# ASHWIN KUMAR

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- Computer Science Ph.D. candidate, working in Explainable AI Planning (XAIP) and fairness in Ridesharing Systems.
- Creating interfaces to explain AI decisions to humans (by updating mental models of the users).
- Designing city-scale ridesharing algorithms for improved fairness and efficiency

## EDUCATION

**PRESENT**

**PH.D. IN COMPUTER SCIENCE, Washington University in St. Louis, MO, USA**
GPA: 4.0
*Course work focused on Artificial Intelligence, Human Computer Interaction and Visualization*

**JUL 2019**

**B.TECH IN MECHANICAL ENGINEERING, Shiv Nadar University, UP, India**
Minor in Communication
University Gold Medal (CGPA: 9.81/10)
*Course work focused on Computational Techniques in Mechanical Engineering*

**JUL 2015**

## SKILLS

**PROGRAMMING LANGUAGES/FRAMEWORKS**
C/C++, Python, Python Machine Learning Libraries, JavaScript, HTML, CSS, D3.js, MATLAB, Mathematica, Linux, SolidWorks

**SOFT SKILLS**
Problem Solving, Flexibility, Adaptability, Leadership and Teamwork.

## TECHNICAL INTERNSHIPS

**JUL 2018**

**RESEARCH INTERN, Indian Institute of Science (IISc), Bangalore, India**
Performed dimensionality reduction of strain energy expression for hyperelastic strip geometry using symbolic tools like Mathematica; solution using Variational Asymptotic Method (VAM) to develop a geometrically and materially non-linear beam theory. Applied to helicopter rotor blades for vibration reduction.

**MAY 2018**

**JUL 2017**

**DESIGN AND ENGINEERING INTERN, BubbleFly Technologies Pvt Ltd, New Delhi, India**
Worked on designing an ergonomic fixed enclosure system for an RC plane (UAV) avionics bay. Conducted research on the design of an adaptable battery mount for ease of installation and removal.

**MAY 2017**

# RESEARCH EXPERIENCE
**WASHINGTON UNIVERSITY IN ST. LOUIS**

**PRESENT**

### FAIRNESS IN URBAN RIDESHARING MATCHING ALGORITHMS
Creating metrics for passenger side fairness in urban ridesharing environments and using these metrics to train models that match passengers to taxis in a fairer manner.

**FEB 2021**

**DEC 2020**

### VISUALIZATION TECHNIQUES FOR DELIVERING EXPLANATIONS TO HUMANS FOR MODEL-RECONCILIATION
Design and comparison of methods to present explanations for Model-Reconciliation Problems (MRPs). User studies to evaluate relative performance of these methods, and to identify cases where textual or visualization-based approaches are preferred.

**AUG 2020**

**SEPT 2020**

### FAIRVIZARD: A VISUALIZATION SYSTEM FOR ASSESSING MULTI-PARTY FAIRNESS OF RIDE-SHARING MATCHING ALGORITHMS
Created a dashboard for analysis of Ride-Sharing Algorithms (RSAs) like NeurADP and ZACBenders, allowing users to visually compare historical taxi allocations across RSAs to assess fairness for various stakeholders.

**MAY 2020**

**APR 2020**

### HIGH DIMENSIONAL GEOMETRIC ENCODING OF BINARIZED NEURONS FOR ROBUSTNESS
*Research rotation with Dr. Netanel Raviv.* Worked on geometric proof techniques and robustness guarantees for higher dimensional encodings of binarized neurons in Deep Neural Networks coded using error correcting codes.

**FEB 2019**

### USING HSDIRS FOR TOR NETWORK ANALYSIS
*Research rotation with Dr. Roch Guerin.* Conducted research on the structure of the Tor network, attempting to de-anonymize hidden services using a compromised Hidden Service Directory (HSDir) to perform correlations across fingerprints.

**DEC 2019**

### BIAS AND FAIRNESS IN INVERSE REINFORCEMENT LEARNING
*Research rotation with Dr. Chien-Ju Ho.* Worked on identifying fairness and bias concerns using Inverse Reinforcement Learning, based on the premise that the 'expert' generating training examples might pass on inherent biases to the learning agent.

**NOV 2019**

### VISUALIZING DIVERGENCE FROM APPOINTED GOALS IN AIRPORT APPLICATIONS USING GOAL RECOGNITION
*Research rotation with Dr. William Yeoh and Dr. Alvitta Ottley.* Created a visualization interface for analyzing airplane movement at airports by estimating goals based on trajectory; using Goal Recognition to identify potential outliers for early warning systems signaling divergent behavior to Air Traffic Controllers.

