

Abrar Anwar

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EDUCATION

University of Texas at Austin

Austin, TX

Bachelors of Science in Computer Science; GPA: 3.66

May 2021

- Thesis: *Learning Consistent Space-Time Representations for Predictive Physical Simulations* (expected Dec. 2020). Advised by Prof. Chandrajit Bajaj
- Relevant Coursework: Machine Learning (G), Geometric Foundations of Data Science, Computer Vision, Autonomous Robotics I/II, Wireless Networks, Predictive Analytics, Compilers
- Current Coursework: Quantum Computing (H), Advanced Probability Theory in Learning, Inference, and Networks (G), Neural Systems I

National University of Singapore

Singapore

Exchange Program funded by Gilman Scholarship

Fall 2019

- Relevant Coursework: AI/RL and Decision Making (G), Natural Language Processing
- Assisted in the development of an object recognition pipeline for the Adaptive Computing Lab

(G) = Graduate course, (H) = Honors

RESEARCH INTERESTS

- Neural networks
- Robotics (focused on localization and navigation)
- Evolutionary optimization
- Computer vision
- Neuromorphic computing
- Human-robot interaction

ACADEMIC WORKS

- [1] **A. Anwar**, C. Vineyard, W. Severa, S. Cardwell. Assessing Noise Resilience in Spiking Weight Agnostic Neural Networks. In *IEEE Space Computing Conference (SCC)*. 2021. (abstract submitted, in prep)
- [2] B. Holman, **A. Anwar**, A. Singh, M. Tec, J. Hart, P. Stone. Watch Where You're Going! Gaze and Head Orientation as Predictors for Social Robot Navigation. In *IEEE International Conference on Robotics and Automation (ICRA)*. 2021. (submitted)
- [3] **A. Anwar**. Learning Consistent Space-Time Representations for Predictive Physical Simulation. Honors Thesis. UT Austin. Expected December 2020.
- [4] Robustness of Binary Activation Neural Networks. Sandia National Laboratories. Internal Technical Advance Submitted for Patent Consideration. 2020.
- [5] **A. Anwar**, C. Vineyard, W. Severa, S. Musuvathy, S. Cardwell. Evolving Spiking Circuit Motifs using Weight Agnostic Networks. In *Computer Science Research Institute Summer Proceedings*. Technical Report, Sandia National Laboratories. 2020.
- [6] **A. Anwar** et al. Evolving Spiking Circuit Motifs using Weight Agnostic Neural Networks. Poster presented at the *ACM International Conference on Neuromorphic Systems (ICONS)*. July 2020.
- [7] **A. Anwar**, B. Holman., C. Sheehan, J. Huang. Using Human-Inspired Signals to Disambiguate Navigational Intentions. Poster presented at the *UT Undergraduate Research Forum*; April 2020.
- [8] F. Wang, J. B. Aimone, **A. Anwar**, and S. Musuvathy. BrainSLAM: Robust autonomous navigation in sensor-deprived contexts. Technical Report SAND2019-11302R, Sandia National Laboratories. 2019.
- [9] **A. Anwar**, B. Holman, M. Shaposhnikov. Bounding Box SLAM: A Fast, Selective SLAM. Poster presented at the *UT Undergraduate Research Forum*; April 2019.

TALKS

- [1] **A. Anwar.** “Research Abroad: Accessibility and How To Get Involved.” Talk for UT’s Autonomous Robotics course students to encourage low-income students to conduct research abroad. October 2020.
- [2] **A. Anwar.** “Weight Agnostic Neural Networks and Neural Architecture Search.” Survey talk for the *NERL Summer Seminar Series* at Sandia National Laboratories. June 2020.
- [3] **A. Anwar** “Grover’s Algorithm: An Introduction to Quantum Algorithms.” Presentation session for *Spring Directed Reading Program Symposium* at UT Austin. May 2019.

