OPTIMIZING RECOMMENDATIONS SYSTEMS BY USING MULTI-AGENT REINFORCEMENT LEARNING FOR ELECTRIC VEHICLE CHARGING STATION

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ABSTRACT
As global awareness for preserving natural energy sustainability rises, electric vehicles (EVs) are increasingly becoming a preferred choice for transportation because of their ability to emit zero emissions, conserve energy, and reduce pollution. Nonetheless, the lack of adequate EVs charging infrastructure remains a significant problem that has resulted in varying charging demands at different locations and times. As a consequence, this inadequacy has posed a challenge for EVs drivers particularly those in large cities as they face difficulty in locating suitable charging stations. Nevertheless, the recent development of deep reinforcement learning is a promising technology that has the potential to improve the charging experience in several ways over the long term. This paper proposes a novel approach for recommending EVs charging stations using multi-agent reinforcement learning (MARL) algorithms by comparing several popular algorithms, including the deep deterministic policy gradient, deep Q-network, multi-agent DDPG (MADDPG), real, and random, in optimizing the placement and allocation of the EV charging stations. The results demonstrated that MADDPG outperformed other algorithms in terms of the mean charge waiting time, CFT, and total saving fee, thus indicating its superiority in addressing the EV charging station problem in a multi-agent setting. The collaborative and communicative nature of the MADDPG algorithm played a key role in achieving these results. Hence, this approach could provide a better user experience, increase the adoption of EVs, and could be extended to other transportation-related problems. Overall, this study highlighted the potential of MARL as a powerful approach for solving complex optimization problems in transportation and beyond. This would also contribute to the development of more efficient and sustainable transportation systems; therefore, further research in this area would be encouraged.

Keywords: Electric Vehicle Charge Station, Multi Agent Reinforcement Learning, Optimizing, Recommendation Systems

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