Dahua Lin

6045 S. Kenwood Ave. • Chicago, IL 60615 • Phone: 617-895-9169 • E-Mail: dhlin@ttic.edu

Personal Website: http://dahua.me

Professional Summary

- Nine years' research experience on machine learning, computer vision, and pattern recognition.
- Outstanding record of academic publication, with over 30 papers published on top conferences and journals, including one that received the best student paper award of NIPS 2010.
- Creativity, passionate commitment, and strong skills in engineering, which are demonstrated not only in academic research, but also in a series of industry-level projects.

Research Interests

- Modeling and analysis of large-scale and dynamically changing data.
- Non-parametric Bayesian models and their applications in Big Data.
- Probabilistic models for computer vision (e.g. motion analysis and scene understanding)

Education

Massachusetts Institute of Technology (MIT) Sep, 2007 - present

Ph.D. Candidate in Computer Science (Advisors: John Fisher and Eric Grimson). I also worked with Alan Willsky, who serves in my thesis committee.

The Chinese University of Hong Kong (CUHK) Aug, 2004 – Jul, 2006

M.Phil. in Information Engineering (Advisor: Xiaoou Tang)

The University of Science and Technology of China (USTC) Sep, 2000 – Jul, 2004

B.Eng. in Information Science and Electronic Engineering

Hong Kong University of Science and Technology (HKUST) Feb, 2003 – Jul, 2003

Exchange student for one semester

Professional Experience

Toyota Technological Institute at Chicago Sep, 2010 – Present

Research Assistant Professor

Microsoft Research Silicon Valley Jun, 2010 – Aug, 2010

Intern Researcher (Mentor: Simon Baker)

Microsoft Research Redmond Jun, 2009 – Aug, 2009

Intern Researcher (Mentor: Simon Baker)

Microsoft Research Asia Feb, 2004 – Jul, 2004

Visiting Student (Mentor: Yingqing Xu)

Awards

- Outstanding reviewer award of ICCV 2011 Year 2011
- **Best student paper award of NIPS 2010** Year 2010
- Outstanding reviewer award of ICCV 2009 Year 2009
- Best master thesis award of engineering school of CUHK Year 2006
- University-wide outstanding bachelor thesis award of USTC Year 2004
- Samsung scholarship (awarded to the student ranked No. 1) Year 2003
- First prize outstanding scholarship Year 2002
- Zhang Zhongzhi scholarship Year 2001
- No.1 in Guangdong province in National Physics Olympiads Year 1999

Professional Skills

- Plenty of experience working with all major operating systems: Microsoft Windows, Linux, and Mac OS X.
- Programming proficiency
  - Strong ability and extensive experience in C/C++, MATLAB, and Python
  - Experience of using C# and Java in real world project development
  - Experience of parallel computing: OpenMP and CUDA
- Strong skills and rich experience in academic writing and presentation

Research Projects

Bayesian Nonparametric Analysis of Big Data (TTIC) 2013 - present

- Goal: scalable inference methods to estimate Bayesian nonparametric models over Big data.
- I developed a novel algorithm to learn Bayesian nonparametric mixture models based on sequential variational approximation, which can reliably estimate a DP mixture model in a single pass with limited memory footprint, making it particularly suited for applications with massive data.
- I am working on developing parallelized algorithms that can be implemented on GPU and other massive parallel computing architecture.

3D Scene Understanding (TTIC) 2013 - present

- Goal: parsing 3D visual scenes based on RGBD videos.
- I developed an MRF model that integrates cuboid detection and 3D object recognition. The model effectively combines appearance, geometric properties, spatial and semantic relations between objects, and other visual cues to provide a holistic interpretation of 3D scenes constructed based on large-scale RGBD datasets.

Probabilistic Modeling of Dynamic Visual Scenes (MIT) 2008 - 2012

- Ph.D. thesis research topic.
- Goal: a unified framework to jointly model appearance, motion, and layer structure of a dynamic visual scene.
- I developed a framework that coherently integrates three new models: (1) a generative image model for appearance modeling that incorporates a probabilistic manifold to express local texture patterns with a family of conditional MRFs for coherent image generation, (2) a geometric flow model for describing persistent motion patterns over space and time, and (3) a dynamic video layer model with a dynamic graph to capture partial depth orders between layers to support consistent occlusion reasoning. The framework can express real world complexities while maintaining good generalization performance and tractable computational cost.

