

“Taking Research From Labs and Conferences To People”

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“Never expected this COVID-19 birthday to turn out this great and so close to my family” (loosely translated from Telugu) were the words of Mrs. Devi just after talking to her family through Robots, we developed at Invento Robotics. The smile on Mrs. Devi’s face after celebrating her birthday with her grandchildren through Robots to whose development I was the pivot, reinforced my decision to delve further and streamline my energies and skills in bringing technology to augment interactive experiences. My **Research Internships** at **GeorgiaTech, IISc, IIM-A**, and Invento shaped me with empathy and compassion towards creating impact using technology but in a nebulous manner. To contribute better solutions I believe in establishing structure and stronger foundations to my learnings. I look forward to pursuing an MS in CS at Brown, to establish structure in my skills and be part of a research infrastructure resonating with my goals of creating impact using an intersection of Deep Learning, HCI, and HRI.

“**Paper** Notification [ACM Multimedia 2020](#)” was the subject of the email which reflected that walking the extra mile to **pursue independent research**, beyond the realm of my curriculum, was fruitful. Having **papers accepted at top venues like [IEEE GLOBECOM 2020](#), [ACM Multimedia](#)** I was confident my direction of research in encouraging people to interact with Deep Learning was a domain with great potential. My papers at ACM Multimedia 2020 and IEEE GLOBECOM 2020 deal with engaging Sports fans with live sports broadcasts. At IEEE GLOBECOM, my paper worked on developing strategies to annotate sports broadcasts into temporal granular events. The framework I developed established a new state of the art result with an accuracy of 97.3% (40% more accurate results than previous methods) for event segmentation from sports broadcast in the field of cricket. At ACM Multimedia I took my previous research one step ahead by using Information Retrieval techniques to extract visual information from segmented events and construct graphs of the live events based on data. Storing cricketing information as graphs allowed us to perform temporal queries on segmented events. We developed interactive services for cricket fans. This included allowing users to query particular events associated with their favorite player across any timeline and club and retrieving video clips as the result. Currently, I am working on generating similar frameworks in supporting Mobile Arcade gamers (nearly 2 Billion gamers) in modeling humans with their gaming avatars based on event segmentation and data-driven approaches. Closely following **Dr. Jeff Hungs** work on data-driven decisions from smartphones from CHI 2021, CHI 2020, and UIST 2012 I look forward to having engaging conversations about modeling humans and their Smartphone gaming traits using frameworks I developed.

My interest in packaging Deep Learning Research into applications started during the early days of my undergraduate under the mentorship of [Dr. Anil Kumar Gupta](#) at the Indian Institute of Management, Ahmedabad. We developed Deep Learning based Computer Vision models to tackle Animal Crop Vandalism. We packaged the models into Low Storage devices such as smartphones and Pi Zeros. Together with farmers, we were able to deploy these devices across fencing protecting 40 hectares of Horticulture farms. This experience of developing products, conducting research in the remotest regions of India changed the way I looked at technology and its impact. We implemented algorithms starting from Paul-Viola Jones’s paper on Object Identification via edges to modern architectures such as YOLO and SSD. The problem does not end here. The remote regions have minimal access to network connectivity. We provided a zero internet-based solution using GSM modules to intimate farmers of a possible animal herd attack on the farm. The whole user experience research, Deep learning models went on to win the best paper at TEAMC 2018 (undergraduate Research conference).

When my paper which revolved around developing ROS based autonomous robots with Deep Learning capabilities to detect danger for Indoor Surveillance won the best paper at [IEEE ICACCP](#) (Computer Vision), I was motivated to push my boundaries further into how Computer Vision and Robotics can

affect individuals and communities. My work at Invento in developing Child-Friendly Navigation algorithms, Voice controlled navigation, Healthcare Robots and bringing Human Robot Interaction closer to Humans align with the goals of **Dr. Stefanie Tellex**. At Invento I was fortunate to develop Robots supporting Telemedicine and augmenting our covid warriors. Robots to whose ROS navigation algorithms I have contributed clocked over 2000 Km across Asia, Europe, and the USA and supported the screening, food distribution, and patient engagement of over 6000 patients. Our work on developing a Reusable Robotic Platforms to disinfect quarantine facilities, engage in telemedicine and autonomous medicine, delivery is under consideration for IROS 2021. At Invento, I developed autonomous navigation algorithms supporting asynchronous wheels which are inexpensive but fail to support autonomous navigation. My work on developing ROS packages for autonomous navigation on asynchronous wheels is currently in review at IEEE RAM 2021 (March). I can not wait to discuss and participate in Lab Sessions and gradually be part of the H2R lab and work on the common goal of empowering every person with a collaborative robot. I have been fortunate to finish all the required prerequisites required for the H2R lab as part of my current workplace and academics.

I shared my paper at IEEE ICACCP-19 with [Prof. Yi-Chang \(James\)](#), who then offered me a **Research Scholar Position** at GeorgiaTech, Atlanta. One of my novel research outcomes as a result of this internship was that I managed to develop a 2D image and 3D LiDAR point cloud registration algorithm by using a **data structure** called **KD-Tree**. This leads to enhanced performance compared to existing work on huge LiDAR point clouds. By thresholding the LiDAR point clouds retro intensity values, I was able to accurately estimate the health of all traffic signs over the entire length of any interstate. Implementing clustering techniques such as HDBSCAN for GPS points instead of the conventional K-Means and DBSCAN allowed to eliminate computations on bogus LiDAR points making runtime quicker. My summer work including automatic traffic sign identification using Neural Networks using both 2D images and 3D point clouds helped the Transportation Lab at GeorgiaTech win the High Impact Research Nationally award at AASHTO.

For the spring of 2020, I was a **Visiting Research Scholar** at the **Indian Institute of Science, Bangalore** under [Prof. Yogesh](#) dealing with Computer Vision techniques on drone feed. Here, I developed algorithms to determine image similarity and reduce computational cost on object detection models. During this internship, my team has developed object detection models that work over shuffled color schemes. This development was done to aid the ongoing research trend of performing object detection on encrypted images. With the rise in COVID-19, I was part of the 'GoCoronaGo' application development at IISc. Here we built a privacy-respecting contact tracing application. Unlike regular contract tracing applications that work on the edge computing device, we built a centralized contact tracing application, which works on generating network graphs. Treating the problem as a graph makes it easier to query N-hop neighbors for every vertex making it rapid to identify and quarantine people.

Brown is a place where research meets empathy and compassion and has impacted millions of lives around the globe. Being the co-founder of a non-profit Edu-Social Community 'Grow' I have had multiple discussions over interesting research problems with students and professors. These conversations and my research experiences in academia with Dr. Tsai, Dr. Yogesh and Dr. Anil Gupta motivates me to be part of academia in the future. I have heard a lot about Dr. Stefanie Tellex and Dr. Jeff Hungs work from my CEO Dr. Balaji for their contributions and active research in HCI and HRI which plays a critical role in us designing our robots at Invento. The MS CS program offers me the perfect platform to organize and improve skills and develop the required aptitude for a Ph.D. Having spent my childhood in Switzerland and with research experiences in the USA and India, I feel apart from academic diversity I will also contribute to cultural diversity and leadership at Brown. As a Master's student and a Doctoral Student in the future I look forward to making research in Deep Learning, HRI, and HCI more tangible and take it from Labs and Conferences to People.