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Real -Time Network Packet Classification Exploiting Computer Vision Architectures

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Abstract: *The upcoming 6G and NextG networks underscore the necessity of sophisticated security methods based on Artificial Intelligence (AI) in order to detect malicious activity and adjust to new threats. Because computer vision techniques may be used to recognize complex patterns, their incorporation into the cybersecurity industry is a promising development. In this work, we present a computationally effective categorization technique that enforces the real-time conversion of packets into pictures by directly acting upon the raw packets gathered at base stations. The suggested solution's novel features include its lightweight implementation, which well satisfies the requirements of upcoming 6G networks, and its network edge operation, which permits early threat detection as near to the packet origin as feasible. We examine the efficacy of this methodology in terms of F1-score and prediction time by employing cutting-edge computer vision architectures and a customized Convolutional Neural Network (CNN) to tackle an intrusion detection task utilizing a substantial 5G dataset. The CNN design is superior than complicated models, as demonstrated by the results of experiments. The CNN consistently beats the other cutting-edge computer vision models over several packet window sizes N (i.e., 10, 50, and 100 packets), reaching very high F1-scores (0.99593, 0.99860, and 0.99895). A scalability investigation reveals a trade- off between the performance and scalability of CNN, with higher N values resulting in longer prediction times. However, the scalability of the other computer vision models is superior, allowing for an ideal model selection free of compromises.*

Keywords: S DoS, computer vision, artificial intelligence, 6G networks, packet classification, convolutional neural networks