UPINDER KAUR

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EDUCATION

Purdue University   West Lafayette, USA
Ph.D. Candidate, School of Engineering Technology   *August 2019 - present*
Advisor: Dr. Richard M. Voyles   *GPA: 3.96/4.00*
Indira Gandhi Delhi Technical University   Delhi, India
Masters of Technology, Robotics and Automation   *August 2015 - June 2017*
Thesis Advisor: Dr. N. K. Chauhan, Dr. Sudipto Mukherjee   *Score: 90.05%*
Amity University   Noida, India
Bachelors of Technology, Mechanical and Automation Engineering *August 2011 - June 2015*
Thesis Advisor: Dr. Gaurav Gupta   *GPA: 8.82/10*

RESEARCH EXPERIENCE

Research Assistant and Lab Manager
Purdue University   Aug 2019 - present
Cyber-Physical Systems with Robot at the Edge
- Designed a semisupervised malware detection framework for a cyber-physical system. Created a dataset and a testbed for validation of the framework.
- Implemented a multi-hop two-stage network with LoRa and BLE for real-time animal health tracking using Thingsboard and ESP32 based circuitry.
- Actively working on an unsupervised learning framework for malware detection and isolation in unauthenticated large-scale cyber-physical systems.
- Organized and managed the collaboration among multiple groups across three universities for timely realization of goals.

Reinforcement Learning in Robots
- Formulated an autonomous framework using the Contextual Multi-Arm Bandits (CMAB) algorithm for multimodal haptics tasks. Implemented using Python and Robot Operating System (ROS) for autonomous contour following using a Barrett gripper on the Baxter robot.
- Helped in the conceptualization and implementation of a reinforcement learning framework for a contact intensive task without reward engineering.
- Lead a team of six in orchestrating the data collection and annotation activities for building a publicly available dataset.

Machine Learning and Robotics
- Implemented a Mask R-CNN based object detector for online path planning of a mobile robot.
- Engineered Haar-based classifier for facial authentication in a low-power wireless system.
- Created an FFT-based feature engineering framework for transfer learning among robots.
- Built 3D models of animals using Realsense and ZED cameras. Building a dynamic model of the physiological movements for health prediction and tracking in bovines.

Research Intern
Microsoft Research   May 2020 - July 2020
Traceability in Agricultural Supply Chains
- Building a sensor-sparse network for tracking crop movement between Critical Traceability Points.
- Designed a sensor pack with positional and orientation tracking for large-volume crops.
- Developed a 3D simulator of the system with validation experiments conducted on actual farms.
- Mentored fellow interns in the design and implementation of solutions.

PROFESSIONAL EXPERIENCE

General Motors Technical Center   Bangalore, India
Senior Software Engineer, ECU Software   August 2017-May 2019
- Developed and implemented verification and validation protocols for ECU software modules.
- Directed a team of four engineers in the design and execution of ECU memory software validation.
- Formulated algorithms for Ethernet protocol validation.
- Trained a group of 65 colleagues in Mexico and USA in internal python-based tools.

ACADEMIC AND PROFESSIONAL ACHIEVEMENTS

- Awarded 6 GM recognition awards for excellence in leading, developing, and supporting various projects and priority customer issues from across the globe.
- **Chancellor's Gold Medal** for exceptional academic performance, 2017
- **Vice Chancellor's Gold Medal** for first rank, 2017
- **Exemplary Performance Silver Plaque**, 2017
- Ministry of Human Resource Development (MHRD) Scholarship (2015-2017).
- TOEFL: 117/120 GRE: 329/340
- Academic Bronze Medal, 2015

KEY SKILLS

- Languages: C/C++, Python, MATLAB
- ML/AI: Pytorch, Keras, Tensorflow, OpenAI Gym
- Computer Vision: OpenCV, ZED SDK
- Platforms: Linux, Windows
- Robotics: KUKA, Baxter, ROS
- Software: Gazebo, Solidworks

PUBLICATIONS

Book Chapter
- **Upinder Kaur**, Richard Voyles, and Shawn Donkin, 2020. "Future of Animal Welfare: Technological Innovations for Individualized Animal Care". In: Temple Grandin, ed., Improving Animal Welfare: A Practical Approach, 3rd ed. Wallingford: CABI.

Journals
- **Upinder Kaur**, Xin Ma, Vishnunandan Venkatesh, and Richard Voyles, "Augmented Haptic Perception with Multi-Modal Sensing for Purposeful Manipulation Using Inspection-on-the-Fly", under review at IEEE Transactions on Haptics.
- Sangjun Eom, **Upinder Kaur**, Haozhe Zhou, David Kusuma, and Richard Voyles, "TupperwareEarth: Knowledge-based Ontological Semantics for the Internet of Kitchen Things", submitted to IEEE Internet of Things Journal.
- Chan Su Han, **Upinder Kaur**, Huiwen Bai, Barbara Roqueto dos Reis, Robin White, Robert A Nawrocki, Richard M. Voyles, Min Gyu Kang, and Shashank Priya, "Frontiers in Precision Dairy Technology I: Sensor technologies for real-time monitoring of the rumen environment",in the Journal of Dairy Science.
- Rammohan Sriramdas, Xiaotian Li, **Upinder Kaur**, Xin Ma, Arunashish Datta, Barbara Roqueto dos Reis, Shreyas Sen, Kristy Daniels, Robin White, Richard M. Voyles, Shashank Priya, "Frontiers in Cyber-Animal Systems: Indwelling Robotics for Active Health Monitoring in Ruminants", submitted to Journal of Dairy Science.
- Victor M.R. Malacco, **Upinder Kaur**, Huiwen Bai, P. Price, Robert A. Nawrocki, Richard M. Voyles, Kristy M. Daniels, Robin R. White and Shawn S. Donkin, "Sensing in Precision Dairy Farming: The Promise and Potential of Sensors in Precision Diary Farming" (tentative title), in preparation for Journal of Dairy Science.
- **Upinder Kaur**, Victor M.R. Malacco, Arunashish Datta, Lei Xin, Kristy Daniels, Robin White, Shreyas Sundaram, George Chiu, Shreyas Sen, Shawn Donkin and Richard M. Voyles, "Frontiers in

