Manifold Learning on Face Data

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November 28, 2017

1 Introduction

We plan to explore manifold learning as presented in [1] for a lower dimensional embedding of images. Since lower dimensional hidden representations allow for generative modeling, we also plan to explore image generation by sampling from this lower dimensional manifold, an idea quite in focus recently with the Generative Adversarial Architectures [2].

2 Data Acquisition and Exploration

There are a multitude of datasets for face images available on the web. UMDFaces Dataset [3] contains 367,888 face annotations for 8,277 subjects divided into 3 batches. It also includes human curated bounding boxes for faces and also the estimated pose (yaw, pitch, and roll), locations of twenty-one keypoints, and gender information generated by a pre-trained neural network. There are other sources like [4], which we may explore.

3 Data Exploitation

We will begin with choosing an appropriate dataset from a plethora that is already available. We will then detect keypoints followed by generating descriptors around those keypoints using a suitable algorithm. Once we obtain the feature vector representation for each image, we will try to learn a parametrized manifold space. This parametrization would not only help us in generating new faces along that manifold, but a suitable choice of parameter may help us in morphing specific features of individual faces.

4 Conclusion : Final Goal

Ideally we should be able to produce an interesting demonstration like [5]. However, subject to practicality constraints and plain old luck, we might also be content with a survey of the field and a solid indepth implementation of a fascinating application of network science!

References

[1] Tenenbaum, Joshua B., et al. "A Global Geometric Framework for Nonlinear Dimensionality Reduction". Science. 2000.

[2] Goodfellow, Ian, et al. "Generative adversarial nets." Advances in neural information processing systems. 2014.

[3] Bansal, Ankan, et al. "UMDFaces: An Annotated Face Dataset for Training Deep Networks", Arxiv preprint, 2016.

[4] Face Recognition Homepage

[5] Chair morphing