

# Jingdong Wang

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## Education

Ph.D, Computer Science Hong Kong University of Science and Technology	2004.09-2007.08
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M.Eng, Automation Tsinghua University Excellent master degree thesis award	2001.09-2004.07
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B.Eng, Automation Tsinghua University Rank: 1/150	1997.09-2001.07
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## Research Interests

### Computer vision and multimedia search

Deep learning and CNN architecture design, person re-identification, large scale indexing, large scale image search, salient object detection, human understanding, image segmentation, image recognition.

### Machine learning and pattern recognition

Large scale machine learning, graph-based learning, probabilistic graphical modeling, kernel methods, spectral clustering.

## Work Experience

Ph.D Supervisor University of Science and Technology, China	2017.09-present
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Senior Researcher Microsoft Research Asia	2017.09-present
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Lead Researcher Microsoft Research Asia	2013.09-2017.08
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Researcher Microsoft Research Asia	2012.03-2013-08
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Associate Researcher Microsoft Research Asia	2007.09-2012.02
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Research and Teaching Assistants Hong Kong University of Science and Technology Advisor: Long Quan	2004.09-2007.08
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Research Intern	2005.07-2005.12
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Microsoft Research Asia  
Mentor: Heung-Yeung Shum

2003.09-2004.05

Research Assistant  
Tsinghua University  
Advisor: Changshui Zhang

2001.09-2004.07

## Professional Activities

### Area/track chairs/senior programme committee

*ACMMM 2018, AAAI 2018, ICPR 2018, ICCV 2017, CVPR 2017, ECCV 2016, ACMMM 2015, ICIP 2017, ICME 2015, ICME 2012*

### Organizers

*ICMR 2014, special session chair*

### Associate editors, editorial board members

*IEEE Transactions on Circuits and Systems for Video Technology (Jan., 2018 - )*

*IEEE Transactions on Multimedia (May, 2016 - )*

*Neurocomputing (April, 2015 - May, 2017)*

*Multimedia Tools and Applications (October, 2011 - )*

### Workshop co-chair

*Target Re-Identification and Multi-Target Multi-Camera Tracking (CVPR 2017)*

*The 1st International Workshop on Deep Learning for Pattern Recognition (DLPR2016), (ICPR 2016)*

*Big Media Data: Understanding, Search, and Mining (ICDM 2015)*

*Advances in LargeScale Multimedia Data Collection, Mining and Retrieval (ICME 2012)*

### Special issue guest editor

*Intelligent urban computing with big data (Machine Vision and Applications, 2017)*

*Big Media Data: Understanding, Search, and Mining (IEEE Transactions on Big Data, 2016)*

*Ad Hoc Web Multimedia Analysis with Limited Supervision (Multimedia Tools and Applications, 2015)*

### Symposium chair

*CVPR 2017 China Pre-Conference*

### Programme committee members or conference reviewers

*ICML (2018), ICLR (2018), CVPR (2009 - 2016, 2018), ICCV (2007/09/11/13/15), ECCV (2010/12/14), ACMMM (2009/12/13/14/17), NIPS (2014 - 2017) SIGIR (2011/13), SIGGRAPH Asia (2010), SIGKDD (2010), SIGCHI (2010), IJCAI (2011/13), ICMR (2011/12), ICME (2009/10/11), CIVR (2010), IJCNN (2007/09), ACCV (2007), ICPR (2006)*

### Journal reviewers

*TPAMI, IJCV, JMLR, TIP, TKDE, TCSVT, TMM, PR, TOIS, TOSN, TOMM, TIST, CVIU, MVA, IVC*

## Awards

Best paper award finalist	ACMMM	2015
Outstanding reviewer	CVPR	2014
Gold star	Microsoft	2009
Graduate Fellowship	HKUST	2004-2007
Excellent Master Degree Thesis Award	Tsinghua University	2004
Excellent Master Scholarship	Tsinghua University	2003
Title of Graduate with Honors (top 5%)	Tsinghua University	2001
Rockwell Scholarship	Tsinghua University	2000
Friend-Eastern Communications Scholarship	Tsinghua University	1999
Outstanding Student Scholarship	Tsinghua University	1998

## Publications (Google scholar citations: 8000+, h-index: 42)

The interns and supervisees are in bold.

### Book

- [1] Jingdong Wang. Graph Based Image Segmentation: A Modern Approach. *ISBN-10: 3639110749, ISBN-13: 978-3639110746*. VDM Verlag Dr. Muller Aktiengesellschaft & Co. KG. 2008.

