

Debarun Kar

941 Bloom Walk, SAL 300, USC, Los Angeles, CA - 90089. +1-323-633-8695

dkar@usc.edu
http://www-scf.usc.edu/~dkar

Research Interests

Algorithmic and Computational Game Theory, Machine Learning, Deep Learning, Optimization, Multi-Agent Systems and Case based Reasoning.

Education

- **University of Southern California** Los Angeles, CA, USA
PhD in Computer Science Aug. 2013 – Present
 - Advisor: **Prof. Milind Tambe** [webpage]
 - Areas of Study: Algorithmic and Behavioral Game Theory, Machine Learning, Computational Sustainability
 - Key Courses: Software Multi-Agent Systems, Security Systems, Artificial Intelligence, Applied Probability II, Computer Communications, Computer Graphics, Advanced Algorithms, Database Systems.
- **Indian Institute of Technology, Madras** Chennai, India
M.S. (Thesis) in CSE; Aug. 2010 – July 2013
 - Advisors: **Dr. Sutanu Chakraborti** [webpage] , **Dr. Balaraman Ravindran** [webpage]
 - Areas of Study: Case Based Reasoning, Machine Learning and Data Mining
 - Key Courses: Machine Learning, Data Mining, Artificial Intelligence, Kernel Methods for Pattern Analysis, Memory based Reasoning in AI, Computer Vision, Optimization Methods.
- **Netaji Subhash Engineering College** Kolkata, India
B.Tech. in Computer Science and Engineering; July 2005 - June 2009
 - Advisor: **Dr. Chandra Das** [webpage]
 - Areas of Study: Machine Learning and Genomics
 - Key Courses: Operations Research and Optimization Techniques, Artificial Intelligence, Data Structures, Design and Analysis of Algorithms, Formal Language and Automata Theory, Language Processors, Computer Graphics and Multimedia, Mathematics (probability, statistics, advanced graph theory, linear and abstract algebra, analytical geometry, calculus).

Experience

- **University of Southern California** Los Angeles, CA, USA
Graduate Research Assistant Aug. 2013 – Present
- **Indian Institute of Technology, Madras** Chennai, India
Teaching Assistant Aug. 2012 – July 2013

Rigorously Refereed Journal Publications

1. **Kar D.**, Fang F., Delle Fave F., Sintov N., Tambe M., Comparing Human Behavior Models in Repeated Stackelberg Security Games: An Extended Study, In: *Artificial Intelligence, Elsevier (Impact Factor: 3.371)*. [Link]
2. Zhang C., Gholami S., **Kar D.**, Sinha A., Jain M., Goyal R., Tambe M., Keeping Pace with Criminals: An Extended Study of Designing Patrol Allocation against Adaptive Opportunistic Criminals, In: *Games Journal, 2016*. [Link]
3. Sinha A., Nguyen T., **Kar D.**, Brown M., Tambe M., Jiang A., From Physical Security to Cyber Security, In: *Journal of Cybersecurity, 2016*. [Link]

Rigorously Refereed Conference Publications

4. **Kar D.**, Sengupta S., Kamar E., Horvitz E., Tambe M., Believe It or Not: Modeling Adversary Belief Formation in Stackelberg Security Games with Varying Information, In: *Proceedings of Advances in Cognitive Systems (ACS)- Full Paper*, May 12-14, 2017. Oral Presentation.
5. **Kar D.**¹, Ford B.¹, Gholami S., Fang F., Plumptre A., Tambe M., Driciru M., Wanyama F., Rwetsiba A., Cloudy with a Chance of Poaching: Adversary Behavior Modeling and Forecasting with Real-World Poaching Data, In: *Proceedings of the International Conference on Autonomous Agents and Multi-Agent Systems (AAMAS)- Full Paper (Acceptance Rate: 26%)*, May 8-12, 2017. Oral Presentation. [Link]
6. Abbasi Y., Ben-Asher N., Gonzalez C., **Kar D.**, Morrison D., Sintov N., Tambe M., Know Your Adversary: Insights for a Better Adversarial Behavioral Model, In: *Proceedings of the 38th Annual Meeting of the Cognitive Science Society (CogSci) - Full Paper (Acceptance Rate: 39%)*, August 10-13, 2016. Poster Presentation. [Link]
7. Sinha A., **Kar D.**, Tambe M., Learning Adversary Behavior in Security Games: A PAC Model Perspective, In: *Proceedings of the International Conference on Autonomous Agents and Multi-Agent Systems (AAMAS) - Full Paper (Acceptance Rate: 24.9%)*, May 9-13, 2016. Oral and Poster Presentation. [Link]
8. Nguyen T., Delle Fave F., **Kar D.**, Srinivas A., Yadav A., Tambe M., Agmon N., Plumptre A., Driciru M., Wanyama F., Rwetsiba A., Making the most of Our Regrets: Regret-based Solutions to Handle Payoff Uncertainty and Elicitation in Green Security Games, In: *Proceedings of the International Conference on Decision and Game Theory for Security (GameSec) - Full Paper*, Nov 4-5, 2015. [Link]

