



Building Geo-aware Tag Features for Image Classification

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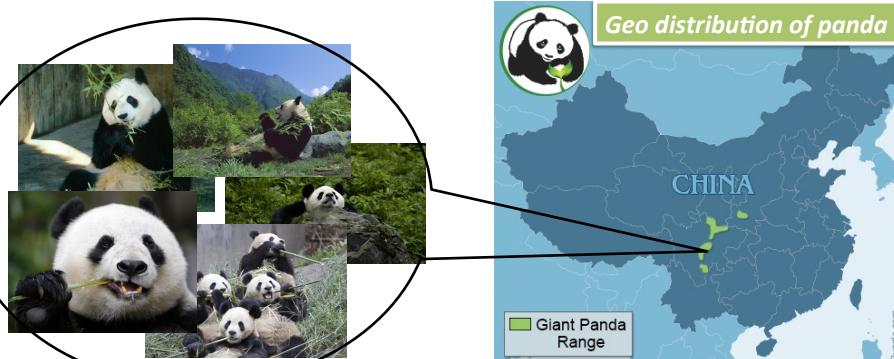
July 16, 2014

Images come with geo tags



Geo-aware image classification?

Knowing where an image was taken may help predict what objects and scenes are present in the image



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Towards geo-aware image classification

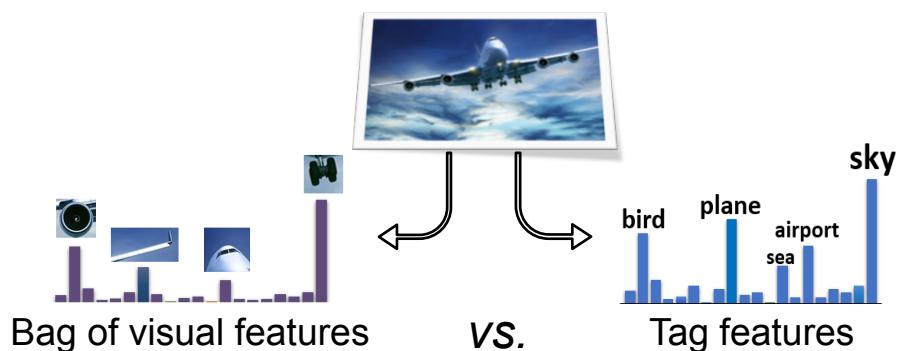
- Geo k -nn classifiers [[Moxley ICMR'08](#)]
- GIS decoding via GeoNames [[Joshi CIVR'08](#)]
- Visual, geo, and temporal k -nn [[Qian Neurocomp'13](#)]
- Batch-mode tagging with geo cues [[Cao TMM'09](#)]
- Fusion of geo and visual classifiers [[Li ICMR'12](#)]
- ...

How to encode geo information at a feature level
has not been well explored

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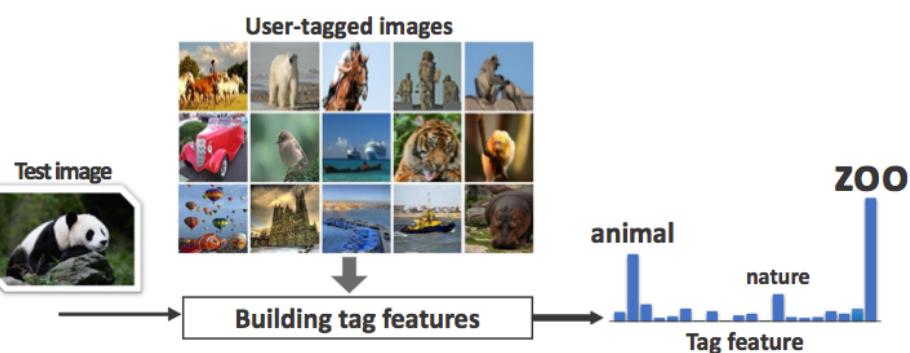
Tag features for image classification

