

Abrar Anwar

Ph.D Student in Computer Science

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EDUCATION

University of Southern California

Ph.D in Computer Science

Los Angeles, CA

Starting Fall 2021

- To-be Advised by Prof. Jesse Thomason

University of Texas at Austin

Bachelors of Science in Computer Science

Austin, TX

May 2021

- Honors Thesis: *Deep Reinforcement Learning for Optimal Refinement of Cross-Sectional Mesh Sequence Finite Elements*. Advised by Prof. Chandrajit Bajaj

National University of Singapore

Exchange Program funded by Gilman Scholarship

Singapore

Fall 2019

RESEARCH INTERESTS

- Human-robot interaction: robots that use anticipatory signals for seamless interactions
- Robot learning: leverage language, vision, etc. for learning how to interact in human environments
- Embodied AI: transfer agents that can interact with simulated environments to real world robots

RESEARCH EXPERIENCE

Cornell University, Google ExploreCSR, UTRGV

Research Assistant - PI: Prof. Tapo Bhattacharjee

June 2021 - Present

Remote

- to be announced

- something really cool!

Building Wide Intelligence Lab at UT Austin

Research Assistant - PI: Prof. Peter Stone; Supervisor: Prof. Justin Hart

May 2018 - Present

Austin, TX

- **Virtual Reality Study on Human Gaze for Robot Social Navigation**

Fall 2020

- Designed an experiment in virtual reality to collect human motion data in a walking task
- Developed a multivariate Gaussian time series model to predict trajectories using eye-tracking data
- Used mixed factor ANOVA and Tukey tests to determine which factors are predictors of motion

- **Gaze Interpretation of Robot Heads**

Spring/Fall 2020

- Characterizing foreshortening in 3D-to-2D projections to create realistic gaze in virtual agents
- Analyzed experiments to quantify humans' interpretation of gaze in people, rendered robot heads, and VR
- Designed a novel hierarchical target design to quantify gaze accuracy of various agents
- Created a VR robot head and a rendered virtual agent to perform gazes with ocular vergence

- **Learning Object Shelving Preferences**

Spring 2020

- Created a word2vec model with triplet and contrastive loss for predicting human-like grocery shelving
- Developed an Amazon MTurk website using JavaScript to collect paired preference data

- **BBSLAM: Selective Mapping and Localization**

Fall 2018 - Spring 2019

- Improved accuracy of ORB-SLAM by 60% in dynamic environments using weighted ORB features based on object classification of non-static objects

- **Miscellaneous Projects/Contributions**

- Contributed to a vision pipeline using CycleGAN to label door signs for autonomous semantic mapping
- Implemented active human operator recognition system for our robots using face and clothing info
- Developed motion planning and simulation of a UR5 robot arm, and investigated manipulation
- Developed a people counting demo using person detection to count and tweet how full the lab is

Computational Visualization Center at UT's Oden Institute

Undergraduate Researcher - PI: Prof. Chandrajit Bajaj

April 2020 - Present

Austin, TX

- Deep Reinforcement Learning for Refinement of Cross-Sectional Mesh Sequences

- Developed the first deep reinforcement learning framework for mesh refinement, and refined “good” quality surface reconstructions of cross-sectional contours using soft-actor critic with initial simulations

Sandia National Laboratories

Research Intern - PI: Dr. Craig Vineyard

May 2020 - Present

Albuquerque, NM

- Evolving Sparse Spiking Neural Networks

- Developed evolutionary method to generate spiking neural network circuits for low-power neural network-hardware co-design, specifically neuromorphic computing, using weight agnostic neural networks
- 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
- Analyzing neural architecture search methods for binary activation neural networks in noisy conditions

Sandia National Laboratories

R&D Autonomy Intern - PI: Dr. James Brad Aimone

May - July 2019

Albuquerque, NM

- BrainSLAM

- 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 autoencoders to learn rotation-invariant latent spaces to reduce the storage of embeddings
- Investigated dense coding approaches to allow for sub-linear growth in map storage

ACADEMIC WORKS

- [1] [Watch Where You're Going! Gaze and Head Orientation as Predictors for Social Robot Navigation](#)
Blake Holman, **Abrar Anwar**, Akash Singh, Mauricio Tec, Justin Hart, Peter Stone
ICRA 2021
- [2] [Evolving Spiking Circuit Motifs using Weight Agnostic Networks](#)
Abrar Anwar
AAAI 2021 Undergraduate Consortium (17% acceptance)
- [3] [Neural Network Robustness via Binary Activation](#)
William Severa, Craig Vineyard, Ryan Dellana, **Abrar Anwar**
Patent Application. Sandia National Labs. 2021.
- [4] [Evolving Spiking Circuit Motifs using Weight Agnostic Networks](#)
Abrar Anwar, Craig Vineyard, William Severa, Srideep Musuvathy, Suma Cardwell.
Sandia Computer Science Research Institute Summer Proceedings. SAND2020-12580R. 2020.
- [5] [BrainSLAM: Robust autonomous navigation in sensor-deprived contexts](#)
Felix Wang, James B. Aimone, **Abrar Anwar**, and Srideep Musuvathy
Sandia National Labs Technical Report SAND2019-11302R. 2019.