RESEARCH EXPERIENCE

Sandia National Laboratories May 2020 - Present
Research Intern - PI: Dr. Craig Vineyard *Albuquerque, NM*

- Developed evolutionary method to generate spiking neural network circuits for low-power neural network-hardware co-design, specifically neuromorphic computing
- Exhibited competitive performance on classification, control, and Atari with a ResNet feature extractor
- Gained a 2x speedup on HPC systems by implementing asynchronous parallel training using OpenMPI
- Analyzed neural architecture search methods for binary activation neural networks in noisy conditions

Building Wide Intelligence Lab July 2019 - Present
Undergraduate Research Intern - PI: Dr. Peter Stone; Supervisor: Dr. Justin Hart *Austin, TX*

- Manage and lead several projects, mentoring students in research
- Designed an experiment in virtual reality to collect human motion data and developed a multivariate Gaussian time series model to predict trajectories using eye-tracking data for robot social navigation
- Designed and statistically analyzed experiments to quantify humans’ ability to interpret gaze in people, rendered robot heads, and virtual reality
- Contributed to a vision pipeline using CycleGAN for autonomous semantic mapping
- Developed an Amazon MTurk website using JavaScript to collect user data and created a word embedding model with triplet-loss for predicting generalizable human-like object shelving

Computational Visualization Center at UT’s Oden Institute April 2020 - Present
Undergraduate Researcher - PI: Dr. Chandrajit Bajaj *Austin, TX*

- Exploring work on generating spatio-temporally consistent, robust mesh tracking
- Develop a time-varying variational autoencoder to encode meshes in a latent space for temporal filtering
- Developed variational Gaussian process for implicit surfaces to reconstruct meshes
- Designed an optical flow estimation neural network by recovering the Helmholtz-Hodge Decomposition

Sandia National Laboratories May - July 2019
R&D Autonomy Intern - PI: Dr. James Brad Aimone *Albuquerque, NM*

- Designed brain-inspired localization methods for a hypersonic glide vehicle in GPS-denied environments
- Architected a novel lightweight, rotation-invariant feature for elevation data for fast template matching
- Trained a rotation-invariant feature extraction autoencoder to reduce storage of place recognition maps.
- Investigated dense coding approaches to allow for sub-linear growth in map storage

Building Wide Intelligence Lab July 2018 - May 2019
Summer Research Fellow - PI: Dr. Peter Stone; Supervisor: Dr. Justin Hart *Austin, TX*

- Combined semantic info from object detection with visual SLAM to increase accuracy by 60% in dynamic environments by reducing drift
- Implemented active operator recognition system for our robots
- Developed motion planning and simulation of a UR5 robot arm, and investigated manipulation methods

SIGNIFICANT PROJECTS

- “Detecting Muscle Cocontraction Through Sliding Window Gaussian Processes”. In “Machine Learning” graduate course with Prof. Dana Ballard (Spring 2020).
 - Created set of GPs for detecting anomalies in 3D motion capture data
- “DeepHHD: Learning Helmholtz-Hodge Decomposition to Predict Optical Flow”. In “Geometric Foundations of Data Science” undergraduate course with Prof. Chandrajit Bajaj (Spring 2020).
 - Developed a UNet-based neural network to estimate optical flow using vector field decomposition
- “Hindsight Experience Replay and Value-Difference Based Exploration for Solving Large Scale Stochastic Environments” In graduate course with Prof. Lee Wee Sun (NUS Fall 2019).
 - Implemented a DQN and MCTS to solve a reward-sparse, discrete driving environment

TEACHING EXPERIENCE

CS309/CS378: Autonomous Robotics I/II

January 2019 - Present

Teaching Assistant for Dr. Justin Hart

Austin, TX

- Taught first/second year CS students to conduct robotics research
- Mentored students on formulating their research projects

UTCS Robotics Camp

July 2018

Residential Advisor

Austin, TX

- Contributed to the curriculum for UT’s first robotics camp for high school students
- Created hands-on activities ranging from soldering to Arduino programming

High School Research Initiative

September 2017 - May 2018

Student Intern

Austin, TX

- Facilitated high school students from underserved schools to engage in STEM research with UT faculty
- Led discussions on student projects to encourage inquiry

UTeach Natural Sciences

August 2017 - May 2018

Student Teacher

Austin, TX

- Taught elementary and middle school students computer science at underprivileged schools to reduce future inequity in STEM fields

AWARDS & HONORS

- Princeton Pathways to Graduate School Admitted Participant 2020
- Benjamin A. Gilman International Scholar Fall 2019
- FRI Summer Research Fellowship Summer 2018
- Horatio Alger Honeywell Scholar 2017
- University Honors 2018-2020
- UT Austin Presidential Scholar 2017-2021
- Asian and Pacific Islander American (APIA) Wells Fargo Scholar 2017

PROGRAMMING SKILLS

Languages: C/C++, Python, MATLAB, Java, R, JavaScript, C#, L^AT_EX

Technologies: PyTorch, Tensorflow, Pandas, NLTK, ROS, scikit-learn, OpenCV, Matplotlib, OpenAI Gym, Unity (VR), OpenMPI, etc.