

# Tianrui Guan

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## EDUCATION

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**University of Maryland**, College of Computer, Mathematical, and Natural Sciences College Park, MD  
*Ph.D., Computer Science, advised by Dinesh Manocha* Fall 2021 – Current  
Master of Science, **Computer Science**, *GPA: 4.0* Fall 2019 – Spring 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 (All semesters)

*Relevant Coursework:* • Object-Oriented Programming • Operating System • Computer Network • Algorithms  
• Data Structure • Probability Theory and Statistics • Linear Algebra • Database System • Distributed System  
• Computer Vision (3D Detection/Segmentation) • Machine Learning • Deep Learning

## PUBLICATIONS / RESEARCH PROJECT

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**Semantic Segmentation on Off-road Dataset**, *Python, Computer Vision (submitted)* Fall 2020

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

**3D Point Cloud Detection with Transformer**, *Python, Computer Vision (in progress)* Fall 2020

- A novel transformer 3D detection network on Point Cloud from KITTI and Waymo dataset

**OF-VO: Reliable Navigation among Pedestrians**, *robotic (submitted)* Fall 2020

- 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

## 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 tree to synchronize multiple servers
  - Used Rabin-Karp chunking with rolling hash to chunk files and RSA encryption for verification
- Database (Class Project), C++, Database (in progress)** *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

## WORKING EXPERIENCE

- Research Assistant at GAMMA, University of Maryland, College Park** *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 Engineering Intern, MicroStrategy, Tysons Corner, VA** *Summer 2019*
- Accepted the offer, but could not make it due to belated working permission
- 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

- [1] Tianrui Guan; Divya Kothandaraman; Rohan Chandra; Dinesh Manocha "GNav: Group-wise Attention Network for Classifying Navigable Regions in Unstructured Outdoor Environments", Under review
- [2] Adarsh Jagan Sathyamoorthy; Utsav Patel; Tianrui Guan; Dinesh Manocha. "Frozone: Freezing-Free, Pedestrian-Friendly Navigation in Human Crowds", *IEEE Robotics and Automation Letters*, 2020
- [3] 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
- [4] 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
- [5] Jing Liang, Yi-Ling Qiao, Tianrui Guan, Dinesh Manocha, "OF-VO: Reliable Navigation among Pedestrians Using Commodity Sensors", Under review