Domain Adaptive Fisher Vector

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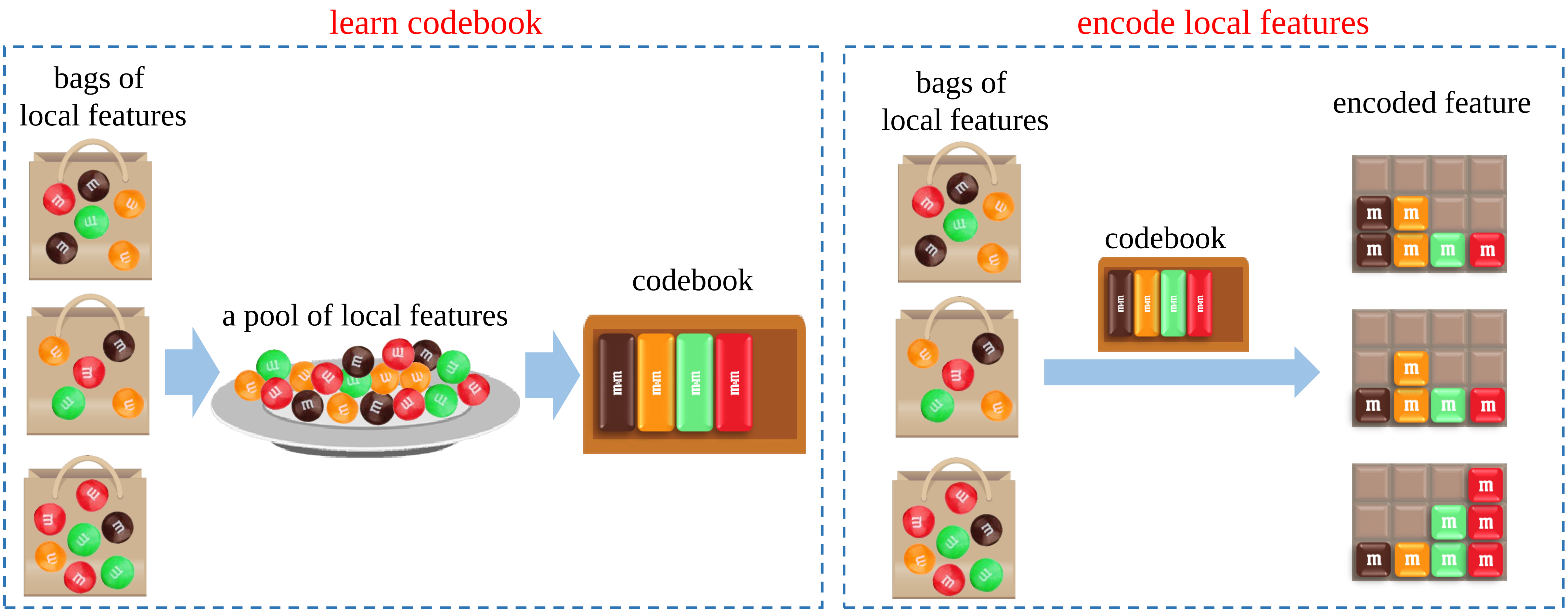
Feature Encoding

Feature encoding: encode each bag of local features into feature vector based on codebook.

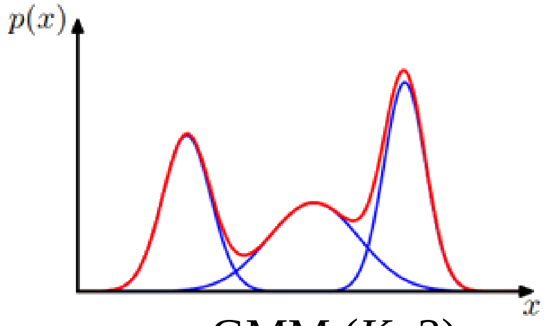


Fisher Vector

Fisher vector: a powerful feature encoding method. [15]

Local feature:
- CNN feature of image proposals
- trajectory feature of video trajectories

Codebook: *K*-component Gaussian Mixture Model (GMM) trained on *d*-dim local features.



