Other - Colloquium on Artificial Intelligence Research and Optimization

Recent Investigations in Machine Learning and Edge Computing

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Abstract:

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(1) Latency-Memory Optimized Splitting of Convolution Neural Networks for Resource Constrained Edge Devices

Abstract:

With the increasing reliance of users on smart devices, bringing essential computation at the edge has become a crucial requirement for any type of business. Many such computations utilize Convolution Neural Networks (CNNs) to perform AI tasks, having high resource and computation requirements, that are infeasible for edge devices. Splitting the CNN architecture to perform part of the computation on edge and remaining on the cloud is an area of research that has seen increasing interest in the field. In this work, we assert that running CNNs between an edge device and the cloud is synonymous with solving a resource-constrained optimization problem that minimizes the latency and maximizes resource utilization at the edge. We formulate a multi-objective optimization problem and propose the LMOS algorithm to achieve a Pareto efficient solution. Experiments done on real-world edge devices show that LMOS ensures feasible execution of different CNN models at the edge and also improves upon existing state-of-the-art approaches.

(2) Federated Learning in a Faulty Edge Ecosystem: Analysis, Mitigation and Applications

Abstract:

Federated Learning deviates from the norm of ”send data to model” to ”send model to data”. When used in an edge ecosystem, numerous heterogeneous edge devices collecting data through different means and connected through different network channels get involved in the training process. Failure of edge devices in such an ecosystem due to device fault or network issues is highly likely. In this work, we first analyse the impact of the number of edge devices on an FL model and provide a strategy to select an optimal number of devices that would contribute to the model. We observe the impact of data distribution on the number of optimal devices. We then investigate how the edge ecosystem behaves when the selected devices fail and provide a mitigation strategy to ensure a robust Federated Learning technique. Finally, we design a real-world application to highlight the impact of the designed mitigation strategy.

Speaker's Bio:

Dr Rajeev Shorey is the CEO of The University of Queensland – IIT Delhi Academy of Research (UQIDAR). Rajeev also serves as an adjunct faculty in the Computer Science & Engineering department at IIT Delhi.

Dr Shorey received his Ph.D. and M.S. (Engg) in Electrical Communication Engineering from the Indian Institute of Science (IISc), Bangalore, India in 1997 and 1991 respectively. He received his B.E degree in Computer Science and Engineering from IISc, Bangalore in 1987.

Dr Shorey’s career spans several reputed research labs – TCS Research & Innovation, General Motors (GM) India Science Laboratory (ISL), IBM India Research Laboratory and SASKEN Technologies. Dr Shorey served as the first President of NIIT University from 2009 to 2013 before joining the TCS Research Labs in 2014.

Dr Shorey’s work has resulted in more than 70 publications in international journals and conferences and several US patents, all in the area of wireless and wired networks. He has 12 issued US patents and several pending US patents to his credit. Dr Shorey serves on the editorial boards of two of the top journals in the area – IEEE Internet of Things Journal and Springer’s Journal of Wireless Networks. His areas of interest are Wireless Networks including 5G Networks, Telematics, IoT, Industrial IoT, IoT Security and Automotive Networks, including Automotive Cybersecurity.

For his contributions in the area of Communication Networks, Dr. Shorey was elected a Fellow of the Indian National Academy of Engineering in 2007. Dr Shorey was recognized by ACM as a Distinguished Scientist in December 2014. He is a Fellow of the Institution of Electronics and Telecommunication Engineers, India and a Senior Member of IEEE.

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