

EdgeRobot Summer Research Seminar #1

Time: Friday 7/15 1:30pm - 3:00pm PST (Pacific Standard Time)

Zoom Link: <https://csudh.zoom.us/j/2187602128>

Presentation 1:

Title: Edge Computing-based Designs for Security

By Kewei Sha, Department of Computing Sciences, University of Houston–Clear Lake

Summary:

As a new computing paradigm, edge computing extends central cloud computing to a distributed format. It complements cloud computing to optimize system performance and supports the Internet of Things (IoT) applications by providing many well-designed services. As the middle layer in the IoT-Edge-Cloud system architecture, edge computing provides a new venue to deploy novel IoT security solutions and to conduct localized data processing and analysis. First, the EdgeSec framework designs a novel security service, consisting of several major components, which is deployed at the Edge layer to systematically enhance the security of IoT systems. Second, the secure and efficient smart data collection framework enables secure data readings from smart grid devices based on a two-phase authentication protocol. These designs not only make use of edge devices to securely connect the smart devices and the cloud, but also consider the physical constraints of all the devices in the entire system.

Short Bio:

Dr. Kewei Sha is an Associate Professor of Computer Science and the Associate Director of the Cyber Security Institute at the University of Houston-Clear Lake (UHCL). Before he moved to UHCL, he was the Department Chair and Associate Professor in the Department of Software Engineering at Oklahoma City University (OCU). His research interests include Network Security and Privacy, Internet of Things, Edge Computing, Blockchain, and Data Analytics. As a PI or co-PI, he received more than 5 million dollars of research support from NSF, NASA, UHCL, and OCU. Dr. Sha has published more than 70 publications in prestigious peer-reviewed journals and conferences. Dr. Sha has served as an associate editor for IEEE IoT Journal, Smart Health, and Computing, key organizing committee member for many conferences, and reviewer for numerous IEEE and ACM Transactions. Dr. Sha is a recipient of the UHCL President's Outstanding Research Award, UHCL University Faculty Fellowship Award, IEEE Outstanding Leadership Award, and Anthony and Barbara Lekkos Endowment Faculty Fellowship. He is a senior member of both ACM and IEEE.

Presentation 2:

Title: Service Function Chain Placement in Cloud Data Center Networks: a Cooperative Multi-Agent Reinforcement Learning Approach

By Bin Tang, Department of Computer Science, California State University Dominguez Hills

Summary:

Service function chaining (SFC), consisting of a sequence of virtual network functions (VNFs) (i.e., firewalls and load balancers), is an effective service provision technique in modern data center networks. By requiring cloud user traffic to traverse the VNFs in order, SFC improves the security and performance of the cloud user applications. In this paper, we study how to place an SFC inside a data center to minimize the network traffic of the virtual machine (VM) communication. We take a cooperative multi-agent reinforcement learning approach, wherein multiple agents collaboratively figure out the traffic-efficient route for the VM communication.

Underlying the SFC placement is a fundamental graph-theoretical problem called the k-stroll problem. Given a weighted graph $G(V, E)$, two nodes s, t , and an integer k , the k-stroll problem is to find the shortest path from s to t that visits at least k other nodes in the graph. Our work is the first to take a multi-agent learning approach to solve the k-stroll problem. We compare our learning algorithm with an optimal and exhaustive algorithm and an existing dynamic programming (DP)-based heuristic algorithm. We show that our learning algorithm, although lacking the complete knowledge of the network assumed by existing research, delivers comparable or even better VM communication time while taking two orders of magnitude less execution time.

Short Bio:

Dr. Tang's research interest lies at the intersection of data, networking, and algorithms. He is particularly interested in identifying and solving new algorithmic problems concerning data placement, storage, and replication in emerging networks. His current focus is on the virtual machine and virtual network function in policy-driven data centers. He also worked on data preservation in wireless ad hoc sensor networks and data anonymity and anonymizing systems in information security.