

# Bharath Raj Nagoor Kani

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## EDUCATION

**Sri Sivasubramaniya Nadar College of Engineering**

*B.E. in Electronics and Communication Engineering (ECE) – CGPA: 8.4/10*

Affiliated to **Anna University**

*June 2015 – Apr 2019*

## EXPERIENCE

**Siemens Digital Industries Software**

*Engineering Services Engineer*

*Associate Engineering Services Engineer*

*Jan 2022 – Present*

*May 2019 – Jan 2022*

Building models, algorithms and systems for myriad autonomous driving and general machine learning applications as part of the Intelligent Control Systems team. A few highlights are elaborated below:

- **Ego-Lane Estimation and Tracking; ROS based Perception Toolchain:**
  - Leveraged concepts from 3D geometry, machine learning, state estimation and more to create a fast and robust ego-lane estimation and tracking system that can effectively handle many challenging scenarios.
  - Designed and implemented integral parts of a ROS based toolchain which contains several nodes that can perform various tasks related to perception for autonomous driving.
- **Maximum Entropy Inverse Reinforcement Learning:**
  - Researched and implemented algorithms based on maximum entropy inverse reinforcement learning to model highway driving styles given expert demonstrations.
- **Unsupervised Variable Length Multivariate Time Series Data Clustering:**
  - Researched and implemented feature extraction techniques and experimented with dimensionality reduction techniques and clustering algorithms to cluster together driver types given multivariate time series data.
- **Bird's Eye View (BEV) Representation Creation:**
  - Experimented with various feature extraction techniques and fusion strategies to extract lane information from LIDAR and images from multiple monocular cameras to be used for creating BEV representations of a scene.
  - Implemented code to create BEV representations given various elements of the scene. The created BEV representations were used for training various imitation learning algorithms.

## PUBLICATIONS

**Exploring Techniques to Improve Activity Recognition using Human Pose Skeletons**

*Bharath Raj N., Anand Subramanian, Kashyap Ravichandran, Venkateswaran N.*

- Explored the efficacy of using hand crafted feature extraction techniques and some train-time techniques such as keypoint dropout on improving human pose skeleton based activity recognition performance.
- Paper was published at the 2020 IEEE Winter Applications of Computer Vision Workshops (WACVW). Poster was presented at the HADC'20 workshop at WACV 2020. [[paper](#)]

**Single Image Haze Removal Using a Generative Adversarial Network**

*Bharath Raj N., Venkateswaran N.*

- Created a conditional GAN based architecture to remove haze from images.
- Code and first version of the preprint were launched in 2018. Project currently has more than 70 stars on GitHub.
- Paper was published at the 2020 International Conference on Wireless Communications, Signal Processing and Networking (WiSPNET). [[paper](#)] [[code](#)]

## PROJECTS

**Neural Radiance Fields (NeRF) in TensorFlow 2 for 360-Degree Inward-Facing Scenes**

- Created an implementation of NeRF from scratch in TensorFlow 2 for 360-degree inward-facing scenes. [[code](#)]
- Includes implementation of components such as a function to find the nearest 3D point to N lines using least squares, inverse transform sampling to sample points along a ray given a piecewise constant probability distribution along the ray, and more.

**Open Source Contributions to Kornia**

- Contributed enhancements and fixes to Kornia, an open source differentiable computer vision library for PyTorch.
- One of my significant contributions to Kornia was the implementation of a Direct Linear Transform (DLT) based Perspective-n-Point (PnP) solver using PyTorch.

**Deploying Tiny YOLOv2 on Jetson Nano using DeepStream**

- Deployed a Tiny YOLOv2 ONNX model on NVIDIA Jetson Nano using the DeepStream SDK.
- Modified existing C++ code to enable it to parse the output of the TinyYOLOv2 model.
- Created a technical article about the project. The article is featured in the Jetson Community Resources page in the Deep Learning section. [[link](#)]

## Activity Recognition System based on Human Pose Estimation

- Created a system to recognize the activity performed by humans in a given video. The system used an activity recognition algorithm that depended on human poses estimated by OpenPose.
- A custom BRIEF based multi-object tracker was used to track human poses across frames obtained from the given video.
- Custom feature extraction techniques were used to extract features from the tracked human poses. An LSTM was trained and used to recognize the activity from the extracted features.
- Multiprocessing and pipelining concepts were used to enhance the inference speed of the system. Of note, copies of a trained LSTM were used in multiple CPU processes to perform activity recognition of multiple humans in parallel.

## Technical Articles

- Authored technical articles on various topics in machine learning and computer vision. A select few articles are mentioned below:
  - *Advances in Generative Adversarial Networks*. (Jan 2019, [[link](#)])
  - *An Overview of Human Pose Estimation with Deep Learning*. (Apr 2019, [[link](#)])

## TECHNICAL SKILLS

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**Languages:** Python, C++, C, JavaScript, MATLAB

**Frameworks & Libraries:** ROS, RViz, TensorFlow, PyTorch, PCL, OpenCV, NumPy, SciPy, Shapely

**Developer Tools:** Git, Docker, GCP, AWS

## COMMUNITY EXPERIENCES

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**Google Code-In Mentor** | *CloudCV*

*Oct 2018 – Dec 2018*

- Google Code-In is an event where students of the age group 13-17 contribute to open source organizations.
- As a mentor for the project Fabrik, I helped students complete their tasks and provided extensive code reviews and feedback.

**Machine Learning Domain Head** | *Tech Club SSN*

- Tech Club SSN is a student run organization of the ECE department of my college.
- As the machine learning domain head of Tech Club SSN during my final year of study, I conducted technical classes for my juniors, and organized events and hackathons.
- Also, I created a website for Tech Club SSN to display information about events and announcements.

## ACHIEVEMENTS

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**People's Choice Award** | *Yet Another Hackathon (SVCE)*

*August 2018*

- Presented a simple carry-on device created using a Raspberry Pi and an accelerometer sensor that can detect if a person has been assaulted and if so sends SMS alerts.

**Runner Up** | *Data Science Challenge (Exebit, IIT Madras)*

*April 2018*

- Runner up in a 10 day online contest involving a highly skewed dataset to detect debit card fraud.

**Runner Up** | *AWS Deep Learning Hackathon (Shaastra, IIT Madras)*

*Jan 2018*

- Trained an object detection algorithm that could detect a few hand signs.

**First Place** | *Project Presentation (SSN)*

*August 2017*

- Presented a live demonstration of a convolutional neural network that could decode some simple captcha.