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D-FICCA: A Density-based Fuzzy Imperialist Competitive Clustering Algorithm for Intrusion Detection in Wireless Sensor Networks

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Abstract:
Owing to the scattered nature of Denial-of-Service attacks, it is tremendously challenging to detect such malicious behavior using traditional intrusion detection systems in Wireless Sensor Networks (WSNs). In the current paper, a hybrid clustering method is introduced, namely a Density-based Fuzzy Imperialist Competitive Clustering Algorithm (D-FICCA). Hereby, the Imperialist Competitive Algorithm (ICA) is modified with a density-based algorithm and fuzzy logic for optimum clustering in WSNs. A density-based clustering algorithm helps improve the imperialist competitive algorithm for the formation of arbitrary cluster shapes as well as handling noise. The fuzzy logic controller (FLC) assimilates to imperialistic competition by adjusting the fuzzy rules to avoid possible errors of the worst imperialist action selection strategy. The proposed method aims to enhance the accuracy of malicious detection. D-FICCA is evaluated on a publicly available dataset consisting of real measurements collected from sensors deployed at the Intel Berkeley Research Lab. Its performance is compared against existing empirical methods, such as K-MICA, K-mean, and DBSCAN. The results demonstrate that the proposed framework achieves higher detection accuracy 87% and clustering quality 0.99 compared to existing approaches.

keyword: Imperialist Competitive Algorithm, density-based clustering, Fuzzy, Intrusion, WSN

1. Introduction

Wireless Sensor Networks (WSNs) provide an ideal schema for gathering data as opposed to sensor nodes and data transmission through wireless networks. This network type finds application in the military [1], health care