Controllable Face Privacy

Introduction

We present the novel concept of Controllable Face Privacy. Existing methods that alter face images to conceal identity inadvertently also destroy other facial attributes such as gender, race or age. This all-or-nothing approach is too harsh. Instead, we propose a flexible method that can independently control the amount of identity alteration while keeping unchanged other facial attributes. Our approach is based on a subspace decomposition technique which effectively decouples facial attributes such as gender, race, age, and identity into mutually orthogonal subspaces, which in turn enable independent control of these attributes. Extensive experiments with a commercial facial analysis software show that our alteration method is indeed effective.

Methodology

1) Multimodal Discriminant Analysis

A vector $X$ is decomposed into orthogonal subspaces (blue axes). Moving in one subspace does not affect others.

2) Algorithm flowchart

- Training: MMDA model
- Preprocessing: Thin-plate-spline non-linear warping
- Decomposition: $y = P^T X$
- Attribute alteration: change $y$ to $y'$
- Reconstruction: $x' = P_r y'$

Experiments

1) Changing single attribute

- change age
- change gender
- change race

2) Changing two attributes

- change age and race
- change age and gender

3) Changing three attributes

Training images

Conclusion: Both user study and quantitative tests confirm that our method effectively changes some facial attributes while preserving others.

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