Tianrui Guan

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EDUCATION

University of Maryland, College of Computer, Mathematical, and Natural Sciences — College Park, MD
Ph.D., **Computer Science**, *advised by Dinesh Manocha, Ming Lin* — *Spring 2022 – Current*
Master of Science with Thesis, **Computer Science**, *GPA: 4.0* — *Fall 2019 – Fall 2021*

University of Maryland, College of Computer, Mathematical, and Natural Sciences — College Park, MD
Bachelor of Science, **Computer Science and Statistics**, *GPA: 3.97* — *Fall 2016 – Spring 2019*
Graduate with Magna Cum Laude Latin Honor in three years

- Computer Science Departmental Honors (each semester)

PUBLICATIONS / RESEARCH PROJECT

UAV Activity Recognition, *Python, Computer Vision (under review)* — *Fall 2021*

- Transformer-based framework with efficient computation
- Use Fast Fourier Transformation for disentangling foreground/background and modeling causality

Campus Navigation with global and local sensing, *Python, Robotics, Computer Vision (in progress)* — *Fall 2021*

- Improve scene and terrain understanding for outdoor navigation from a vision perspective
- Global map analysis for global planning with local sensor

Terrain Segmentation for off-road navigation, *Python, Computer Vision (under review)* — *Fall 2021*

- Proposed a novel group-wise attention semantic segmentation designed for off-road dataset
- A grouping scheme that can boost the accuracy for recognizing terrain condition and navigability

Traversability Estimation for Excavator, *Python, C++, (Internship project, under review)* — *Summer 2021*
RSS 2022

- Terrain traversability estimation in unstructured, complex environment
- A novel geometric and semantic fusion techniques to build traversability map for excavator navigation

M3DETR: 3D Object Detection with Transformers, *Python, Computer Vision* — *Fall 2020*
WACV 2022

- A novel multi-representation, multi-scale, mutual-relation transformer on 3D detection task
- State-of-the-art performance on KITTI and Waymo dataset

OF-VO: Reliable Navigation among Pedestrians, *robotic* — *Fall 2020*
RA-L 2021

- Built a hybrid model that combines segmentation network and optical flow network
- Created a modified version of velocity obstacle algorithm based on partial observation
- Implemented the algorithm in both simulator and turtlebot2 with good successful rate (collision avoidance)

Frozone: Freezing-Free, Pedestrian-Friendly Navigation in Human Crowds, *Robotics* — *Spring 2020*
RA-L and IROS 2020

- Made collision avoidance policy that significantly reduce the freezing robot problem
- Classified pedestrians that could potentially impact motion planning
- Predicted the trajectories of pedestrians to form a Potential Freezing Zone using perception module

Trajectory and Behavior of Road-Agents Using Spectral Clustering in Graph-LSTMs, *Python* — *Fall 2019*
RA-L and IROS 2020

- Extracted and formatted data for Lyft level 5, Argoverse and Apolloscape*)*

- Used a two-stream LSTM network to predict trajectory and behavior of road agents
- Conducted extensive experiments on several state-of-the-art pedestrian prediction algorithms

TrackNPred: A Software Framework for End-to-End Trajectory Prediction *Python/Qt* *Summer 2019*
ACM CSCS 2019 &
DenseCAvoid: Real-time Navigation in Dense Crowds using Anticipatory Behaviors
ICRA 2020

- Created a pipeline of object detection, object tracking and trajectory prediction
- Incorporated several state-of-the-art methods in the pipeline
- Built an GUI to enable switching between different methods and visualizing results
- Deployed the system in a robotic navigation project

WORKING EXPERIENCE

Research Intern, Baidu USA, Sunnyvale, CA *Summer 2021, 2022*

- Resulted in one submission to RAL-ICRA: Terrain traversability estimation for Excavator Application
- Dataset collect for perception in unstructured environment
- Traversability estimation using geometric and semantic information about the surface
- Excavator navigation using traversability map

Research Assistant at GAMMA, University of Maryland, College Park, MD *May 2019 - Present*

- Advised by Professor Dinesh Manocha
- Worked on trajectory prediction, computer vision and robotic projects (See **PUBLICATIONS** section)

Teaching Assistant for Data Structures CMSC420, University of Maryland, College Park *Nov 2018 - Present*

