Shivendra Agrawal

Curriculum Vitae

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Summary - I am a final year **Ph.D. student** at CU Boulder. I am interested in solving real-world problems through machine learning and AI. My research creates foundational AI methods that enable assistive systems to interpret and leverage social and semantic cues to support visually impaired individuals by providing long-term and fine-grain guidance.

Education

2019– **University of Colorado, Boulder**, *Ph.D. Candidate*, *Computer Science*.

2017–2019 **University of Colorado, Boulder**, *MS*, Computer Science.

2009–2014 **Indian Institute of Technology, Kharagpur**, *Dual Degree*, *Mathematics & Computing*.

Research and Publications

Work in Progress

2024 **ShelfAware: Semantic particle filter localization with low-cost sensors**, *Shivendra Agrawal, Ashutosh Naik, Jake Brawer, Bradley Hayes*, *In development*, Summary - A novel semantic Monte Carlo localization algorithm that requires just an RGB-D camera and a visual odometry camera.(PROJECT PAGE).

Publications

2023 **ShelfHelp: Empowering Humans to Perform Vision-Independent Manipulation Tasks with a Socially Assistive Robotic Cane**, ***Shivendra Agrawal***, *Suresh Nayak, Ashutosh Naik, Bradley Hayes*, ACM AAMAS 2023, Summary - A novel product locator algorithm and a Markov Decision Process (MDP) based verbal guidance system that issues fine-grain manipulation guidance to help retrieve desired items from shelves. (PROJECT PAGE).

2022 **Workshop: ShelfHelp: Empowering Humans to Perform Vision-Independent Manipulation Tasks with a Socially Assistive Robotic Cane**, ***Shivendra Agrawal***, *Bradley Hayes*, IEEE IROS 2022 Workshop, (PAPER LINK)(PROJECT PAGE).

2021 **A Novel Perceptive Robotic Cane with Haptic Navigation for Enabling Vision-Independent Participation in the Social Dynamics of Seat Choice**, ***Shivendra Agrawal***, *Mary Etta West, Bradley Hayes*, IEEE IROS 2022.
Summary - A robotics cane system that enables users to navigate to socially preferred empty chairs optimizing for users' privacy, and intimacy. (PAPER LINK)(PROJECT PAGE)

2019 **Explanation-based Reward Coaching to Improve Human Performance via Reinforcement Learning**, *Aaquib Tabrez*, ***Shivendra Agrawal***, *Bradley Hayes*, Best paper runner-up, ACM/IEEE HRI 2019.
Summary - A new framework to infer the human collaborators' mental view of the optimum state, predict future failure based on the inferred human mental model and provide interpretable feedbacks to help the human in a shared task. (PAPER LINK)(PROJECT PAGE)

Previous Work Experience

Sep 2016 – May 2017 **Associate Data Scientist**, NOODLE.AI, Bangalore, India.

- Developed a Django GUI app to perform automatic exploratory data analysis.
- Other projects included developing a demand forecast demo tool and churn analysis for various clients.

Mar 2016 - Aug 2016 **Co-Founder**, Progyrus, Bangalore, India.

- Progyrus provided (Uber-like) large-scale human-powered translations to help brands go vernacular. We worked with 6 clients and 50 translators on the platform
- Designed the order management and task management/allotment systems using AngularJS and Django REST framework.

2014 - 2016 **Senior Engineer (Analytics)**, Robert Bosch GmbH, Bangalore, India.

- Developed prototype optimization using clique-based algorithms for an automobile manufacturer.
- Developed a Tkinter-based GUI app for ticket analysis, involving NLP and D3.js

Presentations

Invited Talks

Apr 2024 **Robotics Seminar Talk: Context-Aware Assistive Guidance**, *University of Colorado Boulder*, Boulder, CO, (Slides).
Presented thesis work on context-aware assistive guidance integrating implicit semantic, social, and physical cues at the robotics program seminar.

Apr 2024 **Guest Lecture: Practical Computer Vision**, *Franklin & Marshall College*, Lancaster, PA, (Slides).
Guest lecture for Intro to Machine Learning (CPS 360), sharing practical computer vision insights derived from my research.

Sep 2023 **Leading with Impact alumni event**, Denver, CO, (Event news).
Represented CU Boulder's robotics research by presenting my work and contributing to a panel discussion on the current state and future of AI.

posters

Apr 2024 **Anomaly Detection and Explanation via Observation Aggregation and Visual-Language Models**, Pervasive Personalized Intelligence 2024, (Poster Link).