GMM (*K*=3)

mean (*d*-dim) diagonal covariance (*d*-dim)

***2Kd*-dim Fisher vector**:

$$\underbrace{[\underbrace{\mathcal{F}_{\boldsymbol{\mu},1}; \mathcal{F}_{\boldsymbol{\sigma},1}}_{2d\text{-dim component}}; \mathcal{F}_{\boldsymbol{\mu},2}, \mathcal{F}_{\boldsymbol{\sigma},2}; \ldots; \mathcal{F}_{\boldsymbol{\mu},K}, \mathcal{F}_{\boldsymbol{\sigma},K}]}_{K \text{ components}}$$

[15] Jaakkola and Haussler , NIPS 1999

Our Method

2*Kd*-dim Fisher vector X: $[\mathcal{F}_{\boldsymbol{\mu},1}, \mathcal{F}_{\boldsymbol{\sigma},1}; \mathcal{F}_{\boldsymbol{\mu},2}, \mathcal{F}_{\boldsymbol{\sigma},2}; \ldots; \mathcal{F}_{\boldsymbol{\mu},K}, \mathcal{F}_{\boldsymbol{\sigma},K}]$

domain invariant component
domain variant component

domain invariant component: capture the common data distribution across domains.

Our Method

***2Kd*-dim Fisher vector X**: $[\mathcal{F}_{\boldsymbol{\mu},1}, \mathcal{F}_{\boldsymbol{\sigma},1}; \mathcal{F}_{\boldsymbol{\mu},2}, \mathcal{F}_{\boldsymbol{\sigma},2}; \ldots; \mathcal{F}_{\boldsymbol{\mu},K}, \mathcal{F}_{\boldsymbol{\sigma},K}]$

domain invariant component

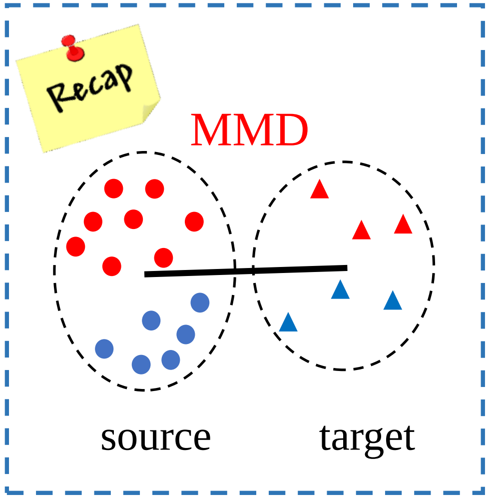
domain variant component

domain invariant component: capture the common data distribution across domains.

Motivation: learn projection $\mathbf{R}$ to identify domain invariant components by minimizing domain distance.

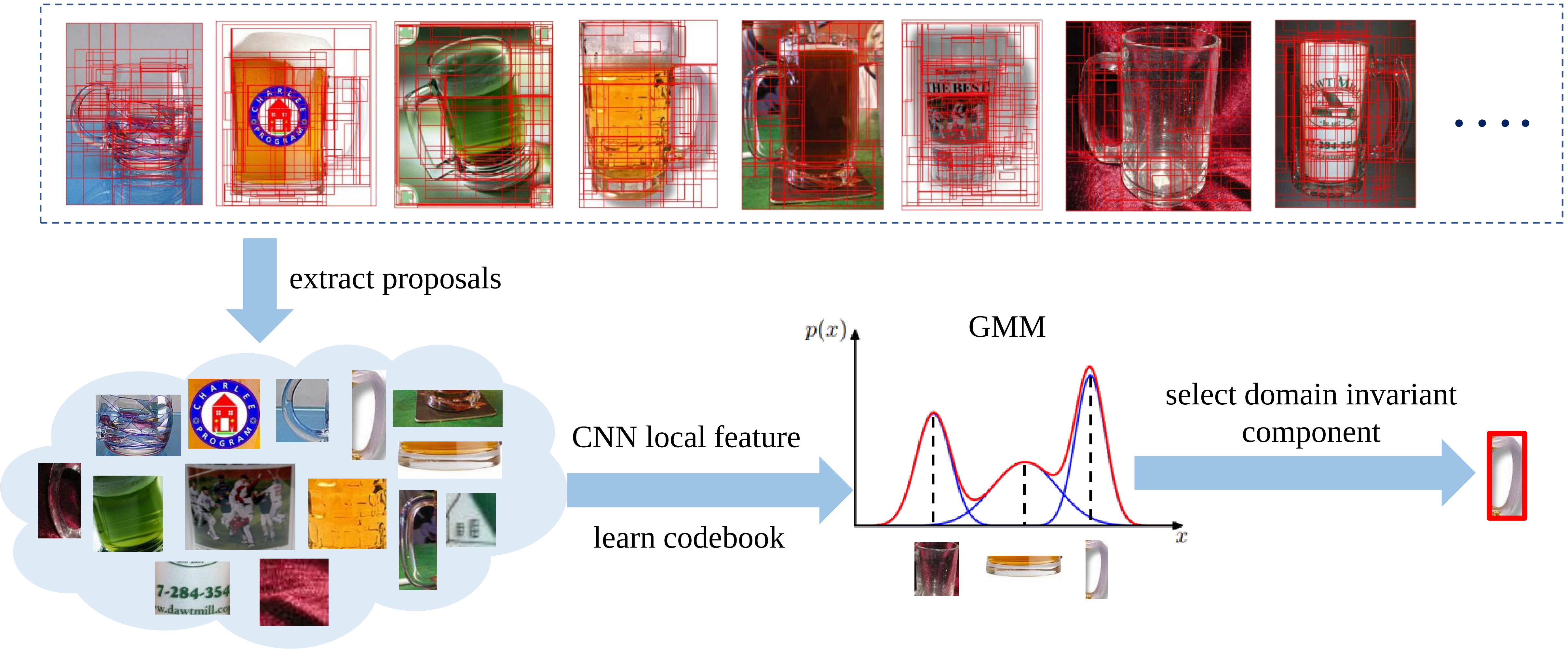
$$\min_{\mathbf{W},\mathbf{R}} \quad \|\mathbf{W}\mathbf{R}\mathbf{X}^s - \mathbf{Y}\|_F^2 + \|\mathbf{W}\|_F^2 + \overbrace{\boxed{\|\tilde{\mathbf{R}}\|_{2,1}}}^{\text{group lasso}} + \overbrace{\boxed{\|\frac{1}{n_s}\mathbf{R}\mathbf{X}^s\mathbf{1} - \frac{1}{n_t}\mathbf{R}\mathbf{X}^t\mathbf{1}\|^2}}^{\text{MMD}}$$

