Title:

Face Recognition via Multi-Level 3D-GAN Colorization.

Abstract:

Crime has undergone a significant transformation, necessitating an enhancement in the security of forensic files and records. To address the increased demand for technological measures in crime identification, detection, and suspect recognition, this report introduces a novel approach utilizing a multi-level 3-dimensional conditional generative adversarial network (3D-cGAN). The proposed system aims to translate and colorize hand-drawn sketches into realistic high-resolution RGB images while preserving spatial facial attributes and pixel-level details.

Introduction:

The evolution of face recognition systems has been pivotal in law enforcement, with an increasing focus on sketch recognition for suspect identification. However, existing methods face challenges such as information loss during sketch conversion and difficulties in handling heterogeneous lighting effects and neighbor feature selection during face synthesis.

Literature Review:

Prior research has explored various techniques, including dual-transfer face sketch methods, deep convolutional neural networks (CNN), and generative adversarial networks (GAN), to improve the efficiency and quality of sketch-to-image translation. However, many existing methods fall short in addressing the changing facial attributes during sketch translation into RGB images.

Proposed Methodology:

The proposed multi-level 3D-cGAN system consists of three cGANs and an image classifier, each with a generator and discriminator. The system undergoes four steps: conversion of the input sketch to grayscale, conversion of the grayscale image to an RGB image considering facial attributes, transformation of the RGB image to a high-resolution RGB image using a pixel modifier, and classification of the high-

resolution image. The use of 3D-Convolution and 3D-Deconvolution, with vectorization, aims to train more attributes and parameters without additional time consumption.

Dataset Development:

To evaluate the proposed model, a face dataset comprising 1000 face images of 100 people was developed. The dataset includes original RGB images, manually drawn sketches, grayscale images, and high-resolution RGB images. These images serve as training data and ground truth for cross-match analysis, providing a comprehensive assessment of the model's performance.

Key Contributions:

1. Development of a multi-level 3D-cGAN for translating sketches into realistic images while preserving spatial facial attributes and pixel-level details.

2. Implementation of 3D-Convolution and 3D-Deconvolution with vectorization for enhanced attribute and parameter training.

3. Generation of high-resolution RGB color images from sketches for improved realism.

4. Consideration of spatial domain's heterogeneous lighting effects and neighbor feature selection.

5. Introduction of a face dataset with ground truth for cross-match analysis, enabling the authentication of the proposed architecture's performance.

Conclusion:

The proposed multi-level 3D-cGAN presents a promising advancement in forensic facial recognition, addressing key challenges in existing methods. By combining cutting-edge technologies and methodologies, this approach contributes to the evolution of face recognition systems, ensuring enhanced accuracy and efficiency in suspect identification and forensic investigations. Further research and validation are necessary to establish the widespread applicability and effectiveness of this innovative approach in real-world scenarios.

References:

1. *Face recognition via Multi-Level 3D-GAN colorization*. (2022). IEEE Journals & Magazine | IEEE Xplore. https://ieeexplore.ieee.org/document/9969619