands and Yngvi Björnsson (2008). Enhanced Realization Probability Search. *New Mathematics and Natural Computation*, 3(6), pp. 329-342.
- Jonathan Schaeffer, Neil Burch, Yngvi Björnsson, Akihiro Kishimoto, Martin Müller, Rob Lake, Paul Lu, Steve Sutphen (2007). Checkers is Solved. *Science*, vol. 317(5844), pp. 1518-1522.  
**Named one of the top ten scientific achievements of the year 2007.**
- Ryan Hayward, Yngvi Björnsson, Michael Johanson, Morgan Kan, Nathan Po and Jack van Rijswijk (2005). Solving 7x7 Hex with domination, fill-in, and virtual-connections, *Theoretical Computer Science*, vol. 349 (2), pp. 123-139.
- Yngvi Björnsson and Tony Marsland (2003). Learning Extension Parameters in Game-Tree Search, *Information Sciences*, vol. 154, pp. 95-118.
- Yngvi Björnsson and Tony Marsland (2001). Multi-cut Alpha-Beta Pruning in Game-Tree Search, *Theoretical Computer Science*, vol. 252, pp. 177-196.
- *Yngvi Björnsson and Tony Marsland (2000). Risk Management in Game-Tree Pruning, Information Sciences, vol. 122, pp. 23-41.*
- Yngvi Björnsson, Tony Marsland, Jonathan Schaeffer and Andreas Junghanns (1997). Searching with Uncertainty Cut-Offs, *International Computer Chess Association Journal*, vol. 29, pp. 29-37.

### Books Edited

- Jaap van der Herik, Nathan Netanyahu, Yngvi Björnsson (2006). *Computers and Games. Revised papers from the Forth International Conference on Computers and Games (CG 2004)*, Ramat-Gan, Israel. Springer-Verlag.
- Jonathan Schaeffer, Martin Müller, Yngvi Björnsson (2003). *Computers and Games. Revised papers from the Third International Conference on Computers and Games (CG 2002)*, Edmonton, Canada. Springer-Verlag.

## **Refereed Conferences and Book Chapters**

- Steinar H. Sigurðarson, Marjan Sirjani, Yngvi Björnsson, and Árni H. Reynisson (2012). Guided Search for Deadlocks in Actor-Based Models. In Proceedings of Formal Aspects of Component Software (FACS), LNCS, Springer, pp. 242-259.
- Yngvi Björnsson (2012). Learning Rules of Simplified Boardgames by Observing. In *European Conference on Artificial Intelligence (ECAI'12)*, pp. 175-180.
- Mark H. M. Winands and Yngvi Björnsson. Alpha-Beta-based Playouts in Monte-Carlo Tree Search. In 2011 IEEE Conference on Computational Intelligence and Games, CIG 2011, Seoul, South Korea, August 31 - September 3, 2011, pp. 110-117, IEEE, 2011.
- Vadim Bulitko, Yngvi Björnsson, Nathan Sturtevant, and Ramon Lawrence. Real-time Heuristic Search for Pathfinding in Video Games (2011). In *Artificial Intelligence for Computer Games*, pp. 1-30, Springer.
- Hilmar Finnsson and Yngvi Björnsson. Learning Simulation Control in General Game-Playing Agents. In The Twenty-Fourth AAAI Conference on Artificial Intelligence, AAAI Press, 2010, pp. 954-959.
- Nathan Sturtevant, Vadim Bulitko, and Yngvi Björnsson (2010). On Learning in Real-Time Heuristic Search. In Proceedings of the 9th International Conference on Autonomous Agents and Multiagent Systems (AAMAS), Toronto, Canada.
- Vadim Bulitko, Yngvi Björnsson. (2009). kNN LRTA\*: Simple Subgoaling for Real-Time Search. Artificial Intelligence and Interactive Digital Entertainment (AIIDE). AAAI Press. Stanford, California. October 14.
- Yngvi Björnsson, Vadim Bulitko, and Nathan Sturtevant (2009). TBA\*: Time-Bounded A\*. In Proceedings of the Twenty-first International Joint Conference on Artificial Intelligence (IJCAI'09), July 11-17, Pasadena, CA, USA, pp. 431-436.
- Pálmi Skowronski, Yngvi Björnsson, and Mark H. M. Winands (2009). Automatic Discovery of Search-Control Features. In Proceedings of the Twelfth International Advances in Computer Games Conference (ACG'09), Pamplona, Spain, May 11-13, pp. 182-194.
- Mark H.M. Winands and Yngvi Björnsson. Evaluation Function Based Monte-Carlo LOA (2009). In Proceedings of the Twelfth International Advances in Computer Games Conference (ACG'09), Pamplona, Spain, May 11-13, pp. 33-44.
- Hilmar Finnsson and Yngvi Björnsson (2008). Simulation-Based Approach to General Game Playing. In Proceedings of the Twenty-Third AAAI Conference on Artificial Intelligence, pp. 259-264.
- Jónheiður Ísleifsdóttir and Yngvi Björnsson (2008). GTQ: A Language and Tool for Game-Tree Analysis. In Proceedings of the Sixth International Computers and Games Conference (CG'08), Beijing, China, September, pp. 217-228.
- Mark Winands and Yngvi Björnsson, Jahn-Takeshi Saito (2008). Monte-Carlo Tree Search Solver. In Proceedings of the Sixth International Computers and Games Conference (CG'08), Beijing, China, September, pp. 25-36.
- Vadim Bulitko, Yngvi Björnsson, Mitja Luvstrek, Jonathan Schaeffer, Sverrir Sigmundarson (2007). Dynamic Control in Path-Planning with Real-Time Heuristic Search. *Proceedings of the International Conference on Automated Planning and Scheduling (ICAPS'07)*. Providence, RI, pp. 49-56.
- Yngvi Björnsson, Ryan Hayward, Michael Johanson, and Jack van Rijswijck (2006). Dead Cell Analysis in Hex and the Shannon Game, *Graph Theory*, Trends in Mathematics, pp. 45-59.

