

CSE webinar on March 19, 2021

Date and Time: Mach 19, 2021 at 6:00 pm, IST

Speaker: [Dr. Heena Rathore](#), University of Texas, SA, USA

Title: *Brain Variable Reward Structure for Cooperative Machine Learning in IoT Network*

Abstract: Recent advances in machine learning research have resulted in state-of-the-art techniques where the Reinforcement Learning (RL) agents are focused on either using value-based methods or policy-based methods with the goal of reducing variance in the reward signal, thereby trying to reach an optimal state in the shortest period. Metrics such as the number of iterations taken to reach optimal reward structure or the number of interactions needed with the environment to achieve this are generally used as key performance indicators. There is a large body of research work that shows how the agents can achieve this using either large amounts of training data or using complex algorithms that require power and resource-intensive computational elements. But such a strategy may not be applicable for resource and power-sensitive network of IoT devices and more importantly differs fundamentally from how humans learn. To overcome this challenge, we have been looking at the field of neuroscience to derive inspiration from how the human brain works, specifically towards the release of dopamine in response to variable reward structure. Typical RL systems focus on receiving observations from the environment, calculating reward, and then deciding on the next set of actions at fixed intervals or based on fixed responses. However, scientific research on human brain activity has shown higher activity in dopamine release in response to rewards received at variable times. In this presentation, findings on two particularly interesting areas in neuroscience and psychology are presented, one is related todopamine-based reward-stimulated learning which supports the concept of cooperative learning. It has been shown that the active dopamine release activity will be available to increase the processing of new information. Second, is related to the study that has found that cooperative groups generate more participation and stimulate multiple brain regions. In such an environment, the efficiency of the network increases dramatically. We will discuss how RL techniques can learn from this behavior, especially in an IoT system that may contain several nodes. Rather than expecting agents running on all the nodes at fixed time intervals, our research investigates the efficiency gain by invoking agents at different time instances, thereby providing them with an opportunity to receive reward signals. Just like variable reward structure results in increased dopamine activity in human brains, such an approach can help achieve higher efficiency in IoT systems.

About the Speaker: Dr Heena Rathore is an Assistant Professor at the University of Texas, San Antonio, USA. Prior to that, she was a visiting assistant professor at Texas A&M University, USA. She also worked as a Data Scientist and Program Manager at Hiller Measurements for a

couple of years. Prior to that, she worked as a postdoctoral researcher for the US-Qatar Joint Collaborative Project between Temple University, USA, University of Idaho, USA, and Qatar University. Also, she was a visiting scholar for Wichita State University. She received her Ph.D. (with distinction) in Computer Science and Engineering Department while she was a Tata Consultancy Services Research Scholar at the Indian Institute of Technology, India. She has been the winner of several prestigious awards including Educationist Empowering India, IEEE R5 Outstanding Individual Achievement Award, IEEE Achievements Award, Young Engineer Award, Global Engineering Impact Award, and Graphical System Design Achievement Award. She has published more than 40 papers in peer-reviewed journals and conferences in her field and is the sole author of Mapping Biological Systems to Network Systems (Springer). She was also featured on TedX, Qatar held by TedXAIdafnaEd in Qatar and her work is covered in professional and major trade publications, major media, such as IEEE.TV, Microwave Journal, Everything RF, Financial Express, Science Reporter, the Times of India, and India Today. She has been invited as a panelist, TPC member and has been a chair for multiple sessions. She is a reviewer of many peer-reviewed journals and conferences in IEEE, ACM, Elsevier, IET etc. She is an ACM distinguished speaker, IEEE senior member, Vice-Chair of IEEE EMBS chapter in San Antonio, and IEEE Central Texas Section in Austin. Her research interests include cognitive AI, cybersecurity, cyber physical systems, deep learning, machine learning, security, cryptocurrency, distributed systems, and biologically inspired systems.

If you wish to attend the talk, please drop an email to office_cse@iitj.ac.in from your official email id to get meeting id.