2023 Biennial Symposium on Communications (BSC 2023)

Montreal, Quebec, Canada
4-7 July 2023

IEEE Catalog Number: CFP2310A-POD
ISBN: 978-1-6654-9381-9

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IEEE Catalog Number:	CFP2310A-POD
ISBN (Print-On-Demand):	978-1-6654-9381-9
ISBN (Online):	978-1-6654-9380-2
ISSN:	2836-3485

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Wednesday, July 5 9:00 - 10:00

Keynote Lecture I

Dr. Marco Di Renzo

Wednesday, July 5 10:20 - 12:00

Resource Allocation

Chair: Dongmei Zhao (McMaster University, Canada)

Integrated Sensing and Multi-Access Computation Offloading in Smart Oceans: A Utility Maximization Design.....N/A

Minghui Dai (University of Macau, Macao); Ning Huang (University of Macau, China); Yuan Wu (University of Macau, Macao); Liping Qian (Zhejiang University of Technology, China); Bin Lin (Dalian Maritime University, China); Zhou Su (Xi'an Jiaotong University, China)

With the increasing exploration of smart oceans, a large number of marine wireless devices have been deployed for different marine applications such as ocean environment monitoring and seabed resource exploitation. Although the paradigm of marine edge computing networks is expected to process a variety of marine tasks with low delay and high data rate, the efficiency of computation offloading is a critical issue due to the complex environment in smart oceans. In this paper, we propose an integrated sensing and multi-access computation offloading scheme in smart oceans, with the objective of maximizing marine wireless devices' utilities. Specifically, underwater wireless sensor (UWS) first perceives ocean information via radar sensing and then uploads its workloads to an unmanned underwater vehicle (UUV) and a sea surface sink node (SN) via non-orthogonal multiple access (NOMA) transmission. To improve the offloading efficiency, we formulate the utility of each party and model the task offloading process among UWS, UUV and SN as a Stackelberg game to optimize the UWS's offloading strategy, UUV's and SN's price strategies. Numerical results demonstrate that the proposed algorithms can obtain the optimal solutions and increase the utilities for marine wireless devices.

Optimum Digital Twin Response Time for Time-Sensitive Applications.....7

Amirhosein Aghaei and Dongmei Zhao (McMaster University, Canada)

As the digital replica of a physical system (PS), a digital twin (DT) is responsible for providing real-time information of its PS to applications. However, random network conditions result in uncertainty in future age of information (AoI) at the DT, which makes it complicated for a DT to decide when to response an application request in order to maintain the best information freshness at the application. In this work, we consider the effect of random wireless channel condition between the PS and the DT on the AoI changes at the DT, and formulate a Markov decision process that finds the optimum response time for the DT to send the PS information to an application after receiving a request from the application. The objective is to minimize the average AoI at the application. The MDP has delayed reward, and is solved by redistributing the reward with LSTM network and then finding the optimal policies using Dueling Double Deep Q-learning. Numerical results show that the solutions provide close-to-optimum average AoI performance.

Buffer-state Aware Task Offloading in Edge Networks With Task Splitting for IoV.....13

Abbas Yekanlou, Ahmed I Salameh and Jun Cai (Concordia University, Canada)

Wednesday, July 5 14:00 - 16:00

Communication System 1

Chair: M. Reza Soleymani (Concordia Univerisity, Canada)

is increased. Finally, methods are presented to measure the likelihood values required in decoding the underlying LDPC. It is shown that the key rate is approximately equal to 0.5log2(4L^2/(4L-1))~0.5\log2(L) where L is the number of looping. Test results (based on measurements between distant nodes over the Internet) are presented, demonstrating the feasibility of the proposed technique. The proposed method is implemented entirely in software (through standard programming at the application layer) without the need to make any changes in the underlying network.

Thursday, July 6 9:00 - 10:00

Keynote Lecture II

Dr. Xuemin (Sherman) Shen

Thursday, July 6 10:20 - 12:00

Communication Systems 2

Chair: Wei-Ping Zhu (Concordia University, Canada)

Optimizing Uniform Linear Arrays for Massive MIMO Applications.....65

Elhamsadat Anarakifirooz and Sergey Loyka (University of Ottawa, Canada)

Massive MIMO (mMIMO) systems with uniform linear arrays (ULA) are considered in the non-asymptotic regime, when the number of antennas is bounded. To reduce the complexity of implementation, their design is optimized subject to signal-to-noise plus interference (SINR) constraints. While the resulting constrained optimization problems have difficult analytical structure (due to their non-convex nature), a novel analytical approach is proposed and a number of globally-optimal solutions/designs are obtained. The proposed designs are robust, they do not require a precise knowledge of directions of arrival for interfering users and preserve other important properties of mMIMO.

