Shivendra Agrawal

Curriculum Vitae

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Summary - I am a third year **Ph.D. student** at CU Boulder. I am broadly interested in Human Robotics Interaction (HRI), Computer Vision (CV), 3D Scene Understanding, and Explainable AI. I am particularly interested in the application of these in Assistive Robotics. I am currently developing a smart cane that uses insights from psychology, CV, NLP, haptics, robotics and HRI to assist people with visual impairments perform day-to-day more independently.

Education

2020– **University of Colorado, Boulder**, *Ph.D. Candidate*, *Computer Science*.

- My work involves creating assistive robotics based solutions focused on helping visually impaired people gain a more independent lifestyle.
- Teaching Assistant - Awarded the David T. Spalding Graduate Teaching Fund Fellowship for excellence in teaching (2021-2022).

2017–2019 **University of Colorado, Boulder**, *GPA: 4.0, Masters of Science*, *Computer Science*.

- Teaching Assistant - Awarded **outstanding TA** for **Algorithms** (2017-2018, 2018-2019)
- Instructor - Awarded the **best part time instructor** 2019-2020 for the undergraduate Algorithms.

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

Publications

October 2021 **A Novel Perceptive Robotic Cane with Haptic Navigation for Enabling Vision-Independent Participation in the Social Dynamics of Seat Choice**, *Under Review*, CU Boulder.

We designed a robotics cane system that leverages computer vision, and insights from psychology and haptics literature to enable users to navigate to socially preferred empty chairs. Our social-norm aware chair selection algorithm optimizes for users privacy, convenience and intimacy creating a potential for blind people to exercise the nuances of seat choices.

September 2018 **Explanation-based Reward Coaching to Improve Human Performance via Reinforcement Learning**, *Best paper nominee, HRI 2019*, CU Boulder.

We introduced 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. (Link to the paper)

Posters

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

This poster presents our work under review that describes a robotic cane system that can find socially preferred seats and navigate its users to the seats using a novel haptics method. (Poster Link)

Projects

Spring 2022 - **Smart Cane to enable independent grocery shopping for people who are visually impaired**.

I am currently working on developing technology that provides haptic space guidance by helping BVI people grab the desired items from a grocery store aisle. The follow up to this research thrust would be the locomotor space guidance that would help us create an end-to-end system that can mimic a sighted guide.

Fall 2020 - Spring 2021 **Table top guidance for people who are visually impaired**, CU Boulder.
Investigated creating assistive technology for kinesthetic and verbal guidance for table top manipulation. I developed optimization (STOMP) based algorithms for robotic manipulator to help a person with visual impairment work as a dyadic team on table top setting.

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 would provide navigation assistance and scene explanation using a physical lease feedback and natural language interface. The goal is 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.
Explored learning a path information using visual cues extracted via a CNN so that the robot can re-trace the path without the 3D map of the environment and with very less demonstrations of the path.
Showed that a vanilla LSTM is still insufficient to generate crucial policies just from a few demonstration and may need attention going forward. (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 in a more intuitive form that enabled learning. We also created a text editor which would help a person with dyslexia to just focus on some text. *My role* - I designed the python backend, the IOS app, the text editor, and helped conceptualize the product.(Link to project)

April 2018 – May 2018 **Logo Generation using GAN**, *Human Centered Machine Learning*, CU Boulder.
We (2 membered team) created a GAN based Logo generator to help generate original and unique initial logo designs. Tried out various variations like WGAN and ACGAN. (Link to report)

May 2018 **Twitter Trend Analysis**, *Big-Data Architecture*, CU Boulder.
We (5 membered team) developed a scalable web app using Kafka, Cassandra, and Spark which could classify upto 6k tweets per minute in real-time. *My role* - project conceptualization, trend similarity, leaflet and front-end development.(Video demo)

Oct 2017 – Dec 2017 **Image Depth Map Estimation**, *Machine Learning*, CU Boulder.
Compared various CNN based architectures including transfer learning, residual layers and fully convolutional networks using Keras. Demonstrated an application of the predicted depth map to create *"Portrait Mode"*. (Link to report)

Other professional experience

Reviewer.
HRI, ICRA, IROS, THRI

2018- **TA/Teaching**.
Instructor for Algorithms (Fall 2019), Algorithms, Human Computer Interactions, Intro to Robotics

Previous Work Experience

Sep 2016 – May 2017 **Associate Data Scientist**, Noodle.ai, Bangalore, India.

- ***Exploratory Data Analysis (EDA) tool*** - Developed a Django app to perform preliminary data analysis. The EDA tool automatically munges data to performs statistical tests, find interesting inferences which may be overlooked if there are a lot of features/data and summarizes the result.
- ***Demand forecast demo tool*** - Developed a demo tool which uses dummy data and shows micro-demand (store-level) predictions focusing FMCG companies. This tool was used a multiple times and proved to be more effective than a slideshow.

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

- Progyrus provided (Uber-like) large scaled human powered translations to help brands go vernacular. We worked with 6 clients to pilot regional content with 50 translators on the platform
- As one of the co-founders I contributed in conceptualizing the idea. Designed the order management and task management/allotment systems. Developed dashboards using AngularJS. Also used Django REST framework + PostgreSQL and developed APIs to automate the translation workflow and integration at client side.

June 2014 – Feb 2016 **Senior Engineer (Analytics)**, Robert Bosch GmbH, Bangalore, India.