### Book chapters

- [1] Jingdong Wang, **Jing Wang**, Gang Zeng, Rui Gan, Shipeng Li, and Baining Guo. Fast Neighborhood Graph Search using Cartesian Concatenation. *Multimedia Data Mining and Analytics: Disruptive Innovation*. Edited by Aaron K. Baughman, Jiang Gao, Jia-Yu Pan, and Valery Petrushin, 397-417, Springer, 2015.
- [2] Jingdong Wang, **Jing Wang**, Qifa Ke, Gang Zeng, and Shipeng Li. Fast Approximate K-Means via Cluster Closures. *Multimedia Data Mining and Analytics: Disruptive Innovation*. Edited by Aaron K. Baughman, Jiang Gao, Jia-Yu Pan, and Valery Petrushin, 373-395, Springer, 2015.
- [3] Jingdong Wang, **Yinghai Zhao**, and Xian-Sheng Hua. Image Search by Color Map. *Internet Multimedia Search and Mining*. Edited by Xian-Sheng Hua, Marcel Worring, and Tat-Seng Chua. Bentham Science Publishers, 2010.

### Technical reports

- [1] **Liming Zhao**, Jingdong Wang, Xi Li, Zhuowen Tu, and Wenjun Zeng. On the connection of deep fusion to ensembling. *CoRR*, abs/1611.07718, 2016.
- [2] Jingdong Wang, **Zhen Wei**, **Ting Zhang**, and Wenjun Zeng. Deeply-fused nets. *CoRR*, abs/1605.07716, 2016.

### Top referred journals: TPAMI (6), IJCV (7), TOG (3), TIP (5), TMM (5), TOMM (2), TKDE (1)

- [1] Jingdong Wang, **Ting Zhang**, **Jingkuan Song**, Nicu Sebe, and Heng Tao Shen. A survey on learning to hash. *IEEE Trans. Pattern Anal. Mach. Intell.*, Accepted, 2017.
- [2] Weiyao Lin, Yang Shen, Junchi Yan, Mingliang Xu, Jianxin Wu, Jingdong Wang, and Ke Lu. Learning Correspondence Structures for Person Re-identification. *IEEE Trans. Image Processing*, Accepted, 2017.
- [3] **Na Qi**, Yunhui Shi, Xiaoyan Sun, Jingdong Wang, Baocai Yin, and Junbin Gao. Multi-Dimensional Sparse Models. *IEEE Trans. Pattern Anal. Mach. Intell.*, Accepted, 2017.
- [4] **Dapeng Chen**, Zejian Yuan, Jingdong Wang, Gang Hua, and Nanning Zheng. Exemplar-Guided Similarity Learning on Polynomial Feature Map for Person Re-Identification. *International Journal of Computer Vision*, Accepted, 2016.
- [5] Jingdong Wang, **Huaizu Jiang**, Zejian Yuan, Ming-Ming Cheng, Xiaowei Hu, and Nanning Zheng. Salient Object Detection: A Discriminative Regional Feature Integration Approach. *International Journal of Computer Vision*, Accepted, 2016.
- [6] **Lingxi Xie**, Jingdong Wang, Weiyao Lin, Bo Zhang, and Qi Tian. Towards Reversal-Invariant Image Representation. *International Journal of Computer Vision*, Accepted, 2016.
- [7] **Dapeng Chen**, Zejian Yuan, Gang Hua, Jingdong Wang, and Nanning Zheng. Multi-timescale collaborative tracking. *IEEE Trans. Pattern Anal. Mach. Intell.*, 39(1):141–155, 2017.
- [8] **Liang Zheng**, Shengjin Wang, Jingdong Wang, and Qi Tian. Accurate image search with multi-scale contextual evidences. *International Journal of Computer Vision*, 120(1):1–13, 2016.

