

# Christian Kroer

## Curriculum Vitae

### Research interests

- Fields Artificial intelligence, algorithms, operations research, economics.
- Specific Equilibrium computation, mechanism design, auctions, prediction markets, convex optimization, machine learning, robust optimization, and practical applications.

### Education

- 2012–present **Ph.D. in computer science**, *Carnegie Mellon University*, Pittsburgh, PA, USA.
- 2009–2012 **M.Sc. IT - software development and technology**, *IT University of Copenhagen*, Copenhagen, Denmark.
- 2006–2009 **B.A. human-centered informatics**, *Aalborg University*, Aalborg, Denmark.

### Employment and Internships

- 2012–present **Carnegie Mellon University**, *Research Assistant*.
- 2016–2017 **Facebook, Operations, Economics and Computation team**, *Research Scientist (short-term contractor position)*.
- Summer 2016 **Facebook, Operations, Economics and Computation team**, *Research Intern*.
- Summer 2015 **Microsoft Research New York City**, *Research Intern*.
- 2012 **Aalborg University**, *Research Assistant (short-term contractor position)*.
- 2011–2012 **IT University of Copenhagen**, *Teaching Assistant*.
- 2010–2011 **Netmester A/S**, *Systems Developer*.

### Honors and Awards

- 2016 - 2018 Facebook Fellowship in economics and computation. One given worldwide per year. Full tuition, fees, stipend, and travel grant for two years, \$183,168.
- 2017 Runner-up in the Informs Computing Society Student Paper Competition

### Publications

#### Working papers

- [1] Christian Kroer, Kevin Waugh, Fatma Kılınc-Karzan, and Tuomas Sandholm. Faster algorithms for extensive-form game solving via improved smoothing functions. In *submission to Mathematical Programming Series A*, 2017.
- [2] Vincent Conitzer, Christian Kroer, Eric Sodomka, and Nicolas E. Stier-Moses.

Multiplicative pacing equilibria in auction markets. In *submission to AAAI*, 2017.

- [3] Christian Kroer, Gabriele Farina, and Tuomas Sandholm. Robust stackelberg equilibria in extensive-form games and extension to limited lookahead. In *submission to AAAI*, 2017.
- [4] Christian Kroer, Nam Ho-Nguyen, George Lu, and Fatma Kılınç-Karzan. Performance evaluation of iterative methods for solving robust convex quadratic problems. In *submission to Optimization for Machine Learning Workshop and work-in-progress*, 2017.

#### Published papers

- [1] Gabriele Farina, Christian Kroer, and Tuomas Sandholm. Regret minimization in behaviorally-constrained zero-sum games. In *ICML*, 2017.
- [2] Christian Kroer, Kevin Waugh, Fatma Kılınç-Karzan, and Tuomas Sandholm. Theoretical and practical advances on smoothing for extensive-form games. In *EC*, 2017.
- [3] Christian Kroer, Gabriele Farina, and Tuomas Sandholm. Smoothing method for approximate extensive-form perfect equilibrium. In *IJCAI*, 2017.
- [4] Noam Brown, Christian Kroer, and Tuomas Sandholm. Dynamic thresholding and pruning for regret minimization. In *AAAI*, 2017.
- [5] Christian Kroer and Tuomas Sandholm. Imperfect-recall abstractions with bounds in games. In *EC*, 2016.
- [6] Christian Kroer, Miroslav Dudík, Sébastien Lahaie, and Sivaraman Balakrishnan. Arbitrage-free combinatorial market making via integer programming. In *EC*, 2016.
- [7] Christian Kroer and Tuomas Sandholm. Sequential planning for steering immune system adaptation. In *IJCAI*, 2016.
- [8] Christian Kroer, Kevin Waugh, Fatma Kılınç-Karzan, and Tuomas Sandholm. Faster first-order methods for extensive-form game solving. In *EC*, 2015.
- [9] Christian Kroer and Tuomas Sandholm. Limited lookahead in imperfect-information games. In *IJCAI*, 2015.
- [10] Christian Kroer and Tuomas Sandholm. Discretization of continuous action spaces in extensive-form games. In *AAMAS*, 2015.
- [11] Christian Kroer and Tuomas Sandholm. Computational bundling for auctions. In *AAMAS*, 2015.
- [12] Christian Kroer and Tuomas Sandholm. Extensive-form game abstraction with bounds. In *EC*, 2014.
- [13] Bruce DeBruhl, Christian Kroer, Anupam Datta, Tuomas Sandholm, and Patrick Tague. Power napping with loud neighbors: optimal energy-constrained jamming and anti-jamming. In *WiSec*, 2014.

- [14] Christian Kroer, Martin Kjær Svendsen, Rune M Jensen, Joseph Kiniry, and Eilif Leknes. Symbolic configuration for interactive container ship stowage planning. *Computational Intelligence*, 2014.
- [15] Paolo Viappiani and Christian Kroer. Robust optimization of recommendation sets with the maximin utility criterion. In *ADT*, 2013.
- [16] Kevin Tierney, Amanda Jane Coles, Andrew Coles, Christian Kroer, Adam M Britt, and Rune Møller Jensen. Automated planning for liner shipping fleet repositioning. In *ICAPS*, 2012.
- [17] Christian Kroer and Yuri Malitsky. Feature filtering for instance-specific algorithm configuration. In *ICTAI*, 2011.

