Two-Dimensional Canonical Correlation Analysis of the Logically Concatenated Cross Binary Pattern for Cross Pose Face Recognition

Kumud Arora, Inderprastha Engineering College, Ghaziabad, India
Poonam Garg, Institute of Management and Technology, Ghaziabad, India

ABSTRACT

Face pose recognition is one of the challenging areas in computer vision. Cross-pose change causes the change in the information of face appearance. The maximization of intrasubject correlation helps to widen the intersubject differences which helps further in achieving pose invariance. In this paper, for cross pose recognition, the authors propose to maximize the cross pose correlation by using the logically concatenated cross binary pattern (LC-CBP) descriptor and two dimensional canonical correlation analysis (2DCCA). The LC-CBP descriptor extracts the local texture details of face images with low computation complexity and the 2DCCA explicitly searches for the maximization of the correlated features to retain most informative content. Joint feature consideration via 2DCCA helps in setting up a better correspondence between a discrete set of nonfrontal pose and the frontal pose of the same subject. Experimental results demonstrate the two dimensional canonical correlation LC-CBP descriptor along with intensity values improve the correlation.

KEYWORDS

CCA (Canonical Correlation Analysis), Face Pose Recognition, LBP (Linear Binary Pattern), LC-CBP (Logically Concatenated Cross Binary Pattern)

INTRODUCTION

Face recognition is one of the well-researched classical problems of computer vision which turns very challenging in the presence of face pose variations. In order to meet these challenges, the authors sought after robust as well as easy to compute feature descriptors describing face. For pose variations, different pose images cause a huge difference in the information of a 2D face image, even though its identity information remains the same. Pose change causes a steep drop in the correlation between the coupled cross pose of identities. Figure 1 shows that the slight change in the pose causes an enormous shift in the distribution estimate of the values of intensity. The change in appearance information reduces the pixel correlation up to 49%.

DOI: 10.4018/IJCVIP.2018070104

Copyright © 2018, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.
Since identity coupled with view spaces are correlated by the identity of the subject, the problem of recognizing cross pose faces can be formulated as minimizing the dissimilarity measure between two vectors from different subspaces. Modelling of the relations between view subspaces of an individual from different viewpoints is done by learning a mapping from one pose to another. By performing CCA on the identity coupled face poses, their latent correlation can be maximized. Li, Shan, Chen, and Gao (2009) first applied CCA on the local face patches for resolving the problem of cross pose recognition. Since the cross-pose face coupling has a nonlinear relationship, the efficacy of relation analysis using raw pixel intensities with CCA remains a bit limited. Obviously, a face descriptor such as the linear binary pattern (LBP) (Ojala, Pietikäinen, & Harwood, 1996), which has the features of computational simplicity, can replace the intensity matrix. However, even with LBP face images, the dimensionality of feature space is still higher than the number of samples. Due to the high dimensionality of feature space to the number of samples ratio, the problem of the singularity of covariance matrix creeps in. For example, an image of size 80x80 dimension has 6400 dimensionality and, if the number of samples is just a hundred, the issue of singularity is bound to arise. Motivated by Kukharev and Kamenskaya’s (2010) idea to extract the covariance matrix from the images themselves, rather than from the vector formulation of the images, the issue of SSS is resolved. In this paper, the authors use their CCArc formulation. CCArc effectively avoids the issue of singularity of SSS by treating an image of size RxC as C images of size Rx1, and R images of size Cx1 thereby always leading to have the dimensionality near to the number of samples, i.e. dim = max{R,C} < (R+C). The main contributions of this paper is the proposal of a simple approach to learn fine texture details of face images by using the logically concatenated cross binary pattern (LC-CBP) descriptor and using it with a two-dimensional framework of canonical correlation analysis (CCA). Further, the authors also propose its multimodal variant descriptor, where the LC-CBP is used in conjunction with intensity values. This fusion improved correlation among the front-pose pair effectively. In the related background section, the authors outline LBP-based descriptors and 2DCCA. The proposed model section comprises the formulation and the description of the LC-CBP descriptor. It can detail the framework of using the LC-CBP with 2DCCA. The section Experimental Results provides the outcomes and their analysis. Finally, the last section presents the conclusion and future works.
Application of Computer Vision Technology to Structural Health Monitoring of Engineering Structures
www.igi-global.com/chapter/application-of-computer-vision-technology-to-structural-health-monitoring-of-engineering-structures/209836?camid=4v1a

Fish Tracking with Computer Vision Techniques: An Application to Vertical Slot Fishways
www.igi-global.com/chapter/fish-tracking-with-computer-vision-techniques/163727?camid=4v1a