To represent an image as a histogram of tags



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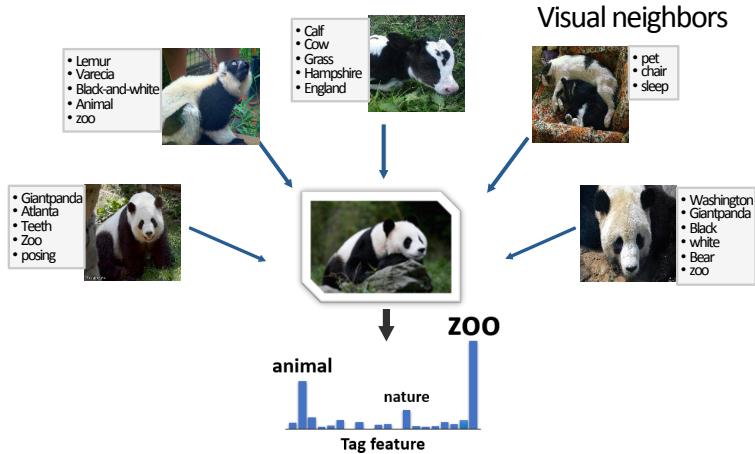
Building tag features by exploiting many socially tagged images



Wang CVPR'09

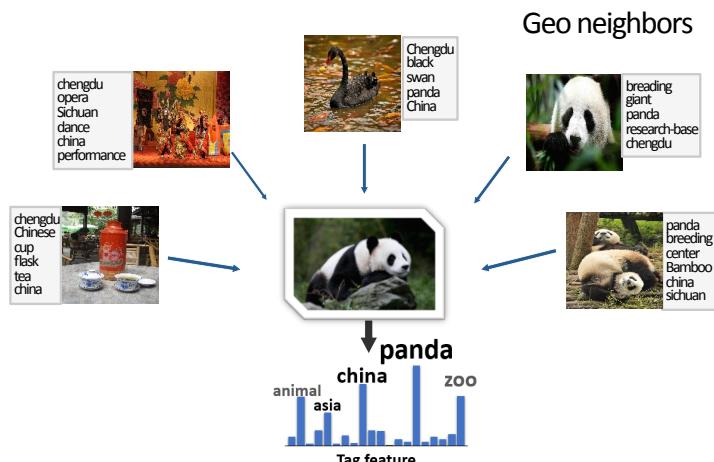
Building tag features by visual knn

How to make the tag feature geo-aware?



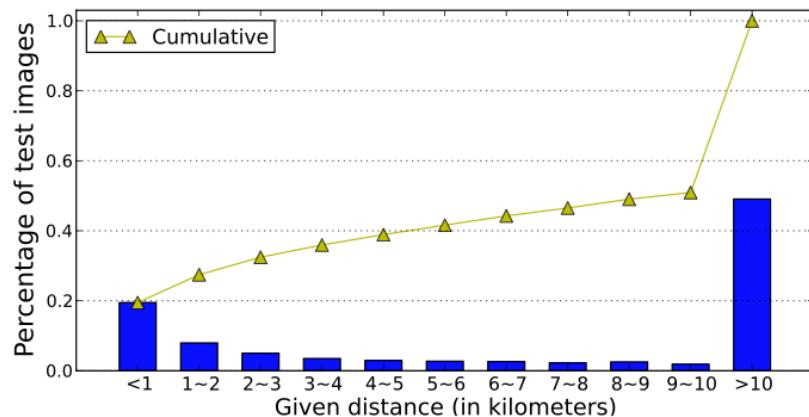
Tag propagation from geo neighbors?

Replace visual neighbors by geo neighbors

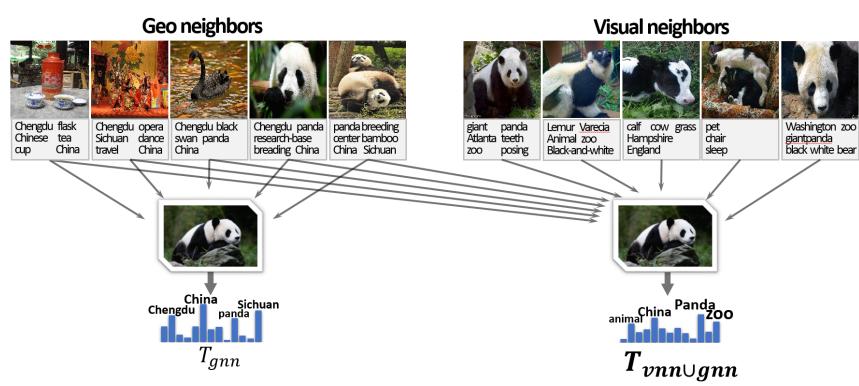


Geo neighborhood is sparse

For over 50% images, their 150 geo neighbors cannot be fully retrieved within a radius of 10 kilometers



