RESEARCH/WORK EXPERIENCE – GIRIDHAR NARASAPURA RAJAGOPALAIAH

Personal Webpage: https://giridharnr.github.io/

I have more than 6 years of experience in image processing and computer vision and 4 years of experience in Machine Learning and Deep Learning.

Specialties and Interests:

1. Computer Vision
2. Machine Learning
3. Deep Learning
4. Deep Reinforcement Learning
5. Medical Image Analysis
6. Robotics and Autonomous Systems
7. GPU Computation

Undergraduate Research Associate: – Nitte Meenakshi Institute of Technology (NMIT)
During my second-year undergraduate, I joined the Centre of Robotics Research (CRR) – NMIT. I worked in funded projects from 'Department of Science and Technology, Government of India' and 'Vision Group of Science and Technology, Government of Karnataka - India'.

- **Research Paper 1:** In my undergraduate thesis titled 'Modelling Fade Transition in a video using Texture Methods', I designed an algorithm to detect gradual transitions in a video. For this purpose, I made use of **Textural Methods** like Gray Level Co-occurrence Matric, Statistical Texture, and Laws Texture features. Based on the behavior of histogram properties on texture images, unique polynomial equations are modelled to detect soft transition in a video.
- **Research Paper 2:** In my second research paper, entitled 'Optical flow for detection of transitions in video, face and facial expression', I formulated an algorithm to detect an abrupt transition in a video. I used **corner detectors** for feature extraction, **optical flow** for feature matching, and **Hough transform** to detect outliers. For face detection, I designed an algorithm to detect objects with pixel intensity like that of human skin and used optical flow to eliminate false objects. The dominant orientation of a 36-bin histogram in each sub-region of the face is used to identify the facial expression.
- Being in CRR, I had the advantage of working with multi-disciplinary teams. During this phase, I understood **Linear and Non-Linear Control System** for Mobile Robots. I used the PID controller and then refined the usage to implement **Linear Quadratic Regulator** (LQR), which helped control velocity and position. We finally designed a self-balancing Skid Steer Mobile Robot.
- **Research Paper 3:** Third research work allows the mobile robot to identify road signs and navigate autonomously. I extracted feature descriptors from corner detectors like SIFT, SURF, and ORB on the computer vision part. These key-points are used to train a 3-layer **Artificial Neural Network**, which would classify the road signs. For segmenting road signs from the background, I built an algorithm using **Maximally Stable Extremal Regions** (MSER) to localize road signs. Key-points extracted from this localized region are used as input to recognize a given road sign. The corresponding signal is sent to the LQR controller to help the robot navigate autonomously.

Research Engineer: – Philips Research India

Moving from academia to industry proved pivotal to my carrier. After my undergraduate, I joined Philips R&D Bangalore as a Research Engineer, where I began my work in **deep learning.** My role was to contribute to an interdisciplinary team of scientists and doctors to identify value proposition in healthcare field – ultrasound, Obstetrics-Gynecology.

- **WAssist-AI:** I designed a **Deep Learning** (DL) architecture to identify Obstetric Patients. My experience in CRR-NMIT helped me to build an **Optical Character Recognition System** to recognize characters on an ultrasound-image. I was responsible for optimizing the DL model so it could run on a portable hardware. Made use of **OpenVino** to convert it to an intermediate representation form for better performance on an Intel NUC.
- **Fetal Heart-AI:** Identifying key-view planes in a fetal heart is a tedious task as it is a dynamic structure. For this purpose, I researched and developed a **deep reinforcement-learning algorithm** to acquire and learn the behavior of key planes in a fetal heart. To track the fetal-valve moments, i.e. systole and diastole phases, I developed a **real-time pose estimation model**. To have real-time inference on a subject, I optimized these models and used **TensorRT** as backend inference-engine.

Acting-CTO: - AIvolved Technologies Pvt Ltd

Eager to broaden my horizons, I parallelly co-founded AIvolved technologies Pvt.

- During the peak **covid-19** time in Bangalore -India, maintaining social distance and wearing masks were mandatory. To support the field marshals, we worked with **Bangalore Police Commissioner**. As chief architect and tech lead, I designed and developed a deep learning algorithm for target detection and tracking. We sent triggers to the field marshals to take required action if any violations were found. A 15-day pilot was done at the Bangalore command centre, which served the cause.
- We started to work with **Bangalore Traffic Police** to monitor and catch the traffic violators. As chief architect, I took the lead in developing algorithm to detect traffic violations. I formulated an algorithm, that used of object detection method with Channel and Spatial Reliability (CSRT) tracker to id each vehicle. To view the object at the farthest point, I converted the 2D matrix into an eagle view and based on this all objects are at equal view from a camera. At last based on position and direction of each vehicle, we were able to capture the violations.
- Currently, we are working with **People Tee Hospital Group** for GAIT analysis. With my experience in real-time pose estimation and semantic segmentation, I was able to crack the three rockers, that an orthopaedic doctor would look for to study a kid's locomotion. Based on these three rockers we were able to generate GAIT parameters. It usually takes 4-5 hours to generate these parameters, but our design helped in generating it in 25-30 min.