Application for MS in CS at Purdue

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"Congratulations: **Research Paper Accepted** (Robotics, Computer Vision) at **IEEE ICACCP 2019**" was an email that reflected that walking the extra mile for Research, beyond the realm of my curriculum and interning at Invento Robotics was fruitful. Winning the **Best Paper Award** at IEEE ICACCP which has a mere acceptance of 26% motivated me to further work on Computer Vision. This work helped me bag the position of **Research Intern** at **Georgia Institute of Technology, Atlanta**. I also filed a **patent** (wearable IoT and Computer Vision prototype) for the problem of physical abuse against women. This illustrates my passion for pursuing research to create a global impact and this resonates with Purdue's vision of being a research university to create impact. I would like to delve deeper into the field of Computer Vision and AI for which I am seeking admission at Purdue's reputed MS CS Graduate program.

I utilized the summer break of my freshman year to **Intern** at SRISTI-UNICEF under the able guidance of Dr.Anil Kumar Gupta at the **National Innovation Foundation, Government of India**. SRISTI allowed me to connect with farmers and discuss the parameters and problems affecting crop yield. I started exploring Computer Vision solutions to deal with the problem where animals were vandalizing crops. Tackling detection of cattle through Haar Cascades based on the Paul Viola Paper which took only edge and pixel intensities as features was less fruitful since the slightest change in orientation of cattle proved to be a failure. I noticed the need to incorporate more features for detection and hence used transfer learning on the Faster_RCNN_Resnet model over various hyperparameters. We **published** our results at **TEAMC 2018**, an undergraduate research paper conference, where we won the **Best Research Paper.**

My internship at Invento Robotics under Mr. Balaji Vishwanathan (**CEO Invento Robotics**) allowed me to get a first-hand experience with 3D mapping using LiDAR and ROS (Robot Operating System). I was able to achieve a **60% faster** performance than the previously established object detection stack by choosing to train and **deploy** a less dense neural network architecture (tiny-yolo) making it suitable for embedded systems on Invento's flagship robot 'Mitra'. 'Mitra' is currently used for navigation by travelers at the Indira Gandhi International Airport, New Delhi, India and uses detection algorithms that I had developed during this internship.

My experience with Computer Vision algorithms on ROS at Invento paved the path for my next **research paper**. In this paper, we discussed how Neural Networks could be treated as ROS nodes and keep publishing outputs in the form a ROS message as a stream to the ROS base node which is used for navigation and motion. After training the Neural Network (for threat detection) node on various hyperparameters, we **published** the performance of our algorithm at **IEEE ICACCP 2019** where we **won the Best Research Paper** under the computer vision and robotics category.

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 am currently leading ('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 and research for solving real-world problems.

I shared my paper at IEEE ICACCP 2019 with Prof. Yi-Chang Tsai, who then offered me a Computer Vision **Research Internship** at **GeorgiaTech, Atlanta**. The research work I undertook there closely resembles with the work being done in **Prof. Avinash Kak's RVL Lab at Purdue** on 3D interpretation and identifying object properties. Two of my **novel Research outcomes** as a result of this internship were that I managed to develop a 2D image and 3D LiDAR point cloud registration algorithm by using a data structure called KD-Tree. By thresholding, the LiDAR point clouds retro-intensity values and using the HDBSCAN clustering technique, I was able to accurately detect traffic signs in 3D point clouds. If given a chance, I will be really excited to know what interesting results could arise while deciphering object properties and interpreting scenes with the introduction of a LiDAR in the ongoing projects at RVL Lab.

Purdue is a place where research meets empathy and compassion and it has impacted millions of lives around the globe. An admit to Purdue will give me an opportunity to grow under the able guidance of elite professors and undertake research in Computer vision and AI to develop solutions for global problems. Research at Purdue will prepare me for my Ph.D. After which I see myself as a part of research labs to pursue research for overcoming challenges through technology and ensure that research results are not confined to journals and conferences but reach masses.