

# Recent Advances in Mobile Ad Hoc Networks

Michel Kadoch

Department of Electrical Engineering, Ecole de Technologie Supérieure, Montreal, QC H3C 3J7, Canada; Michel.Kadoch@etsmtl.ca

## 1. Introduction

Mobile ad hoc networks (MANETs) represent a featured domain of wireless networks, which are well-differentiated from cellular network infrastructure and have attracted decades of research effort. Traditional MANET research focuses on routing issues among nodes with low power and weak ability. Recently, to serve a much wider range of civil, industrial, and manufacturing applications, the types of MANET devices have proliferated rapidly. For example, intelligent UAVs and smart vehicles have distinct physical characteristics and levels of ability compared to MANET nodes. The increased spatial dimension, high speed of movement, and heterogeneous node genre pose a huge challenge to the existing MANET architectures and protocols. At the same time, MANETs are also entangled with modern cellular networks, such as 5G, which has many innovative features and functions, making the system even more complicated. Thanks to the surging computing and caching capabilities of in-unit chips and the evolution of radio communication technologies, future MANETs will have the opportunity to adopt computational dense artificial intelligence (AI) approaches to address this multi-folded complexity. Interesting and challenging topics are foreseen to emerge during the process. The papers published in this Special Issue mainly focus on the above-mentioned situation.

## 2. The Present Issue

In response to the call for papers, we received a good number of submissions, and seven of these manuscripts have been accepted for publication.

Selected as the starter of the Special Issue, the paper entitled “Secured by Fluctuating Topology Using the Fluctuating Topology of MANETs to Secure Key Exchange” [1], presents a key exchange technique, which builds upon the inherent characteristic of MANETs: their fluctuating topology. By splitting key exchange information into multiple parts and spraying them over space or time, the ever-changing topology of the network almost completely removes an active attacker’s success ratio.

The second paper, entitled “An Improved UAV-PHD Filter-Based Trajectory Tracking Algorithm for Multi-UAVs in Future 5G IoT Scenarios” [2], explores the vital role of UAVs in future 5G-IoT networks and proposes a UAV-probability hypothesis density (UAV-PHD) filter to improve the traditional Gaussian mixture PHD (GM-PHD) filter, by applying machine learning to the emergency detection and trajectory tracking of UAV targets. Finally, this paper presents an out-of-sight detection algorithm for multiple UAVs to improve tracking performance.

The third paper, entitled “Improved Kalman Filter Variants for UAV Tracking with Radar Motion Models” [3], makes a derivation on the motion-model consistency of mobile radar with constant velocity, and extends common filter algorithms into earth-centered earth-fixed (ECEF) coordinates to filter out random errors. The improved algorithms provide more efficiency and compatibility in mobile radar scenes.

The fourth paper, entitled “EV Charging Behavior Analysis Using Hybrid Intelligence for 5G Smart Grid” [4], proposes a smart grid communication network architecture, based on cloud computing and fog computing to effectively manage, and dispatch the charging



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and discharging behavior of electric vehicles (EVs) in the smart grids (SGs). This architecture could facilitate the rapid growth of grid-to-vehicle (G2V) and vehicle-to-grid (V2G) services. The authors propose a user behavior analysis method, combining the human in the loop (HITL)-based K-Means clustering and k-nearest neighbors (KNN) algorithm as a potential solution. The proposed method could label the dataset through an automatic process and make it unnecessary to perform clustering each time a new user joins the charging network and schedule the electric vehicles for the smart grid more efficiently.

The fifth paper, entitled “Prioritized Uplink Resource Allocation in Smart Grid Backscatter Communication Networks via Deep Reinforcement Learning” [5], puts forward a backscatter communication model based on business priority and cognitive network. To achieve optimal throughput of a system, an asynchronous advantage actor critic (A3C) algorithm is designed to tackle the problem of uplink resource allocation.

The sixth paper, entitled “Real-Time Remote Health Monitoring System Driven by 5G MEC-IoT” [6], proposes a telemedicine system based on mobile edge computing (MEC) and artificial intelligence (AI), for remote health monitoring and automatic disease diagnosis. The system consists of an IoT layer, MEC layer, and a cloud computing layer. The deep learning model for electrocardiogram (ECG) diagnosis is deployed on the MEC layer. The proposed model shows the high accuracy of prediction on multiple categories in the ECG dataset, enabling the whole system to present a more efficient medical information analysis ability.

Finally, the seventh paper, entitled “A Human-Guided Machine Learning Approach for 5G Smart Tourism IoT” [7], proposes a tourist behavior decision-making method, based on human-guided machine learning called KNN classification. This paper proposes a method that can effectively help tourists to decide whether to choose a certain travel destination based on historical order data and historical browsing information gathered from tourism IoT.

### 3. Future

The digital wave is rapidly spreading to vertical industries. Future factories would be fully occupied by IoT devices to handle real-time control tasks. As a result, MANET will face many new challenges in terms of reliability, security, power control, and mobility management. The future MANET will have the opportunity to use artificial intelligence methods to solve various complex problems. We hope this Special Issue can not only serve as a valuable reference, but also encourage more researchers to contribute to this field.

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