





Liron Cohen

Curriculum Vitae

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SUMMARY

My work focuses on high-level decision making for autonomous agents and combinatorial optimization. Much of my research is in developing heuristic search-based methods that plan for moving agents. These methods can efficiently and effectively solve multi-agent path finding and motion planning problems with hundreds of agents operating in a shared environment. I also work on other kinds of problems such as execution monitoring frameworks for multi-agent systems, fast embeddings of graphs in Euclidean spaces or potential fields, and other constraint optimization problems.

INDUSTRY & INTERNSHIPS

- 2019 **European Patent (Application)**
Inventor, patent no. 19176506.4 – 1205.
- 2016 **X (Google), California**
High-level decision making at the self-driving car planning team – implemented incremental search algorithms (e.g., D^ -lite & Truncated- D^*) for navigation in dynamic environments.*
- 2014 **Social Intelligence, California**
Natural language processing and prediction – used NLP tools (e.g., NLTK, word2vec & scikit-learn) to mine data from the Web and machine learning techniques to learn scoring rules.
- 2013 **Telic, California**
Data analytics – used machine learning techniques (e.g., boosted decision-trees) to predict customers behavior.
- 2006–8 **Intel Development Center, Israel**
Hardware engineering and logic design – offloaded parts of the TCP protocol from software to hardware.

EDUCATION

- 2020 **Ph.D. in Computer Science**
UNIVERSITY OF SOUTHERN CALIFORNIA
Dissertation: Efficient Bounded-Suboptimal Multi-Agent Path Finding and Motion Planning via Improvements to Focal Search
Adviser: Sven Koenig
- 2012 **M.Sc. in Computer Science**
HEBREW UNIVERISTY OF JERUSALEM
Thesis: The Easy-Factors Heuristic
Adviser: Jeffrey S. Rosenschein
- 2007 **B.Sc. in Computer Engineering**
HEBREW UNIVERISTY OF JERUSALEM

ACADEMIC ACTIVITIES AND AWARDS

- 2019 **Workshop Chair**
The 3rd International Workshop on Multi-Agent Path Finding, IJCAI-19.
- 2019- **Program Committee**
AAMAS-19, IJCAI-19.
- 2018 **Technology Commercialization Award – USC Stevens Center for Innovation**
Multi-Agent Path Finding for Fulfillment Centers.
- 2016 **ICAPS Best Paper Award – Robotics Track**
Multi-agent path finding with kinematic constraints.
- 2016 **Best TA Award**
University of Southern California.
- 2009-10 **Outstanding Teacher Award**
Jerusalem College of Engineering.
- 2007 **Best Engineering Project Award**
“Embedded KVM redirection over IP,” Hebrew University of Jerusalem.
- 2013- **Reviewer**
ICAPS-13, AIIDE-14, ICAPS-14, PlanRob-14, AIIDE-15, ICAPS-15, MIG-15, ICAPS-16, PlanRob-16, WOMPF-16, MIG-16, ICAPS-17, SOCS-17, AIIDE-17, MIG-17, OptMAS-18, AIES-18, AIIDE-18, WAFR-18, AIES-19, IROS-19, COG-19, PlanRob-19, MIG-19, AIIDE-19, WAFR-20.

TEACHING

- 2015–19 **University of Southern California**
Teaching Assistant: Introduction to Artificial Intelligence.
- 2009–12 **Hebrew University of Jerusalem**
Head Teaching Assistant: Introduction to Artificial Intelligence.
- 2008–12 **Jerusalem College of Engineering**
Lecturer: Hardware to Software lab, Introduction to Artificial Intelligence, Linear Systems, Data Structures, Object-Oriented Programming.

ARMY

- 2000–3 **Israeli Air Force**
Recruited to pilot's academy, after deposition served as avionics electrician and released as staff sergeant.

LANGUAGES

English – Fluent; Hebrew – Mother Tongue.