Compressive Sensing-Based Channel Estimation for MIMO OTFS Systems.....71

Ali Mohebbi, Wei-Ping Zhu and M. Omair Ahmad (Concordia University, Canada)

Orthogonal time frequency space (OTFS) modulation is a novel two-dimensional modulation technique that performs in the delay-Doppler (DD) domain. In this work, we present a new compressive sensing (CS)-based algorithm for estimating the channel in the DD domain for multiple-input multiple-output (MIMO) OTFS systems. Exploiting the property that the MIMO channel in the DD domain exhibits structured sparsity, we first obtain a row-block sparse formulation for channel estimation (CE) problem. Then, we propose a row-block orthogonal matching pursuit (RBOMP) algorithm to estimate the channel. Computer simulations demonstrate that the proposed algorithm enhances the estimation accuracy compared with the conventional minimum mean squared error (MMSE)-based and the existing CS-based CE techniques.

Principal-Minimum Eigenvalue Algorithm for Signal Sensing.....N/A

Yumin Zhong and Yanhua Li (Beijing Research Institute of Telemetry, China)

In this paper we propose a promising signal sensing method based on principal components of eigenvalue to minimum of eigenvalue of the received signal. The signal model and performance of theoretical analysis are provided in detail. In comparison with energy detection, the proposed method does not need prior

information of signal and noise. Therefore, it can be widely used in noise power uncertainty scenarios, such as signal transmission in hypersonic plasma sheath. Simulation results show the proposed method has excellent performance even for very low signal-noise-ratio (SNR) signals. Besides, compared with other state-of-the-art methods including MME, EME and AGM, the performance of PME is close to MME method, and has advantages over other methods 5~8dB better respectively.

Thursday, July 6 14:00 - 15:00

Keynote Lecture III

Dr. Olgica Milenkovic

Thursday, July 6 15:20 - 16:40

Integrated Computation and Communication

Chair: Weiyang Feng (Beijing Jiaotong University, China)

Edge-Coordinated On-Road Perception for Connected Autonomous Vehicles Using Point Cloud.....77

Jiawei Hou, Peng Yang and Tian Qin (Huazhong University of Science and Technology, China); Wen Wu (Peng Cheng Laboratory, China)

In this paper, we tackle the problem of selecting connected autonomous vehicles (CAVs) with the most valuable point cloud data for edge-coordinated on-road perception. Through extensive experiments, we find that adding a CAV for collaborative perception yields diminishing gain in understanding the on-road environments, while the generated point cloud data size grows linearly with the number of employed CAVs. Meanwhile, both vehicular mobility and diversified road topology lead to the dynamics of data size of the captured point clouds. Based on those findings, we then formulate an optimization problem that maximizes the utility of collaborative perception at edge nodes. Considering the submodularity of collaborative perception utility and heterogeneity of point cloud data size from individual vehicles, a CAV candidate selection algorithm is proposed. The marginal gain of processing the point cloud data of each candidate is firstly evaluated and ranked, based on which a subset of CAVs are selected subject to bandwidth capacity. Finally, experimental results on an open dataset are presented to demonstrate the superiority of the proposed algorithm under dynamic traffic conditions and bandwidth fluctuations.

Worker Assignment in Deadline-aware Heterogeneous Distributed Computing Systems.....83

Mehrad Mehrabi, Maryam Ardakani and Masoud Ardakani (University of Alberta, Canada)

Recently, distributed computing systems have become prevalent due to their ability to manage large-scale computations required by emerging machine learning algorithms and signal processing tasks. In real-world scenarios, distributed computing systems often receive multiple tasks that have to be completed within specific deadlines. Additionally, service providers may provide varying levels of services based on the subscription tiers of their users. In this work, we consider worker assignment for a heterogeneous coded distributed computing system consists of multiple masters with different subscription tiers. Each master has a time-sensitive matrix-vector multiplication task, needs to be done before a deadline. The system receives reward by finishing tasks before their deadlines and prioritizing tasks with higher subscription tiers. The goal is to develop a worker assignment policy that maximizes the system's total reward. To do so, we propose a worker assignment policy namely ``reward greedy". Simulation results show that our proposed algorithm

Friday, July 7 9:00 - 10:00

Keynote Lecture IV

Dr. Octavia A. Dobre

Friday, July 7 10:20 - 12:20

Communication Networks

Chair: Samuel Dayo Okegbile (Concordia University, Canada)

for optimizing their corresponding application deployments (i.e., which applications should be deployed on which edge nodes and how long they should be deployed in advance). Specifically, a residual LSTM framework is utilized for mobility prediction, and based on this, a low-complexity greedy algorithm is developed. Simulation shows the feasibility of the proposed scheme and demonstrate its superiority over counterparts.