Mar 2023 **ShelfHelp: Empowering Humans to Perform Vision-Independent Manipulation Tasks with an Assistive Robotic Cane**, *Winner*, Annual Research Expo, CU Boulder, (Poster Link).

Mar 2022 **"Is this seat taken?" Towards a Novel Robotic Cane for Participation in the Social Dynamics of Seat Choice**, *Winner*, Annual Research Expo, CU Boulder, (Poster Link).

Teaching

Instructor CSCI 3104 Algorithms - Best Part Time Graduate Instructor (2019-2020).

TA CSCI 3104 Algorithms - Outstanding TA award (2018, 2019).

CSCI 3002 Fundamentals of Human Computer Interaction.

CSCI 3302 Intro to Robotics - Outstanding TA award (2022).

CSCI 4302/5302 Advanced Robotics (2023).

Other professional experience

2024 Social Media Chair at HRI 2024.

2023 Volunteer at AAMAS 2023.

2019- Reviewer for ACM/IEEE HRI, IEEE ICRA, IEEE IROS, ACM THRI.

Awards and scholarships

2024 Bell Family Endowed CS Scholarship.

2024 Publication Recognition Award, CU Boulder.

2022, 2023 Conference Support Fellowship, CU Boulder.

2022, 2023 Winner at Annual Research Expo, CU Boulder.

2022 Summer Research Fellowship, CU Boulder.

2021-2022 David T. Spalding Graduate Teaching Fund Fellowship for excellence in teaching.

2019-2020 Best part-time instructor award for undergraduate Algorithms CSCI 3104.

2017-2019 Outstanding TA awards for CSCI 3104, 3002.

Other Projects

2024 **Autonomous Anomaly Explanation**, *NEC Corporation*, Prof. Brad Hayes, CU Boulder.
We developed a proof-of-concept system that uses a Vision Language Model (VLM) and a mobile robot to autonomously explain spatial anomalies. (Video demo)

Feb 2019 - Apr 2019 **Robot guide dog for visually impaired**, *Prof. Brad Hayes*, CU Boulder.
We emulated a guide dog in indoor scenario to guide the human to the nearest exit. The robot provided navigation assistance and scene explanation to help the visually impaired reach their goal faster and safer. (Video demo)

Feb 2019 - Apr 2019 **Visual memory with sparse demonstrations**, *Prof. Chris Heckman*, CU Boulder.
Investigated LSTM's ability to learn path policies using visual cues so that the robot can re-trace the path without the 3D map of the environment and minimal demonstrations of the path. (Link to project)

August 2018 - December 2018 **An ARKit app to help people with learning disabilities**, *Virtual Reality*, CU Boulder.
We made an IOS app with a python ML backend that parsed text from images and represented it intuitively to foster learning. We also created a focus-enabled text editor that could assist a person with dyslexia. (Link to project)

April 2018 – May 2018 **Logo Generation using GAN**, *Human Centered Machine Learning*, CU Boulder.
We created a GAN based Logo generator to help generate original and unique initial logo designsusing WGAN and ACGAN. (Link to report)

May 2018 **Twitter Trend Analysis**, *Big-Data Architecture*, CU Boulder.
We developed a scalable web app using Kafka, Cassandra, and Spark which could classify upto 6k tweets per minute in real-time. (Video demo)

Mentorship

Masters Independent Studies

Siddharth De, *Incoming Intern @ Meta*.

Ashutosk Naik, *Information Technology Analyst @ Nomura*.

Shanthi Lekkala, *Software Engineer @ Amazon Web Services*.

Tanmay Desai, *Ph.D. student @ Colorado School of Mines*.

Suresh Nayak, *Senior Software Engineer @ Arrcus*.

Undergraduate mentorship

Lara Chunko, *Associate Sofware Engineer @ Northrop Grumman*.

Chris Beggs, *Autopilot Senior Software Engineer @ Tesla*.

Skills & Abilities

Languages Python, Javascript, R, C++

Frameworks AngularJS, Django REST, Flask, React

Libraries PyTorch, Scikit-Learn, Selenium, Elasticsearch

Databases MongoDB, PostgreSQL

Robotics Motion Planning, ROS, SLAM, Sensor Fusion, Localization

Others Machine Learning, Algorithms, Data Structures, Data Mining, Unix/Linux, Human-subject evaluations, Numerical Optimization, Anomaly detection , LLM, full-stack