¹Joint first authors

9. **Kar D.**, Fang F., Delle Fave F., Sintov N., Tambe M., “A Game of Thrones”: When Human Behavior Models Compete in Repeated Stackelberg Security Games, In: *Proceedings of the International Conference on Autonomous Agents and Multi-Agent Systems (AAMAS) - Full Paper (Acceptance Rate: 24.9%)*, May 4-8, 2015. Oral and Poster Presentation.[Link]
10. Haskell W. B., **Kar D.**, Fang F., Tambe M., Cheung S., Denicolla E., Robust Protection of Fisheries with COMPASS, In: *Proceedings of the Conference on Innovative Applications of Artificial Intelligence (IAAI) - Emerging Applications Paper*, July 27-31, 2014. Oral Presentation.[Link]
11. Kwak J., **Kar D.**, Haskell W. B., Varakantham P., Tambe M., Building THINC: User Incentivization and Meeting Rescheduling for Energy Savings, In: *Proceedings of the International Conference on Autonomous Agents and Multi-Agent Systems (AAMAS) - Full Paper (Acceptance Rate: 23.8%)*, May 5-9, 2014. Oral and Poster Presentation.[Link]
12. **Kar D.**, Kumar A., Chakraborti S., and Ravindran B., iCaseViz : Learning Case Similarities through Interaction with a Case Base Visualizer, In: *Case-based Reasoning Research and Development - Proceedings of the International Conference on Case based Reasoning (ICCBR), LNAI (Springer) - Full Paper (Acceptance Rate: 43.5%)*, July 8-11, 2013. Oral Presentation.[Link]
13. **Kar D.**, Chakraborti S., and Ravindran B., Feature Weighting and Confidence based Prediction for Case Based Reasoning Systems, In: *Case-based Reasoning Research and Development - Proceedings of the International Conference on Case based Reasoning (ICCBR), LNAI (Springer) - Full Paper (Acceptance Rate: 37.2%)*, Sept 3-6, 2012. Oral Presentation.[Link]
14. Choudhury P. P., Sahoo S., Hasssan S. K., Basu S., **Kar D.**, Ghosh D., Ghosh A., Ghosh A., and Ghosh A.K., Classification of Cellular Automata Rules based on their Properties, In: *Proceedings of the International Conference on Trends in Optics and Photonics (ICONTOP)*, Mar 2009. Oral Presentation.[Link]

Workshop Publications (published in Technical reports)

15. **Kar D.**, Fang F., Delle Fave F., Sintov N., Tambe M., Conducting Longitudinal Experiments with Behavioral Models in Repeated Stackelberg Security Games on Amazon Mechanical Turk, In: *AAMAS Human-Agent Interaction Design and Models (HAIDM) Workshop*, May 4, 2015. Oral Presentation.[Link]
16. **Kar D.**, Fang F., Delle Fave F., Sintov N., Sinha A., Galstyan A., An B., Tambe M., Learning Bounded Rationality Models of the Adversary in Repeated Stackelberg Security Games, In: *AAMAS Adaptive Learning Agents (ALA) Workshop*, May 5, 2015. Oral Presentation.[Link]

17. **Kar D.**, Fang F., Delle Fave F., Sintov N., Tambe M., Effectiveness of Probability Perception Modeling and Defender Strategy Generation Algorithms in Repeated Stackelberg Games: An Initial Report, In: *AAAI Workshop on Computational Sustainability*, Jan 25-30, 2015. Oral and Poster Presentation.[Link]

