# Risheng Liu

*Curriculum Vitae*

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> *"Entities should not be multiplied unnecessarily."*
> *— Ockham's Razor*

## Experiences

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| 2016.01–Now | **Hongkong Scholar**, *Department of Computing*, Hongkong Polytechnical University (PolyU), Hong Kong. |
| 2015.12–Now | **Associate Professor**, *School of Software Technology*, Dalian University of Technology (DUT), P.R.China. |
| 2014.10–2015.11 | **Assistant Professor**, *School of Software Technology*, Dalian University of Technology (DUT), P.R.China. |
| 2013.09–2014.01 | **Guest Researcher**, *Institute of Computing Technology (ICT)*, Chinese Academy of Sciences (CAS), P.R.China.<br>Host: Prof. Shiguang Shan |
| 2012.11–2014.09 | **Assistant Professor**, *Faculty of Electronic Information and Electrical Engineering*, Dalian University of Technology (DUT), P.R.China. |

## Educations

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| 2010.9–2012.3 | **Joint Ph.D. in Computer Science**, *Robotics Institute*, Carnegie Mellon University, USA.<br>Advisor: Dr. Fernando De la Torre (CMU). |
| 2007.09–2012.09 | **Ph.D. in Computational Mathematics**, *School of Mathematical Sciences*, Dalian University of Technology, P.R.China.<br>Advisor: Prof. Zhixun Su (DUT) and Prof. Zhouchen Lin (PKU). |
| 2003.09–2007.06 | **B.S. in Pure Mathematics**, *School of Mathematical Sciences*, Dalian University of Technology, P.R.China. |

## Professional Services

### Conference Services

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| 2014 | ICM 2014 Satellite Conference on Data Science, Organization Committee. |
| 2013 | CSIAM Geometric Design & Computing 2013, Organization Committee. |

### Journal Reviews

IJCV, IEEE Trans. on Pattern Analysis and Machine Intelligence, IEEE Trans. on Knowledge and Data Engineering, PLOS ONE, IEEE Trans. on Circuits and Systems for Video Technology, IEEE Trans. on Image Processing, IEEE Trans. on Neural Networks and Learning System, IEEE Trans. on Systems, Man, and Cybernetics (Part B), Neural Networks, IEEE Trans. on Parallel and Distributed Systems, Neurocomputing, Computational Statistics and Data Analysis, Neural Processing Letters, IET Image Processing, etc.

Conference Reviews

ICCV, CVPR, ECCV, NIPS, IJCAI

## Grants

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| 2014.1-2016.12 | National Natural Science Foundation of China (No. 61300086). |
| 2012.12-2014.12 | China Postdoctoral Science Foundation (No. 2014T70249). |
| 2012.12-2014.12 | China Postdoctoral Science Foundation (No. 2013M530917). |
| 2014.1-2015.12 | Open Project Program of the State Key Lab of CAD&CG, Zhejiang University (No. A1404). |
| 2013.6-2015.6 | Open Foundation of State Key Laboratory for Novel Software Technology, Nanjing University (No. KFKT2013B13). |

## Honors

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| 2015.7 | Best Student Paper Award from ICME 2015 |
| 2014.7 | Best Student Paper Award from ICME 2014 |
| 2011.12 | Distinguished Ph.D. Graduate Award of DUT (the Class of 2012). |
| 2011.11 | City-Level Tri-A Student Award of Dalian (Top 2%). |
| 2011.10 | Distinguished Ph.D. Student Award of DUT. |
| 2010.5 | China Scholarship Council (CSC) Scholarship. |
| 2009.12 | Distinguished Graduate Student Award of DUT. |
| 2008.10 | Third Class Award of National Technological Business Plan Competition. |
| 2007.12 | Winning Award of Dalian Robot Soccer Cup 3rd. |

## Research Sketch

My core research interests are deep learning, sparse and low-rank modeling, Bayesian statistics, convex and submodular optimization and their applications in machine learning, pattern recognition and computer vision.