#### Workshop papers

- [1] Vincent Conitzer, Christian Kroer, Eric Sodomka, and Nicolas E. Stier-Moses. Multiplicative pacing equilibria in auction markets. In *Workshop on Algorithmic Game Theory and Data Science at EC*, 2017.
- [2] Gabriele Farina, Christian Kroer, and Tuomas Sandholm. Regret minimization in behaviorally-constrained zero-sum games. In *Algorithmic Game Theory Workshop at IJCAI*, 2017.
- [3] Noam Brown, Christian Kroer, and Tuomas Sandholm. Dynamic thresholding and pruning for regret minimization. In *Algorithmic Game Theory Workshop at IJCAI*, 2016.
- [4] Christian Kroer and Tuomas Sandholm. Imperfect-recall abstractions with bounds. In *Algorithmic Game Theory Workshop at IJCAI*, 2015.
- [5] Christian Kroer and Tuomas Sandholm. Extensive-form game abstraction with bounds. In *Workshop on Computer Poker and Imperfect Information at AAAI*, 2015.

#### Invited talks

- 2017 Multiplicative Pacing Equilibria in Auction Markets. INFORMS Annual Conference
- 2017 Multiplicative Pacing Equilibria in Auction Markets. Duke University CS-ECON Seminar
- 2016 Arbitrage-Free Combinatorial Market Making via Integer Programming. INFORMS Annual Conference.
- 2015 Faster First-Order Methods for Extensive-Form Game Solving. INFORMS Annual Conference.
- 2015 Faster First-Order Methods for Extensive-Form Game Solving. 22nd International Symposium on Mathematical Programming (ISMP).
- 2013 Computational Bundling for Auctions. INFORMS Annual Conference.

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## Other talks

- 2016 First-Order Methods for Extensive-Form Game Solving. CMU AI Seminar.
- 2016 Faster First-Order Methods for Extensive-Form Game Solving. INFORMS Annual Conference.
- 2016 Arbitrage-Free Combinatorial Market Making via Integer Programming. Facebook Operations, Economics and Computation group.
- 2016 Abstraction and convex optimization in sequential game solving. CMU graduate AI class.
- 2015 Discretization of Continuous Action Spaces in Extensive-Form Games. INFORMS Annual Conference.
- 2014 Sequential game solving overview. CMU undergrad AI class.
- 2014 Extensive-Form Game Abstraction with Bounds. CMU theory lunch.
- 2014 Extensive-Form Game Abstraction with Bounds. CMU open house.

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## Teaching

- 2017 **Vertical mentor**, *Electronic Negotiation*, Carnegie Mellon University.
- 2016 **Vertical mentor**, *Electronic Negotiation*, Carnegie Mellon University.
- 2016 **TA**, *Graduate Artificial Intelligence*, Carnegie Mellon University.
- 2015 **Vertical mentor**, *Electronic Negotiation*, Carnegie Mellon University.
- 2015 **TA**, *Artificial Intelligence*, Carnegie Mellon University, Nominated for TA award.
- 2014 **Vertical mentor**, *Electronic Negotiation*, Carnegie Mellon University.
- 2012 **TA**, *Intelligent Systems Programming*, IT University of Copenhagen.
- 2011 **TA**, *Algorithm Design*, IT University of Copenhagen.

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## Service

- Reviewing TARK 2017, EC 2017, AAAI 2017, AISTAT 2017, ICML 2016, WINE 2015, JAA-MAS 2015, 2016, ACM Transactions on Economics and Computation, 2013, 2014, Transactions on Computational Intelligence and AI in Games 2014, 2015.
- Societies INFORMS, AAAI, ACM
  - 2017 Member of the CMU CSD Speakers Club.
  - 2017 Program committee member for the Computer Poker Workshop at AAAI.
  - 2016 Program committee member for IJCAI.
- 2014 - 2016 CMU CS Ph.D. admissions committee member.
- 2013 CMU CSD Immigration Course coordinator.

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## Programming

Strong  
experience

Java, Python, C++, C#.

Medium SQL, C, HTML, CSS.  
experience  
Familiar with R, Matlab, Scala, XSLT, Ruby, Javascript.

## Frameworks

OS	Linux, OS X, Windows.	Statistics/ML	pandas, scikit-learn, tidyverse.
Version control	Git, SVN, Mercurial.	Web	ASP.NET, React, Bootstrap, Flask.
Optimization	CPLEX, Gurobi, NumPy, CVXPY.		

## References

### **Tuomas Sandholm**

Professor, Computer Science  
Carnegie Mellon University  
Pittsburgh, PA  
✉ [sandholm@cs.cmu.edu](mailto:sandholm@cs.cmu.edu)

### **Vincent Conitzer**

Professor, Computer Science  
Duke University  
Durham, NC  
✉ [conitzer@cs.duke.edu](mailto:conitzer@cs.duke.edu)

### **Michael P. Wellman**

Professor, Computer Science  
University of Michigan  
Ann Arbor, MI  
✉ [wellman@umich.edu](mailto:wellman@umich.edu)

### **Fatma Kılınç-Karzan**

Assoc. Professor of Operations Research  
Tepper School of Business  
Carnegie Mellon University  
Pittsburgh, PA  
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### **Nicolas E. Stier-Moses**

Research Scientist Manager  
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Facebook Core Data Science  
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