- [9] **Dingwen Zhang**, Junwei Han, Chao Li, Jingdong Wang, and Xuelong Li. Detection of co-salient objects by looking deep and wide. *International Journal of Computer Vision*, 120(2):215–232, 2016.
- [10] Xi Li, Xueyi Zhao, Zhongfei Zhang, Fei Wu, Yueting Zhuang, Jingdong Wang, and Xuelong Li. Joint multilabel classification with community-aware label graph learning. *IEEE Trans. Image Processing*, 25(1):484–493, 2016.
- [11] Weiyao Lin, **Yang Mi**, Weiyue Wang, Jianxin Wu, Jingdong Wang, and Tao Mei. A diffusion and clustering-based approach for finding coherent motions and understanding crowd scenes. *IEEE Trans. Image Processing*, 25(4):1674–1687, 2016.
- [12] Xi Li, Liming Zhao, Lina Wei, Ming-Hsuan Yang, Fei Wu, Yueting Zhuang, Haibin Ling, and Jingdong Wang. Deepsaliency: Multi-task deep neural network model for salient object detection. *IEEE Trans. Image Processing*, 25(8):3919–3930, 2016.
- [13] **Jingkuan Song**, Heng Tao Shen, Jianfeng Wang, Zi Huang, Nicu Sebe, and Jingdong Wang. A distance-computation-free search scheme for binary code databases. *IEEE Trans. Multimedia*, 18(3):484–495, 2016.
- [14] Jinhui Tang, **Xiangbo Shu**, Zechao Li, Guo-Jun Qi, and Jingdong Wang. Generalized deep transfer networks for knowledge propagation in heterogeneous domains. *TOMCCAP*, 12(4s):68:1–68:22, 2016.
- [15] **Jianfeng Wang**, Jingdong Wang, Jingkuan Song, Xin-Shun Xu, Heng Tao Shen, and Shipeng Li. Optimized cartesian k-means. *IEEE Trans. Knowl. Data Eng.*, 27(1):180–192, 2015.
- [16] **Lingxi Xie**, Jingdong Wang, Bo Zhang, and Qi Tian. Fine-grained image search. *IEEE Trans. Multimedia*, 17(5):636–647, 2015.
- [17] Jingdong Wang, **Naiyan Wang**, **You Jia**, Jian Li, Gang Zeng, Hongbin Zha, and Xian-Sheng Hua. Trinary-projection trees for approximate nearest neighbor search. *IEEE Trans. Pattern Anal. Mach. Intell.*, 36(2):388–403, 2014.
- [18] Jingdong Wang, **Huaizu Jiang**, **Yangqing Jia**, Xian-Sheng Hua, Changshui Zhang, and Long Quan. Regularized tree partitioning and its application to unsupervised image segmentation. *IEEE Trans. Image Processing*, 23(4):1909–1922, 2014.
- [19] Qinghua Huang, **Bisheng Chen**, Jingdong Wang, and Tao Mei. Personalized video recommendation through graph propagation. *TOMCCAP*, 10(4):32:1–32:17, 2014.
- [20] **Peng Wang**, Gang Zeng, Rui Gan, Jingdong Wang, and Hongbin Zha. Structure-sensitive superpixels via geodesic distance. *International Journal of Computer Vision*, 103(1):1–21, 2013.
- [21] Houqiang Li, **Yang Wang**, Tao Mei, Jingdong Wang, and Shipeng Li. Interactive multimodal visual search on mobile device. *IEEE Trans. Multimedia*, 15(3):594–607, 2013.
- [22] **Tianjia Shao**, Weiwei Xu, Kun Zhou, Jingdong Wang, Dongping Li, and Baining Guo. An interactive approach to semantic modeling of indoor scenes with an RGBD camera. *ACM Trans. Graph.*, 31(6):136:1–136:11, 2012.
- [23] Tie Liu, Zejian Yuan, Jian Sun, Jingdong Wang, Nanning Zheng, Xiaoou Tang, and Heung-Yeung Shum. Learning to detect a salient object. *IEEE Trans. Pattern Anal. Mach. Intell.*, 33(2):353–367, 2011.
- [24] **Xinmei Tian**, Linjun Yang, Jingdong Wang, Xiuqing Wu, and Xian-Sheng Hua. Bayesian visual reranking. *IEEE Trans. Multimedia*, 13(4):639–652, 2011.
- [25] Jingdong Wang, Fei Wang, Changshui Zhang, Helen C. Shen, and Long Quan. Linear neighborhood propagation and its applications. *IEEE Trans. Pattern Anal. Mach. Intell.*, 31(9):1600–1615, 2009.
- [26] Tie Liu, Jingdong Wang, Jian Sun, Nanning Zheng, Xiaoou Tang, and Heung-Yeung Shum. Picture collage. *IEEE Trans. Multimedia*, 11(7):1225–1239, 2009.

- [27] Long Quan, Jingdong Wang, Ping Tan, and Lu Yuan. Image-based modeling by joint segmentation. *International Journal of Computer Vision*, 75(1):135–150, 2007.
- [28] Ping Tan, Gang Zeng, Jingdong Wang, Sing Bing Kang, and Long Quan. Image-based tree modeling. *ACM Trans. Graph.*, 26(3):87, 2007.
- [29] Long Quan, Ping Tan, Gang Zeng, Lu Yuan, Jingdong Wang, and Sing Bing Kang. Image-based plant modeling. *ACM Trans. Graph.*, 25(3):599–604, 2006.

