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EDITORIAL

Editorial

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Big data has become an integral part of modern networks. With the increasing amount of data generated by devices, machines, and applications, networks are constantly being challenged to handle and process this data in a timely and efficient manner. The size, complexity, and variety of data in networks are increasing rapidly, which requires new approaches to handle and analyze this data. Big data analytics provides the tools and techniques to manage, process, and extract insights from massive datasets in networks. One of the key applications of big data in networks is network management and optimization. Big data analytics can help network operators to monitor and analyze network traffic, identify anomalies, and optimize network performance. By processing large amounts of data in real-time, network operators can quickly identify potential issues and take proactive measures to prevent network downtime. Furthermore, big data analytics can help network operators to make informed decisions about network investments, capacity planning, and service delivery, based on the analysis of historical and real-time data. Overall, big data has a significant impact on the network industry, enabling network operators to improve network performance, reduce costs, and deliver better services to their customers.

This collection includes a wide array of topics related to the theory and applications of network models.

Multiple Obnoxious Facility Location: The Case of Protected Areas (Miklas-Kalczynska and Kalczynski 2024) addresses the challenging problem of locating obnoxious facilities, such as power plants, communication towers, weather instruments, and missile silos, while considering the protection of environmentally

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sensitive areas. It introduces novel heuristics to efficiently solve this problem, balancing the need for such facilities with environmental conservation efforts.

Distributed Continuous-Time Optimization for Convex Problems with Coupling Linear Inequality Constraints (Khamisov 2024) focuses on distributed optimization in multi-agent systems, this article proposes techniques to handle convex optimization problems where the cost function is a sum of local strictly convex functions. By distributing the optimization process, it offers scalable solutions for complex systems with coupled equality and inequality constraints.

Implicitly Normalized Forecaster with Clipping for Linear and Non-linear Heavy-Tailed Multi-Armed Bandits (Dorn et al. 2024) presents a novel approach to multi-armed bandit problems. This article introduces an implicitly normalized forecaster with clipping to address multi-armed bandit problems with heavy-tailed distributions. It leverages online mirror descent techniques to efficiently explore and exploit in dynamic decision-making scenarios.

Analysis of Weakly Correlated Nodes in Market Network (Semenov et al. 2024) examines market networks, investigating the correlation between stock returns and the topology of the network. By analyzing degrees distribution and identifying hubs and independent sets, it offers insights into weakly correlated nodes, as in case of risk assessment and portfolio management.

Primal-Dual Gradient Methods for Searching Network Equilibria in Combined Models with Nested Choice Structure and Capacity Constraints (Kubentayeva et al. 2024) contributes to traffic forecasting and assignment in combined models with nested choice structures and capacity constraints. By employing accelerated primal-dual gradient methods, it addresses the challenges of network equilibrium search, facilitating more accurate trip distribution and traffic management.

Preconditioning Meets Biased Compression for Efficient Distributed Optimization (Pirau et al. 2023) focuses on distributed optimization and proposes techniques that combine the Error Feedback (EF) convergence stabilizer method and biased compression to enhance the efficiency of first-order methods for convex and non-convex minimization. These approaches improve scalability and convergence rates in distributed optimization settings, which is empirically proved using EF with preconditioning over EF with SGD and EF with Adam in the Resnet training problem.

Affiliations-Based Bibliometric Analysis of Publications on Parkinson's Disease (Aleskerov et al. 2023) uses network analysis techniques to examine bibliometric data related to Parkinson's disease publications. By identifying citation patterns and centrality measures based on affiliations, the study provides insights into research collaboration and knowledge dissemination within the Parkinson's disease research community.

Decentralized Convex Optimization on Time-Varying Networks with Application to Wasserstein Barycenters (Yufereva et al. 2023) addresses decentralized optimization on time-varying computational networks, developing algorithms for computing Wasserstein barycenters. By leveraging dual oracle methods, the study enables efficient consensus building in dynamic network environments, with applications in data fusion and distribution.

Decentralized Optimization with Affine Constraints over Time-Varying Networks (Yarmoshik et al. 2023) focuses on decentralized optimization with affine

constraints in evolving network structures, where agents can only communicate with neighbors in the communication graph. By designing algorithms tailored to time-varying networks, the research provides the first linearly convergent decentralized algorithm for time-varying networks.

Potts Game on Graphs: Static Equilibria (Leonidov 2023) investigates discrete choice games and analyzes static equilibria in Potts games on graphs. By considering Gumbel noisy discrete choices, the study contributes to the understanding of equilibrium behaviors and decision-making dynamics for configuration models graphs.

Decentralized Optimization over Slowly Time-Varying Graphs: Algorithms and Lower Bounds (Metelev et al. 2023a) focuses on decentralized optimization and presents algorithms tailored to slowly time-varying graphs. By analyzing convergence rates of first-order-optimization algorithms and providing lower bounds, the study offers insights into the trade-offs between communication efficiency and optimization performance in dynamic network settings.

Decentralized Saddle-Point Problems with Different Constants of Strong Convexity and Strong Concavity (Metelev et al. 2023b) addresses decentralized optimization and investigates saddle-point problems in time-varying graphs. By considering varying levels of strong convexity and concavity of the smooth objectives, the research develops algorithms with inexact deterministic and stochastic oracles to achieve consensus while accounting for uncertainty and noise.

Non-Smooth Setting of Stochastic Decentralized Convex Optimization Problem over Time-Varying Graphs (Lobanov et al. 2023) tackles non-smooth decentralized optimization in time-varying graphs. By employing gradient-free algorithms with an l_2 smoothing scheme, the study addresses challenges arising from stochasticity and non-smoothness, enhancing optimization performance in dynamic network environments.

Mathematical Modeling for Further Improving Task Scheduling on Big Data Systems (Souravlas et al. 2023) presents mathematical models to improve task redistribution and scheduling efficiency, reducing latency and eliminating network congestion. By analyzing data streams and redistributing tasks dynamically, the study enhances system throughput and resource utilization in large-scale computing environments.

Gradient-Free Methods for Non-Smooth Convex Stochastic Optimization with Heavy-Tailed Noise on Convex Compact (Kornilov et al. 2023) introduces novel gradient-free methods for non-smooth convex stochastic optimization in the presence of heavy-tailed noise. By leveraging techniques such as gradient clipping and stochastic mirror descent, the study addresses challenges associated with noisy and non-smooth objective functions, improving convergence and robustness in optimization.

Accelerated Methods for Weakly-Quasi-Convex Optimization Problems (Guminov et al. 2023) focuses on α-weakly-quasi-convex problems and proposes accelerated methods to improve convergence rates and optimization performance. By leveraging first-order techniques tailored to non-convex problems, the study enhances efficiency in optimizing functions with varying degrees of convexity, extending results related to the special case of 1-weak-quasi-convexity.

Modularity Planted Partition Model (Koshelev 2023) investigates the modularity of the planted partition model, exploring label restoration techniques in graph-based scenarios. By analyzing the properties of modularity in partitioned graphs, the study contributes to the understanding of community detection and label inference in network structures.

Each of these articles offers novel insights and methodologies that advance the field of network analysis and applications, addressing a wide range of challenges across different domains including optimization, game theory, bibliometrics, and mathematical modeling, to name a few. Through innovative approaches, rigorous analysis, and empirical evaluations, these contributions advance existing knowledge and provide more efficient and effective techniques for understanding and utilizing networked systems in various real-world contexts.

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