- Yngvi Björnsson, Jonathan Schaeffer, Nathan Sturtevant (2006). Partial Information Endgame Databases, *Lecture Notes in Computer Science* Vol. 4250. *Proc. Advances in Computer Games 11*, Taipei, Taiwan, pp. 11-22.
- Yngvi Björnsson and Kári Halldórsson (2006). Improved Heuristics for Optimal Pathfinding on Game Maps, *Proceedings of the 2nd International Conference on Artificial Intelligence and Interactive Entertainment (AIIDE'06)*, Marina Del Ray, CA.
- Jonathan Schaeffer, Yngvi Björnsson, Neil Burch, Akihiro Kishimoto, Martin Muller, Rob Lake, Paul Lu and Steve Sutphen (2005). Solving Checkers, *International Joint Conference on Artificial Intelligence (IJCAI'05)*, Edinburgh, pp. 292-297. **Distinguished Paper Prize**
- Yngvi Björnsson, Markus Enzenberger, Rob Holte and Jonathan Schaeffer (2005). Fringe Search: Beating A\* at Pathfinding on Computer Game Maps, *Proceedings of the IEEE Symposium on Computational Intelligence and Games*, pp. 125-132.
- Yngvi Björnsson, Vignir Hafsteinsson, Ársæll Jóhannsson, Einar Jónsson (2004). Efficient Use of Reinforcement Learning in a Computer Game, in *Proceedings of the International Conference on Computer Games: Artificial Intelligence, Design and Education*, pp. 379-383.
- Yngvi Björnsson and Darse Billings (2003). Search and Knowledge in Lines of Action, *Advances in Computer Games*, J. van den Herik, H. Iida, E. Heinz (eds.), Kluwer, pp. 231-248.
- Ryan Hayward, Yngvi Björnsson, Michael Johanson, Morgan Kan, Nathan Po and Jack van Rijswijk (2003). Solving 7x7 HEX: Virtual Connections and Game-State Reduction, *Advances in Computer Games*, J. van den Herik, H. Iida, E. Heinz (eds.), Kluwer, pp. 261-278.
- Jonathan Schaeffer, Yngvi Björnsson, Neil Burch, Robert Lake, Paul Lu and Steve Sutphen (2003). Building the Checkers 10-piece Endgame Databases, *Advances in Computer Games*, J. van den Herik, H. Iida, E. Heinz (eds.), Kluwer, pp. 193-210.
- Yngvi Björnsson, Markus Enzenberger, Rob Holte, Jonathan Schaeffer, and Peter Yap (2003). Comparison of Different Abstractions for Pathfinding on Maps, *The 19<sup>th</sup> International Joint Conference on Artificial Intelligence (IJCAI 03)*, pp. 1511-1512.
- Yngvi Björnsson and Tony Marsland (2001). Learning Search Control in Adversary Games, *Advances in Computer Games 9*, J. van den Herik and B. Monien (eds.), University of Maastricht, pp. 157-174.
- Yngvi Björnsson and Tony Marsland (1999). Multi-cut Alpha-Beta Pruning, *Computers and Games (CG'98)*, pp. 15-24. Springer-Verlag, *Lecture Notes in Computer Science* #1558.
- Yngvi Björnsson and Tony Marsland (1999). Selective Depth-First Search Methods, *Games in AI Research*, J. van den Herik and H. Iida (eds.), University of Maastricht, pp. 31-56.
- Andreas Junghanns, Jonathan Schaeffer, Mark Brockington, Yngvi Björnsson and Tony Marsland (1997). Diminishing Returns for Additional Search in Chess, *Advances in Computer Chess VIII*, J. van den Herik and J. Uiterwijk (eds.), University of Maastricht, pp. 53-67.

