Anand Balakrishnan

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EDUCATION

B.S. Computer Engineering, University at Buffalo   **Expected 2018**

Cumulative GPA: 3.760/4.000

EXPERIENCE

Undergraduate Researcher   **2016 - Ongoing**

Distributed Robotics and Networked Embedded Systems Lab   University at Buffalo

Advisor: Karthik Dantu

- Worked on developing and testing optical flow algorithms to run directly on-board micro aerial vehicles
- Built modules for the platform UB-ANC to deploy GPS-enabled drones indoors.
- Involved in projects involving usage of Wi-Fi signals and data for sensing in indoor spaces, especially for exploration and mapping.
- Working on developing a **first-of-its-kind** dataset that can be used to develop and benchmark Wi-Fi augmented visual sensing algorithms, especially simultaneous localization and mapping (SLAM).

Undergraduate Teaching Assistant   **Fall 2017**

CSE331: Algorithm Analysis and Design   University at Buffalo

Supervisor: Atri Rudra

RESEARCH PROJECTS

Dataset for WiFi Augmented Sensing

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- Compile a dataset that incorporates streams of depth images (RGB-D) along with WiFi data for development of simultaneous localization and mapping algorithms that are augmented with WiFi.
- Involves collecting large amounts of visual and laser data, WiFi signals, and ground-truth layout, in sessions that span several hours.
- Designed robot setup consisting of a Turtlebot 2 fitted with a Microsoft Kinect RGB-D camera and a Velodyne VLP-16 LIDAR for collecting depth images and laser scans, along with an NVIDIA Tegra X1 single-board computer for collecting WiFi signal information.
- The data is collected using the Robotics Operating System (ROS) and stored in the *rosbag* log format, along with more human readable formats like images and text files.
- The groundtruth is generated using the Google Cartographer SLAM package and then manually smoothed using the floor-plan as a reference.

Robotic Sensing for Art and New Media

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Collaboration: *Jordan Geiger, Center for Architecture and Situated Technologies*

- Collaborate with Architecture and Planning students to generate 3D maps to several spaces to use for generating new media content.
- Use sensors like the Microsoft Kinect depth camera (RGB-D) and the Velodyne VLP-16 (3D LIDAR) to gather the data.
- Implement and use 3D mapping pipelines, like Google Cartographer and RTAB Map, to generate 3D point clouds of the spaces.

Indoor Feature Detection for Micro-Aerial Vehicles

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- Test and develop efficient proprioception algorithms, like optical flow, that can run directly on-board the MAV, namely the Crazyflie 2.0, without impeding the stabilization loop.
- Involved writing firmware level code to interface lightweight camera, writing PID controllers for both, off-board and on-board control of the MAV.
- Presented poster at the University of Buffalo Symposium for Celebration of Excellence.

Platform for Indoor Deployment of GPS-enabled Drones

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- Developing an interface between motion controller systems and commercially available drones that use the MAVLINK protocol to facilitate further research on indoor navigation.
- Build on the UB-ANC platform, an existing testbed platform which facilitates quick testing and comparison of data from MAVLINK enabled agents.
- Built a quadrotor using a Raspberry Pi, a commercially available chassis, and an autopilot board as a means to test the platform.

ADDITIONAL PROJECTS

Pendragon   GitHub://PendragonGame/pendragon
Languages: JavaScript

- A HTML5 and JavaScript based, desktop RPG game, built with a realistic reputation engine that uses gossip protocols.
- Implements a probability-based information spread algorithm that simulates conversations.

WeeDigDug   GitHub://anand-bala/wee-dig-dug
Language: ARM Assembly

- A text-based simulation of the popular arcade game DigDug by Namco, Japan.
- Developed in ARM assembly for the LPC2138 Education Board (ARM7TDMI).

Another Real-Time Embedded OS (atre-os)   GitHub://anand-bala/atre-os
Language: C, Assembly

- A simple real-time, embedded operating system containing using tools and concepts learned from coursework and projects.
- Currently contains bare-bones thread and scheduler implementation.
- Tested working on Raspberry Pi 0 (BCM2835 processor).

ShoutOut   GitHub://anand-bala/ShoutOut
Language: Node.js

- A platform to facilitate relief and aid in disaster affected areas.
- Uses SMS as a means of communication, when connection to the Internet is unavailable.
- Uses SMS parsers to deliver information to relief parties subscribing to the platform channels.
- Developed in response to the severe floods in Chennai, India in November 2015.

POSTER PRESENTATIONS

1. Anand Balakrishnan et al. "Dataset for Experimental Validation of Wi-Fi Sensing". In: *6th Annual Northeastern Robotics Colloquium*. NERC '17. Poster. Northeastern University, Boston MA, Oct. 2017.

Honors and Awards

- CURCA Undergraduate Grant for Multi-robot Systems Research   University at Buffalo   2017
- Undergraduate Dean's List   University at Buffalo   Fall 2015 – Spring 2016
- International Global Students' Scholarship   University at Buffalo   Fall 2014 – Spring 2018

Technical Skills

Programming & Scripting	C, C++, Python, JavaScript, Matlab, Assembly (ARM, MIPS) Java, Rust, Go
Applications & Libraries	Robotics Operating System (ROS), Android, Arduino SPICE Simulation, KiCad, EagleCAD

Relevant Coursework

Computer Science and Engineering

Software Engineering Principles, Operating Systems, Intro to Microprocessors, Real-time and Embedded Systems, Computer Organization, Intro to Algorithm Analysis and Design, Data Structures

Mathematics

Linear Algebra, Applied Probability, Differential Equations

Electrical Engineering

Basic Electronic Instrumentation, Electronic Devices and Circuits, Signals and Systems

Organizations

Advanced Honors Scholar	Honors College	University at Buffalo	Since 2016
Member	ACM, Student Branch	University at Buffalo	Since 2015

References

1. **Karthik Dantu**
   Assistant Professor
   Department of Computer Science and Engineering
   University at Buffalo

2. **Bina Ramamurthy**
   Research Associate Professor
   Department of Computer Science and Engineering
   University at Buffalo

3. **Atri Rudra**
   Associate Professor
   Department of Computer Science and Engineering
   University at Buffalo