High-dimensional Sparse Optimization for Machine Learning and Computer Vision

2010.4-Now   In recent years, the research for more scalable algorithms for high-dimensional sparse optimization problems has prompted a return to first-order methods. One striking example of this is the current popularity of iterative thresholding algorithms for $l_1$ norm minimization problems arising in compressed sensing. Similar iterative thresholding techniques can be applied to the problem of recovering a low-rank matrix from an inncomplete (but clean) subset of its entries. Our goal of this project is to push more applications of sparse optimization and solve the related optimization problems that we encounter.

#### Learning PDEs via Optimal Control for Computer Vision and Image Processing

2009.8-Now    Most traditional partial differential equations (PDEs) methods in computer vision can be attributed to better designing the form of PDEs and the deployment of them in relevant applications. However, designing PDEs requires high mathematical skills and good insight to the problems. Moreover, the preselected design-based PDEs may not be able to handle complex situations in real vision applications. In this project, borrowing the "*learning strategy*" from machine learning, we propose a general framework for learning PDEs from real data via optimal control to accomplish specific vision tasks (e.g., image processing and image understanding). To our best known, this is the first work introducing "learning strategy" to PDEs-based image processing and computer vision.

#### Geometry-driven Feature Extraction and Its Applications

2008.12-2009.6    In this project, we introduce advanced geometric concepts, e.g., semi-Riemannian geometry and vector bundle, to help unify the existing methods and also propose more effective feature extraction algorithms.

## Publications

### *2016*

[46]. **Risheng Liu\***, Guangyu Zhong, Junjie Cao, Zhouchen Lin, Shiguang Shan, and Zhongxuan Luo. Learning to Diffuse: A New Perspective to Design PDEs for Visual Analysis. *IEEE Trans. on Pattern Analysis and Machine Intelligence (IF=5.728, SCI)*

[45]. Kewei Tang, David B. Dunson, Zhixun Su, **Risheng Liu**, Jie Zhang and Jiangxin Dong. Subspace Segmentation by Dense Block and Sparse Representation. *Neural Networks, 2016 (IF=1.927, SCI).*

[44]. **Risheng Liu** and Zhixun Su. Advanced Manifold Learning: Feature Extraction via Vector Bundle Learning. *Mathematical Problems in Data Science, Springer, 2016 (Book Chapter)*

[43]. Yiyang Wang, **Risheng Liu\***, Xiaoliang Song and Zhixun Su. Linearized Alternating Direction Method with Penalization for Nonconvex and Nonsmooth Optimization. In *AAAI 2016*.

### *2015*

[42]. **Risheng Liu\***, Guangyu Zhong, Junjie Cao and Zhixun Su. Diffuse Visual Attention for Saliency Detection. *Journal of Electronic Imaging. (IF=0.85, SCI).*

[41]. **Risheng Liu\***, Shanshan Bai, Zhisun Su, Changcheng Zhang and Chunhai Sun. Robust Visual Tracking via L0 Regularized Local Low-Rank Feature Learning. *Journal of Electronic Imaging. (IF=0.85, SCI).*

[40]. Guangyu Zhong, **Risheng Liu**, Junjie Cao and Zhixun Su. A Generalized Nonlocal Mean Framework with Object-Level Cues for Saliency Detection. *Visual Computer 2015 (IF=1.073, SCI).*

[39]. Yuntao Li, Xin Fan, **Risheng Liu**, Yuyao Feng, Zhongxuan Luo and Zezhou Li. Characteristic Number Regression for Facial Feature Extraction. In *ICME 2015*, (Oral, Best Student Paper Award).

[38]. Guangyu Zhong, **Risheng Liu\***, and Zhixun Su. Robust Visual Tracking via Discriminative Sequential Ranking. In *ICIP 2015*.

[37]. Jing Wang, Yiyang Wang, **Risheng Liu\*** and Zhixun Su. Visual Tracking via Orthogonal Sparse Coding. In *ICIP 2015*.

[36]. Di Wang, **Risheng Liu\***, and Zhixun Su. Robust Visual Tracking via Guided Low-Rank Subspace Learning. In *ICIP 2015*.

[35]. Difei Gao, Lili Pan, **Risheng Liu**, Rui Chen, and Mei Xie. Correlated Warped Gaussian Processes for Gender-Specific Age Estimation. In *ICIP 2015*.