#### Referred journals

- [1] **Baoguang Shi**, Xiang Bai, Wenyu Liu, and Jingdong Wang. Face Alignment with Deep Regression. *IEEE Trans. Neural Netw. Learning Syst.*, Accepted, 2016.
- [2] **Lingxi Xie**, Jingdong Wang, Bo Zhang, and Qi Tian. Incorporating visual adjectives for image classification. *Neurocomputing*, 182:48–55, 2016.
- [3] **Min Tan**, Baoyuan Wang, Zhaohui Wu, Jingdong Wang, and Gang Pan. Weakly supervised metric learning for traffic sign recognition in a lidar-equipped vehicle. *IEEE Trans. Intelligent Transportation Systems*, 17(5):1415–1427, 2016.
- [4] Congyan Lang, Jiashi Feng, Songhe Feng, Jingdong Wang, and Shuicheng Yan. Dual low-rank pursuit: Learning salient features for saliency detection. *IEEE Trans. Neural Netw. Learning Syst.*, 27(6):1190–1200, 2016.
- [5] **Shiyang Lu**, Tao Mei, Jingdong Wang, Jian Zhang, Zhiyong Wang, and Shipeng Li. Exploratory product image search with circle-to-search interaction. *IEEE Trans. Circuits Syst. Video Techn.*, 25(7):1190–1202, 2015.
- [6] Weiwei Xu, Zhouxu Shi, Mingliang Xu, Kun Zhou, Jingdong Wang, Bin Zhou, Jinrong Wang, and Zhenming Yuan. Transductive 3d shape segmentation using sparse reconstruction. *Comput. Graph. Forum*, 33(5):107–115, 2014.
- [7] Jingdong Wang, **Jiazhen Zhou**, **Hao Xu**, Tao Mei, Xian-Sheng Hua, and Shipeng Li. Image tag refinement by regularized latent dirichlet allocation. *Computer Vision and Image Understanding*, 124:61–70, 2014.
- [8] **Shiyang Lu**, Tao Mei, Jingdong Wang, Jian Zhang, Zhiyong Wang, and Shipeng Li. Browse-to-search: Interactive exploratory search with visual entities. *ACM Trans. Inf. Syst.*, 32(4):18:1–18:27, 2014.
- [9] Jingdong Wang, **Zhe Zhao**, **Jiazhen Zhou**, Hao Wang, Bin Cui, and Guojun Qi. Recommending flickr groups with social topic model. *Inf. Retr.*, 15(3-4):278–295, 2012.
- [10] **Tianjia Shao**, Weiwei Xu, KangKang Yin, Jingdong Wang, Kun Zhou, and Baining Guo. Discriminative sketch-based 3d model retrieval via robust shape matching. *Comput. Graph. Forum*, 30(7):2011–2020, 2011.
- [11] Jingdong Wang, **Liyan Jia**, and Xian-Sheng Hua. Interactive browsing via diversified visual summarization for image search results. *Multimedia Syst.*, 17(5):379–391, 2011.
- [12] Jingdong Wang, **Yinghai Zhao**, Xiuqing Wu, and Xian-Sheng Hua. A transductive multi-label learning approach for video concept detection. *Pattern Recognition*, 44(10-11):2274–2286, 2011.
- [13] Jingdong Wang and Xian-Sheng Hua. Interactive image search by color map. *ACM TIST*, 3(1):12:1–12:23, 2011.
- [14] **Zheng-Jun Zha**, Tao Mei, Jingdong Wang, Zengfu Wang, and Xian-Sheng Hua. Graph-based semi-supervised learning with multiple labels. *J. Visual Communication and Image Representation*, 20(2):97–103, 2009.
- [15] Fei Wang, Jingdong Wang, Changshui Zhang, and James T. Kwok. Face recognition using spectral features. *Pattern Recognition*, 40(10):2786–2797, 2007.

- [16] Jianguo Lee, Jingdong Wang, Changshui Zhang, and Zhaoqi Bian. Visual object recognition using probabilistic kernel subspace similarity. *Pattern Recognition*, 38(7):997–1008, 2005.

Top refereed conferences: CVPR (20), ICCV (14), ECCV (4), ACMMM (11), ICML (3), SIGIR (3), KDD (1), IJCAI (1), AAAI (1)

