

Describing Geographical Characteristics with Social Images

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Outline

- Motivation
- Geographical Latent Attribution Model
- Experiments
- Conclusions



Motivation

Photos in social media



Pervasive

Nowadays, photos are widely spread with social media.



Intuitive

Compared with text, photos provides an intuitive understanding of the world.



Objective

Photos are objective. Less ambiguity than text.



Comprehensive

Photos embody users' interests

To understand a specific region

- From Users



To understand a specific region

- From Text

- Not intuitive
- Choice of proper words

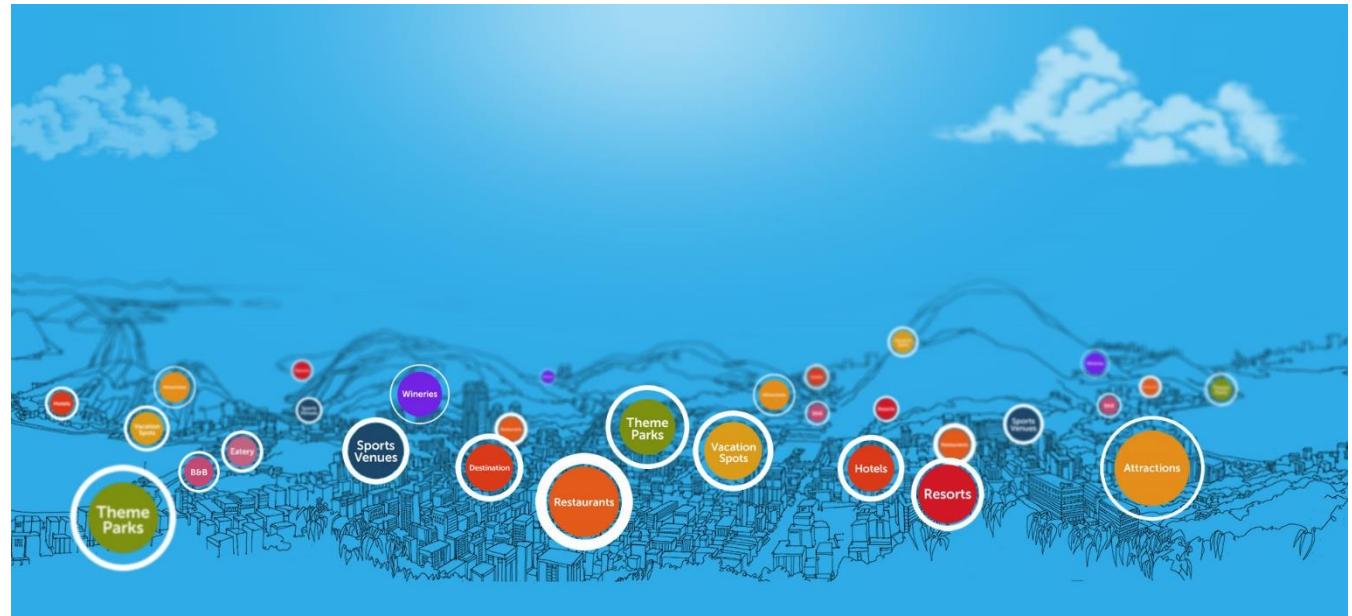


Applications

Advertising



Tourist recommendation & Location retrieval



Geographical Latent Attribution Model

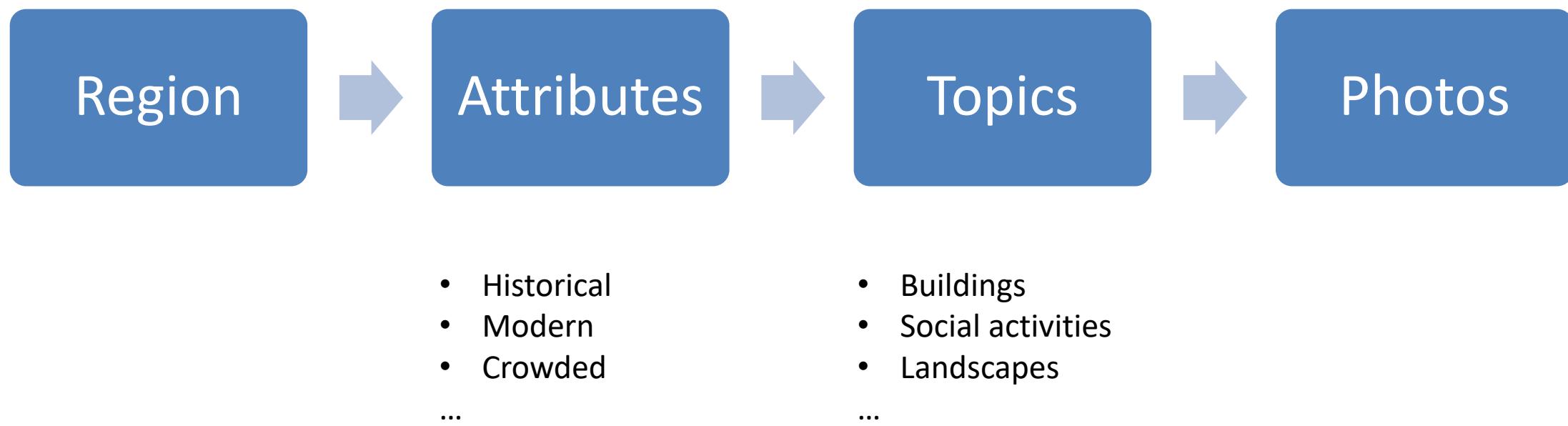
Geographical Latent Attribution Model

Data: Regions and photos in this region



Geographical Latent Attribution Model

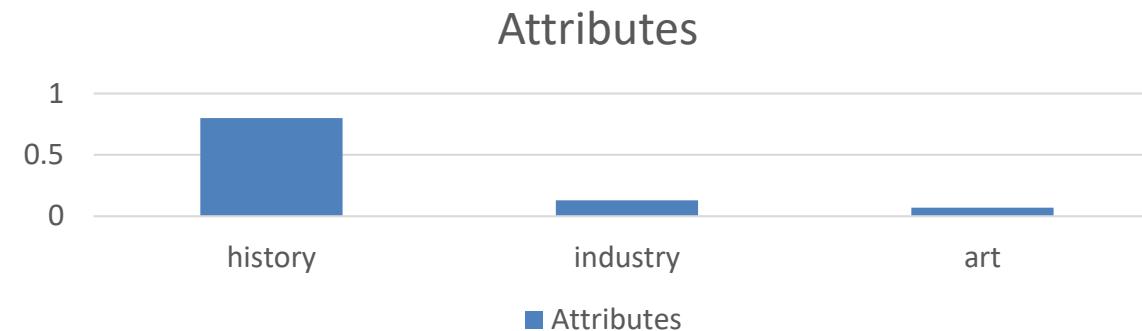
Design GLAM to hierarchically model regional characteristics



