

# Shivendra Agrawal

## Curriculum Vitae

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**Summary** - I am a 4th year **Ph.D. student** at CU Boulder. I am broadly interested in Accessibility, HCI, Human Robotics Interaction (HRI), Computer Vision (CV), and Explainable AI. My current research interests lie in the application of an amalgamation of these to create real-world Assistive Technology. I am currently spearheading a research effort developing a robotic smart cane that combines concepts from CV, NLP, haptics, SLAM and HRI to assist people with visual impairments to perform day-to-day tasks more independently.

## Education

- 2020– **University of Colorado, Boulder**, *Ph.D. Candidate, Computer Science.*
- 2017–2019 **University of Colorado, Boulder**, *GPA: 4.0, MS, Computer Science.*
- 2009–2014 **Indian Institute of Technology, Kharagpur**, *Dual Degree, Mathematics & Computing.*

## Publications

- 2022 **ShelfHelp: Empowering Humans to Perform Vision-Independent Manipulation Tasks with a Socially Assistive Robotic Cane**, Shivendra Agrawal, Suresh Nayak, Ashutosh Naik, Bradley Hayes, Under Review, We developed a novel product locator algorithm based on autoencoders and a novel verbal guidance algorithm to create an assistive system that issues fine-grain manipulation guidance to help locate and retrieve desired items from the haptic space of a user. ([PROJECT PAGE](#)).
- 2022 **Workshop: ShelfHelp: Empowering Humans to Perform Vision-Independent Manipulation Tasks with a Socially Assistive Robotic Cane**, Shivendra Agrawal, Bradley Hayes, IROS 2022 Workshop (Kyoto, Japan), ([PAPER LINK](#))([PROJECT PAGE](#)).
- 2022 **"Is this seat taken?" Towards a Novel Robotic Cane for Participation in the Social Dynamics of Seat Choice for Blind Individuals**, Shivendra Agrawal, Mary Etta West, Bradley Hayes, [Winner, Annual Research Expo](#) (CU Boulder), ([POSTER](#)).
- 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, IROS 2022 (Kyoto, Japan).  
We designed a robotics cane system that leverages computer vision, and insights from psychology to enable 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**, Aaqib Tabrez, Shivendra Agrawal, Bradley Hayes, [Best paper nominee, HRI 2019](#) (Daegu, South Korea).  
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. ([PAPER LINK](#))([PROJECT PAGE](#))

## Other professional experience

- 2019 Instructor undergraduate Algorithms.
- 2018– Teaching Assistant for Algorithms, Human Computer Interactions, Intro to Robotics.
- 2019– Reviewer for HRI, ICRA, IROS, THRI.

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## Awards and scholarships

- 2022 Conference Support Fellowship, CU Boulder.
- 2022 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.

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## Course Projects

- 2020 **Table top guidance for people who are visually impaired**, *Prof. Brad Hayes*, CU Boulder.  
Investigated creating assistive technology for kinesthetic and verbal guidance for table top manipulation. I developed optimization based algorithms for robotic manipulator to help a person with visual impairment work as a dyadic team on table top setting.
- Feb 2019 - **Robot guide dog for visually impaired**, *Prof. Brad Hayes*, CU Boulder.
- Apr 2019 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 - **Visual memory with sparse demonstrations**, *Prof. Chris Heckman*, CU Boulder.
- Apr 2019 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 - **An ARKit app to help people with learning disabilities**, *Virtual Reality*, CU Boulder.
- December 2018 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* - Designed the python backend, the IOS app, the text editor. ([LINK TO PROJECT](#))
- April 2018 – **Logo Generation using GAN**, *Human Centered Machine Learning*, CU Boulder.
- May 2018 We 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 developed a scalable web app using Kafka, Cassandra, and Spark which could classify upto 6k tweets per minute in real-time. *My role* - trend similarity, leaflet and front-end development. ([VIDEO DEMO](#))
- Oct 2017 – **Image Depth Map Estimation**, *Machine Learning*, CU Boulder.
- Dec 2017 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](#))

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## Previous Work Experience

- Sep 2016 – **Associate Data Scientist**, NOODLE.AI, Bangalore, India.
- May 2017
  - **Exploratory Data Analysis (EDA) tool** - Developed a Django app to perform automatic preliminary data analysis which included performing statistical tests, and finding interesting inferences.
  - *Demand forecast demo tool*
- Mar 2016 – **Co-Founder**, PROGYRUS, Bangalore, India.
- Aug 2016
  - 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
  - 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 – **Senior Engineer (Analytics)**, ROBERT BOSCH GMBH, Bangalore, India.
- Feb 2016