

Various Techniques of Reinforcement Learning for implementing Wireless Sensor Network

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Abstract

Generally, WSN contains various issues and challenges. Reinforcement learning offers various techniques to overcome these issues in supervised as well as in unsupervised manner. Reinforcement learning which is a sister branch of machine learning is also offering simple and robust approaches to present WSN issues in order to improve complete network performances. Reinforcement learning has various components like State, Action, Agent and Reward system which deals with unknown dynamic environments to find optimum solution by learning. This paper has carried out extensive survey of more than ten years with complete observation in connection of RL and WSN to provide better opportunities to perform significant research towards latest WSN challenges.

Keywords: Reinforcement Learning, Wireless Sensor Network, Q-Learning, Agent, State, Action and Reward.

Introduction

The Wireless sensor network is a very emerging area towards researcher community. There are various challenges in this area which requires possible solution through various techniques. Here we have reviewed various techniques of reinforcement learning for wireless sensor network from the past era to the present era. Reinforcement learning incorporates the experience based value function to develop some sort of policy to work with wireless sensor network.

Various Techniques of Reinforcement Learning for WSN

Authors	Techniques
Christopher J.C.H. Watkins, Peter Dayan [01]	This research paper provides the basics of q-learning with state, reward, policy and value functions.
Leslie Pack Kaelbling, Michael L. Littman, Andrew W. Moore [02]	Here author had given various issues of reinforcement learning with certain exposure to find experience for better qos.
Yu-Han Chang, Tracey Ho, Leslie Pack Kaelbling [03]	This paper presents multi agent reinforcement learning.
Jamal N. Al-Karaki, Ahmed E. Kamal [04]	This paper presents Routing Challenges And Design Issues in WSNs, advantages and performance issues of each routing technique, and Routing Protocols of WSNs.
Aram Galstyan, Bhaskar	Authors presented game dynamics using RL.

Krishnamachari, Kristina Lerman [05]	
Z Liu, I Elhanany [06]	Here, RL-MAC has been introduced for WSN which contains an RL framework.
Niklas Wirstrom [07]	In this Master's thesis Author explore self-configuration of WSN nodes using RL methods.
Ping Wang, Ting Wang [08]	Here, authors present a routing scheme based upon RL.
Vladimir Dyo, Cecilia Mascolo [09]	Here duty cycle is explored to take profit of temporal patterns.
Anna Egorova-Forster, Amy L. Murphy [10]	The author focuses on to create less cost routes with saving of available resources with the help of exchanging information among nodes.
Anna Forster [11] [13]	This is a survey of various RL techniques to better improve WSN.
Anna Forster, Amy L. Murphy [13]	This work describes a study of applying reinforcement learning to balance energy expenditure in wireless sensor Networks.
Kunal Shah, Mohan Kumar [14]	Here, Author presented Distributed Independent Reinforcement Learning (DIRL) to better utilize resources.
Mihail Mihaylov, Karl Tuyls, Ann Nowé [15]	Here, author presents a reinforcement learning algorithm to explore the complete network lifetime of WSN.
Anna Forster Amy L. Murphy [16]	Here, author presents CLIQUE, which gives freedom to sensor node whether they want to become cluster head or not based upon machine learning approach.
Somayeh Kianpisheh, Nasrolah Moghadam Charkari [17]	Here, author presents algorithms to better save battery life.
Raghavendra V. Kulkarni, Senior Member, IEEE, Anna Forster, Member, IEEE and Ganesh Kumar Venayagamoorthy, Senior Member [18]	Here, author presents an extensive CI techniques for WSNs.
Kok-Lim Alvin Yau A, Peterkomisarczuk A,B, Paul D. Teal [19]	Author present context awareness and intelligence techniques.
Anju Arya, Amita Malik [20]	Here authors showed the use of various routing protocols under RL for WSN.
Varun K. Sharma & Shiv Shankar Prasad Shukla, Varun Singh , Kok-Lim Alvin Yau , Wenjing Guo, Mr. Ankit B. Patel [21][22][23][24]	Here authors made the focus on routing, algorithms, intelligence, and general framework in WSN using RL,
Ibrahim Mustapha, Borhanuddin Mohd Ali , Mohd Fadlee A. Rasid , Aduwati Sali And Hafizal Mohamad , Feng-Cheng Chang, Hsiang-Cheh Huang , Mohammad Abdulaziz Alwadi [25][26][27]	Here authors have given techniques for WSN using RL to better improve energy optimization, better clustering and various practical applications.
Thien T. T. Le And Sangman Moh , Maksura Mahjabeen	This research study has give topology control and task scheduling approach for WSN using RL.

[28][29]	
Gabriel Martins Dias, Maddalena Nurchis And Boris Bellalta [30]	This paper has shown research on sampling interval in wireless sensor network using RL.

Conclusion

Reinforcement learning technique is basically derived from machine learning with the nature of Unsupervised. Now days wireless sensor network deploys at various critical places where learning through Quick experiences is always required for data prediction as well as for better quality of services. The above mentioned techniques helps wireless sensor network to improve data collection, data delivery, data throughput, energy optimization, less delay and better utilization of available resources in real time simulations.

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