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Voice Liveness Detection Using Kolmogorov Arnold Networks

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Abstract : Voice biometric liveness detection is customized to certify an authentication process of the voice data presented is genuine and not a recording or synthetic voice. With the rise of deepfakes and other equivalently sophisticated spoofing generation techniques, it's becoming challenging to ensure that the person on the other end is a live speaker or not. Voice Liveness Detection (VLD) system is a group of security measures which detect and prevent voice spoofing attacks. Motivated by the recent development of the Kolmogorov-Arnold Network (KAN) based on the Kolmogorov-Arnold theorem, we proposed KAN for the VLD task. To date, multilayer perceptron (MLP) based classifiers have been used for the classification tasks. We aim to capture not only the compositional structure of the model but also to optimize the values of univariate functions. This study explains the mathematical as well as experimental analysis of KAN for VLD tasks, thereby opening a new perspective for scientists to work on speech and signal processing-based tasks. This study emerges as a combination of traditional signal processing tasks and new deep learning models, which further proved to be a better combination for VLD tasks. The experiments are performed on the POCO and ASVSpoof 2017 V2 database. We used Constant Q-transform, Mel, and short-time Fourier transform (STFT) based front-end features and used CNN, BiLSTM, and KAN as back-end classifiers. The best accuracy is 91.26 % on the POCO database using STFT features with the KAN classifier. In the ASVSpoof 2017 V2 database, the lowest EER we obtained was 26.42 %, using CQT features and KAN as a classifier.

Keywords : Kolmogorov Arnold networks, multilayer perceptron, pop noise, voice liveness detection
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