Dependent Nonparametric Bayesian Model (MIT) 2010 - 2012

- Goal: a dynamic nonparametric mixture model that allows both the number of component models and their parameters can evolve over time.
- I developed a new construction of dependent Dirichlet processes (DDP) based on the inherent connections between Dirichlet and Poisson processes, as well as the concept of complete. I also derived a Markov chain of DPs that inherently supports dynamic creation of new models, removal of existing models, and variation of model parameters, while maintaining important properties for efficient inference.
- This work led to a paper that won the best student paper award of NIPS 2010, the highest honor to NIPS authors.

Matching Text and Images across Web-pages (MSR) 2010

- Goal: locate relevant textual descriptions for web images by leveraging the semantic connections between text on multiple web sites.
- I formulated a probabilistic framework that couples a generative topic model and semi-supervised discriminative model that build upon the links between related images, and developed a learning algorithm that can automatically collect new training samples from the web pages to enhance both the topic model and the classifier.
- This project has been tested on web-scale data and led to a prototype system of descriptive text pop-up for the Bing search engine.

Joint People, Event, and Location Recognition (MSR) 2009

- Goal: a new technique for photo album annotation that can jointly recognize people, events, and locations of the photos by exploiting the statistical relations between them.
- I formulated a probabilistic framework that unifies both the intra-domain links based on feature similarities and the inter-domain links that capture co-occurrence statistics. I developed a semi-supervised variational inference algorithm that jointly recognizes the entities in different domains and builds the relations between them.
- I built a prototype system integrating all components: feature extraction, model estimation, and recognition.

IDFace: A Practical Face Recognition System (CUHK) 2006 - 2007

- This is a project targeting practical deployment, with funding of over 1 million US dollars from Hong Kong Innovation and Technology Fund. I served as a team leader and system architect in the project.

- The primary goal is to develop a practical system for border control, which integrates several cooperative modules: people and vehicle tracking, face detection, and face verification. This system demonstrated superior performance to other competing systems under a variety of conditions.

Face Recognition and Super-resolution (CUHK) 2004 - 2006

- The goal is to develop novel and effective algorithms for face recognition and super-resolution.
- I developed a variety of algorithms to seek optimal representation spaces for face recognition, including improved linear discriminant analysis, information oriented feature extraction, and classifier ensemble learning. I also developed recognition techniques tailored to infrared images and high-resolution images.
- I developed novel super-resolution and synthesis techniques, including tensor-patch, couple space learning, and quality-driven super-resolution and recovery.

Facial Expression Re-targeting (MSR Asia) 2004

- The goal is to combine vision and graphics techniques to re-target facial expression, i.e. synthesize facial expressions on a specific face that are similar to reference expressions.
- I developed a tensor-based approach to model the interaction between different factors in face imaging: identities, expression, and lighting and use it for facial expression re-targeting.

Academic Service

- Oral and poster presentations in CVPR 2005, ICCV 2005, ECCV 2006, CVPR 2006, CVPR 2009, CVPR 2010, ECCV 2010, NIPS 2010, CVPR 2012, and NIPS 2012.
- Review papers for
  - IEEE Transaction on Pattern Analysis and Machine Intelligence (TPAMI)
  - IEEE Transaction on Image Processing (TIP)
  - IEEE Transaction on Circuits and Systems for Video Technology (TCSVT)
  - Neural Computation
  - International Conference on Computer Vision (ICCV)
  - IEEE Conference on Computer Vision and Pattern Recognition (CVPR)
  - European Conference on Computer Vision (ECCV)
  - Asian Conference on Computer Vision (ACCV)
  - Neural Information Processing Systems (NIPS)

Teaching Assistance

• MIT 6.867	Machine Learning	Lecturer: Leslie Kaelbling	2011
• CUHK IERG 4190	Multimedia Coding and Processing.	Lecturer: Jianzhuang Liu	2006
• CUHK IERG 4190	Multimedia Coding and Processing.	Lecturer: Xiaoou Tang	2005

Open Source Contributions

- **Statistical Learning Toolbox (sltoolbox):** A MATLAB Toolbox with a collection of algorithms on pattern recognition, feature extraction, manifold learning, and clustering. Since released, it has been downloaded over 20,000 times.
- **Light-Matrix Library:** A C++ template library for efficient matrix-based computation. This library provides high level interfaces for library users while generating efficient low-level codes (e.g. SIMD & Open MP) through template meta-programming.
- **Julia Language and Packages:** Julia is a high-performance dynamic programming language for technical computing, which provides high-level interface as in MATLAB and high efficiency (comparable to C) through Just-in-Time compilation. I am an important contributor to the development of this language, and the leading developer of multiple key libraries (e.g. NumericExtensions, Stats, Graphs, Distributions, Regression, and Clustering).

