Sahil Garg

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Research Interest

For the past 9 years, I have been conducting *problem-driven* (interdisciplinary) research, developing software solutions for real-world tasks, and been making significant novel contributions to the field of artificial intelligence, published for top-tier conferences in *computer science.*

MACHINE LEARNING (low resource, robustness, interpretative, nearly unsupervised, information theory, non-parametric, sparse modeling, nonstationarity, convolution kernels, recurrent neural networks).
NATURAL LANGUAGE PROCESSING (biomedical relation extraction, dialog modeling, semantic parsing, text clustering).
DEEP NEURAL NETWORKS (continual learning, optimization).
COMPUTATIONAL PSYCHIATRY (early diagnosis, therapeutic dialogues, psychosis, schizophrenia, post-traumatic stress disorder, chronic pain, major depression, drug addiction, anti-NMDA receptor encephalitis).
NEUROSCIENCE (auto-encoding, neurogenesis, life-long learning).
ROBOTICS (information gathering, spatio-temporal stochastic phenomena).

Education

University of Southern California (USC)   Aug 2013 -Aug 2019
PhD in Computer Science (Machine Learning)   Advisor: Aram Galstyan
Title: "Hashcode Representations of Natural Language for Relation Extraction"
Committee: Aram Galstyan (chair), Kevin Knight, Irina Rish, Greg Ver Steeg, Roger Ghanem (external).

Thapar Institute of Engineering and Technology July 2005 - July 2009
Bachelor of Engineering (B.E.) in Computer Science

Selected Publications

Conference Proceedings

Modeling Dialogues with Hashcode Representations. Sahil Garg*, Irina Rish, Guillermo Cecchi, Palash Goyal, Sarik Ghazarian, Shuyang Gao, Greg Ver Steeg, Aram Galstyan. Proceedings of the AAAI Conference on Artificial Intelligence (**AAAI-20**).

Nearly-Unsupervised Hashcode Representations for Relation Extraction. Sahil Garg*, Aram Galstyan, Greg Ver Steeg, Guillermo Cecchi. Proceedings of the Conference on Empirical Methods in Natural Language Processing (**EMNLP-19**).

Kernelized Hashcode Representations for Relation Extraction. Sahil Garg*, Aram Galstyan, Irina Rish, Guillermo Cecchi, Shuyang Gao. Proceedings of the AAAI Conference on Artificial Intelligence (**AAAI-19**).

Neurogenesis-Inspired Dictionary Learning: Online Model Adaption in a Changing World. Sahil Garg*, Irina Rish, Guillermo Cecchi, Aurelie Lozano. Proceedings of the International Joint Conference on Artificial Intelligence (**IJCAI-17**).

Extracting Biomolecular Interactions Using Semantic Parsing of Biomedical Text. Sahil Garg*, Aram Galstyan, Ulf Hermjakob, Daniel Marcu. Proceedings of the *AAAI* Conference on Artificial Intelligence (**AAAI-16**).

Persistent Monitoring of Stochastic Spatio-temporal Phenomena with a Small Team of Robots. Sahil Garg*, Nora Ayanian. Proceedings of Robotics: Science and Systems (**RSS-14**).

Learning Nonstationary Space-Time Models for Environmental Monitoring. Sahil Garg*, Amarjeet Singh, Fabio Ramos. Proceedings of the *AAAI* Conference on Artificial Intelligence (**AAAI-12**).

Workshop Proceedings
Therapeutic Dialogue Modeling via Locality Sensitive Hashing. Sahil Garg*, Guillermo Cecchi, Irina Rish, Shuyang Gao, Greg Ver Steeg, Palash Goyal, Aram Galstyan. Presented in *ICML* 2018 Workshop, AI and Computational Psychology: Theories, Algorithms and Applications (CompPsy 2018).

Dialogue Modeling via Hashing Functions. Sahil Garg*, Guillermo Cecchi, Irina Rish, Shuyang Gao, Greg Ver Steeg, Sarik Ghazarian, Palash Goyal, Aram Galstyan. Proceedings of *IJCAI* 2018 Workshop, Linguistic and Cognitive Approaches to Dialog Agents (LaCATODA 2018).

Neurogenesis-Inspired Dictionary Learning: Online Model Adaption in a Changing World. *Sahil Garg**, Irina Rish, Guillermo Cecchi, Aurelie Lozano. *ICLR* 2017 - Workshop Track.

Efficient Space-Time Modeling for Informative Sensing. *Sahil Garg**, Amarjeet Singh, Fabio Ramos. Proceedings of KDD 2012 Workshop, Knowledge Discovery from Sensor Data (SensorKDD 2012).