PUBLICATIONS

- [1] S. Gopalakrishnan, L. Cohen, S. Kambhampati, and T. K. S. Kumar, "Embedding directed graphs in potential fields using fastmap," in *Proceedings of the International Symposium on Combinatorial Search (SOCS)*, 2020.
- [2] E. Boyarski, A. Felner, D. Harabor, P. Stuckey, L. Cohen, J. Li, and S. Koenig, "Depth-first conflict-based search with incremental search methods," in *Proceedings of the International Joint Conference on Artificial Intelligence (IJCAI)*, 2020.
- [3] S. Koenig, T. Uras, and L. Cohen, "Teaching undergraduate artificial intelligence classes: An experiment with an attendance requirement," in *Proceedings of the AAAI Symposium on Educational Advances in Artificial Intelligence (EAAI)*, 2020.
- [4] L. Cohen, T. Uras, T. Kumar, and S. Koenig, "Optimal and bounded-suboptimal multi-agent motion planning," in *Proceedings of the International Symposium on Combinatorial Search (SOCS)*, 2019.
- [5] E. Boyarski, L. Cohen, J. Li, A. Felner, and S. Koenig, "Using incremental search for the low level of conflict-based search," in *the 3rd International Workshop on Multi-Agent Path Finding (WoMAPF)*, 2019.
- [6] G. Belov, L. Cohen, M. Banda, D. Harabor, S. Koenig, and X. Wei, "Position paper: From multi-agent pathfinding to pipe routing," in *the 3rd International Workshop on Multi-Agent Path Finding (WoMAPF)*, 2019.
- [7] R. Stern, N. Sturtevant, A. Felner, S. Koenig, H. Ma, T. Walker, J. Li, D. Atzmon, L. Cohen, T. S. Kumar, E. Boyarski, and R. Bartak, "Multi-agent pathfinding: Definitions, variants, and benchmarks," in *Proceedings of the International Symposium on Combinatorial Search (SOCS)*, 2019.
- [8] L. Cohen, M. Greco, H. Ma, C. Hernandez, A. Felner, S. Koenig, and T. Kumar, "Any-time focal search with applications," in *Proceedings of the International Joint Conference on Artificial Intelligence (IJCAI)*, 2018.
- [9] L. Cohen, T. Uras, S. Jahangiri, A. Arunasalam, S. Koenig, and T. Kumar, "The fastmap algorithm for shortest path computations," in *Proceedings of the International Joint Conference on Artificial Intelligence (IJCAI)*, 2018.
- [10] A. Felner, J. Yang, E. Boyarski, H. Ma, L. Cohen, T. Kumar, and S. Koenig, "Adding heuristics to conflict-based search for multi-agent path finding," in *Proceedings of the International Conference on Automated Planning and Scheduling (ICAPS)*, 2018.
- [11] Z. Wang, L. Cohen, S. Koenig, and T. Kumar, "The factored shortest path problem and its applications in robotics," in *Proceedings of the International Conference on Automated Planning and Scheduling (ICAPS)*, 2018.
- [12] L. Cohen, G. Wagner, D. Chan, H. Choset, N. Sturtevant, S. Koenig, and T. Kumar, "Rapid randomized restarts for multi-agent path finding: Preliminary results," in *Proceedings of the International Joint Conference on Autonomous Agents and Multiagent Systems (AAMAS)*, 2018.
- [13] L. Cohen, G. Wagner, D. Chan, H. Choset, N. Sturtevant, S. Koenig, and T. Kumar, "Rapid randomized restarts for multi-agent path finding," in *Proceedings of the International Symposium on Combinatorial Search (SOCS)*, 2018.
- [14] W. Hoenig, T. Kumar, H. Ma, L. Cohen, H. Xu, S. Koenig, and N. Ayanian, "Path finding for multi-robot systems with kinematic constraints in occluded environments," in *Journal of Artificial Intelligence Research (JAIR)*, (Accepted) 2017.
- [15] H. Ma, W. Hoenig, L. Cohen, T. Uras, H. Xi, T. Kumar, N. Ayanian, and S. Koenig,

- “Overview: A hierarchical framework for plan generation and execution monitoring in multi-robot systems,” in *IEEE Intelligent Systems*, vol. 32, pp. 6–12, 2017.
- [16] W. Hoenig, T. Kumar, L. Cohen, H. Ma, H. Xu, N. Ayanian, and S. Koenig, “Multi-agent path finding with kinematic constraints,” in *International Joint Conference on Artificial Intelligence (IJCAI), Sister Conference Best Paper Track*, 2017.
- [17] H. Ma, J. Yang, L. Cohen, T. Kumar, and S. Koenig, “Feasibility study: Moving non-homogeneous teams in congested video game environments,” in *AAAI Conference on Artificial Intelligence and Interactive Digital Entertainment (AIIDE)*, 2017.
- [18] L. Cohen, T. K. S. Kumar, T. Uras, H. Xu, N. Ayanian, and S. Koenig, “Improved bounded-suboptimal multi-agent path finding solvers,” in *International Joint Conference on Artificial Intelligence (IJCAI)*, 2016.
- [19] H. Ma, S. Koenig, N. Ayanian, L. Cohen, W. Honig, T. Kumar, T. Uras, H. Xu, C. Tovey, and G. Sharon, “Overview: Generalizations of multi-agent path finding to real-world scenarios,” in *IJCAI-16 Workshop on Multi-Agent Path Finding*, 2016.
- [20] W. Hoenig, T. Kumar, L. Cohen, H. Ma, H. Xu, N. Ayanian, and S. Koenig, “Multi-agent path finding with kinematic constraints,” in *International Conference on Automated Planning and Scheduling (ICAPS)*, 2016.
- [21] W. Honig, T. Kumar, L. Cohen, H. Ma, S. Koenig, and N. Ayanian, “Path planning with kinematic constraints for robot groups,” in *Southern California Robotics (SCR) Symposium*, 2016.
- [22] L. Cohen, T. Uras, and S. Koenig, “Feasibility study: Using highways for bounded-suboptimal multi-agent path finding,” in *Proceedings of the International Symposium on Combinatorial Search (SOCS)*, 2015.
- [23] M. Furuhata, K. Daniel, S. Koenig, F. Ordonez, M. Dessouky, M.-E. Brunet, L. Cohen, and X. Wang, “Online cost-sharing mechanism design for demand-responsive transport systems,” in *IEEE Transactions on Intelligent Transportation Systems*, vol. 16, pp. 692–707, 2015.
- [24] M. Furuhata, L. Cohen, S. Koenig, M. Dessouky, and F. Ordonez, “Characterizing online cost-sharing mechanisms for demand responsive transport systems,” in *Proceedings of the International Joint Conference on Autonomous Agents and Multiagent Systems (AAMAS)*, 2014.
- [25] T. Kumar, L. Cohen, and S. Koenig, “Incorrect lower bounds for path consistency and more,” in *Proceedings of the Symposium on Abstraction, Reformulation, and Approximation (SARA)*, 2013.
- [26] T. Kumar, L. Cohen, and S. Koenig, “Submodular constraints and planar constraint networks: New results,” in *Proceedings of the Symposium on Abstraction, Reformulation, and Approximation (SARA)*, 2013.
- [27] B. Sankaran, M. Ghazvininejad, X. He, D. Kale, and L. Cohen, “Learning and optimization with submodular functions,” *arXiv preprint arXiv:1505.01576*, 2013.