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ADAPTIVE SCHEDULING OF SPACE-GROUND INTEGRATED NETWORK RESOURCES BASED ON COMPETITIVE DQN

Abstract

The rapid development of emerging applications, such as AR, UAV, and intelligent driving, put forward a higher demand on ground wireless communication networks. The combination of LEO satellite network and ground-based networks is becoming a promising alternative due to its low delay and cost, wide coverage and broadband, etc. However, its inherent heterogeneity, high dynamism, and spatial correlation causes a serious impediment to the popularization of the Space-ground integrated network service. This paper studies the resources scheduling of heterogeneous space-ground integrated network for mega LEO satellite constellations. The network is constructed by considering the kinematical and dynamical characteristics of satellite nodes. The state of network components and users are simulated by actual resources, and thus a spatial-temporal topological network is established by the time-spread graph. We employ the network virtualization (NV) method to the integrated ground-based networks, which transforms the heterogeneous resource scheduling to a multi-domain virtual network embedding (VNE) problem. A competitive dual DQN algorithm is designed based on deep reinforcement learning, involving competition and target network architectures. This operation accelerates the convergence speed of the deep neural network and enhances stability of the training process. Three indices are introduced to evaluate the performance of the proposed adaptive scheduling method, including long-term average revenue, long-term benefit-cost ratio, and request reception rate under multiple LEO satellite sizes. Simulation results validate its effectiveness.