$$\text{s.t.} \quad \mathbf{R}\mathbf{X}\mathbf{H}\mathbf{X}'\mathbf{R}' = \mathbf{I}$$



Experiments

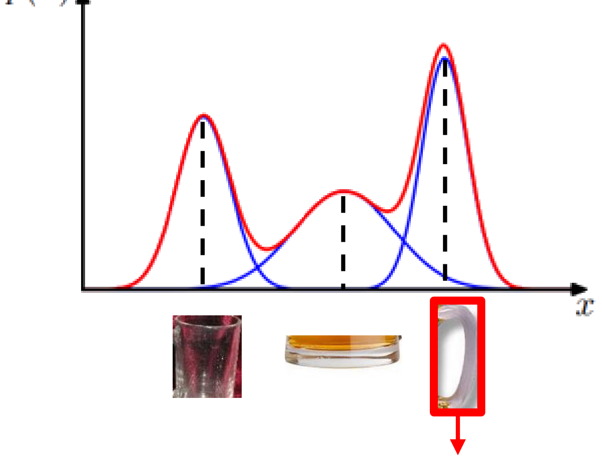
Domain Adaptive Fisher Vector for Classifying “Beer Mug”



Experiments

Domain Adaptive Fisher Vector for Classifying “Beer Mug”

codebook (GMM)

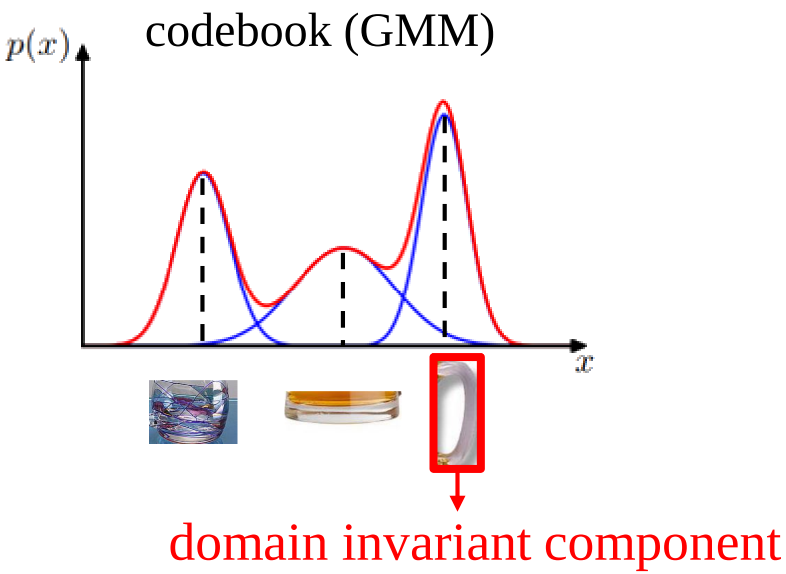


domain invariant component

top proposals corresponding to domain invariant component

Experiments

Domain Adaptive Fisher Vector for Classifying “Beer Mug”



top proposals corresponding to domain invariant component

Accuracies (%) on the Bing-Caltech256 dataset

AGMM	EM_RGMM	KMM	GFK	TCA	SA	SDDL	LTSL	CORAL	**Ours**
76.8	77.4	73.6	73.6	74.8	74.2	62.4	77.6	75.2	**79.4**