Publication

1. **Dahua Lin**, Eric Grimson, and John Fisher. Poisson-based Dependent Dirichlet Processes. *To be submitted to Journal of Machine Learning Research (JMLR)*.
2. **Dahua Lin**. Online Learning of Nonparametric Mixture Models via Sequential Variational Approximation. To appear in *Advances in Neural Information Processing Systems (NIPS), 2013.*
3. **Dahua Lin**, Sanja Fidler, and Raquel Urtasun. Holistic Scene Understanding for 3D Object Detection with RGBD Cameras. *To appear in International Conference on Computer Vision (ICCV), 2013.*
4. **Dahua Lin**, and Jianxiong Xiao. Characterizing Layouts of Outdoor Scenes Using Spatial Topic Processes. *To appear in International Conference on Computer Vision (ICCV), 2013.*
5. Dihong Gong, Zhifeng Li, **Dahua Lin**, Jianzhuang Liu, and Xiaoou Tang. Hidden Factor Analysis for Age Invariant Face Recognition. *To appear in International Conference on Computer Vision (ICCV), 2013.*
6. **Dahua Lin**, and John Fisher. Coupling Nonparametric Mixtures via Latent Dirichlet Processes. *Advances in Neural Information Processing Systems (NIPS), 2012.*
7. **Dahua Lin** and John Fisher. Coupled Dirichlet Processes: Beyond HDP. *NIPS 2012 Workshop on Bayesian Nonparametric Models (BNMP) for Reliable Planning and Decision-Making Under Uncertainty, 2012.*
8. Donglai Wei**, Dahua Lin** and John Fisher. Learning Deformations with Parallel Transport. *Proceedings of 12th European Conference on Computer Vision (ECCV), 2012.*
9. Ashish Kapoor**, Dahua Lin**, Simon Baker, Gang Hua, and Amir Akbarzadeh. How to Make Face Recognition Work: The Power of Modeling Context. *Proceedings of workshops at the 26th AAAI Conference, 2012.*
10. **Dahua Lin** and John Fisher. Manifold Guided Composite of Markov Random Fields for Image Modeling. *Proceedings of IEEE Computer Society Conference on Computer Vision and Pattern Recognition (CVPR), 2012.*
11. **Dahua Lin** and John Fisher. Low Level Vision via Switchable Markov Random Fields. *Proceedings of IEEE Computer Society Conference on Computer Vision and Pattern Recognition (CVPR), 2012.*

12. **Dahua Lin**, and John Fisher. Efficient Sampling from Combinatorial Space via Bridging. *Proceedings of 15th Conferences on Artificial Intelligence and Statistics (AISTATS), 2012.*

13. Jingqing Zhang, Ardemis A. Boghossian, Paul W. Barone, Alina Rwei, Jong-Ho Kim, **Dahua Lin**, Daniel A. Heller, Andrew J. Hilmer, Nitish Nair, Nigel F. Reuel, and Michael S. Strano. Single Molecule Detection of Nitric Oxide Enabled by d(AT)15 DNA Adsorbed to Near Infrared Flurescent Single-Walled Carboon Nanotubes. Journal of American Chemistry Society, Volume 133 (3), pages 567-581, 2011.

