

# Abrar Anwar

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Education	<b>University of Texas at Austin</b> <i>Bachelor of Science</i> , Computer Science, GPA: 3.66 Relevant Coursework: Machine Learning (G), Geometric Foundations of Data Science, Computer Vision, Autonomous Robotics I/II, Wireless Networks, Quantum Computing, Predictive Analytics, Compilers	Austin, TX May 2021
	<b>National University of Singapore</b> Exchange Program funded by Gilman Scholarship Relevant Coursework: AI and Decision Making (G), Natural Language Processing	Singapore Fall 2019
(G) = Graduate course		
Interests	<ul style="list-style-type: none"><li>• Neural networks</li><li>• Robotics</li><li>• Evolutionary optimization</li><li>• Computer vision</li><li>• Neuromorphic computing</li><li>• Human-robot interaction</li></ul>	
Academic Works	<p>[1] <b>A. Anwar</b>, C. Vineyard, W. Severa, S. Musuvathy, S. Cardwell. “Evolving Spiking Circuit Motifs using Weight Agnostic Networks”. <i>Computer Science Research Institute Summer Proceedings</i>. Technical Report, Sandia National Laboratories. 2020. (in progress)</p> <p>[2] <b>A. Anwar</b> et al. “Evolving Spiking Circuit Motifs using Weight Agnostic Neural Networks.” Poster presented at the <i>International Conference on Neuromorphic Systems</i>; July 2020.</p> <p>[3] F. Wang, J. B. Aimone, <b>A. Anwar</b>, and S. Musuvathy. “BrainSLAM: Robust autonomous navigation in sensor-deprived contexts”. Technical Report SAND2019-11302R, 2019.</p> <p>[4] <b>A. Anwar</b>, B. Holman., C. Sheehan, J. Huang. “Using Human-Inspired Signals to Disambiguate Navigational Intentions.” Poster presented at the <i>UT Undergraduate Research Forum</i>; April 2020.</p> <p>[5] <b>A. Anwar</b>, B. Holman, M. Shaposhnikov. “Bounding Box SLAM: A Fast, Selective SLAM.” Poster presented at the <i>UT Undergraduate Research Forum</i>; April 2019.</p>	
Talks	<p>[1] <b>A. Anwar</b>. “Weight-Agnostic Neural Networks and Neural Architecture Search.” Talk for the <i>NERL Summer Seminar Series</i> at Sandia National Laboratories. June 2019.</p> <p>[2] <b>A. Anwar</b> “Grover’s Algorithm: An Introduction to Quantum Algorithms.” Presentation session for <i>Spring Directed Reading Program Symposium</i> at UT Austin. May 2019.</p>	

Research  
Experience

**Sandia National Laboratories**

Research Intern

May 2020 - Present

Albuquerque, NM

*Neural Exploration and Research Lab*

*PI: Craig Vineyard*

- Developed and optimized evolutionary method to evolve spiking-like neural network circuits for low-power, edge computing cases, specifically neuromorphic computing
- Assessed my approach on various tasks ranging from classification and continuous control, to playing Atari using a ResNet feature extractor
- Implemented parallel, asynchronous evolutionary training to speed up training process by 2x on HPC systems using OpenMPI
- Working on extensions for low-power neural network-hardware co-design

**Computational Visualization Center**

Undergraduate Researcher

April 2020 - Present

Austin, TX

*PI: Chandrajit Bajaj*

- Develop a novel unsupervised optical flow estimation neural network by reconstructing the Helmholtz-Hodge Decomposition
- Use a deep reinforcement learning module to selectively refine residual patches in a coarse-to-fine manner

**Building Wide Intelligence Lab**

Undergraduate Researcher

January 2020 - Present

Austin, TX

*PI: Peter Stone. Supervisor: Justin Hart.*

- Managed and lead several projects, mentoring students in research
- Using eye tracking and 3D depth tracking to model the navigational intent of humans interacting with robots
- Created a word embedding model to shelve groceries in a human-like manner with a training process that allows for predicting generalizable human-like object placement. Designed Amazon MTurk experiments to collect data.
- Designed experiments to quantify humans' ability to interpret the gaze of virtual/physical agents

**Sandia National Laboratories**

Autonomy Intern

May - July 2019

Albuquerque, NM

*Neural Exploration and Research Lab*

*PI: Brad Aimone*

- Developed brain-inspired localization network for a hypersonic glide vehicle
- Designed rotation-invariant representations of images using Monte Carlo-like partial pixel estimation to develop a lightweight, circular feature
- Trained a rotation-invariant feature extraction autoencoder to reduce storage requirements of place recognition maps. Explored hierarchical, dense coding approaches to allow for sub-linear growth in map storage

	<b>Building Wide Intelligence Lab</b> Undergraduate Researcher/Summer Research Fellow <i>PI: Peter Stone. Supervisor: Justin Hart.</i>	July 2018 - May 2019 Austin, TX
	<ul style="list-style-type: none"> <li>• Combined semantic info from object detection with visual SLAM to increase SLAM accuracy by 60% in dynamic environments by reducing drift</li> <li>• Implemented active facial recognition system for RoboCup@Home competition</li> <li>• Developed motion planning and simulation models for UR5 robot arm</li> </ul>	
Projects	<b>Gaussian Processes for Detecting Cocontraction</b>	May 2020
	<ul style="list-style-type: none"> <li>• Implemented Gaussian processes (GP) from scratch to detect muscle cocontraction from shifts in the hyperparameters of sliding windows of the non-parametric GP models using 3D motion capture data</li> </ul>	
Teaching Experience	<b>Autonomous Robots I/II</b> Teaching Assistant/Peer Mentor	January 2019 - Present Austin, TX
	<ul style="list-style-type: none"> <li>• Taught freshman CS students how to conduct robotics research for the BWI Lab</li> <li>• Mentored students on numerous projects such as facial detection and frontier exploration</li> </ul>	
	<b>UTCS Robotics Camp</b> Residential Advisor	July 2018 Austin, TX
	<ul style="list-style-type: none"> <li>• Designed curriculum for an all-encompassing robotics summer camp for high school students</li> <li>• Created hands-on activities ranging from soldering to Arduino programming</li> </ul>	
	<b>High School Research Initiative</b> Student Intern	September 2017 - May 2018 Austin, TX
	<ul style="list-style-type: none"> <li>• Facilitated students to explore biology research with UT faculty</li> <li>• Led discussions on student projects to encourage inquiry</li> </ul>	
	<b>UTeach Natural Sciences</b> Student Teacher	August 2017 - May 2018 Austin, TX
	<ul style="list-style-type: none"> <li>• Taught elementary, then later middle school students computer science at underprivileged schools to facilitate interest in the field</li> </ul>	
Awards & Honors	<ul style="list-style-type: none"> <li>• Princeton Pathways to Graduate School Admitted Participant</li> <li>• Benjamin A. Gilman International Scholarship, Fall 2019</li> <li>• FRI Summer Research Fellowship, Summer 2018</li> <li>• Horatio Alger Honeywell Scholar, 2018</li> <li>• University Honors, Spring 2018 - Spring 2020</li> </ul>	

## Skills

**Languages:** C/C++, Python, MATLAB, Java, R, L<sup>A</sup>T<sub>E</sub>X

**Technologies:** PyTorch, Tensorflow, ROS, OpenMPI, scikit-learn, OpenCV