POSTERS PRESENTATIONS

- [1] [Do you see what I see? Gaze understanding in people, 3D-rendered robot heads, and virtual reality](#)
Akash Singh, **Abrar Anwar**, Justin Hart
UT Undergraduate Research Forum. April 2021. (**Best CS Poster**)
- [2] [Watch Where You're Going! Gaze and Head Orientation as Predictors for Social Robot Navigation](#)
Blake Holman, **Abrar Anwar**, et al.
UT Undergraduate Research Forum. April 2021.
- [3] [Evolving Spiking Circuit Motifs using Weight Agnostic Neural Networks](#)
Abrar Anwar et al.
ACM International Conference on Neuromorphic Systems (ICONS). July 2020.

[4] [Using Human-Inspired Signals to Disambiguate Navigational Intentions](#)

AbRAR Anwar, Blake Holman, Connor Sheehan, Jeffery Huang
UT Undergraduate Research Forum. April 2020.

[5] [Bounding Box SLAM: A Fast, Selective SLAM](#)

AbRAR Anwar, Blake Holman, Michail Shaposhnikov
UT Undergraduate Research Forum. April 2019.

TALKS

- [1] “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] “Weight Agnostic Neural Networks and Neural Architecture Search.” Survey talk for the *NERL Summer Seminar Series* at Sandia National Laboratories. June 2020.

Links to papers, code, and posters at my website: abrar.anwar.github.io

SELECTED PROJECTS

- “**Calibrated Feedback for Language-Guided Reinforcement Learning**”. In “Advanced Machine Learning” graduate course (Spring 2021).
 - Increased RL agent performance on reward-sparse Atari games by combining research on neural net uncertainty calibration and language feedback to develop a model-based interactive RL algorithm
- “Negative Dependence in Machine Learning”. In “Advanced Probability” graduate course (Fall 2020).
 - Wrote a survey paper on negatively-associated measures for ML like determinantal point processes
- “Detecting Muscle Cocontraction Through Sliding Window Gaussian Processes”. In “Machine Learning” graduate course (Spring 2020).
 - Created set of overlapping GPs for detecting anomalies in the joints of 3D motion capture data
- “DeepHHD: Learning Helmholtz-Hodge Decomposition to Predict Optical Flow”. In “Geometric Foundations of Data Science” undergraduate course (Spring 2020).
 - Developed a UNet-based neural network to estimate vector field decompositions for optical flow
- “Hindsight Experience Replay and Value-Difference Based Exploration for Solving Large Scale Stochastic Environments” In reinforcement learning graduate course (NUS Fall 2019).
 - Improved performance of 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

- Mentored students on formulating and conducting their research projects.
- Research projects supervised: “GAN Segmentation and Frontier Exploration for Autonomous Semantic Mapping” and “Assessing the Importance of Ocular Convergence with Gaze Cues in Binocular Vision”
- Assisted students in a range of topics such as symbolic reasoning, ROS, computer vision, and neural nets

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 through collaboration

UTeach Natural Sciences

August 2017 - May 2018

Student Teacher

Austin, TX

- Taught elementary and middle school students computer science and engineering through project-based methods at underprivileged schools to reduce future inequity in STEM

AWARDS, HONORS & RECOGNITION

- Google Research/UTRGV ExploreCSR Workshop (17% acceptance rate) 2021
- Research Distinction, UT Austin College of Natural Sciences - top 5% of UT seniors in research 2021
- CNS Award for Excellence in Computer Science (\$500) - Undergraduate Research Forum, UT Austin 2021
- Google Computer Science Research Mentorship Program (CSRMP) Class of 2021 2021
- AAAI Undergraduate Consortium - 1 of 14 accepted out of 82 applicants 2021
- 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 2017-21
- University Honors 2018-20

PROGRAMMING SKILLS

Languages: C/C++, Python, MATLAB, Java, R, JavaScript, C#, \LaTeX

Technologies: PyTorch, Tensorflow, Pandas, NLTK, ROS, sklearn, OpenCV, OpenAI Gym, Unity, OpenMPI