### **Refereed Workshops**

- Hilmar Finnsson and Yngvi Björnsson (2011). Game-Tree Properties and MCTS Performance. In *IJCAI'11 Workshop on General Intelligence in Game Playing Agents*.
- Stefán Freyr Guðmundsson and Yngvi Björnsson (2011). MCTS: Improved Action Selection for Deterministic Games. In *IJCAI'11 Workshop on General Intelligence in Game Playing Agents*.
- Hilmar Finnsson and Yngvi Björnsson (2009). Simulation Control in General Game Playing Agents. In *IJCAI'09 Workshop on General Intelligence in Game Playing Agents*.
- Yngvi Björnsson and Jónheiður Ísleifsdóttir (2007). GTQL: A Query Language for Game Trees. *Computer Games Workshop 2007*. Amsterdam, The Netherlands.
- Sverrir Sigmundarson and Yngvi Björnsson (2006). Value Back-Propagation vs. Backtracking in Real-Time Heuristic Search, *21st National Conference on Artificial Intelligence (AAAI'06)*, Workshop on Learning for Search, pp. 136-141.

## **Unrefereed Publications**

- Winands, Mark H. M and Yngvi Björnsson (2007). Enhanced Realization Probability Search. *Proceedings of the 10<sup>th</sup> Joint Conference on Information Sciences*. pp. 643-649 (Invited).
- Yngvi Björnsson and Jónheiður Ísleifsdóttir (2006). Tools for Debugging Large Game Trees". *The 11<sup>th</sup> Games Programming Workshop*. Extended abstract (Invited).
- Yngvi Björnsson (2005). Report on the 13<sup>th</sup> World Computer Chess Championship. BNVKI Newsletter of the Belgium-Netherland Association for Artificial Intelligence, Vol 22, No. 5, pp. 110-111.
- Yngvi Björnsson (2005). Report on Pieter Spronck's Ph.D. Thesis Defense and the Machine Learning for Commercial Game AI Symposium. BNVKI Newsletter of the Belgium-Netherland Association for Artificial Intelligence, Vol 22, No. 3, pp. 53-54.
- Yngvi Björnsson and Tony Marsland (2002). Learning Control of Search Extensions, *Proceedings of the Sixth Joint Conference on Information Sciences (JCIS'02)*, pp. 446-449. (Invited).
- Yngvi Björnsson and Mark Winands (2002). YL wins Lines-of-Action Tournament, *International Computer Games Journal*, vol. 25, pp.185-186. (Technical note).
- Yngvi Björnsson (2002). Selective Depth-First Game-Tree Search. Phd thesis, Department of Computing Science, University of Alberta.
- Yngvi Björnsson and Mark Winands (2001). YL wins Lines-of-Action Tournament, *International Computer Games Journal*, vol. 24, pp.180-181. (Technical note).
- Yngvi Björnsson (2000). YL wins Lines-of-Action Tournament, *International Computer Games Journal*, vol. 23, pp.178-179. (Technical note).

