Abstract

Face and object recognition is a challenging problem in the field of computer vision. It deals with identifying faces or objects form an image or video. Due to its numerous applications in biometrics, security, multimedia processing, on-line shopping, psychology and neuroscience, automated vehicle parking systems, autonomous driving and machine inspection, it has drawn attention from a lot of researches. Researchers have studied different aspects of this problem. Among them pose robust matching is a very important problem with various applications like recognizing faces and objects in uncontrolled scenarios in which the images appear in wide variety of pose and illumination conditions along with low resolution.

In this thesis, we propose three discriminative pose-free descriptors, Subspace Point Representation (*DPF-SPR*), Layered Canonical Correlated (*DPF-LCC*) and Aligned Discriminative Pose Robust (*ADPR*) descriptor, for matching faces and objects across pose. They are also robust for recognition in low resolution and varying illumination. We use training examples at very few poses to generate virtual intermediate pose subspaces. An image is represented by a feature set obtained by projecting its low-level feature on these subspaces. This way we gather more information regarding the unseen poses by generating synthetic data and make our features more robust towards unseen pose variations. Then we apply a discriminative transform to make this feature set suitable for recognition for generating two of our descriptors namely *DPF-SPR* and *DPF-LCC*. In one approach, we transform it to a vector by using subspace to point representation technique which generates our *DPF-SPR* descriptors. In the second approach, layered structures of canonical correlated subspaces are formed, onto which the feature set is projected which generates our *DPF-LCC* descriptor. In a third approach we first align the remaining subspaces with the frontal one before learning the discriminative metric and concatenate the aligned discriminative projected features to generate *ADPR*.

Experiments on recognizing faces and objects across varying pose are done. Specifically we have done experiments on MultiPIE and Surveillance Cameras Face database for face recognition and COIL-20 and RGB-D dataset for object recognition. We show that our approaches can

even improve the recognition rate over the state-of-the-art deep learning approaches. We also perform extensive analysis of our three descriptors to get a better qualitative understanding. We compare with state-of-the-art to show the effectiveness of the proposed approaches.