Professional Services	**Program Committee Member for Conferences in CS**	
	The AAAI Conference on Artificial Intelligence (AAAI)	2017, 2018, 2020
	Neural Information Processing Systems (NeurIPS)	2017, 2018, 2019
	International Conference on Machine Learning (ICML)	2018, 2019, 2020
	International Conference on AI and Statistics (AISTATS)	2019, 2020
	International Conference on Learning Representations (ICLR)	2019, 2020

Reviewer for Journals
IEEE Robotics and Automation Letters (2019)

Present Research Collaborations Icahn School of Medicine at Mount Sinai, IBM Research, MIT, U. of Montreal, MILA, NYU, USC, Yale.

Research Experience

Icahn School of Medicine at Mount Sinai   **Postdoctoral Fellow**
Sept 2019 - present   Advisor: Guillermo Cecchi, Cheryl Corcoran
Exploring the beautiful field of computational psychiatry to understand the challenges clinical practitioners face, and how machine learning can contribute to the field. Developing machine learning models, interpretative and data-efficient, for research problems in computational psychiatry. Analyzing audio transcripts and videos of open-ended interviews with patients conduced by psychiatrists, for an early diagnosis of psychosis and therapeutic dialogue modeling.
Keywords: computational psychiatry, machine learning, text clustering, dia-

logue modeling, diagnosis, interpretative, information theory, sparse modeling.
Collaborators: Anusha Yeshokumar, Irina Rish, Yulia Landa, Adriana Feder, Marianne Goodman, Keren Bachi, Helen Mayberg, David Dorfman, Mary-Catherine George.

University of Southern California (USC)   **Research Assistant**
Mar 2015 - Aug 2019   Advisor: Aram Galstyan
Developed machine learning models, which are computationally scalable, trainable in a robust manner on small sets of labeled examples, applicable to natural language processing for real world problems in healthcare. Managed pipeline of a software deliverable for a multi-million dollar project in relation to personalized cancer treatment, Big Mechanism, sponsored by DARPA.
Keywords: bio-informatics, machine learning, relation extraction, abstract meaning representations (semantic parsing), recurrent neural networks, convolution kernels, robustness, scalability, information theoretic representation learning, nearly unsupervised.
Collaborators: Daniel Marcu, Kevin Knight, Ulf Hermjakob, Andrey Rzhetsky, Jose Luis Ambite, Hrant Khachatrian, Peter Sorger, Prem Natarajan, Gully Burns, Philip Cohen, Greg Ver Steeg, Shuyang Gao, David Kale.

May 2015 - Mar 2016   Advisor: Aram Galstyan
Information-theoretic modeling of brain fMRI dynamics using CorEx.
Keywords: fMRI, machine learning, information theory, unsupervised representations, interpretive.
Collaborators: Greg Ver Steeg, Fabrizio Pizzagalli, Paul Thompson.

June 2014 - Oct 2015   Advisor: Aram Galstyan
Phase transitions in community detection using CorEx.
Keywords: information theory, unsupervised representations, statistical physics, network science, machine learning.
Collaborators: Greg Ver Steeg, Cristopher Moore.

April 2014 - Sept 2014   Advisor: Aram Galstyan
Generative modeling of a complex network and its structural properties like clustering, power law degree distribution, degree correlation, etc.
Keywords: network science, machine learning, generative models, hyperbolic spaces, stochastic variational Bayes, causal inference.
Collaborators: Greg Ver Steeg.

Oct 2013 - April 2014   Advisor: Nora Ayanian
Persistent sensing of environmental phenomena with a team of robotic sensors.
Keywords: spatio-temporal stochastic phenomena, machine learning, Bayesian modeling, nonstationarity, path planning, information theory, kernel functions, multi-robots coordination.

June 2013 - Sept 2013   Advisor: Milind Tambe
Developing computationally scalable game theoretic algorithms for safe-guarding natural resources such as fish in the gulf of Mexico.
Keywords: game theory, reinforcement learning, scalability, spatio-temporal stochastic phenomena.
Collaborators: Albert Jiang, William Haskell, Yundi Qian.

IIIT Delhi   **Undergraduate Research Assistant**
April 2011 - May 2013   Advisor: Amarjeet Singh
Learning non-stationary models efficiently for sensing environment dynamics.
Keywords: spatio-temporal stochastic phenomena, nonstationarity, machine learning, path planning, information theory, kernel functions, scalability.
Collaborators: Fabio Ramos.