- [1] **Guotian Xie**, Ting Zhang, Kuiyuan Yang, Jianhuang Lai, and Jingdong Wang. Coupled Convolutions for CNNs. In *the Thirty-Second AAAI Conference on Artificial Intelligence, AAAI 2018*.
- [2] **Ting Zhang**, Guo-Jun Qi, Bin Xiao, and Jingdong Wang. Interleaved Group Convolutions. In *2017 IEEE International Conference on Computer Vision, ICCV 2017*.
- [3] **Liming Zhao**, Xi Li, Yueting Zhuang, and Jingdong Wang. Deeply-Learned Part-Aligned Representations for Person Re-Identification. In *2017 IEEE International Conference on Computer Vision, ICCV 2017*.
- [4] **Ke Sun**, Cuiling Lan, Junliang Xing, Jingdong Wang, Wenjun Zeng, Dong Liu. Human Pose Estimation using Global and Local Normalization. In *2017 IEEE International Conference on Computer Vision, ICCV 2017*.
- [5] **Song Bai**, Zhichao Zhou, Jingdong Wang, Xiang Bai, Longin Jan Latecki, Qi Tian. Ensemble Diffusion for Retrieval. In *2017 IEEE International Conference on Computer Vision, ICCV 2017*.
- [6] **Lixin Liao**, Yao Zhao, Shikui Wei, and Jingdong Wang. Finding the Secret of CNN Parameter Layout under Strict Size Constraint. In *Proceedings of the 2017 ACM Conference on Multimedia Conference, MM 2017*.
- [7] Guo-Jun Qi, Jiliang Tang, Jingdong Wang, and Jiebo Luo. Mixture Factorized Ornstein-Uhlenbeck Processes for Time-Series Forecasting. In *KDD 2017*.
- [8] **Gangming Zhao**, Jingdong Wang, and Zhaoxiang Zhang. Random Shifting for CNN: a Solution to Reduce Information Loss in Down-Sampling Layers. In *Proceedings of the Twenty-Fourth International Joint Conference on Artificial Intelligence, IJCAI 2017, Melbourne, Australia, August 19-25, 2017*, pages 3476–3482, 2017.
- [9] **Lingxi Xie**, **Liang Zheng**, Jingdong Wang, Alan L. Yuille, and Qi Tian. Interactive: Inter-layer activeness propagation. In *2016 IEEE Conference on Computer Vision and Pattern Recognition, CVPR 2016, Las Vegas, NV, USA, June 27-30, 2016*, pages 270–279, 2016.
- [10] **Xiaojuan Wang**, **Ting Zhang**, Guo-Jun Qi, Jinhui Tang, and Jingdong Wang. Supervised quantization for similarity search. In *2016 IEEE Conference on Computer Vision and Pattern Recognition, CVPR 2016, Las Vegas, NV, USA, June 27-30, 2016*, pages 2018–2026, 2016.
- [11] **Ting Zhang** and Jingdong Wang. Collaborative quantization for cross-modal similarity search. In *2016 IEEE Conference on Computer Vision and Pattern Recognition, CVPR 2016, Las Vegas, NV, USA, June 27-30, 2016*, pages 2036–2045, 2016.
- [12] **Lingxi Xie**, Jingdong Wang, **Zhen Wei**, Meng Wang, and Qi Tian. Disturblabel: Regularizing CNN on the loss layer. In *2016 IEEE Conference on Computer Vision and Pattern Recognition, CVPR 2016, Las Vegas, NV, USA, June 27-30, 2016*, pages 4753–4762, 2016.
- [13] Lingxi Xie, Qi Tian, John Flynn, Jingdong Wang, and Alan L. Yuille. Geometric neural phrase pooling: Modeling the spatial co-occurrence of neurons. In *Computer Vision - ECCV 2016 - 14th European Conference, Amsterdam, The Netherlands, October 11-14, 2016, Proceedings, Part I*, pages 645–661, 2016.
- [14] **Liang Zheng**, Zhi Bie, Yifan Sun, Jingdong Wang, Chi Su, Shengjin Wang, and Qi Tian. MARS: A video benchmark for large-scale person re-identification. In *Computer Vision - ECCV 2016 - 14th European Conference, Amsterdam, The Netherlands, October 11-14, 2016, Proceedings, Part VI*, pages 868–884, 2016.

- [15] **Qi Dai**, Jianguo Li, Jingdong Wang, and Yu-Gang Jiang. Binary optimized hashing. In *Proceedings of the 2016 ACM Conference on Multimedia Conference, MM 2016, Amsterdam, The Netherlands, October 15-19, 2016*, pages 1247–1256, 2016.
- [16] Jian Liang, Zhihang Li, Dong Cao, Ran He, and Jingdong Wang. Self-paced cross-modal subspace matching. In *Proceedings of the 39th International ACM SIGIR conference on Research and Development in Information Retrieval, SIGIR 2016, Pisa, Italy, July 17-21, 2016*, pages 569–578, 2016.
- [17] **Dapeng Chen**, Zejian Yuan, Gang Hua, Nanning Zheng, and Jingdong Wang. Similarity learning on an explicit polynomial kernel feature map for person re-identification. In *IEEE Conference on Computer Vision and Pattern Recognition, CVPR 2015, Boston, MA, USA, June 7-12, 2015*, pages 1565–1573, 2015.
- [18] **Dingwen Zhang**, Junwei Han, Chao Li, and Jingdong Wang. Co-saliency detection via looking deep and wide. In *IEEE Conference on Computer Vision and Pattern Recognition, CVPR 2015, Boston, MA, USA, June 7-12, 2015*, pages 2994–3002, 2015.
- [19] **Ting Zhang**, Guo-Jun Qi, Jinhui Tang, and Jingdong Wang. Sparse composite quantization. In *IEEE Conference on Computer Vision and Pattern Recognition, CVPR 2015, Boston, MA, USA, June 7-12, 2015*, pages 4548–4556, 2015.
- [20] **Lingxi Xie**, Jingdong Wang, Weiyao Lin, Bo Zhang, and Qi Tian. RIDE: reversal invariant descriptor enhancement. In *2015 IEEE International Conference on Computer Vision, ICCV 2015, Santiago, Chile, December 7-13, 2015*, pages 100–108, 2015.
- [21] **Liang Zheng**, Liyue Shen, Lu Tian, Shengjin Wang, Jingdong Wang, and Qi Tian. Scalable person re-identification: A benchmark. In *2015 IEEE International Conference on Computer Vision, ICCV 2015, Santiago, Chile, December 7-13, 2015*, pages 1116–1124, 2015.
- [22] **Yang Shen**, Weiyao Lin, Junchi Yan, Mingliang Xu, Jianxin Wu, and Jingdong Wang. Person re-identification with correspondence structure learning. In *2015 IEEE International Conference on Computer Vision, ICCV 2015, Santiago, Chile, December 7-13, 2015*, pages 3200–3208, 2015.
- [23] **Botong Wu**, Qiang Yang, Wei-Shi Zheng, Yizhou Wang, and Jingdong Wang. Quantized correlation hashing for fast cross-modal search. In *Proceedings of the Twenty-Fourth International Joint Conference on Artificial Intelligence, IJCAI 2015, Buenos Aires, Argentina, July 25-31, 2015*, pages 3946–3952, 2015.
- [24] **Xiangbo Shu**, Guo-Jun Qi, Jinhui Tang, and Jingdong Wang. Weakly-shared deep transfer networks for heterogeneous-domain knowledge propagation. In *Proceedings of the 23rd Annual ACM Conference on Multimedia Conference, MM '15, Brisbane, Australia, October 26 - 30, 2015*, pages 35–44, 2015.
- [25] **Lingxi Xie**, Jingdong Wang, Baining Guo, Bo Zhang, and Qi Tian. Orientational pyramid matching for recognizing indoor scenes. In *2014 IEEE Conference on Computer Vision and Pattern Recognition, CVPR 2014, Columbus, OH, USA, June 23-28, 2014*, pages 3734–3741, 2014.
- [26] **Weiyue Wang**, Weiyao Lin, Yuanzhe Chen, Jianxin Wu, Jingdong Wang, and Bin Sheng. Finding coherent motions and semantic regions in crowd scenes: A diffusion and clustering approach. In *Computer Vision - ECCV 2014 - 13th European Conference, Zurich, Switzerland, September 6-12, 2014, Proceedings, Part I*, pages 756–771, 2014.
- [27] **Ting Zhang**, **Chao Du**, and Jingdong Wang. Composite quantization for approximate nearest neighbor search. In *Proceedings of the 31th International Conference on Machine Learning, ICML 2014, Beijing, China, 21-26 June 2014*, pages 838–846, 2014.
- [28] **Jianfeng Wang**, Heng Tao Shen, Shuicheng Yan, Nenghai Yu, Shipeng Li, and Jingdong Wang. Optimized distances for binary code ranking. In *Proceedings of the ACM International Conference on Multimedia, MM '14, Orlando, FL, USA, November 03 - 07, 2014*, pages 517–526, 2014.

