Dr. Nurali Virani

Research Scientist, Machine Learning and AI  
GE Research

**EDUCATION**

* Ph. D. in Mechanical Engineering (2017), Pennsylvania State University   
  [Area: Data-driven modeling and stochastic control]
* M. S. in Electrical Engineering (2016), Pennsylvania State University   
  [Area: Game theory and robotics]
* M. S. in Mechanical Engineering (2015), Pennsylvania State University

[Area: Time-series analysis and sensor fusion]

* M. Tech. in Industrial Engineering (2011), Indian Institute of Technology (IIT) Kharagpur [Area: Optimization]
* B. Tech. in Manufacturing Science (2011), Indian Institute of Technology (IIT) Kharagpur [Area: Robotics]

**RESEARCH EXPERIENCE**

Dr. Nurali Virani is a Research Scientist in the Machine Learning team under AI organization at GE Research. He is a multidisciplinary researcher with a strong academic and research background in machine learning, statistical modeling, optimization theory, control theory, sensor fusion, signal processing, motion planning, and mechatronics. He works on designing, developing, and deploying algorithms to systematically address some challenges in learning and control. He has worked on several projects including: 1) AI-driven control of wind farms, 2) active learning for surrogate modeling and sequential optimization of oil reservoirs, 3) learning from demonstration in tele-robotics, 4) AI-driven safe control of power generation units, and 5) insider threat detection for cybersecurity (IARPA SCITE). He is also a member in GE team on the DARPA ASKE program to automatically create computational graphs from semantic knowledge graphs curated from code, documentation, and publications with human-in-the-loop. His current research interest is in making AI aware of its competence and to improve its competence via continuous learning (*Humble AI*) as well as making AI consistent with human knowledge.

Prior to joining GE, he was a research assistant at Penn State with primary assistantship from U. S. Air Force Office of Science and Research (AFOSR). His research was on data-driven modeling of context using statistical learning, nonparametric methods for density estimation, Bayesian sensor fusion, and Markov decision processes for context-aware sensor selection in multi-modal surveillance. As a part of Networked Robotics and Systems Lab, he worked on game theory and robust optimization for his MS thesis in Electrical Engineering. In Penn State, he was key researcher on *Intelligent Sensor Fusion for Fault Detection* project from U. S. Office of Naval Research (ONR) and *Sensor Array Fusion for Border-Crossing Target Detection and Classification* from U. S. Army Research Office (ARO). He was awarded a silver medal for academic excellence, when he graduated from Indian Institute of Technology in 2011.

**SELECTED PATENTS AND PUBLICATIONS**

* Virani, N., Phoha, S. and Ray, A., 2018. Learning from Multiple Imperfect Instructors in Sensor Networks. IEEE Transactions on Neural Networks and Learning Systems, (99), pp.1-7.
* Virani, N., Lee, J.W., Phoha, S. and Ray, A., 2014, December. Dynamic Context-Aware Sensor Selection for Sequential Hypothesis Testing. In 53rd IEEE Conference on Decision and Control (pp. 6889-6894). IEEE.
* Virani, N., Lee, J.W., Phoha, S. and Ray, A., 2015, July. Learning Context-Aware Measurement Models. In 2015 American Control Conference (ACC) (pp. 4491-4496). IEEE. (**Best Presentation in Session (Machine Learning) Award**)
* Virani, N. and Zhu, M., 2016, July. Robust adaptive motion planning in the presence of dynamic obstacles. In 2016 American Control Conference (ACC) (pp. 2104-2109). IEEE.
* Virani, N., Jha, D.K., Yuan, Z., Shekhawat, I. and Ray, A., 2018. Imitation of Demonstrations using Bayesian Filtering with Nonparametric Data-Driven Models. Journal of Dynamic Systems, Measurement, and Control, 140(3), p.030906.

**OTHER SELECTED PUBLICATIONS**

* Virani, N., Jha, D. K., Ray, A. and Phoha, S., “Sequential Hypothesis Testing and Symbolic Time-series Analysis for Streaming Data from Physical Processes,” in Engineering Applications of Artificial Intelligence, accepted.
* Virani, N., 2017. Learning Data-Driven Models for Decision-Making in Intelligent Physical Systems. (Ph. D. Dissertation)
* Virani, N., Lee, J.W., Phoha, S. and Ray, A., 2016, July. Information-space partitioning and symbolization of multi-dimensional time-series data using density estimation. In 2016 American Control Conference (ACC) (pp. 3328-3333). IEEE.
* Virani, N., Sarkar, S., Lee, J.W., Phoha, S. and Ray, A., 2016. Algorithms for context learning and information representation for multi-sensor teams. In Context-Enhanced Information Fusion (pp. 403-427). Springer, Cham.
* Sarkar, S., Sarkar, S., Virani, N., Ray, A. and Yasar, M., 2014. Sensor fusion for fault detection and classification in distributed physical processes. Frontiers in Robotics and AI, 1, p.16.

**AWARDS**

* GE Global Research CTO Technology Award for Outstanding Research (5 Under 5), 2018
* Institute Silver Medal from IIT Kharagpur
* Prof. G. S. Sanyal Cup from IIT Kharagpur for Best Outgoing Student in Technology 2011
* Aga Khan Foundation International Scholarship 2011-13
* Aga Khan Youth Award for Excellence 2013 for Outstanding Special Achievements
* Proficiency Award for Best Project in M. Tech. in Industrial Engineering in 2011 at IIT Kharagpur
* Proficiency Award for Best Project in B. Tech. in Manufacturing in 2010 at IIT Kharagpur
* Best Student Paper Award at 2016 ACM SIGKDD Workshop on Machine Learning for Prognostics and Health Monitoring
* 2 GE Impact Awards in 2018
* 3 GE Above & Beyond Awards in 2017