**OCT 2019**

## ACADEMIC PROJECTS

**MAY 2021**

### USING GAUSSIAN PROCESSES AS VALUE FUNCTION APPROXIMATORS
Developed a Gaussian Process (GP) model that could be used as a value function approximator for the problem of ridesharing allocation. Performed data sparsification for scalability using geographical features to consolidate representative data points and compared performance with selected baseline approaches.

**JAN 2021**

**DEC 2020**

### GESTURE-CONTROLLED HOME AUTOMATION
Developed a gesture control device that maps simple hand gestures to smart device automation controls using AWS IoT. Implemented using an accelerometer for simple flicks and image-processing using an IR camera for complex gestures, aimed at aiding people with speech-impediments with smart-home interactivity.

**AUG 2020**

**APR 2020**

### ADVERSARIAL TRAINING AGAINST SEMANTIC ATTACKS USING SP LAYERS
Adversarially trained an MNIST digit classifier against Semantic attacks (translation, occlusion, brightness and contrast) by using semantic layers, showing higher bounds for certified robustness.

**JAN 2020**

**DEC 2019**

### HOSTILE TAKEOVERS IN EM-BASED CROWDSOURCING SYSTEMS
Explored the possibility of hostile takeovers in crowd-sourced systems where a small group of influential users can ensure wrong decisions in a bi-partisan voting scenario, where algorithms like Expectation-Maximization are used to aggregate votes.

**AUG 2019**

**MAY 2019**

### SMART HEXAPOD
Designing and fabricating a smart hexapod robot with automated gait selection and terrain sensing capabilities for search and rescue operations in disaster areas. Created an algorithm for gait-based control of any general legged robot.

**AUG 2018**

## LEADERSHIP, AWARDS AND RECOGNITION

- Vice-President of UMANG, WashU's Indian graduate student group (2019-20)
- National Finalists at IIT-B's Eureka, Asia's largest B-Plan competition. Proposed the B-Plan for a startup idea to optimize India's logistics and trucking network using relay systems and machine learning. (2018)
- Presented work on Deriving an Analytical Expression for Strain Energy Density of a Hyperelastic Strip, at SNU's Opportunities for Undergraduate Research (OUR) Conference. (2017)
- Recipient of the Dean's List award for academic performance for achieving an SGPA of 10 (Monsoon 2017) and for academic excellence (Spring 2018).
- Student Teacher (Data Structures and Intro to CS) at SNU under the Learning and Academic Support Centre (LASC) program. Designed and delivered lectures, took tests and conducted interactive problem-solving sessions. (2017-18)
- President of INTERACT (Rotary International), spearheaded literacy drives and Book-bank projects for underprivileged children. (2014)
- Part of student delegation to Malta (Europe) as part of a cultural student exchange program. (2013)

## PUBLICATIONS

- **VIZXP: A VISUALIZATION FRAMEWORK FOR CONVEYING EXPLANATIONS TO USERS IN MODEL RECONCILIATION PROBLEMS.**
  **Ashwin Kumar**, Stylianos Loukas Vasileiou, Melanie Bancilhon, Alvitta Ottley, and William Yeoh. In *Proceedings of the International Conference on Automated Planning and Scheduling (ICAPS)*, 2022

- **A LOGIC-BASED EXPLANATION GENERATION FRAMEWORK FOR CLASSICAL AND HYBRID PLANNING PROBLEMS.**
  Stylianos Loukas Vasileiou, William Yeoh, Tran Cao Son, **Ashwin Kumar**, Michael Cashmore, and Daniele Magazzeni. In *Journal of Artificial Intelligence Research (JAIR) Vol 73,* 2022*.*

- **INTENT MATTERS: IMPROVING ZONAL FAIRNESS OF RIDESHARING SYSTEMS.**
  **Ashwin Kumar**, Yevgeniy Vorobeychik, and William Yeoh. In *Proceedings of the Workshop on Trustworthy Autonomous Systems Engineering (TRASE-22),* 2022.

- **FAIRVIZARD: A VISUALIZATION SYSTEM FOR ASSESSING FAIRNESS OF RIDE-SHARING MATCHING ALGORITHMS.**
  **Ashwin Kumar,** Sanket Shah, Meghna Lowalekar, Pradeep Varakantham, Alvitta Ottley, and William Yeoh. In *Proceedings of the International Conference on Automated Planning and Scheduling (ICAPS)* (System Demonstration), 2021