- [29] **Huaizu Jiang**, Jingdong Wang, Zejian Yuan, Yang Wu, Nanning Zheng, and Shipeng Li. Salient object detection: A discriminative regional feature integration approach. In *2013 IEEE Conference on Computer Vision and Pattern Recognition, Portland, OR, USA, June 23-28, 2013*, pages 2083–2090, 2013.
- [30] **Peng Wang**, Jingdong Wang, Gang Zeng, Weiwei Xu, Hongbin Zha, and Shipeng Li. Supervised kernel descriptors for visual recognition. In *2013 IEEE Conference on Computer Vision and Pattern Recognition, Portland, OR, USA, June 23-28, 2013*, pages 2858–2865, 2013.
- [31] **Naiyan Wang**, Jingdong Wang, and Dit-Yan Yeung. Online robust non-negative dictionary learning for visual tracking. In *IEEE International Conference on Computer Vision, ICCV 2013, Sydney, Australia, December 1-8, 2013*, pages 657–664, 2013.
- [32] **Jing Wang**, Jingdong Wang, Gang Zeng, Rui Gan, Shipeng Li, and Baining Guo. Fast neighborhood graph search using cartesian concatenation. In *IEEE International Conference on Computer Vision, ICCV 2013, Sydney, Australia, December 1-8, 2013*, pages 2128–2135, 2013.
- [33] **Honghui Zhang**, Jingdong Wang, Ping Tan, Jinglu Wang, and Long Quan. Learning crfs for image parsing with adaptive subgradient descent. In *IEEE International Conference on Computer Vision, ICCV 2013, Sydney, Australia, December 1-8, 2013*, pages 3080–3087, 2013.
- [34] **Quannan Li**, Jingdong Wang, David P. Wipf, and Zhuowen Tu. Fixed-point model for structured labeling. In *Proceedings of the 30th International Conference on Machine Learning, ICML 2013, Atlanta, GA, USA, 16-21 June 2013*, pages 214–221, 2013.
- [35] **Jianfeng Wang**, Jingdong Wang, Nenghai Yu, and Shipeng Li. Order preserving hashing for approximate nearest neighbor search. In *ACM Multimedia Conference, MM '13, Barcelona, Spain, October 21-25, 2013*, pages 133–142, 2013.
- [36] Xian-Sheng Hua, Linjun Yang, Jingdong Wang, **Jing Wang**, Ming Ye, Kuansan Wang, Yong Rui, and Jin Li. Clickage: towards bridging semantic and intent gaps via mining click logs of search engines. In *ACM Multimedia Conference, MM '13, Barcelona, Spain, October 21-25, 2013*, pages 243–252, 2013.
- [37] **Jing Wang**, Jingdong Wang, Gang Zeng, Zhuowen Tu, Rui Gan, and Shipeng Li. Scalable k-nn graph construction for visual descriptors. In *2012 IEEE Conference on Computer Vision and Pattern Recognition, Providence, RI, USA, June 16-21, 2012*, pages 1106–1113, 2012.
- [38] **Junyang Lu, Jiazhen Zhou**, Jingdong Wang, Tao Mei, Xian-Sheng Hua, and Shipeng Li. Image search results refinement via outlier detection using deep contexts. In *2012 IEEE Conference on Computer Vision and Pattern Recognition, Providence, RI, USA, June 16-21, 2012*, pages 3029–3036, 2012.
- [39] **Jing Wang**, Jingdong Wang, Qifa Ke, Gang Zeng, and Shipeng Li. Fast approximate k-means via cluster closures. In *2012 IEEE Conference on Computer Vision and Pattern Recognition, Providence, RI, USA, June 16-21, 2012*, pages 3037–3044, 2012.
- [40] **Peng Wang**, Jingdong Wang, Gang Zeng, Jie Feng, Hongbin Zha, and Shipeng Li. Salient object detection for searched web images via global saliency. In *2012 IEEE Conference on Computer Vision and Pattern Recognition, Providence, RI, USA, June 16-21, 2012*, pages 3194–3201, 2012.
- [41] **Naiyan Wang, Tiansheng Yao**, Jingdong Wang, and Dit-Yan Yeung. A probabilistic approach to robust matrix factorization. In *Computer Vision - ECCV 2012 - 12th European Conference on Computer Vision, Florence, Italy, October 7-13, 2012, Proceedings, Part VII*, pages 126–139, 2012.
- [42] Jingdong Wang and Shipeng Li. Query-driven iterated neighborhood graph search for large scale indexing. In *Proceedings of the 20th ACM Multimedia Conference, MM '12, Nara, Japan, October 29 - November 02, 2012*, pages 179–188, 2012.



