Deep learning-based AP selection method in software-defined networks

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Abstract

In the Software Defined Network (SDN), the terminal has been connected to the network in the process when an access point failure or damage, if the access point is not properly selected, it will lead to a decline in the quality of service applications. To address this problem, most traditional AP selection methods use access point selection based on received signal strength without take into account the channel and channel capacity of the access point access, while this paper uses Deep Neural Networks (DNN)-based access point (AP) selection method and considers the channel and channel capacity as part of the parameters. In the SDN controller, the received signal strength, throughput, number of connected devices, channel, and the channel capacity and access point performance quality are used as the input and label of the DNN, respectively. The analysis and simulation results show that the algorithm can select AP with better performance quality compared with the traditional AP selection method based on received signal strength, and the correct rate is significantly improved by 5% when compared with the AP selection method based on feedforward neural network. Meanwhile, the DNN-based access point selection method in SDN achieves flexible control of network traffic and balances the load of access points in the network.

System Model

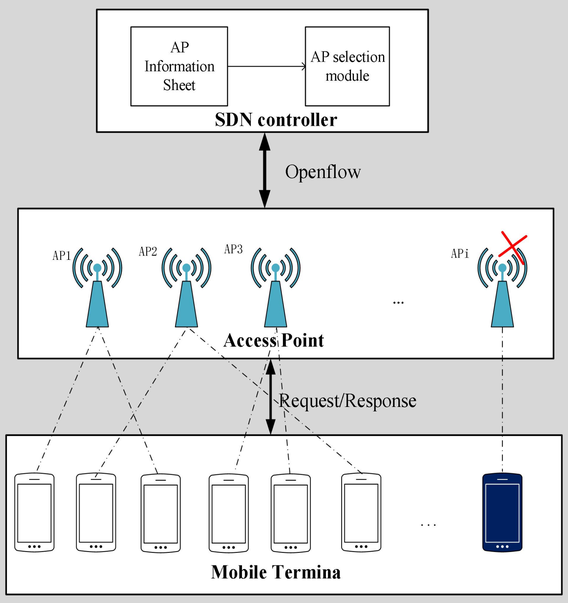

Figure I. System model

As in Figure Ⅰ, when one AP in the network is damaged or malfunctioned, the target mobile terminal will not be able to connect to the previous access point, so how to select the optimal AP for target terminal will be a big problem. At this time, if the current access point cannot reach its service request, the AP submits the request to the SDN controller through the Openflow protocol, detects and collects the AP information around the mobile terminal through its AP monitoring function, and generates a list of AP information to be selected in . This information list is then passed to the AP selection module running on the host of the SDN controller, and the AP selection method in the module analyzes and judges the APs with good service quality within the service request range and issues commands to connect to the mobile terminal through the SDN.

Deep Neural Network

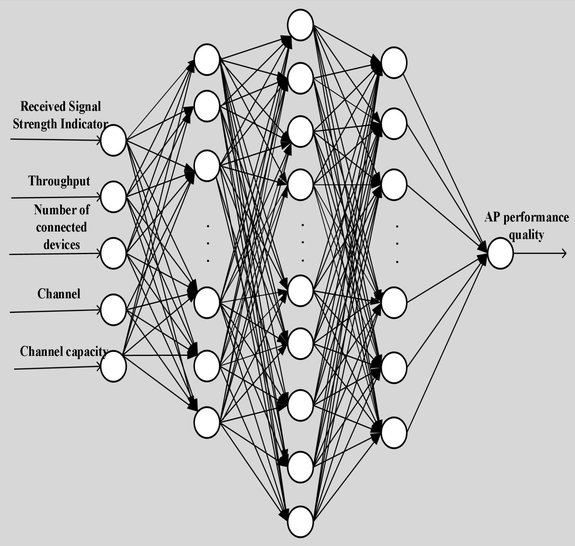

Figure II. Deep neural network

As in Figure II, this paper uses deep neural networks in deep learning for AP method selection.

Results

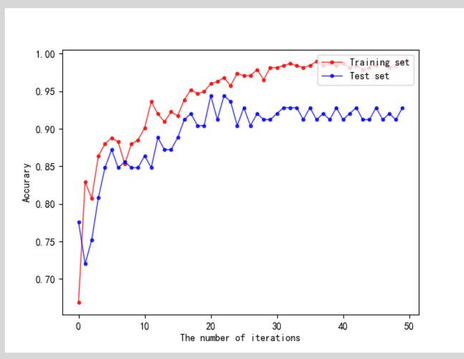

Figure III. Accuracy of DNN training set and test set

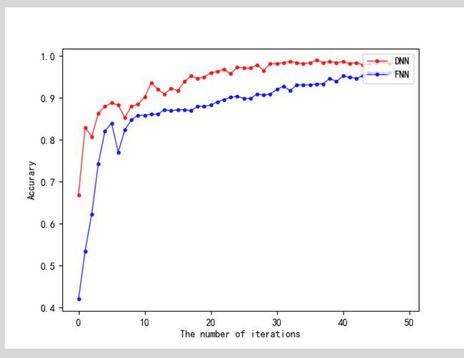

Figure IV. Relationship between the number of iterations and the correct rate

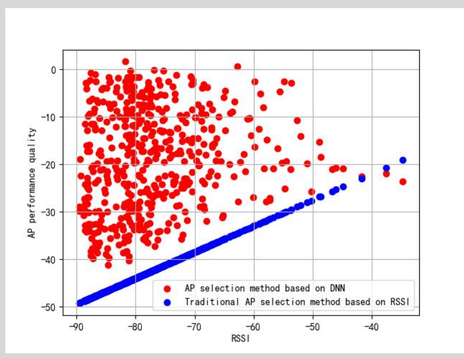

Figure V. Relationship between RSSI and AP quality Q for the same data set

Conclusion

In this paper, we consider the application of deep neural network-based AP selection method in software-defined network to solve the problem of changing of the network configuration, and use DNN to quickly select the next best access point for the mobile terminal in case of service demand change or failure of an access point in the network. The SDN controller in the software-defined network collects information about all APs in the network and provides real-time information feedback, then takes the received signal strength, throughput, number of mobile terminals accessed, channel, and the channel capacity as input, and calculates the Q value for the corresponding label to quickly select the optimal AP excepting for the faulty AP. The deep neural network-based access point selection method considers not only the received signal strength, throughput and the number of connected devices, but also the channel and channel capacity. Simulation results show that deep neural network-based access point selection method gives priority to APs with better overall performance in the selection process than the traditional AP selection method. At the same time, the method in this paper has a higher correct rate than the feedforward neural network AP selection method. Therefore, the use of deep learning-based AP selection method in SDN is more conducive to the selection of optimal APs by integrating various parameters in the access points, while balancing the load of APs and improving the flexible control of SDN.