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Kinship Verification

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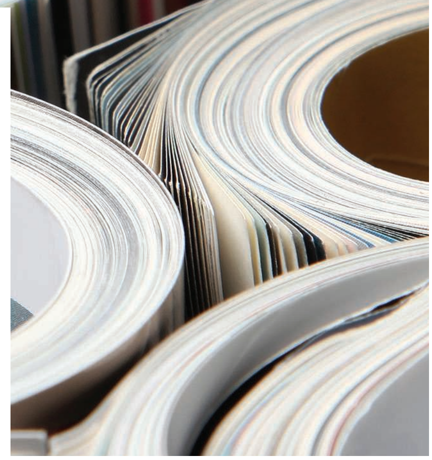

This installment of Computer's series highlighting the work published in IEEE Computer Society journals comes from IEEE Transactions on Pattern Analysis and Machine Intelligence.

The goal of kinship verification is to determine whether there is a kin relationship between people shown in photos. This is significant for many real-world applications, such as forensic investigations, family photo-album organization, social media analysis, and missing-person cases. A recent paper[1] proposes a solution and provides experimental results that show how the proposed method compares to existing state-of-the-art methods.

Kinship verification is challenging due to the lack of large kinship data sets and the types of variations that exist in family member images, as opposed to most traditional image-classification problems. The authors describe these challenges as follows.

> *Pre-existing datasets for visual kinship-based tasks are not large enough to capture the true data distributions of a family and their members. What's more, modern-day data driven models (i.e., deep learning) need big data.*[1]

> *Kin relations in the visual domain are less discriminant than other more conventional problems of its kind (e.g., facial recognition or object classification), as it contain more complex hidden factors affecting the facial appearances among family members.*[1]

To solve these challenges, the authors introduce a unified framework that is split into two pieces:

1. translate the parents to their younger ages to mitigate the age gap
2. use sparse discriminative metric (SDM) loss to guide the deep-learning architecture.

Experimental results using the kinship benchmark "Families in the Wild" data set show additional performance improvement by introducing the young version of parents and SDM loss to guide deep learning.

This type of face recognition is only one set of the challenges that researchers are tackling in the larger domain of face processing, including face recognition (matching images), facial analytics (determining attributes about the person, such as age, gender, race, and body mass index), facial attributes (determining characteristics about the face, including type of nose, size of lip, and color of eyebrow), and facial generative models (generate synthetic alterations to the face or entirely new faces). Facial generative models are the hottest area of research because they show

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promise to greatly improve the factors of face processing mentioned earlier by using adversarial neural networks.

Generative adversarial neural networks are composed of two types of neural networks, a generator and a detector. As the names indicate, these networks compete against each other, thereby improving them both. The benefit of these generative models is the need for substantially less data than traditional convolutional neural network methods. The generator learns how to create an endless supply of data used to fool ("teach") the detector networks. I am investigating the use of these models to mitigate model (algorithm) negative bias in face recognition and facial analytics. In addition, my laboratory is exploiting these generative models to detect others, known as *deep fakes*.

REFERENCE

1. S. Wang, Z. Ding, and Y. Fu, "Cross-generation kinship verification with sparse discriminative metric," *IEEE Trans. Pattern Anal. Mach. Intell.*, vol. 41, no. 11, pp. 2783–2790, 2019.

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