- [43] **Jianping Shi, Xiang Ren**, Guang Dai, Jingdong Wang, and Zhihua Zhang. A non-convex relaxation approach to sparse dictionary learning. In *The 24th IEEE Conference on Computer Vision and Pattern Recognition, CVPR 2011, Colorado Springs, CO, USA, 20-25 June 2011*, pages 1809–1816, 2011.
- [44] Gang Zeng, **Peng Wang**, Jingdong Wang, Rui Gan, and Hongbin Zha. Structure-sensitive superpixels via geodesic distance. In *IEEE International Conference on Computer Vision, ICCV 2011, Barcelona, Spain, November 6-13, 2011*, pages 447–454, 2011.
- [45] **Hao Xu**, Jingdong Wang, Zhu Li, Gang Zeng, Shipeng Li, and Nenghai Yu. Complementary hashing for approximate nearest neighbor search. In *IEEE International Conference on Computer Vision, ICCV 2011, Barcelona, Spain, November 6-13, 2011*, pages 1631–1638, 2011.
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## Patents

Computing visual and textual summaries for tagged image collections	US patent	9092673	1	2015/7/28
Intelligent image search results summarization and browsing	US patent	8774526	1	2014/7/8
Bayesian video search reranking	US patent	8180766	2	2012/5/15
Approximate K-means via cluster closures	US patent	9710493	1	2017/7/18
Transductive multi-label learning for video concept detection	US patent	8218859	1	2012/7/10
Contextual dominant color name extraction	US patent	8873845	1	2012/7/10
Interactive multi-modal image search	US patent	9411830	2	2016/8/9
Optimized KD-tree for scalable search	US patent	8645380	1	2014/2/4
Hybrid neighborhood graph search for scalable visual indexing	US patent	8370363	1	2013/2/5
Reranking using confident image samples	US patent	9384241	1	2016/7/5
Salient object segmentation	US patent	9042648	1	2015/5/26
Document-related representative information	US patent	8712991	1	2014/4/29
Interactively ranking image search results using color layout relevance	US patent	8369656	1	2013/2/5
Concept-structured image search	US patent	8706740	2	2014/4/22
Image searching by approximate K-NN graph	US patent	8705870	1	2014/4/22

## Product Transfer

Neighborhood graph search	Shipped to Bing index, 2017
Fast human detection	Shipped to XiaoIce, 2017

How-Old Fasion	Shipped to XiaoIce, 2016
How-Old 2.0	Shipped to XiaoIce, 2015
Celebrity for chat	Shipped to XiaoIce, 2015, 2017
Similar image search for image chat	Shipped to XiaoIce, 2015
Similar video search for video chat	Shipped to XiaoIce, 2015
Similarity search	Shipped to Ads Selection, 2015
XiaoIce book recognition	Shipped to Weibo in XiaoIce, 2014
Nearest neighbor search	Shipped to Microsoft Bing image search in 2014.
Image match	Shipped to Microsoft Bing image search in 2014.
Visual attribute enhanced image relevance ranker	Shipped to Microsoft Bing image search in 2012. Cognitive service. 2015
Dominant color filter	Shipped to Microsoft Bing image search, 2012
Image search by color map	Shipped to Microsoft Bing image search, 2010

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Xuan Huang	USTC (07-08)	
Jianxiong Xiao	HKUST	
Fei Wang	Tsinghua University (05-06)	IBM T. J. Watson Research Lab
Yangqing Jia	Tsinghua University (07)	University of California, Berkeley
Dan Zhang	Tsinghua University (07, 10)	Purdue University
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## Research highlights

My research interests include image search, Hashing and quantization for similarity search, indexing structures for similarity search, saliency analysis, person re-identification, pose estimation, tracking, video object detection, and CNN architecture design for mobile applications.

