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Generative Adversarial Network Based Fingerprint Anti-Spoofing Limitations

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Abstract : Fingerprint Anti-Spoofing approaches have been actively developed and applied in real-world applications. One of the main problems for Fingerprint Anti-Spoofing is not robust to unseen samples, especially in real-world scenarios. A possible solution will be to generate artificial, but realistic fingerprint samples and use them for training in order to achieve good generalization. This paper contains experimental and comparative results with currently popular GAN based methods and uses realistic synthesis of fingerprints in training in order to increase the performance. Among various GAN models, the most popular StyleGAN is used for the experiments. The CNN models were first trained with the dataset that did not contain generated fake images and the accuracy along with the mean average error rate were recorded. Then, the fake generated images (fake images of live fingerprints and fake images of spoof fingerprints) were each combined with the original images (real images of live fingerprints and real images of spoof fingerprints), and various CNN models were trained. The best performances for each CNN model, trained with the dataset of generated fake images and each time the accuracy and the mean average error rate, were recorded. We observe that current GAN based approaches need significant improvements for the Anti-Spoofing performance, although the overall quality of the synthesized fingerprints seems to be reasonable. We include the analysis of this performance degradation, especially with a small number of samples. In addition, we suggest several approaches towards improved generalization with a small number of samples, by focusing on what GAN based approaches should learn and should not learn.

Keywords : anti-spoofing, CNN, fingerprint recognition, GAN
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