

Anchor Concept Graph Distance for Web Image Re-ranking

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Background



Text-based image search is widely used when people access online images



flickr[™]

Direct results given by search engines are usually unsatisfactory

- Ambiguity in texts
- Gap between textual and visual contents

Methods

Learning anchor concepts

Anchor concepts: most visually-coherent query expansions

Algorithm 1 Concept Discovery through Query Expansion **Require:** Query q, image collection \mathcal{I}_q , surrounding texts \mathcal{T}_q . **Ensure:** Learned concept set $C_q = \{c_i\}_{i=1}^{M_q}$. 1: Initialization: $C_q := \emptyset$, $r_I(w) := 0$. V-coherent region 2: for all images $I_k \in \mathcal{I}_q$ do Find the top K visual neighbors, denote as $\mathcal{N}(I_k)$ Let $W_{I_k} = \{w_{I_k}^i\}_{i=1}^T$ be the T most frequent words in the surrounding texts of $\mathcal{N}(I_k)$. for all wordS $w_{I_k}^i \in W(I_k)$ do Update V-coherent scores



Image Re-ranking: refine the text-based results by visual information



Motivations

Graph-based methods are prevalent and effective



 $r_I(w_{I_k}^i) := r_I(w_{I_k}^i) + (T-i).$ for textual words end for

end for

9: Combine q and top M_q words with largest $r_I(w)$ to form \mathcal{C}_q .

Estimating Concept Correlations

- Anchor concepts are correlated to each other
- Estimated using Google Kernel^[3]

Cor("giant panda"," panda suv")

= GoogleExp("giant panda")•GoogleExp("panda suv")

Concept Projections

- Represent images using anchor concepts
- Encode each image using a M-dim probability vector
- Multi-class SVM is used to perform encoding

ACG Distance

Smooth (incorporating concept correlations) $p_1^* = \sum \alpha^n \bar{W}^n p_1 = (I - \alpha \bar{W})^{-1} p_1$

- Difference
- Image distance is a corner stone of graph-based methods
- Distances based on low-level visual features suffer from semantic gap
- Learn a **high-level** distance, **adaptive** to each query

Framework

Define a high-level distance based on Anchor Concept Graph



 $dist^{ACG} = \|(I - \alpha \bar{W})^{-1}(p_1 - p_2)\|_1$

Experiments

Dataset: MSRA-MM (68 queries) and INRIA (352 queries) $DCG_{p} = \sum_{i=1}^{p} \frac{2^{rel_{i}} - 1}{\log_{2}(i+1)}$ **Evaluation Metric: NDCG**





Reference

[1] W. Hsu, L. Kennedy, and S.-F. Chang. Video search reranking through random walk over document-level context graph. In ACM MM, 2007. [2] N. Morioka and J. Wang. Robust visual reranking via sparsity and ranking constraints. In ACM MM, 2011. [3] M. Sahami and T. D. Heilman. A web-based kernel function for measuring the similarity of short text snippets. In WWW, 2006.