Research Internship Experience

IBM T. J. Watson Research Center   Computational Biology Center
Summers of 2016, 2017   Mentors: Irina Rish & Guillermo Cecchi

June 2016 - present
We investigated computational plausibility of *adult neurogenesis* phenomenon.
Keywords: machine learning, sparse modeling, neuroscience, continual online learning, context switching, unsupervised representations.
Collaborators: Aurelie Lozano, Amit Dhurandhar.

June 2017 - present
We developed an information-theoretic framework for modeling therapeutic dialogues via hash functions.
Keywords: dialog modeling, machine learning, scalable, data-efficient, interpretive, hashcode representations, non-parametric, neural networks, kernel functions.
Collaborators: Shuyang Gao, Palash Goyal, Sarik Ghazarian, Greg Ver Steeg, Aram Galstyan.

Teaching Experience

University of Southern California (USC)
Coordinated Mobile Robotics, Spring 2014   Teaching Advisor: Nora Ayanian

Software Engineering Experience

Snowpal Software Services   Co-founder
June 2010 - Dec 2011   Manager: Harman Singh & Krish Palaniappan
Developed a server side application in education domain including database design and a RESTful API.
Contributions: requirement analysis, database design, architecture design, product development, team recruitment & training.
Technology: Ruby on Rails, My SQL.

Commdel, India   Software Engineer
Aug 2009 - June 2010   Manager: Srinivasareddy Chennareddy
Developed core module for a software to parse data packets, as per configurable ISO8583 format, into business objects for financial transactions. The software was awarded as the best loyalty program in India, and processes transactions worth more than $1.2 billion yearly (2012 statistics).
Contributions: database design, architecture, product development, client interaction for business understanding, managing production team.
Technology: Java, Dot Net, SQL Server.

Global Logic, India   Software Engineering Intern
Feb 2009 - Aug 2009   Manager: Atul Srivastava
Developed a software component for subscribing RSS feeds in a user friendly manner with an efficient search utility.

	Contributions: database design, architecture design.
	Technology: Dot Net, SQL Server.
Graduate Coursework	Artificial Intelligence, Database Systems, Coordinated Mobile Robotics, Machine Learning, Applied Linear Algebra, Estimation Theory, Advanced Analysis of Algorithms, Randomized Algorithms (A), Digital Geometry Processing, Scientific Computing and Visualization.
Educational programs	2015 Complex Systems Summer School, Santa Fe Institute.
Other Accomplishments	99% percentile secured in all India entrance exams IIT-JEE-05 (200k participants) and AIEEE-05 (600k participants). 1st rank secured in C++ skill exams (for online placements in undergrad school) conducted by companies Informatica Business Solutions (CS batch of 80 students), and Global Logic (220 students).

Research References

Aram Galstyan	galstyan@isi.edu
Research Associate Professor	Univ. of Southern California
Director of AI Division	USC ISI
Irina Rish	rish@us.ibm.com
Associate Professor	MILA, Univ. of Montreal
Guillermo A. Cecchi	gcecchi@us.ibm.com
Principal Research Staff Member	IBM T. J. Watson Research Center
Greg Ver Steeg	gregv@isi.edu
Research Associate Professor	Univ. of Southern California
Daniel Marcu	marcu@isi.edu
Research Associate Professor	Univ. of Southern California
Director of MT/NLP	Amazon
Kevin Knight	kevin.crawford.knight@gmail.com
Professor	Univ. of Southern California
Chief Scientist for NLP	Didi Chuxing
Amarjeet Singh	amarjeet@iiitd.ac.in
Assistant Professor	IIIT Delhi
Co-Founder & Chief Technology Officer	Zenatix
Fabio Ramos	fabio.ramos@sydney.edu.au
Professor	Univ. of Sydney

Engineering References

Nitin Gupta	nitin@commdel.net
Co-Founder & Managing Partner	Commdel Consulting Services Pvt Ltd
Co-Founder & Director- Product & Strategy	Agility MobileForce Solutions
Co-Founder & Director	Core Doc2Info Services Pvt. Ltd.

Amit K Verma   amit@commdel.net
Co-Founder & Director   Commdel Consulting Services Pvt Ltd
Co-Founder & Director   Agility MobileForce Solutions
Co-Founder   Core Doc2Info Services Pvt. Ltd.

Srinivasareddy Chennareddy   srinivasa.chennareddy@gmail.com
VP Products, Digital Marketing & Sales   CG Parivar Group
Co-Founder (exited in 2015)   Agility MobileForce Solutions

Harman Singh   hpssahni@gmail.com
Senior Software Engineer   Amazon
Co-Founder (exited in 2011)   Snowpal Software Services