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Detecting Synthetic Faces *via* GAN Inversion and Biometric Traits Analysis

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Introduction

The widespread adoption of Generative Adversarial Networks (GANs) has facilitated the generation of highly realistic synthetic faces, posing challenges for biometric authentication and forensic analysis. In this short communication, we present a novel approach for detecting synthetic faces by combining GAN inversion techniques with biometric traits analysis. By leveraging the inherent differences between synthetic and real faces, our method aims to enhance the robustness of facial recognition systems and forensic investigations in identifying artificially generated images.

Description

GAN inversion refers to the process of reverse-engineering GAN-generated images to approximate their corresponding latent vectors in the generator's latent space. Recent advancements in GAN inversion techniques, such as StyleGAN Inversion and Contrastive Inversion, enable the reconstruction of high-quality facial images from synthetic counterparts. By iteratively optimizing latent vectors to minimize the perceptual difference between generated and reconstructed images, GAN inversion facilitates the analysis of synthetic faces' underlying characteristics and deviations from real facial features [1].

Biometric traits analysis involves the extraction and quantification of distinctive features from facial images for biometric authentication and identification purposes. Traditional biometric traits, such as facial landmarks, texture descriptors, and geometric measurements, serve as discriminative cues for distinguishing between individuals and verifying their identities. By analyzing biometric traits extracted from facial images, researchers can assess the authenticity and integrity of face images, discerning between genuine and synthetic representations based on subtle differences in feature distributions and configurations [2].

The integration of GAN inversion and biometric traits analysis offers a comprehensive approach to detecting synthetic faces and discerning them from genuine counterparts. By reconstructing synthetic faces through GAN inversion and extracting biometric traits from both original and reconstructed images, our method enables direct comparisons and feature-level analyses to identify inconsistencies indicative of artificial generation. Discrepancies in facial landmarks, texture patterns, and geometric proportions between synthetic and real faces serve as reliable indicators for distinguishing between authentic and synthetic images [3].

To evaluate the effectiveness of our proposed approach, we conducted experiments on synthetic face datasets generated by state-of-the-art GAN models, including StyleGAN and ProGAN. By applying GAN inversion algorithms to reconstruct synthetic faces and extracting biometric traits using facial recognition techniques, we quantified the differences in feature distributions and configurations between synthetic and real faces. Experimental results demonstrate the feasibility of detecting synthetic faces with high accuracy and reliability, highlighting the potential of our method for enhancing biometric authentication systems and forensic analysis tools [4,5].

Conclusion

We present a novel approach for detecting synthetic faces through the integration of GAN inversion and biometric traits analysis. By leveraging GAN inversion techniques to reconstruct synthetic faces and extracting biometric traits for feature-level comparisons, our method enables the identification of subtle discrepancies indicative of artificial generation. With the proliferation of synthetic face generation techniques, our approach offers a valuable tool for enhancing the security and reliability of facial recognition systems and forensic investigations. Future research directions may include further refinement of GAN inversion algorithms and biometric traits analysis methods to improve detection accuracy and robustness against evolving synthetic face generation techniques.

Acknowledgement

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Conflict of Interest

None.

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