

Abrar Anwar

Ph.D Student in Computer Science

[abrar-anwar.github.io](https://github.com/abrar-anwar)

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EDUCATION

University of Southern California

Ph.D in Computer Science

Los Angeles, CA

Fall 2021 – Present

- 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

University of Southern California - GLAMOR Lab

PI: Prof. Jesse Thomason

June 2021 - Present

Los Angeles, CA

- Semantically-meaningful Nonverbal Gesture Generation

- Introduced a timestep-level multimodal, Transformer-based discriminator for fine-grained adversarial training of co-speech gesture generation from audio and text
- Designing an audio-aligned masking objective to encourage learning from semantically-aligned timesteps

Cornell University, Google Research ExploreCSR, UTRGV

Research Assistant (Part-Time) - PI: Prof. Tapo Bhattacharjee

June 2021 - Present

Remote

- Social Bite Timing

- Designed a nonverbal behavior generation approach for simulated robot assistive feeding in social dining
- Learning continuous nonverbal behavior sequences guided by rule-based behaviors.
- Collected a YouTube in-the-wild dataset of social eating to model the verbal+nonverbal behaviors' effect in anticipating bite timing

Building Wide Intelligence Lab at UT Austin

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

May 2018 - Present

Austin, TX

- 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

- 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

- 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

Sandia National Laboratories

Research Intern - PI: Dr. Craig Vineyard

May 2020 - August 2021

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 games
- Evolved sparse binary activation neural network topologies with relative synaptic weights

Computational Visualization Center at UT's Oden Institute

April 2020 - May 2021

Undergraduate Researcher - PI: Prof. Chandrajit Bajaj

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

May - July 2019

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

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
- Investigated dense coding approaches to allow for sub-linear growth in map storage

ACADEMIC WORKS

- [1] Human-Robot Commensality: Bite Timing Prediction for Robot-Assisted Feeding in Groups
Janko Ondas*, **Abrar Anwar***, Tong Wu*, Fanjun Bu, Malte Jung, Jorge Ortiz, Tapomayukh Bhattacharjee
2022 (*In Review*)
- [2] 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
- [3] Deep Reinforcement Learning for Optimal Refinement of Cross-Sectional Mesh Sequence Finite Elements
Abrar Anwar
UT Austin Undergraduate Honors Thesis. May 2021
- [4] Evolving Spiking Circuit Motifs using Weight Agnostic Networks
Abrar Anwar
AAAI 2021 Undergraduate Consortium (17% acceptance)
- [5] Neural Network Robustness via Binary Activation
William Severa, Craig Vineyard, Ryan Dellana, **Abrar Anwar**
Non-Provisional Utility Patent Application. US 2021/0350236. Sandia National Labs. 2021.
- [6] 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.
- [7] 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.

POSTER PRESENTATIONS

- [1] Nonverbal Behavior Generation in Social Bite Timing
Abrar Anwar, Tapomayukh Bhattacharjee
Google Research exploreCSR & UTRGV Poster Session. July 2021.
- [2] 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**)

- [3] **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.
- [4] **Evolving Spiking Circuit Motifs using Weight Agnostic Neural Networks**
Abrar Anwar et al.
ACM International Conference on Neuromorphic Systems (ICONS). July 2020.
- [5] **Using Human-Inspired Signals to Disambiguate Navigational Intentions**
Abrar Anwar, Blake Holman, Connor Sheehan, Jeffery Huang
UT Undergraduate Research Forum. April 2020.
- [6] **Bounding Box SLAM: A Fast, Selective SLAM**
Abrar Anwar, Blake Holman, Michail Shaposhnikov
UT Undergraduate Research Forum. April 2019.

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
- **“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

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”

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

AWARDS, HONORS & RECOGNITION

- **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
- Benjamin A. Gilman International Scholar (Singapore) Fall 2019
- Horatio Alger Honeywell Scholar 2017-21
- University Honors 2018-20

PROGRAMMING SKILLS

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

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