Cyber-Animal Systems 4: Implementation and Integration of Precision Dairy Systems" (tentative title), in preparation for Journal of Animal Science.

- **Upinder Kaur**, Victor M.R. Malacco, Arunashish Datta, Lei Xin, Kristy Daniels, Robin White, Shreyas Sundaram, George Chiu, Shreyas Sen, Shawn Donkin and Richard M. Voyles, "IoT Systems for Sustainable Animal Agriculture and Welfare: A Survey" (tentative title), in preparation for IEEE Internet of Things.
- Haoguang Yang, Mythra V. Balakuntala, Upinder Kaur, Jhon J. Qui noneb, Abigayle E. Moserb, Ali Doosttalab,Antonio Esquivel-Puentes, Tanya Purwar, Luciano Castillo, Xin Ma, Richard M. Voyles, "Occupant-Centric Robotic Air Filtration and Planning for Classrooms for SaferSchool Reopening Amid Respiratory Pandemics", under review at Robots and Autonomous Systems.
- **Upinder Kaur**, Glebys Gonzalez, Md Masudur Rahman, Vishnunandan Venkatesh, Natalia Sanchez, Gregory Hager, Yexiang Xue, Richard Voyles, and Juan Wachs, "From the DESK (Dexterous Surgical Skill) to the Battlefield - A Robotics Exploratory Study" in Military Health System Research Symposium (Military Medicine), 2020.
- Masadur Rahman, Mythra V. Balakuntala, Glebys Gonzalez, Mridul Agarwal, **Upinder Kaur**, Vishnunandan Venkatesh, Natalia Sanchez-Tamayo, Yexian Xue, Richard Voyles, Vaneet Aggarwal, and Juan Wachs, "SARTRES: a semi-autonomous robot teleoperation environment for surgery". Computer Methods in Biomechanics and Biomedical Engineering: Imaging Visualization, pp.1-8. 2020.
- **Upinder Kaur**, Urfi Khan, Nathi Ram Chauhan, and Sudipto Mukherjee, "Collision Detection and Inverse Dynamics Control of KUKA LBR IIWA Robot", in International Journal of Mechatronics and Automation (IJMA), Inderscience Publishers, 2020.

Conferences and Workshops

- **Upinder Kaur**, Haozhe Zhou, Xiaxen Shen, Byung-Cheol Min, and Richard M. Voyles, "RoboMal: Malware Detection for Robot Network Systems", in 5th Annual IEEE Robotics Computing (IRC), 2021.
- **Upinder Kaur**, Arunashish Datta, Haozhe Zhou, Xiaxen Shen, Shreyas Sen, Byung-Cheol Min, and Richard M. Voyles, "PAAg: A Reference Architecture and Testbed for Closed-Loop Precision Animal Agriculture", submitted to International Conference of Cyber Physical Systems (ICCPS), 2021.
- **Upinder Kaur**, Praveen Abbaraju, Harrison McCarty, and Richard Voyles, "Clutter Slices Approach for Identification-on-the-Fly of Indoor Spaces", in Proceedings of PRAConBE, International Conference on Pattern Recognition (ICPR), 2020. (available on arxiv)
- Mythra V. Balakunthala, **Upinder Kaur**, Xin Ma, Juan Wachs and Richard Voyles, "Learning Multimodal Contact-Rich Skills from Demonstrations Without Reward Engineering", in IEEE International Conference on Robotics and Automation (ICRA), 2021.
- Glebys Gonzalez, Mridul Agarwal, Mythra V. Balakunthala, Md Masudur Rahman, **Upinder Kaur**, Yexian Xue, Richard Voyles, Vaneet Aggarwal, V. and Juan Wachs, "DESERTS:Delay-Tolerant Semi-Autonomous Robot Teleoperation for Surgery" in IEEE International Conference on Robotics and Automation (ICRA), 2021.
- Arunashish Datta, **Upinder Kaur**, Victor Malacco, Shawn Donkin, Richard M. Voyles, and Shreyas Sen, "Channel Modeling for In-body to Out-of-body Communication at 400MHz for Cows", submitted to IEEE Engineering in Medicine and Biology Conference, 2021.
- Yuanmeng Huang, Jonathan Miller, **Upinder Kaur**, Ram M.S. Ramdas,Shashank Priya, and Richard M. Voyles, "Hybridization Through Modularity: Exploring Complex Modes of Locomotion with a "Bag of Robotic Modules"", submitted in ReMAR 2021.