Book Chapters

18. **Kar D.**, Nguyen T., Fang F., Brown M., Sinha A., Tambe M., Jiang A., Trends and Applications in Stackelberg Security Games, In: *Handbook on Dynamic Game Theory, Springer, 2017*.
19. Nguyen T., **Kar D.**, Brown M., Sinha A., Tambe M., Jiang A., Towards a Science of Security Games, In: *New Frontiers of Multi-Disciplinary Research in STEAM-H, 2015*. [Link]

Symposium Publications (published in Technical reports)

20. Sintov N., **Kar D.**, Nguyen T., Fang F., Hoffman K., Lyet A., Tambe M., From the Lab to the Classroom and Beyond: Extending a Game-Based Research Platform for Teaching AI to Diverse Audiences, In: *Symposium on Educational Advances in Artificial Intelligence (EAAI) 2016*. [Link]
21. **Kar D.**, Fang F., Delle Fave F., Sintov N., Tambe M., Effectiveness of Probability Perception Modeling and Defender Strategy Generation Algorithms in Repeated Stackelberg Games, Presented At: *AAAI Spring Symposium 2015 (held at Stanford University)*, Oral Presentation.
22. Kwak J., **Kar D.**, Haskell W. B., Varakantham P., Tambe M., Building THINC: Towards Efficient Fair Division of Credit in Energy Systems, Presented At: *AAAI Spring Symposium 2014 (held at Stanford University)*, Oral Presentation.

Demonstrations

23. Fang F., **Kar D.**, Thomas D., Sintov N., Tambe M., PAWS: Protection Assistant for Wildlife Security, In: *National Conference on Artificial Intelligence (AAAI), February, 2016*. — *Best Application of AI at the AAAI 2016 Video Competition, and Best Student Video Award Finalist at the AAAI 2016 Video Competition* [Link]
24. Ford B., **Kar D.**, Delle Fave M., Yang R., Tambe M., PAWS: Adaptive Game-theoretic Patrolling for Wildlife Protection, In: *Proceedings of the International Conference on Autonomous Agents and Multiagent Systems (AAMAS) - Demonstrations Track Paper*, May 5-9, 2014. [Link]

Thesis and Dissertations

25. **Kar D.** Complexity Guided Feature Weighting, Confidence Augmented Prediction and Visualization for Case based Reasoning Systems, *Masters Thesis*, Advisors: Sutanu Chakraborti, Balaraman Ravindran, Indian Institute of Technology (IIT) Madras, 2013.[Link]

Working Papers

26. Sintov N., Seyranian V., Hohman Zachary P., **Kar D.**, Weingust S., Tambe M., A Reverse Gateway: Conservation Caring as a Protective Factor Against Poaching Behavior.

Internships

- **DPS Technologies India Pvt. Ltd.** Kolkata, India
Website 2008
 - Developed Java based web applications for the search engine optimization team.

Product Development Experience

- **INTERCEPT: An anti-poaching decision aid** Los Angeles, USA
USC, Team partner: Benjamin Ford, Shahrzad Gholami May 2016 – December 2016
 - Designed and developed a decision-tree ensemble based decision aid for rangers in Uganda. Takes as input, data about foot patrols, recorded poaching activities, and terrain and other relevant domain features and gives a poaching prediction map as output. The maps are created by tying our predictions with QGIS. The codes were written in R and Matlab.
- **COMPASS: US Coast Guards patrol generator** Los Angeles, USA
USC, Team partner: Fei Fang September 2013 – March 2014
 - Designed and developed a decision aid for the US Coast Guard that generates effective patrols to prevent illegal fishing in the Gulf of Mexico. Takes as input, data about boat patrols, recorded illegal fishing activities, and fish population densities and gives a future boat patrol route to follow as output. Implements an algorithm developed based on robust optimization. The codes were written in Java and Matlab.
- **iCaseViz: Multi-dimensional data visualizer & analyzer** Chennai, India
IIT Madras, Team partner: Anand Kumar September 2012 – February 2013
 - Designed and developed the application using C++ and Qt. Used a tiled display similar to maps application to reduce memory footprint and responsiveness. It supports representing large datasets, repositioning axes and zooming in/out with greater efficiency as compared to existing tools. Options to facilitate data analysis by interacting with the visualizer has been researched upon and developed.
- **InfoChrom (AAT): Decision aid for farmers in India** Chennai, India
IIT Madras September 2010 – August 2012
 - Designed and developed a decision aid that extracts chromatogram image features, uses those features to predict amounts and quality of various soil nutrients and then finally suggests appropriate crops to cultivate in that land.