**Deep learning and CNN architecture design.** My research on deep learning contains two aspects. In the work, Weakly-Shared Deep Transfer Networks for Heterogeneous-Domain Knowledge Propagation, we built a multi-modality deep neural network for cross-domain knowledge propagation. It was selected into the *Best Paper Award finalist* in ACM Multimedia 2015. On the other hand, I have been working

on convolutional neural network architecture design for mobile devices in order to achieve a better balance between accuracy, efficiency and model size. My work, "*interleaved group convolutions*" published in ICCV 2017, presents a novel architecture, using structured sparse kernel matrices to compose a dense kernel matrix. Its counterpart algorithm in network compression is sparse matrix decomposition, which, I believe, is a novel promising direction. In addition, sparse matrix decomposition is a challenging problem for researchers in matrix analysis and rarely studied while low-rank decomposition, also applied to network compression, is widely studied in matrix analysis.

**Person re-identification.** Person re-identification is a problem of matching person captured from different cameras, and is a fundamental and hot problem in video surveillance. My contributions lie in two aspects. The first is that we build a large image dataset, *Market-1501*, which is now the standard dataset for evaluation. The second is that we design many algorithms. We handle the key challenge: part-misalignment, and learn *part-aligned representations*, only from person matching annotations without extra part annotation. This approach achieves state-of-the-art performance, and the matching process is efficient and benefits from approximate-nearest neighbor algorithms for searching over a large database as the simple distance measure, Euclidean distance, is adopted. This work is published in ICCV 2017.

**Hashing and quantization.** I have published about 10 papers in CVPR, ICML, and ACM Multimedia. I have published a survey paper *A Survey on Learning to Hash* in TPAMI, which is the first comprehensive survey paper and is a must-read paper for researchers in this area. Many researchers start the research by first reading my paper. My work, *Composite quantization* for approximate nearest neighbor search is the state-of-the-art and contributes to the hashing area by firstly presenting the theory on how and why quantization can be used to accelerate the search with small code sizes and high accuracy. In this work, I present a generalized triangle inequality, explaining how composite quantization algorithms balance search accuracy and search efficiency. Many researchers follow and extend the composition quantization algorithm.

**Indexing structures for similarity search.** My study started from an extension of kd-trees to trinary-projection trees, was published in CVPR 2010 and later TPAMI. Our later-proposed *neighborhood graph search* algorithm, and the neighborhood graph building algorithm was published in ACMMM 2012 and ICCV 2013. Up to now, this neighborhood graph search algorithm is probably still the best algorithm in research. Inside Microsoft, the evaluation by the product teams shows that my algorithm exceeds other algorithms, including the optimized version of the well-known FLANN algorithm. Thus, this algorithm has been selected to the first choice for large scale similarity search in Microsoft products, and has been applied to many products, including ads recommendation, similar image search, XiaoIce chatbot. In particular, the combination of this neighborhood graph search algorithm and the quantization algorithm have been adopted to design the indexing platform, which is the first investigation in industry to the best knowledge.

**Saliency analysis.** I have published several papers in TPAMI, IJCV, CVPR, and ICCV. My work, *learning to detect a salient object*, published in TPAMI, is regarded as one of the landmark works pushing the second wave of interest in attention analysis. Another work, *Salient Object Detection: A Discriminative Regional Feature Integration Approach*, was published in IJCV and CVPR 2013, was regarded as an inspiring work: Shifting the unsupervised solution, the dominant solution before my work, to the supervised solution. A lot of subsequent works followed my supervised framework and adopted deep learning as the supervised algorithm. In particular, my work on salient object detection is transferred to Bing image search and used in color filter, where the dominant color is extracted on the dominant object in an image identified by my salient object detection algorithm. This color filter feature is the second most frequently-used filter among all filters in Bing image search.

**Image search.** I have published several papers in CVPR and ACM Multimedia. I have developed the *first commercial color-sketch image search system*, which was shipped to Bing image search. I have a paper about the work Interactive Image Search by Color Map published in ACM TIST. I have extensively studied the problem of image search reranking, and published papers in ACM Multimedia and CVPR. Together with image quality features, my image search reranking technology was shipped to Bing image search for boosting relevance ranking. This improved Bing image search quality dramatically, making Bing image search firstly on par with Google image search.