## **Other Professional Activities**

### **Executive Posts**

- Associate Editor, IEEE Transactions of Computational Intelligence and AI in Games. 2008-2012
- International Computer Games Association Vice President 2005-2011

### **Recent Invited Talks**

- "Learning MCTS Simulation Control in General Game Playing Agents". Department of Knowledge Engineering, SIKS-BNVKI Symposium, Universiteit Maastricht, The Netherlands, September 2010.
- "Simulation-Based Approach to General Game Playing". Department of Computing Science, Games Group Lecture Series, University of Alberta, April 2008.  
  
"General Game Playing". IEEE Computational Intelligence and Games Conference (CIG'09), Milan, Italy, September 2009. (Keynote speaker)
- "Simulation-Based Approach to General Game Playing". Department of Computing Science, Games Group Lecture Series, University of Alberta, April 2008.
- "CADIA-Player". Department of Computer Science Lecture Series, Dresden Technical University (DTU). November, 2007.

- "Tools for Debugging Large Game Trees". *The 11<sup>th</sup> Games Programming Workshop*, November 2006, Hakone, Japan.
- "Enhanced Heuristics for Optimal Path-finding on Game Maps". *Japan Advanced Institute for Science and Technology (JAIST)*, November 2006, Nomi, Japan.
- "Using User-Input to Speed-up Reinforcement Learning in Computer Games", *Machine Learning for Commercial Game AI, IKAT-SIKS Symposium*, May 2005, Maastricht, The Netherlands.
- "Reinforcement Learning in Computer Games", Machine Intelligence Seminar, Department of Computer Science, Aalborg University, April 2005, Aalborg, Denmark

### **Program (Co-)Chair**

- General Intelligence in Game-Playing Agents (IJACI Workshop) 2013
- General Intelligence in Game-Playing Agents (IJACI Workshop) 2011
- General Intelligence in Game-Playing Agents (IJACI Workshop) 2009
- Fourth International Conference on Computers and Games (CG'04) 2004
- Third International Conference on Computers and Games (CG'02) 2002

### **Program Committee Member**

- International Conference on Computers and Games (CG'13) 2013
- Twenty-Seventh National Conference on Artificial Intelligence (AAAI'13) 2013
- Twentieth European Conference on Artificial Intelligence (ECAI'12) 2012
- Twenty-Sixth National Conference on Artificial Intelligence (AAAI'12) 2012
- Twenty-Fourth National Conference on Artificial Intelligence (AAAI'10) 2010
- Joint International Conference on Artificial Intelligence (JICAI'11) 2011
- Twenty-Fourth National Conference on Artificial Intelligence (AAAI'10) 2010
- Nineteenth European Conference on Artificial Intelligence (ECAI'10) 2010
- International Conference on Computers and Games (CG'10) 2010
- Symposium on Abstraction, Reformulation and Approximation (SARA'09) 2009
- Advances in Computer Games (ACG12) 2009
- Joint International Conference on Artificial Intelligence (JICAI'09) 2009
- International Conference on Computers and Games (CG'08) 2008
- ECAI Workshop on Artificial Intelligence in Games (AIG'08) 2008
- Fifth International Conference on Computers and Games (CG'06) 2006
- Advances in Computer Games (ACG11) 2005
- Twenty-First International Conference on Machine Learning (ICML'04) 2004
- Third International Conference on Entertainment Computing (ICEC'04) 2004
- Nineteenth National Conference on Artificial Intelligence (AAAI'04) 2004
- Eighteenth National Conference on Artificial Intelligence (AAAI'02) 2002
- Symposium on Abstraction, Reformulation and Approximation (SARA'02) 2002

### **Industrial Ties and Experience**

- **Landsvirkjun hf.** 2011-...  
Common research grant; using AI techniques for optimization in hydro-electrical production.
- **Valka ehf.** 2006-2008

Common research grant; using informed search, integer programming techniques and, probabilistic models to improve software for controlling a production line.

- **TM software (Computer Images Inc.)**  
Worked as software developer and project manager.

1988-1994

## Personal Information

**Citizenship:** Iceland

**Birthday:** November 9<sup>th</sup>, 1964