CONCLUSION

SDN-based fog computing architectures are the trending networking paradigms for several applications based on the IoT infrastructure. Fog computing systems are vulnerable to various types of Botnet attacks. Hence, there is a need to integrate a security framework that empowers the SDN to monitor the network anomalies against the Botnet attacks. DL algorithms are considered more effective for the IoT-based infrastructures that work on unstructured and large amounts of data. DL based intrusion detection schemes can detect Botnet attacks in the SDN-enabled fog computing IoT system.

We created a framework that utilizes a hybrid DL detection scheme to identify the IoT botnet attacks. It is trained against the dataset that contains normal and malicious data, and then we used this framework to identify botnet attacks that targeted different IoT devices. Our methodology comprises a botnet dataset, a botnet training paradigm, and a botnet detection paradigm.

Our botnet dataset was built using the N_BaIoT dataset, which was produced by driving botnet attacks from the Gafgyt and Mirai botnets into six distinct types of IoT devices. Five attack types, including UDP, TCP, and ACK, are included in both Gafgyt and Mirai attacks. We developed a botnet detection based on three hybrid models_ DNN-LSTM, CNN2D-LSTM, and CNN2D-CNN3D. Using this training model as a foundation, we developed a botnet detection paradigm that can recognise significant botnet attacks. The botnet detection approach is part of a multiclass classification model that can distinguish between the sub-attacks and innocuous data. The fact-finding analysis showed that our hybrid framework DNN-LSTM model had the highest accuracy of 99.98% at identifying the gafgyt and

Mirai botnets in the N_BaIoT environment. In 2014 and 2016, the gafgyt and Mirai botnets essentially targeted home routers and IP cameras. The NBaIoT dataset we used for our experiments revealed that rather than the type of IoT devices, the type of training models has a more significant impact on botnet detection performance. We think creating DNN-LSTM-based IoT botnet detection models would be an excellent strategy to enhance botnet identification for different IoT devices.

In the future, we have in mind to compare the performance of the proposed hybrid algorithm to that of other IoT datasets with a more considerable number of nodes. Further, there is a need to test more combinations of DL algorithms and traditional machine learning algorithms.