[34]. Meng Pang, Chuang Lin, **Risheng Liu**, Xin Fan and Jifeng Jiang. Sparse Concept Discriminant Matrix Factorization for Image Representation. In *ICIP 2015*, (Oral, <span style="color:red">Top 10% paper</span>).

[33]. Binghui Wang, **Risheng Liu**, Chuang Lin, Xin Fan. Matrix Factorization with Column L0-Norm Constraint for Robust Mult-subspace Analysis. In *ICDM(W) 2015*

### 2014

[32]. Xiuping Liu, Shuhua Li, **Risheng Liu**, Jun Wang, Hui Wang, and Junjie Cao. Properly-constrained Orthonormal Functional Maps for Intrinsic Symmetries. *Computers & Graphics, (SMI 2014) (IF=1.029, SCI)*.

[31]. Xiuping Liu. Jie Zhang, **Risheng Liu**, Bo Li, Jun Wang, and Junjie Cao. Low-Rank 3D Mesh Segmentation and Labeling with Structure Guiding. *Computers & Graphics, (SMI 2014) (IF=1.029, SCI)*.

[30]. Yiyang Wang, **Risheng Liu**, Xiaoliang Song, and Zhixun Su. Saliency detection via nonlocal L0 minimization. In *ACCV*, 2014. (Oral, acceptance reate < 4%).

[29]. **Risheng Liu\***, Zhixun Su, Wei Jin and Changcheng Zhang. Latent subspace projection pursuit with online optimization for robust visual tracking. *IEEE MultiMedia, (IF = 1.767, SCI)*.

[28]. Zhouchen Lin, **Risheng Liu\***, and Huan Li. Linearized alternating direction method with parallel splitting and adaptive penalty for separable convex programs in machine learning. *Machine Learning Journal, (IF=1.454, SCI)*.

[27]. **Risheng Liu\***, Zhouchen Lin, and Zhixun Su. Learning markov random walks for robust subspace clustering and estimation. *Neural Networks, (IF=1.927, SCI)*..

[26]. Yuxia Song, Junjie Cao, **Risheng Liu**, Guangyu Zhong, and Zhixun Su. Saliency detection via ranking with reconstruction error. *Journal of Information and Computational Science (EI)*.

[25]. **Risheng Liu**, Junjie Cao, Zhouchen Lin and Shiguang Shan. Adaptive Partial Differential Equation Learning for Visual Saliency Detection In *CVPR*, 2014. (<span style="color:red">Oral, acceptance rate: 5.75%, 104 papers accepted out of 1,807 submissions</span>).

[24]. Kewei Tang, **Risheng Liu**, Zhixun Su, and Jie Zhang. Structure Constrained Low-rank Representation. *IEEE Trans. on Neural Networks and Learning System (IF=3.766, SCI)*.

[23]. **Risheng Liu\***, Maoran Bian, Zhixun Su, Jinshan Pan, and Bo Li. Saliency Detection Using Prior Guided Multi-view Low-rank Modeling. *Journal of Information and Computational Science (EI)*.

[22]. **Risheng Liu**, Zhouchen Lin, Zhixun Su and Junbin Gao. Linear Time Principal Component Pursuit and Its Extensions Using $\ell_1$ Filtering. *Neurocomputing (IF=1.634, SCI)*. (arXiv:1108.5359).

[21]. Jinshan Pan, **Risheng Liu**, Zhixun Su, and Guili Liu. Motion blur kernel estimation via salient edges and low rank prior. In *ICME*, 2014. (Oral).

[20]. Wei Jin, **Risheng Liu\***, Zhixun Su, Changcheng Zhang and Shanshan Bai. Robust Visual Tracking Using Latent Subspace Projection Pursuit. In *ICME*, 2014. (Oral, <span style="color:red">Best Student Paper Award</span>).

[19]. Shanshan Bai, **Risheng Liu\***, Zhixun Su, Changcheng Zhang and Wei Jin. Incremental Robust Local Dictionary Learning for Visual Tracking. In *ICME*, 2014.

### 2013

[18]. **Risheng Liu**, Zhouchen Lin, and Zhixun Su. Linearized Alternating Direction Method with Parallel Splitting and Adaptive Penalty for separable convex programs in machine learning.