- **Cellular automaton simulator**

Indian Statistical Institute

Kolkata, India

September 2008 – October 2008

- Generates outcome for the complete set of 1-d and 2-d cellular automaton rules for successive iterations starting from a user-specified initial seed position. Also enables the user to generate rules based on a pre-defined set of Boolean operations and visualize the outcome.

Teaching Experience

- **Teaching Assistant**

IIT Madras

Chennai, India

2012 – 2013

- **CS6250: Memory based Reasoning in AI** : Delivered lectures on Complexity measures, Visualization techniques, Feature Weighting and Similarity Learning Methods, Footprint based Retrieval and related topics. Also guided six groups for their term projects on various topics.
- **CS6370: Natural Language Processing** : Assignment evaluation, selecting research papers for presentation.

Students Guided

- **USC**

USC

Los Angeles, USA

2013 – Present

- **Brian Schwedock (B.S. Student)** [Linkedin]- Project: Designing effective strategies for patrolling in downtown Los Angeles based on historical patrol and crime data from that region.
- **Nikhil Cherukuri (B.S. Student)** [Linkedin]- Project: Designing interactive web games based on Google Maps API and HTML5 with Javascript to study the human belief formation and update process.
- **Amit Plaha (M.S. Student)** [Linkedin]- Project: Designing interactive web games based on Google Maps API and HTML5 with Javascript to study the human belief formation and update process.
- **Jie Zheng (M.S. Student): Now at Oracle** [Linkedin]- Project: Designing an interactive web game based on Google Maps API and HTML5 with Javascript to study adversary behavior in Green Security Games.
- **Chiao-meng Huang (M.S. Student): Now at Google** [Linkedin]- Project: Designing an interactive web game based on Google Maps API and HTML5 with Javascript to study adversary behavior in Green Security Games.
- **Providence Ilisevich (Research Assistant at CREATE Homeland Security Center)** [Linkedin]- Project: Analyzing human behavior data collected via Amazon Mechanical Turk to understand how poachers act in the real world.
- **Kevin Hoffman (Teacher from Alliance Health Services Academy High School, now a Blended Learning Analyst in Aspire Public Schools)** - Project: Developing a game theory course curriculum for Alliance Health Services Academy High School, as part of the NSF Research Experience for Teachers (RET) program.

- **Madhavi Yenugula**[\[Linkedin\]](#)- Project: B.Tech. thesis on “Classification of Wikipedia Content using Hyperlinks”.

Proposals Helped In

- *Building a Science of Cyber-Security Games*, 09/01/2015-09/01/2018, approx. \$750,000, Army Research Office.
- *Predictive Modeling for Early Identification of Suicidal Thinking in Social Networks*, Submission to Army Research Office.
- *Optimization of biosensor arrays using POMDP*, Submission to National Science Foundation (NSF).

Professional Activities

- Main Organizer for ADVERSE & SecMAS Workshop at AAMAS 2017, AAMAS 2016 [\[Link\]](#)
- Conference Reviewing: IJCAI 2017, AAI 2017, AAMAS 2016, IJCAI 2015
- Journal Reviewing: Artificial Intelligence (Elsevier), IEEE Intelligent Systems, Simulation-Transactions of the Society for Modeling and Simulation International
- Workshop Reviewing: AICS (Artificial Intelligence for Cyber Security) at AAI 2016
- Symposium Reviewing: AAI Spring Symposium 2017, 2015
- An active member of the ‘USC CS PhD Committee’ Management Team (2013-2015)

Invited Talks and Presentations

- 4th International Conference on Computational Sustainability 2016 - Talk on *Human Behavior Models to Predict Wildlife Crime*.
- Army Research Office (ARO) Workshop on Cyber Deception at George Mason University, July 2015: Invited by Prof. Sushil Jajodia (BDM International Professor of Information Technology, and Director of the Center for Secure Information Systems, Volgenau School of Engineering, GMU) - Talk on *Human Behavior Modeling for Physical and Cyber Security*.
- 22nd International Symposium on Mathematical Programming (ISMP), July 2015: Invited talk on *SHARP: A Novel Human Behavior Model in Repeated Stackelberg Security Games*.
- IIT Madras CSE (February 2015): Talk on *Game Theory and Machine Learning in Green Security Games*.