Geographical Latent Attribution Model

Use of latent variables to present attributes

- Each region has a distribution over the latent attributes



- Each attribute has a distribution over the latent topics (clusters)

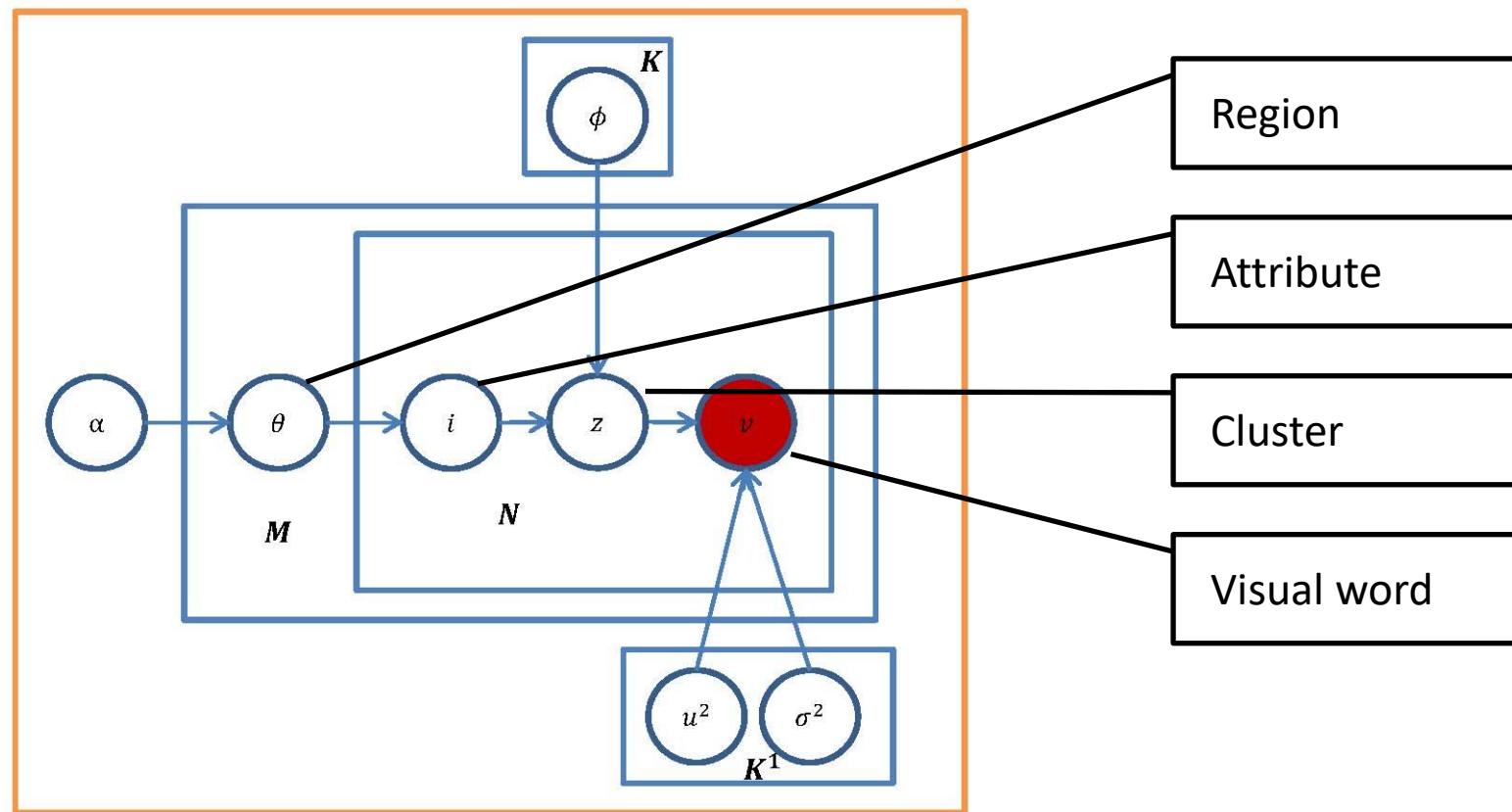


Geographical Latent Attribution Model

Hierarchical Modeling of Images



Geographical Latent Attribution Model



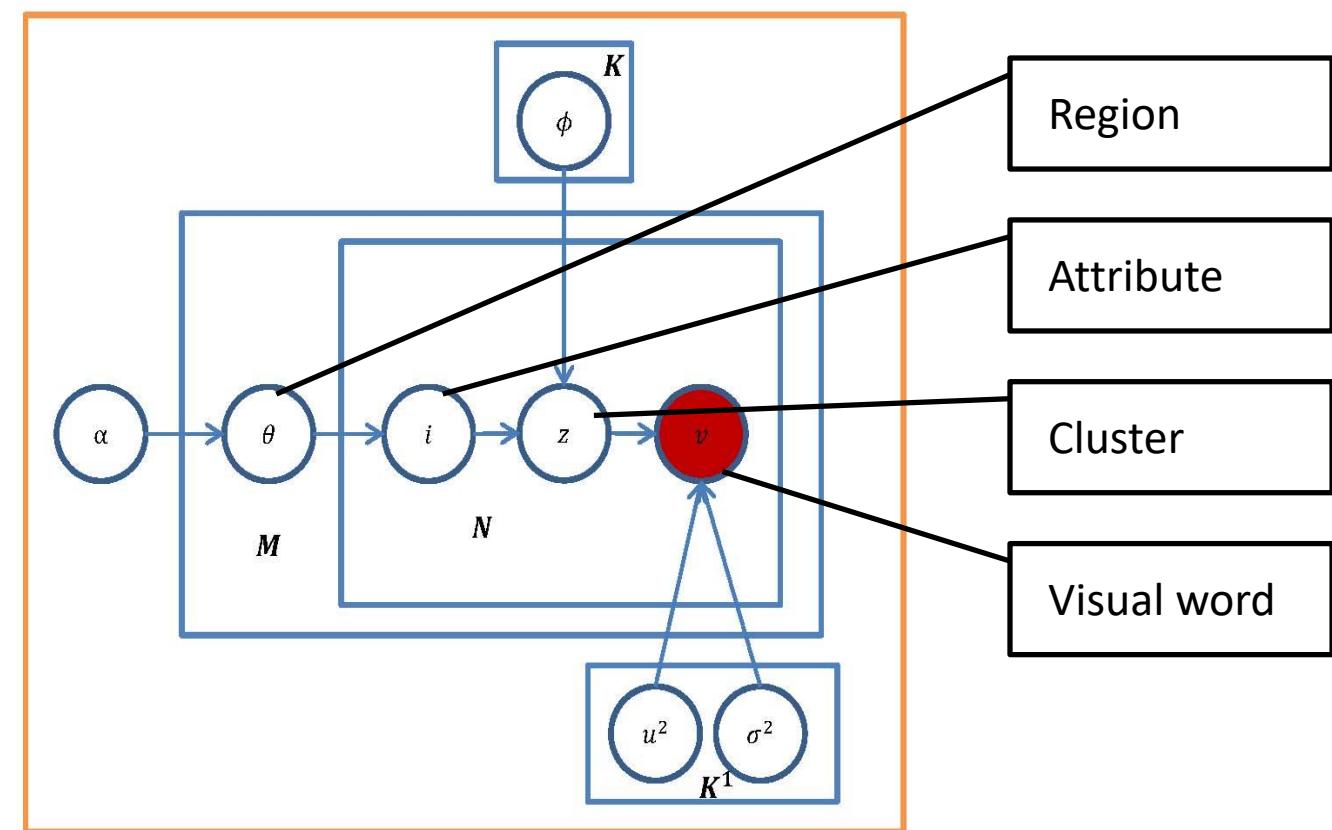
Geographical Latent Attribution Model

Generative procedure

- Choose regional interest proportion $\theta_m \sim Dir(\alpha)$.
- Choose the interest of one image $i_{mn} \sim Multinomial(\theta_m)$.
- Choose the cluster $z_{mn} \sim Multinomial(\phi_{i_{mn}})$, where $i_{mn} \in \{1, 2, \dots, K\}$.
- Choose each visual vector $v_{mn} \sim \mathcal{N}(\mu_{z_{mn}}, \sigma_{z_{mn}} \mathbf{I})$, where $z_{mn} \in \{1, 2, \dots, K'\}$.

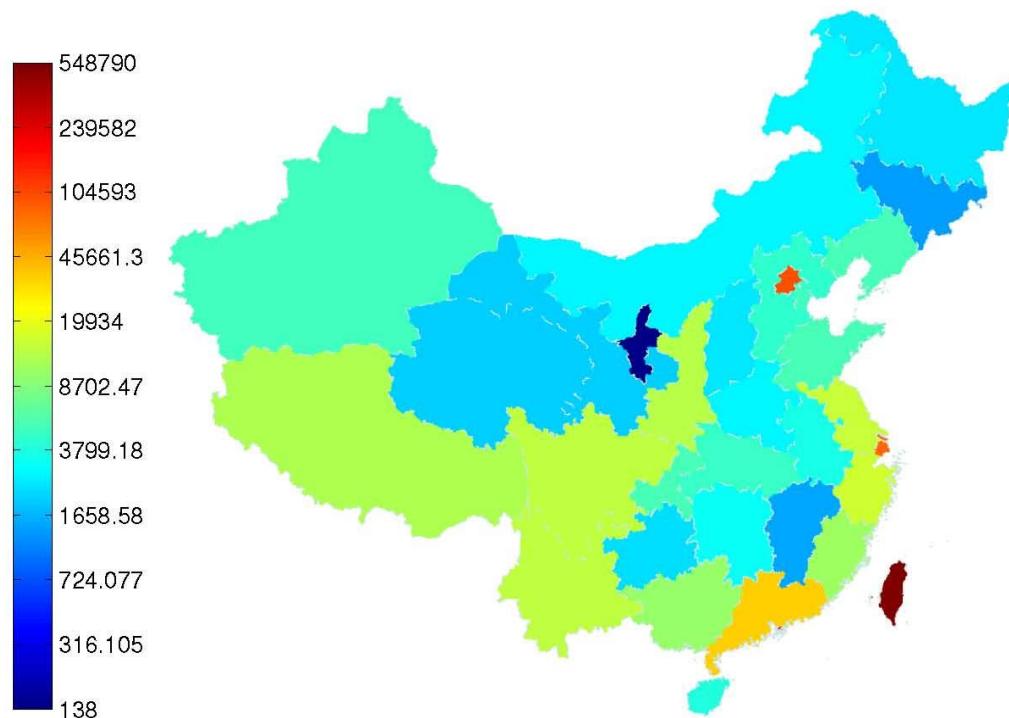