- Assisted students with study materials and coding for a class of 150 people for 4 semesters
- Created homework and test, and handled grading
- Implemented additional functionality to the base code previously developed by instructors
- Developed more robust testing code for project grading

Software Testing Intern, Advanced Geophysical Technology, Houston, TX *Summer 2017*

- Provided solutions for GUI Test Automation for NoveSeis
- Explored squish for Qt, froglogic and Sikuli Script

LIST of PUBLICATIONS (Google Scholar)

[1] Tianrui Guan; Jun Wang; Shiyi Lan; Rohan Chandra; Zuxuan Wu; Larry Davis; Dinesh Manocha "M3DeTR: Multi-representation, Multi-scale, Mutual-relation 3D Object Detection with Transformers", IEEE Winter Conference on Applications of Computer Vision (WACV), 2022

[2] Tianrui Guan; Zhenpeng He; Ruitao Song; Dinesh Manocha; Liangjun Zhang "TTNS: Terrain Traversability Mapping and Navigation System for Autonomous Excavators", Robotics: Science and Systems, 2022

[3] Tianrui Guan; Divya Kothandaraman; Rohan Chandra; Adarsh Jagan Sathyamoorthy; Kasun Weerakoon; Dinesh Manocha "GANav: Group-wise Attention Network for Classifying Navigable Regions in Unstructured Outdoor Environments", Under review

[4] Divya Kothandaraman; Tianrui Guan; Xijun Wang; Sean Hu; Ming Lin; Dinesh Manocha "Fourier Disentangled Space-Time Attention for Aerial Video Recognition", Under review

[5] Adarsh Jagan Sathyamoorthy, Kasun Weerakoon, Tianrui Guan, Jing Liang, Dinesh Manocha "TerraPN: Unstructured terrain navigation through Online Self-Supervised Learning", Under review

[6] Jing Liang, Yi-Ling Qiao, Tianrui Guan, Dinesh Manocha, "OF-VO: Reliable Navigation among Pedestrians Using Commodity Sensors", *IEEE Robotics and Automation Letters (RAL), 2021*

[7] Adarsh Jagan Sathyamoorthy; Utsav Patel; Tianrui Guan; Dinesh Manocha. "Frozone: Freezing-Free, Pedestrian-Friendly Navigation in Human Crowds ", *IEEE Robotics and Automation Letters (RAL), 2020*

[8] Rohan Chandra; Tianrui Guan; Srujan Panuganti; Trisha Mittal; Uttaran Bhattacharya; Aniket Bera; Dinesh Manocha. "Forecasting Trajectory and Behavior of Road-Agents Using Spectral Clustering in Graph-LSTMs", *IEEE Robotics and Automation Letters (RAL), 2020*

[9] Adarsh Jagan Sathyamoorthy; Jing Liang; Utsav Patel; Tianrui Guan; Rohan Chandra; Dinesh Manocha." DenseCAvoid: Real-time Navigation in Dense Crowds using Anticipatory Behaviors", *IEEE International Conference on Robotics and Automation (ICRA), 2020*

Reviewer Duty

- IROS 2022, 2021, 2020
- ICRA 2022, 2021
- CVPR 2022
- ECCV 2022
- RAL

ENGINEERING PROJECTS

Distributed Storage System, *Go, Distributed System.* *Fall 2020*

- Built distributed servers with consensus algorithm RAFT for file storage and restoration
- Created a simple client file system using FUSE to store data persistently on the server
- Used anchors and claim to build mutable semantics on immutable data chunks
- Used Merkle tress to synchronize multiple servers
- Used Rabin-Karp chunking with rolling hash to chunk files and RSA encryption for verification

Database (Class Project), *C++, Database* *Fall 2020*

- Implemented thread-pool and process-pool database system
- Implemented lock manager and various concurrency control (Sequential and Parallel OCC, MVCC)

GeekOS, *C, Operating System* *Spring 2020*

- Implemented fundamental functionality of an operating system (pipe, fork, exec, etc..)
- Handled signals, memory allocation and concurrency in kernel thread and register
- Implemented read/write, paging and virtual memory from scratch in geekOS

Overlay Routing & Distributed Transaction Processing, *Ruby/C, Computer Network* *Fall 2018*

- Connected nodes at the application layer in CORE virtual environment
- Listened and sent out control messages on each node to help carry traffic
- Built routing table and used link-state routing to converge the network
- Supported fragmentation and kept an internal clock