- USC Civil Engineering Department (2014): Invited by Prof. Burcin Becerik-Gerber (Stephen Schrank Early Career Chair in Civil and Environmental Engineering) - Talk on *Game Theoretic Applications in Computational Sustainability*.
- Conference presentations: CompSust 2016, ISMP 2015, AAAI Spring Symposium (2015, 2014), AAAI 2015, AAMAS (2016, 2015, 2014), IAAI 2014, ICCBR (2013, 2012).

Achievements & Awards

- **Nominated for Biswajit Sain Memorial Award for best M.S. thesis at IIT Madras for 2014.**
- **Outstanding Teaching Assistant Award at IIT Madras**
 - For the course Memory based Reasoning in AI
- **Winner : Yahoo HackU 2011 (Science Category), out of 40 hacks**
 - Tweets of Interest : Deliver smart digests of tweets interesting to a user over email based on the user's preferences.
- **First prize in Deep Blue (Machine Learning Event) at Shaastra (IITM Technical Fest) ² 2011.**
 - Only single member team to win an award, out of 30 teams (approx.).
- Got **99.45%ile and 99.36%ile in Graduate Aptitude Test in Engineering ³** (GATE CSE 2009 & 2010), out of **43,170 and 1,03,876** students respectively.
- **National Merit Scholarship**
 - Ranked 54th out of 6,000,00 students (approx.) in the secondary board examination.
- **Gold Medal**
 - A++ (Highest Grade) in Achievement cum Diagnostic Test in Mathematics (ADTM), conducted by The Centre for Pedagogical Studies in Mathematics, India
- **Gold Medal**
 - A+ (Highest Grade) in Science Aptitude and Talent Search Test (SATST), conducted by the All India Science Teacher's Association
- **Travel Scholarships**

²Shaastra is IIT Madras' student-run annual technical festival which holds the distinction of being the first such event in the world to be ISO 9001:2000 certified for implementing a Quality Management System.

³An all India examination that primarily tests the comprehensive understanding of various undergraduate subjects in Engineering and Technology. GATE is conducted jointly by the Indian Institute of Science and seven IITs and is similar to the subject GRE.

- CompSust Scholarship 2016, IFAAMAS Scholarship (2016, 2015, 2014), AAAI Scholarship 2015, Department of Science and Technology (DST) India Travel Grant to attend ICCBR 2012, Yahoo Summer School on Information Retrieval (2011) at IISC Bangalore (India), Softcomp (2008).

- **Infosys Campus Connect Programme**

- Selected as one of the top students during Undergraduate studies, to attend the Infosys Campus Connect Programme in 2008.

Skills

- **Languages:** C/C++, Matlab, Python, Java, R, Javascript, HTML/CSS, \LaTeX
- **Softwares/Libraries:** Weka, Tensorflow, Keras, QGIS, GTK+, Qt, Visual Studio SDK
- **Experiment Platforms:** AWS, Mechanical Turk

Extra-curricular Activities

- Co-organisor of CS Cup (CSE department sporting event) at IITM
- Co-ordinator of PG Schroeter (Institute wide sporting event for PG students) at IITM
- Runners-up of CPL fall 2014 cricket tournament at USC
- Amateur Poker player.

References

- **Prof. Milind Tambe**

Helen N. and Emmett H. Jones Professor in Engineering,
Professor, Computer Science & Industrial and Systems Engineering Departments,
University of Southern California,
941 Bloom Walk,
Salvatory Computer Sciences (SAL) 300,
Los Angeles, CA 90089, USA.
Email: tambe@usc.edu

- **Dr. Nicole Sintov**

Research Assistant Professor, Arnold Schwarzenegger Institute of State and Global Policy,
USC Sol Price School of Public Policy,
Research Leader, USC Information Sciences Institute,
Lecturer, USC Department of Psychology,
University of Southern California,
635 Downey Way,
Verna & Peter Dauterive (VPD) Hall 201,
Los Angeles, CA 90089, USA.
Email: sintov@usc.edu

- **Dr. Sutanu Chakraborti**

Associate Professor,
Computer Science & Engineering Department,
Indian Institution of Technology (IIT) Madras,
Bulding Sciences Block (BSB) 304,
Chennai, Tamilnadu 600036, India.
Email: sutanuc@cse.iitm.ac.in

- **Dr. Balaraman Ravindran**

Associate Professor,
Computer Science & Engineering Department,
Indian Institution of Technology (IIT) Madras,
Bulding Sciences Block (BSB) 349,
Chennai, Tamilnadu 600036, India.
Email: ravi@cse.iitm.ac.in