Inference and Learning

- Variational inference: we apply variational distributions to approximate the posterior latent variables
- Optimize the variational lower bound using EM algorithm:
 - E step: estimate the variables
 - M step: learn and update parameters



Experiments

Experiment setting



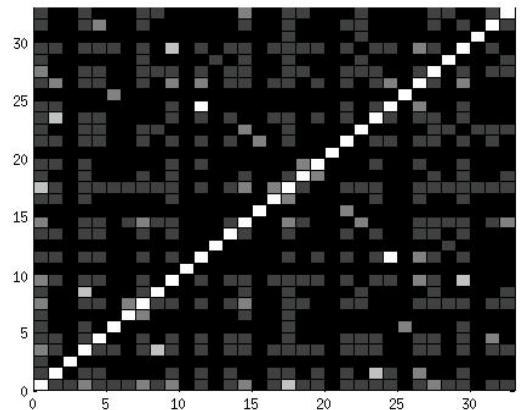
- Dataset:
YFCC100M dataset
 - 4.8M photos on flickr community
 - 1.1M photos filtered in China
 - Divided into 34 province
- Image representation:
1024-dimension vector extracted by GoogLeNet
(Average pooling)
- Parameters: (Empirically)
 - #Cluster: 200,500
 - #Interest: 10,15,20
 - #Region: 34

Quantitative Evaluation

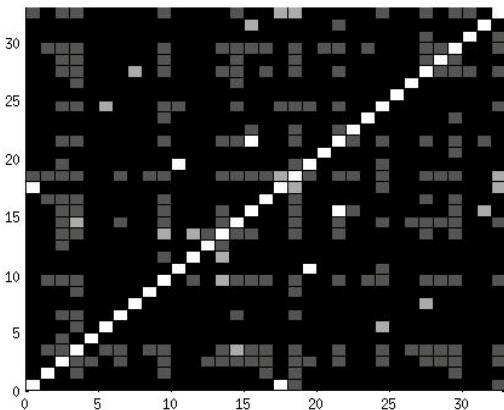
- Each region 10 documents from:
<https://www.travelchinaguide.com/>
- General introduction, facts, even life details
- Learn topics with LDA
- Comparison city similarity



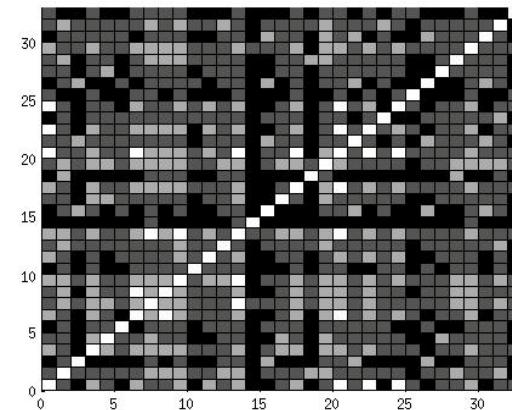
Quantitative Evaluation



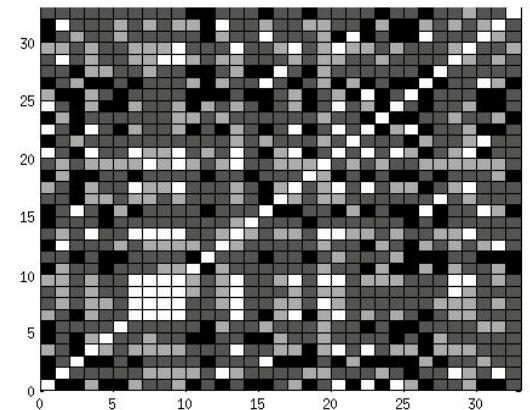
Text Feature



GLAM



GMM



Avg CNN

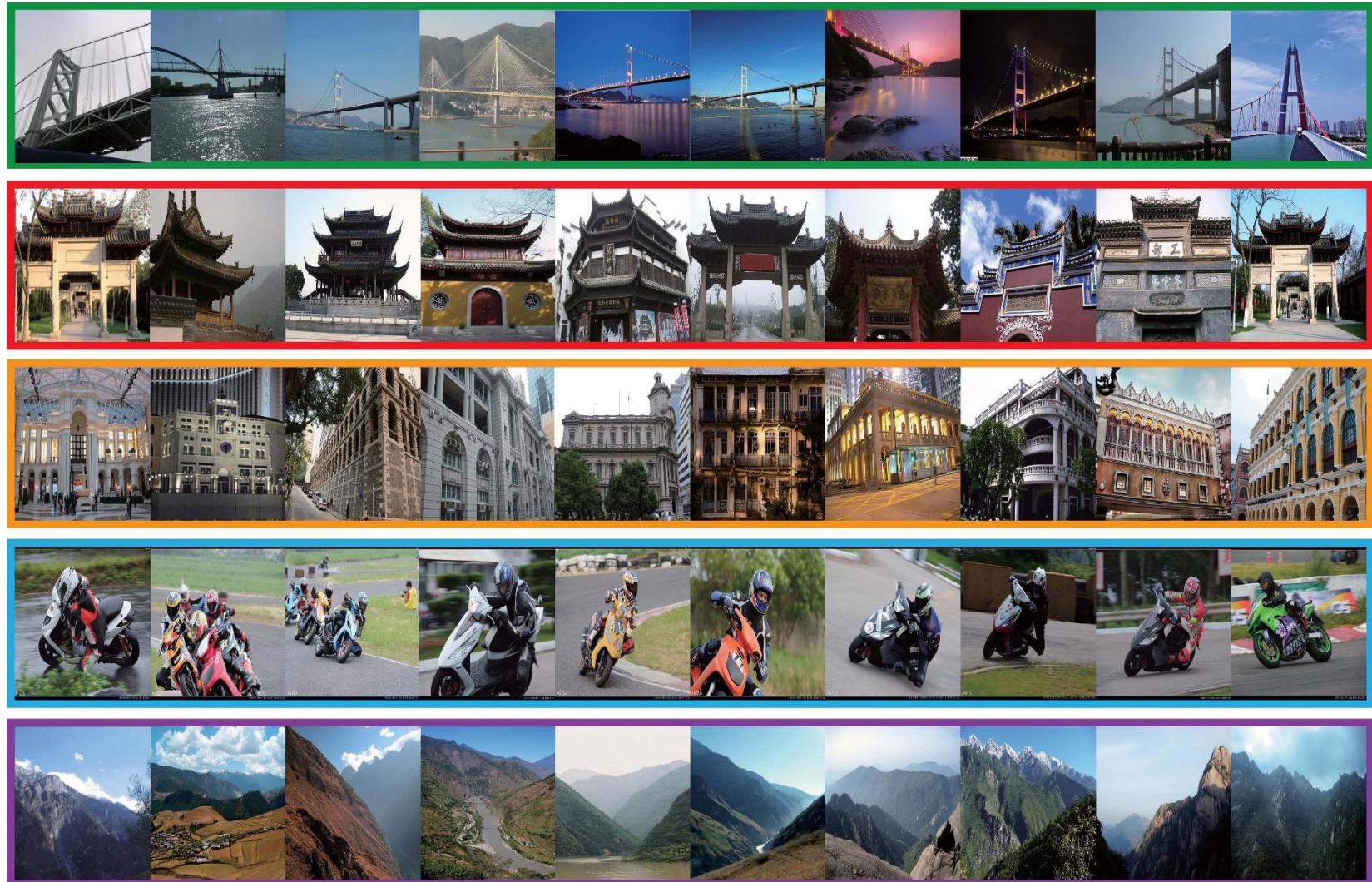


Quantitative Evaluation

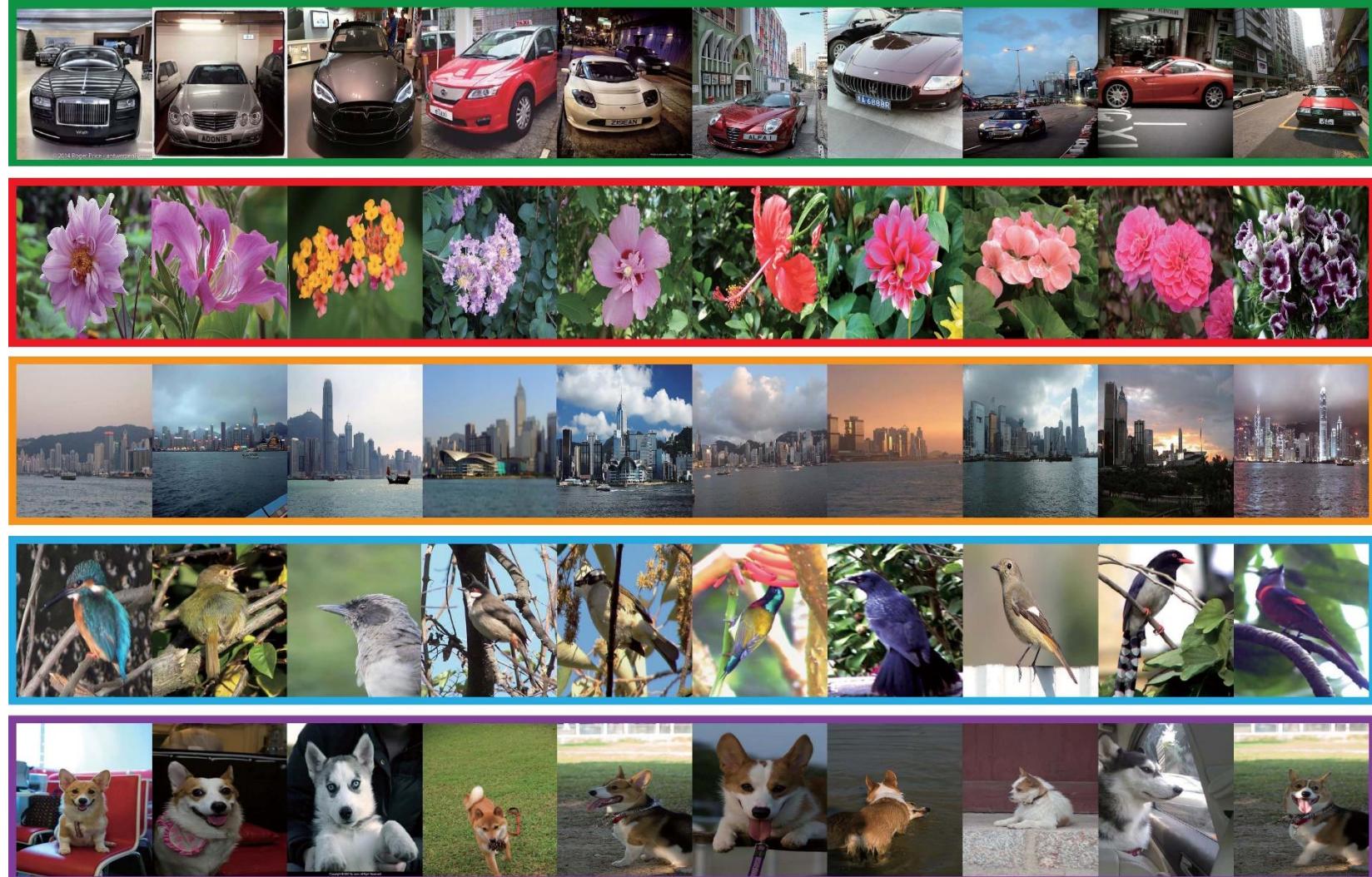
Correlation with text

	GLAM $K'=200$			GMM $K' = 200$	GLAM $K'=500$			GMM $K' = 500$	θ_{avg}
	θ_{10}	θ_{15}	θ_{20}		θ_{10}	θ_{15}	θ_{20}		
$Text_{5topics}$	0.5548	0.5945	0.5835	0.3904	0.5910	0.6010	0.6192	0.3912	0.3484
$Text_{10topics}$	0.6191	0.6515	0.6568	0.3920	0.6310	0.6571	0.6780	0.4040	0.3726
$Text_{15topics}$	0.6764	0.7414	0.7251	0.4304	0.7021	0.7827	0.7574	0.4467	0.4038
$Text_{20topics}$	0.7550	0.8014	0.7842	0.5064	0.7704	0.8212	0.8195	0.5163	0.4595
$Text_{25topics}$	0.7253	0.7843	0.7725	0.4739	0.7502	0.8130	0.7982	0.4973	0.4510
$Text_{30topics}$	0.7181	0.7838	0.7670	0.4865	0.7446	0.8056	0.7941	0.4836	0.4477

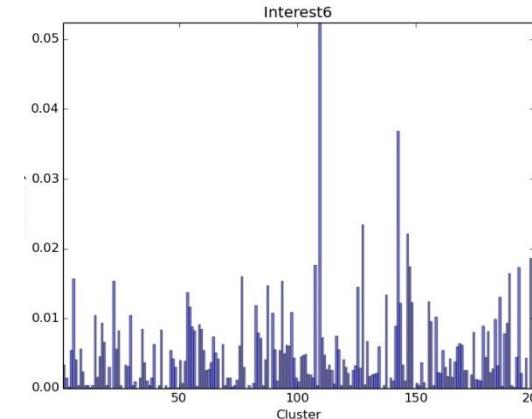
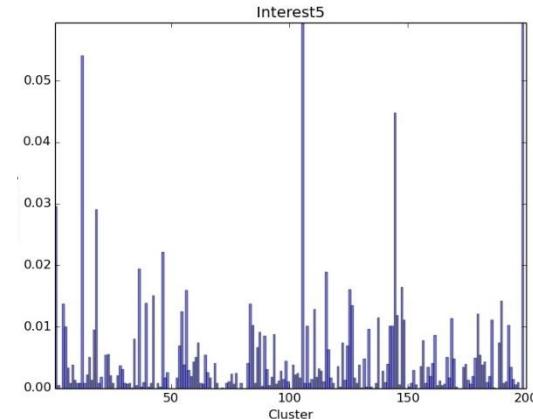
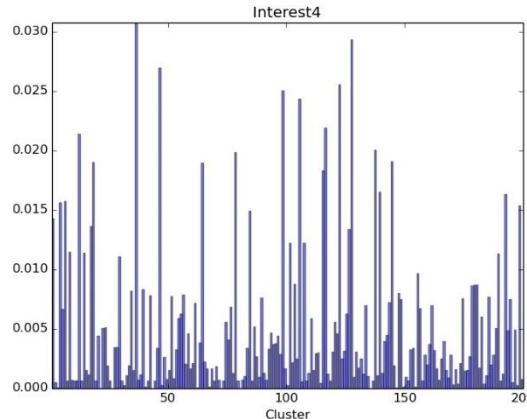
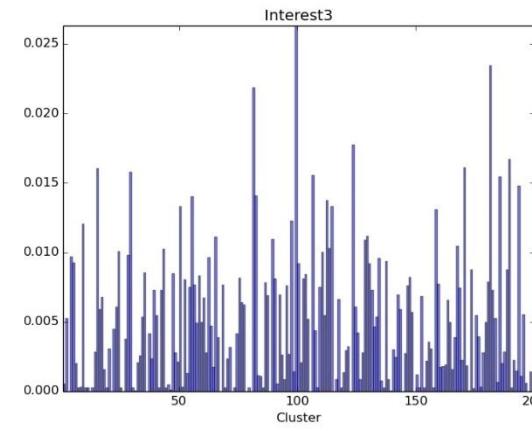
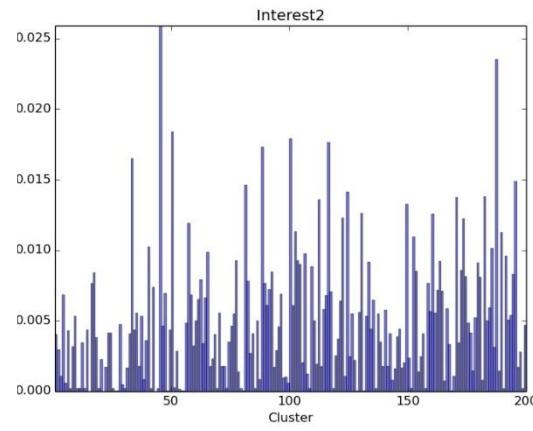
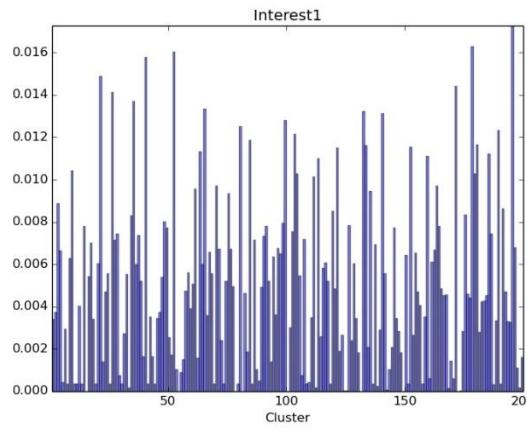
Clusters



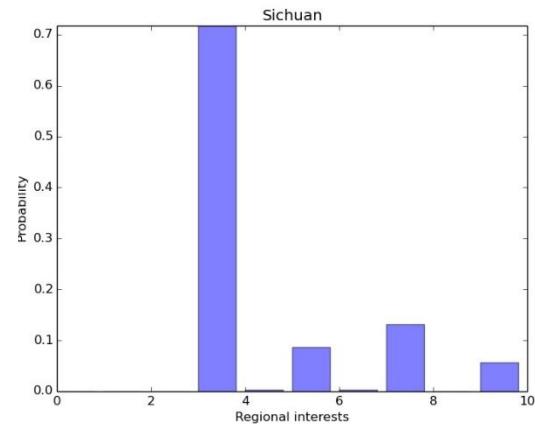
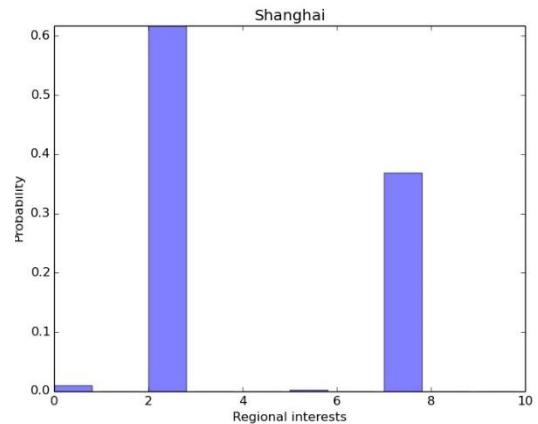
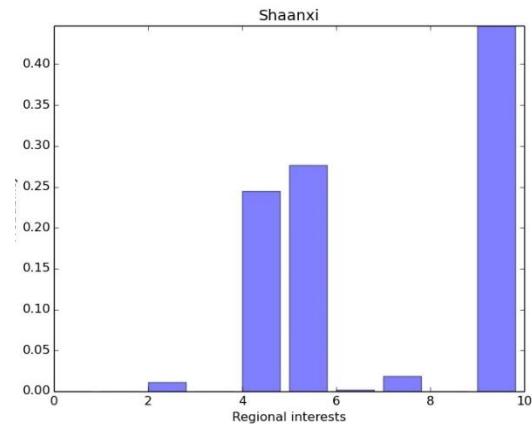
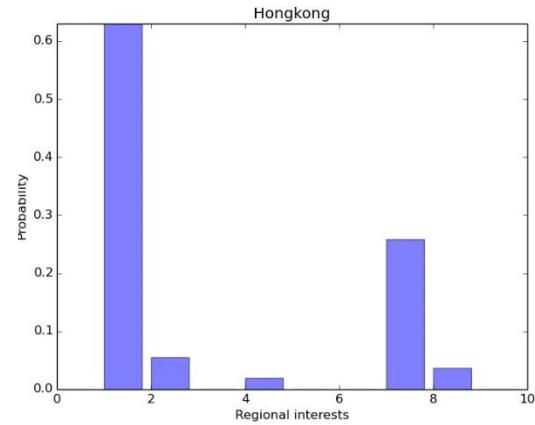
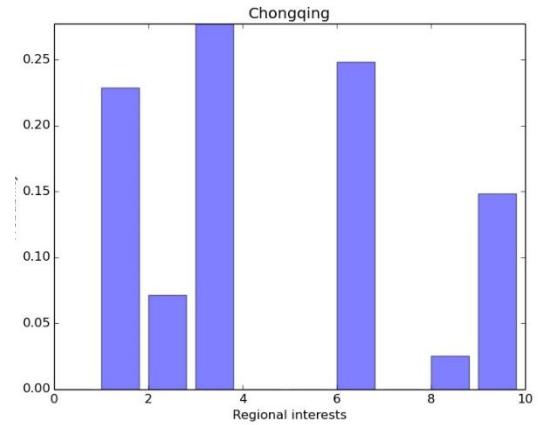
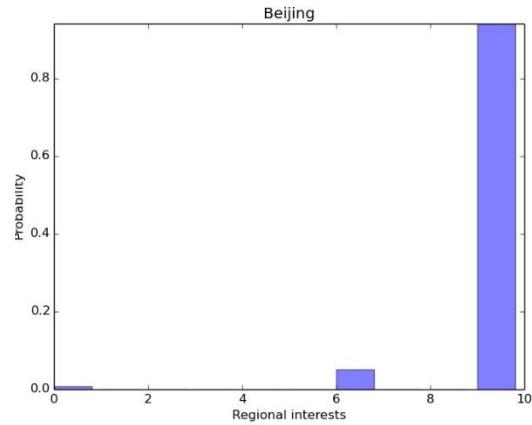
Clusters

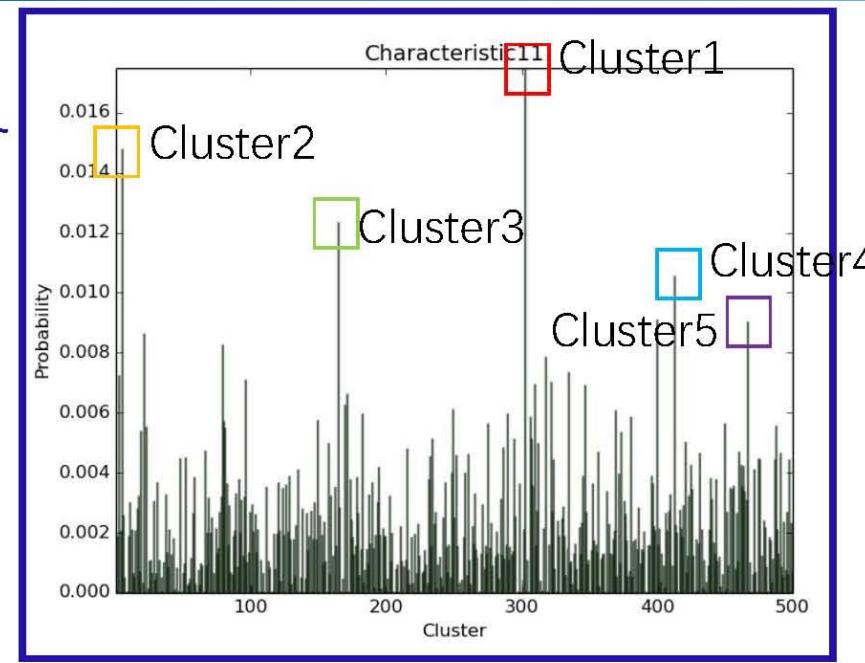
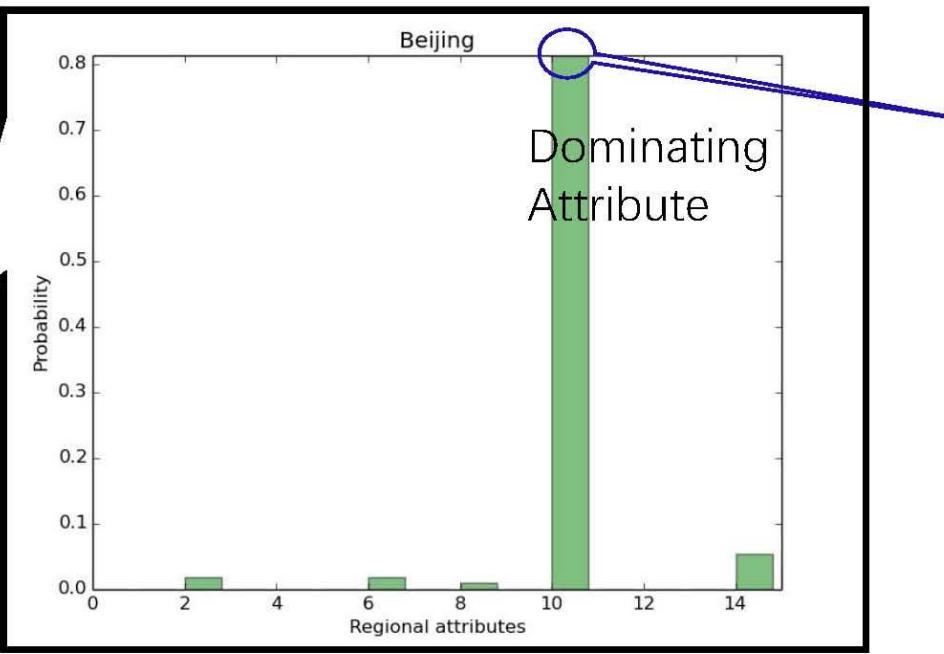


Attribute distribution over clusters



Region' s attribute distribution



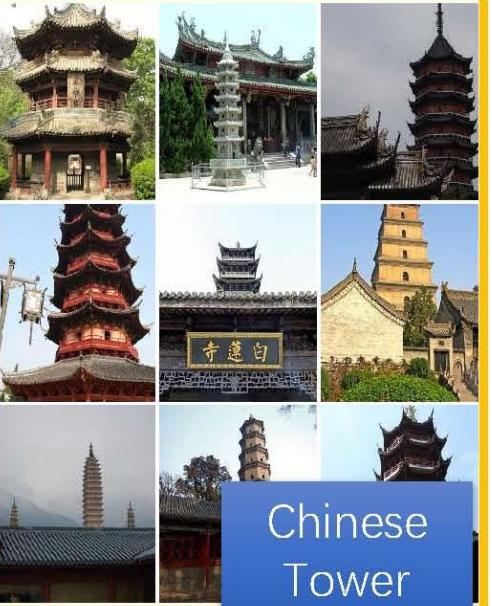


Cluster1



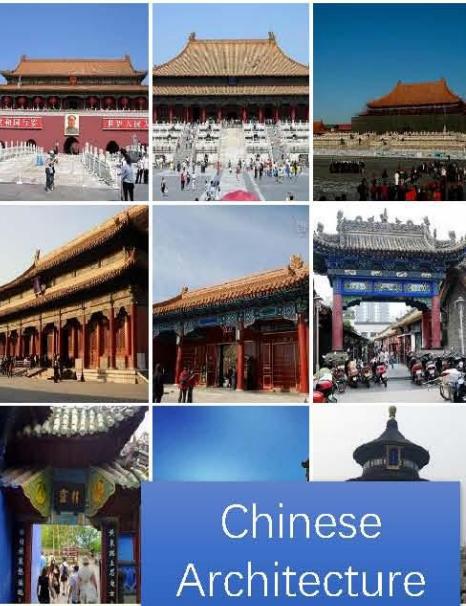
Chinese
Antique

Cluster2



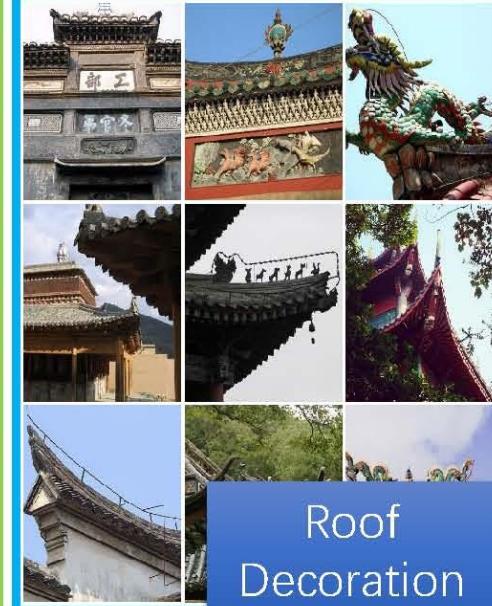
Chinese
Tower

Cluster3



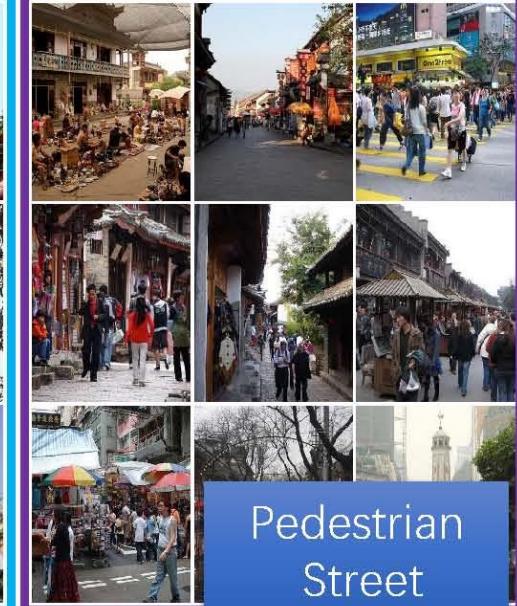
Chinese
Architecture

Cluster4



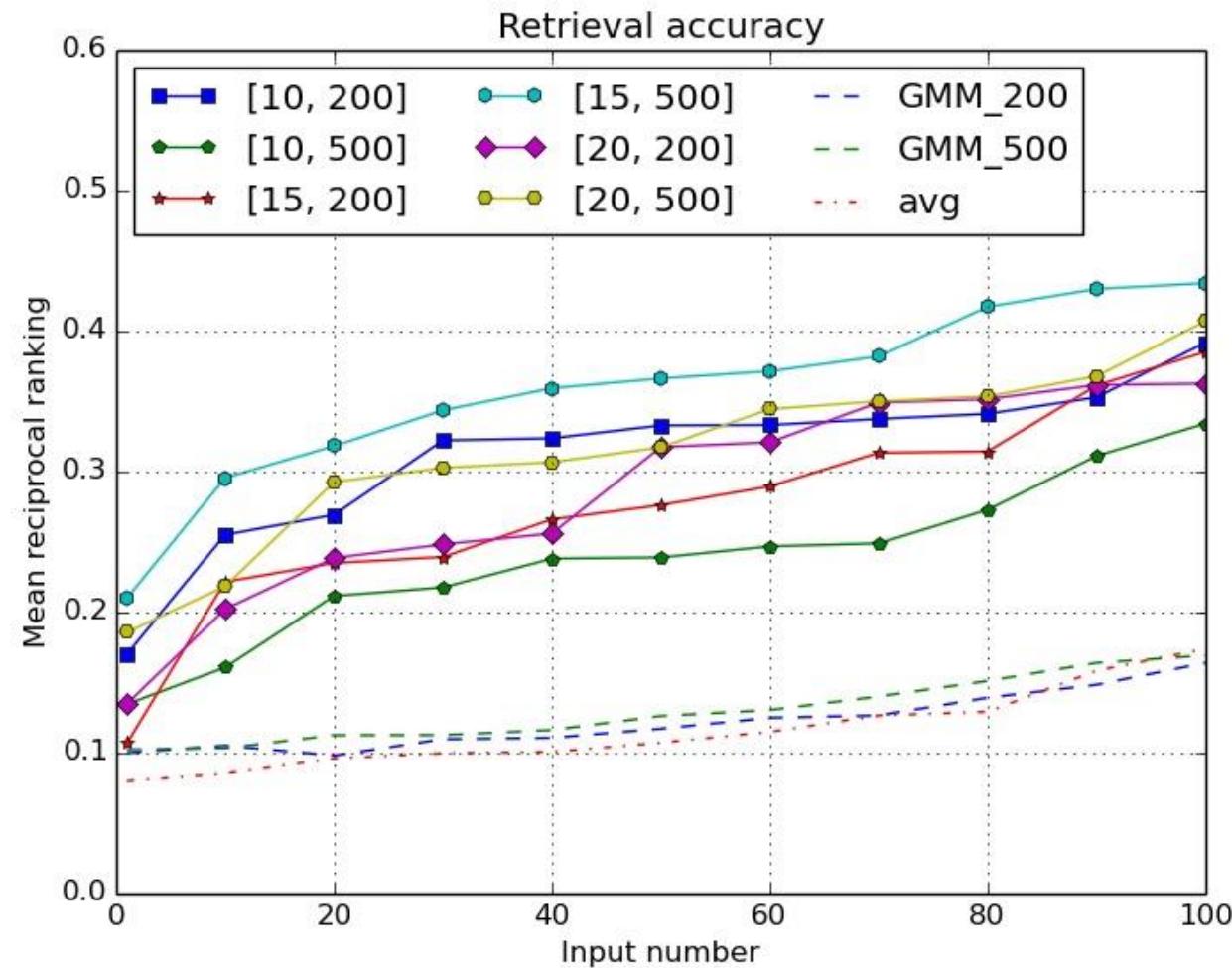
Roof
Decoration

Cluster5



Pedestrian
Street

Tourist recommendation



Tourist Recommendation



Yunnan

Chongqing

Jiangxi

Conclusions

Conclusions

- Describe the characteristics in one specific from images
- Latent variable model to capture attributes
- Experiments in China prove the effectiveness
- Based on model, tourist recommendation could be developed



Thank you!