Our proposal: Tag propagation from visual/geo neighbors



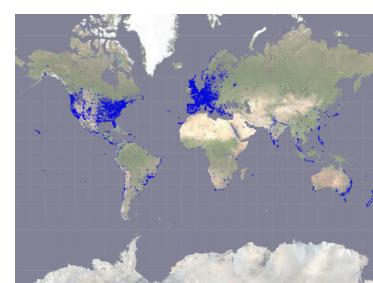
Questions to justify

- Are geo-aware tag features better?
 - when used alone
 - when used in combination with visual features

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Experimental setup

- Source set
 - One million geo-tagged images from Flickr
- Geo-tagged part of NUS-WIDE [[Chua CIVR'09](#)]
 - Training set: 41,173 images
 - Test set: 27,401 images



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Experimental setup

- Tag features
 - Vocabulary: 2000 top frequent tags in the source set
 - Number of visual/geo neighbors: 150
- Visual feature:
 - 1,204-d Bag of SIFT [[van de Sande TPAMI'10](#)]
- Classification models
 - Fast intersection kernel SVMs [[Maji CVPR'08](#)]
- Performance metric
 - Average Precision

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Results: Comparing different features

Feature	Method	mAP
T_{vnn}	Tag propagation from visual neighbors	0.159
T_{gnn}	Tag propagation from geo neighbors	0.138
$T_{vnn \cup gnn}$	Tag propagation from visual/geo neighbors	0.271

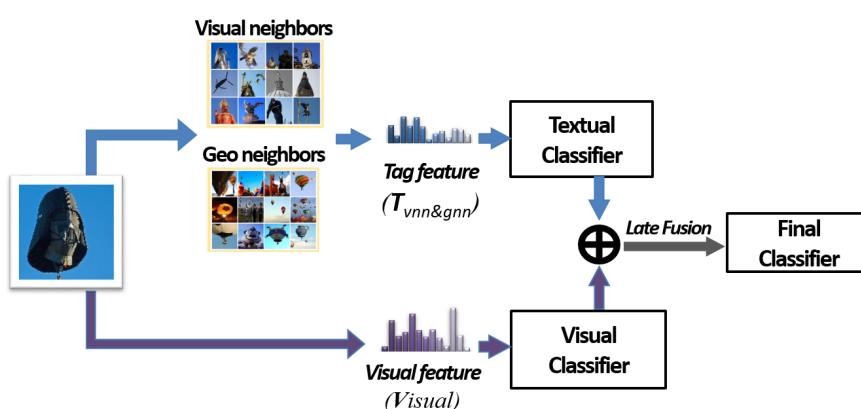
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Questions to justify

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Combining textual and visual classifiers



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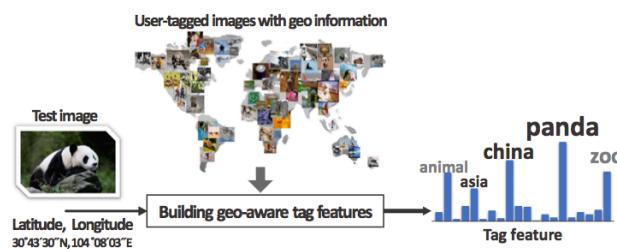
System-level comparison

System	mAP
<i>GeoVisualKNN</i> [Qian Neurocomp'13]	0.113
<i>Visual</i>	0.226
<i>Visual + geoknn</i> [Li ICMR'12]	0.251
<i>Visual + T_{vnn}</i> [Wang CVPR'08]	0.236
<i>Visual + T_{vnn} ∪ gnn</i> (this work)	0.325

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Conclusions

- Geo-aware tag features help image classification
- A simple method to build geo-aware tag features



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