*Journal of Machine Learning Research*, 29, 2013. (In *ACML*, long oral presentation, accepted rate: 12%).

[17]. Yue Deng, Qionghai Dai, **Risheng Liu**, Zengke Zhang, and Sanqing Hu. Low-rank Structure Learning via Non-convex Heuristic Recovery. *IEEE Trans. on Neural Networks and Learning System*, 24(3):383–396, 2013. (IEEE Computational Intelligence Magazine <span style="color:red">Publication Spotlight</span>)

[16]. **Risheng Liu**, Zhouchen Lin, Wei Zhang, Kewei Tang, and Zhixun Su. Toward Designing Intelligent PDEs for Computer Vision: An Optimal Control Approach. *Image and Vision Computing*, 31(1):43–56, 2013.

[15]. Changcheng Zhang, **Risheng Liu***, Tianshuang Qiu, and Zhixun Su. Robust Visual Tracking via Incremental Low-rank Features Learning. *Neurocomputing*, 119(7):125–130, 2013.

[14]. Jinshan Pan, **Risheng Liu**, Zhixun Su, and Xianfeng Gu. Kernel Estimation from Salient Structure for Robust Motion Deblurring. *Signal Processing: Image Communication*, 28(9):1156–1170, 2013.

[13]. Lili Pan, **Risheng Liu**, and Mei Xie. Mixture of Related Regressions for Head Pose Estimation. In *ICIP*, 2013.

[12]. Jinshan Pan, Zhixun Su, Maoran Bian, and **Risheng Liu**. Saliency Detection Based on an Edge-preserving Filter. In *ICIP*, 2013.

[11]. Kewei Tang, **Risheng Liu**, and Zhixun Su. Dimensionality Reduction via Low Rank Regression. In *CSIAM Geometric Design & Computing*, 2013. (<span style="color:red">Best Student Paper Award</span>).

### *2012*

[10]. **Risheng Liu**, Zhouchen Lin, Fernando De la Torre, and Zhixun Su. Fixed-rank Representation for Unsupervised Visual Learning. In *CVPR*, 2012.

[9]. Lijun Wang, **Risheng Liu**, and Zhixun Su. Robust Visual Tracking via Incremental Lorentzian Discriminant Projection. *Journal of Information and Computational Science*, 9(1):1–8, 2012.

### *2011*

[8]. Zhouchen Lin, **Risheng Liu**, and Zhixun Su. Linearized Alternating Direction Method with Adaptive Penalty for Low-rank Representation. In *NIPS*, 2011.

[7]. Hao Ji, **Risheng Liu**, Fei Su, Zhixun Su, and Yan Tian. Convex Regularized Sparse Regression for Head Pose Estimation. In *ICIP*, 2011.

[6]. **Risheng Liu**, Ruru Hao, and Zhixun Su. Mixture of Manifolds Clustering via Low Rank Embedding. *Journal of Information and Computational Science*, 8(5):725–737, 2011.

[5]. Kewei Tang, Chao Yu, **Risheng Liu**, and Zhixun Su. A Semi-supervised Dimensionality Reduction Framework for Face Recognition Based on Sparse Lorentzian Metric Tensors. *Journal of Information and Computational Science*, 8(4):601–608, 2011.

[4]. Kewei Tang, **Risheng Liu**, Hui Du, and Zhixun Su. A New Method for Dimensionality Reduction Based on Tensor and Lorentzian Geometry. *Acta Automatica Sinica*, 37(9):1151–1156, 2011. (in Chinese).

### *2010*

[3]. **Risheng Liu**, Zhouchen Lin, Zhixun Su, and Kewei Tang. Feature Extraction by Learning Lorentzian Metric Tensor and Its Extensions. *Pattern Recognition*, 43(10):3298–3306, 2010.

[2]. **Risheng Liu**, Zhouchen Lin, Wei Zhang, and Zhixun Su. Learning PDEs for Image Restoration via Optimal Control. In *ECCV*, 2010.

### *2009*

[1]. **Risheng Liu**, Zhixun Su, Zhouchen Lin, and Xiaoyu Hou. Lorentzian Discriminant Projection and Its Applications. In *ACCV*, 2009.