Generalized Multiview Analysis: A Discriminative Latent Space

Abhishek Sharma  Abhishek Kumar  Hal Daumé III  David W. Jacobs
Computer Science Department, University of Maryland, College Park

Contribution
We introduce a multi-view, supervised, domain independent, generalizable to unseen classes and kernelizable mapping to latent space to facilitate multi-view classification and retrieval. Our method has a close-form solution. We show significant improvements over CCA and other domain dependent approaches.

Mathematical Formulation continued..

GMMFA: \( A_i = S_i(B_i) \), \( B_i = S_i(W_i) \), \( Z_i = X_i \), where \( S_i^{k}(W_i) = \sum_{i \in k, k'} W_{i,k'} \). The within class compression or intrinsic graph-\( W_{wi} = \left\{ \begin{array}{ll} 1 & : k \in R^{k2}(l) \or l \in R^{k2}(k) \ \text{where} \ R^{k2}(l) \text{indicates the index set of the } k \text{ nearest neighbors of the sample } x_i \text{ in the same class. The between class separation or penalty graph- } W_{ki} = \left\{ \begin{array}{ll} 1 & : (k, l) \in P^{k2}(c_k) \or (k, l) \in P^{k2}(c_l) \ \text{where } P^{k2}(c_k) \text{ is a set} \ \end{array} \right. \}
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Unified view and supervised extensions under GMA

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Algorithmic view of the overall framework
Step 1: Input multi-view paired data \( X_i \) with label/similarity information.
Step 2: Learn projection directions \( v_i \) using GMA.
Step 3: Project \( X_i \) to latent space using \( v_i \).
Step 4: Use k-NN matching or learn a classifier in the latent space.

Experimental Results
MultiPIE pose and lighting invariant face recognition
Manually annotated fiducial points for cropping are publicly available\(^1\), simple intensity used as feature.
Mode 2: Training: 129 subjects, 5 lighting; Testing: Different 120 subjects, 18 lightings, frontal pose gallery in illum 7.

Fig 1 Recognition accuracy for MultiPIE. Red curves indicate domain dependent methods under multi-view setting.

Text-image retrieval
Wikipedia text-image data: 10 classes, 2173/693 training/testing, publicly available features\(^2\)
Pascal image-tag data: 20 classes, 2808/2841 training/testing, publicly available features\(^3\)

Project
Step 1:
Step 2:
Step 3:
Step 4: