"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" were the words of Mrs. Devi just after talking to her family through Interactive Multimedia software, we developed at Invento Robotics. The smile on Mrs. Devi's face 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. My research interests in multimedia and UCSC's representation at Gaming, HCI/HRI, and Multimedia conferences motivate me to apply for a Ph.D. at USCS's Computational Media and be part of a research infrastructure resonating with my goals of creating impact using an intersection of Deep Learning, HCI/HRI, and Mobile Gaming.

"**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 Core A/A* venues like IEEE GLOBECOM 2020, ACM Multimedia** was a testimonial that my 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 mapping humans with their gaming avatars based on event segmentation and data-driven approaches. As a part of my research, I look to apply Generative Modelling to generate game sequences that would have never happened. My research interests closely match **Dr. Magy Seif El-Nasr's** work on data-driven decisions, affective gaming. Having conversations with her on common research interests, research proposals, and upcoming workshops at PAKDD 2020, I look forward to working on modeling humans and their Smartphone gaming traits using frameworks I developed under her wing.

The NFHS-4 quotes that nearly 30% of women in the age group 15-49 in India have experienced physical violence. The team of undergraduate researchers I lead ('Team Impact') at Thapar, wanted to explore technical solutions to this problem. We developed a cognitive textile that used Computer Vision for the first time to tackle such abuse against women by analyzing live camera feed through cameras embedded in it. This IoT and AI prototype has been filed for an Indian Patent (A personal safety device and method thereof) bearing application number 201911005811 and is an accepted entry at the prestigious Sir James Dyson Design Challenge . This patent is a reflection of my vision of amalgamating technology to develop solutions directed towards helping people. My work on developing robots to assist people with limited eyesight in indoor environments such as Museums, hotels, and Hospitals is currently under review at IEEE RAM 2021. My work/patents/paper on developing assistive technologies closely aligns with **Dr. Sri Kurniawan**. I look forward to having engaging conversations with Dr. Sri Kurniwan, on augmenting experiences of people with special needs in Navigation through assistive technologies.

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. Leila Takayama**. 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 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 of the HRI lab and work on the common goal of empowering every person with a collaborative robot.

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 3D Graphic Interface to map 2D images with 3D LiDAR point clouds. This registration algorithm was developed 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.

UCSC 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 motivate me to remain in academia. I have heard a lot about **Dr. Leila Takayama** and **Dr.Sri Kurniawan's** work from my CEO Dr. Balaji for their contributions and active research in HRI and Assistive technologies which play a critical role in us designing our robots at Invento to help people. I have referred to **Dr. Adam Smith's and Dr. Magy Seif El-Nasr** works in developing a research proposal for my 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 UCSC.

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