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Learning a Generative Model of Human Faces Through Inverse Rendering

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Abstract

Generative models in an inverse graphics framework are appealing models for visual perception. How might children acquire them? We present a computational procedure for learning generative models of human faces using developmentally plausible input. Our statistical model of shape and appearance initially uses the average face as a template with a simple Gaussian process model of deformations. We iteratively learn the statistical distribution of faces by performing analysis-by-synthesis on a small number of images and combine the results to construct an improved generative model. Our analysis-by-synthesis framework combines a convolutional neural network for fast inference with a Markov chain Monte Carlo process for detailed refinement. This learning strategy quickly captures the variation of natural faces and demonstrates an efficient way to learn the distribution of faces.