14. **Dahua Lin**, Eric Grimson, and John Fisher. Construction of Dependent Dirichlet Processes based on Poisson Processes. *Advances in Neural Information Processing Systems (NIPS), 2010.* **(Best Student Paper Award of NIPS)**

15. **Dahua Lin**, Ashish Kapoor, Gang Hua, and Simon Baker. Joint People, Event, and Location Recognition in Personal Photo Collections Using Cross-Domain Context. *European Conference on Computer Vision (ECCV), 2010.*

16. **Dahua Lin**, Eric Grimson, and John Fisher. Modeling and Estimating Persistent Motion with Geometric Flows. *Proceedings of IEEE Computer Society Conference on Computer Vision and Pattern Recognition (CVPR), 2010.*

17. **Dahua Lin**, Eric Grimson, and John Fisher. Learning Visual Flows: A Lie Algebraic Approach. *Proceedings of IEEE Computer Society Conference on Computer Vision and Pattern Recognition (CVPR), 2009.*

18. Zhifeng Li, **Dahua Lin**, and Xiaoou Tang. Nonparametric Discriminant Analysis for Face Recognition. *IEEE Transaction on Pattern Analysis and Machine Intelligence (TPAMI), Vol. 31, No. 4, Pages 755-761, 2009.*

19. **Dahua Lin**, and Xiaoou Tang. Quality-Driven Face Occlusion Detection and Recovery. *Proceedings of IEEE Computer Society Conference on Computer Vision and Pattern Recognition (CVPR), 2007.*

20. Zhifeng Li, **Dahua Lin**, and Xiaoou Tang. Discriminant Mutual Subspace Learning for Indoor and Outdoor Face Recognition. *Proceedings of IEEE Computer Society Conference on Computer Vision and Pattern Recognition (CVPR), 2007.*

21. **Dahua Lin**, Shuicheng Yan, and Xiaoou Tang. Pursuing Informative Projection on Grassmann Manifold. *Proceedings of IEEE Computer Society Conference on Computer Vision and Pattern Recognition (CVPR), 2006.*

22. **Dahua Lin** and Xiaoou Tang. Recognize High Resolution Faces: From Macrocosm to Microcosm. *Proceedings of IEEE Computer Society Conference on Computer Vision and Pattern Recognition (CVPR), 2006.*

23. **Dahua Lin** and Xiaoou Tang. Conditional Infomax Learning: An Integrated Framework for Feature Extraction and Fusion. *Proceedings of 9th IEEE European Conference on Computer Vision (ECCV), 2006.*

24. **Dahua Lin** and Xiaoou Tang. Inter-Modality Face Recognition. *Proceedings of 9th IEEE Euro- pean Conference on Computer Vision (ECCV), 2006.*

25. **Dahua Lin**, and Xiaoou Tang. Coupled Space Learning for Image Style Transformation. *Proceedings of 10th IEEE International Conference on Computer Vision (ICCV), 2005.*

26. Wei Liu, **Dahua Lin**, and Xiaoou Tang. Hallucinating Faces: TensorPatch Super-Resolution and Coupled Residue Compensation. *Proceedings of IEEE Computer Society Conference on Computer Vision and Pattern Recognition (CVPR), 2005.*

27. Zhifeng Li, Wei Liu, **Dahua Lin**, and Xiaoou Tang. Nonparametric Subspace Analysis for Face Recognition. *Proceedings of IEEE Computer Society Conference on Computer Vision and Pattern Recognition (CVPR), 2005.*

28. **Dahua Lin**, Shuicheng Yan, and Xiaoou Tang. Feedback-based Dynamic Generalized LDA for Face Recognition. *Proceedings of IEEE International Conference on Image Processing (ICIP), 2005.*

29. **Dahua Lin**, Shuicheng Yan, and Xiaoou Tang. Comparative Study: Face Recognition on Unspecific Persons using Linear Subspace Methods. *Proceedings of IEEE International Conference on Image Processing (ICIP), 2005.*

30. **Dahua Lin**, Wei Liu, and Xiaoou Tang. Layered Local Prediction Network with Dynamic Learning for Face Super-resolution. *Proceedings of IEEE International Conference on Image Processing (ICIP), 2005.*

31. **Dahua Lin**, Yingqing Xu, Xiaoou Tang, and Shuicheng Yan. Tensor-based Factor Decomposition for Relighting. *Proceedings of IEEE International Conference on Image Processing (ICIP), 2005.*

32. Wei Liu, **Dahua Lin**, and Xiaoou Tang. Face Hallucination through Dual Associative Learning. *Proceedings of IEEE International Conference on Image Processing (ICIP), 2005.*

33. Wei Liu, **Dahua Lin**, and Xiaoou Tang. Neighbor Combination and Transformation for Hallucinating Faces. *Proceedings of IEEE International Conference on Multimedia and Expo (ICME), 2005.*