Zhiqiang (Jimmy) Lao, PhD

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Nationality: US citizen

Skills and qualifications

- ✔ 25 Years experience in AI, ML, CV, PR, content based data mining
- ✔ 7 Years experience in computational neuroscience
- ✔ 5 Years experience in biomarker detection in medical images
- ✔ 3 Years experience in time series prediction, Recommendation system
- ✔ Authored and coauthored 50+ peer-review journal and conference papers
- ✔ 5 granted US patents + multiple applications

Tech stack

- Python, C++, Matlab
- Transformer, CNN, RNN, LSTM, GRU, Logistic regression, SVM, ANN
- PyTorch, TensorFlow, Caffe, Keras, OpenCV
- Unix, Linux, Windows

Working experience

🚧 **Sr staff researcher/engineer | Futurewei Technologies, Inc.** 2016 - present

Working on deep learning models for computer vision, image processing, computational advertisement, IoT, system storage optimization, etc

Recommendation system

- Developed recommendation system using deep learning models (open source)
- Developed and open-source ads inventory forecasting using attention aware seq2seq model (open source)
- Developed and open source CTR prediction using behavior-based user interest modeling (open source)
- Conducted user ranking and lookalike expansion which can scale-up to billion users (open source)

IMU signal processing

- Recognized human activity with smartphone using CNN and LSTM

Computer vision

Deep learning models on edge device

- Developed image classification and object detection for various heterogeneous classes, such as merchandise, flowers and documents etc. using CNN

Deep learning models on cloud

- Detected and classified logos in real-world scenarios
- Segmented human bodies from selfie photos
- Conducted salient object detection and segmentation

Image processing and special effects

- Improved foreground segmentation using Dense CRF
- Automated the generation of color splash effects

Awards

- Received Innovation Awards from Futurewei Technologies Inc in 2019 (Human activity recognition)
- Received Innovation Awards from Futurewei Technologies Inc in 2020 (Ads inventory forecasting)
- Received Spotlight Award from Futurewei Technologies Inc in 2021

Principal research scientist | Safran Morpho Trust USA, 05/2012 - 11/2016

Worked on machine learning models for computer vision, image processing, face recognition

Face recognition

- FFT frequency analysis-based illumination removal (prototype, validated and delivered to product)
- LBP (Local binary pattern) based feature extraction (implemented and delivered to product)
- Demographic classification (including gender, ethnicity and age) algorithm with novel feature definition and machine learning techniques (prototype, validate and delivered to product, US patent No.: 10,235,408 B1)
- Novel mapping score-based feature definition for face recognition (general purpose feature definition for fusion of various face recognition algorithms, prototype, validate and delivered to product)
- VGG feature based face recognition (delivered to product)
- Face template (feature vector) quantification to 8-bit, 4-bit, 2-bit or even 1-bit for fast matching purpose (delivered to product)
- Fusion of VGG and AlexNet based face recognition (implemented,

validated and delivered to product, but was not the best face recognition algorithm pipeline)
- Fusion of multiple face recognition algorithms based on higher level matching score-based feature definition, reduction and discriminant enhancement (implemented and delivered to product)
- Optimal algorithm pipeline selection in face recognition (extensive experience based on tons of experiments)
- Score fusion of multiple face recognition algorithms (major technique is the normalization of matching scores from different face recognition algorithms)

Machine learning

- PCA, LDA, SVM (support vector machine), NN (Neural network: feed-forward, recurrent, convolutional, etc.)
- Metric learning, triplet training and Joint Bayesian for improving discriminant ability
- Tailored Joint Bayesian formulation so that it can work with PCA for feature reduction (original formulation cannot work with PCA directly)
- Adaboost in training for improving discriminant ability
- Deep learning (CNN, RNN, etc.) with software package of caffe, tensorflow and network structure of VGG, FCN
- Large scale intensive training of machine learning model with millions of images

Segmentation

- Fully automatic human body segmentation (hair, face, shoulder and arm with arbitrary condition) from arbitrary background in still image (US patent No.: US 10,255,709 B2).
- Grabcut and CRFasRNN (conditional random fields as recurrent neural networks, deep learning)
- Fusion of segmented foreground probability with new background for better visualization purpose
- Image local SVD (singular value decomposition) based hair map generation (included in human upper body segmentation software)

Face hallucination

- High resolution face image reconstruction from low resolution face images (implementation and extensive validation)
- Patch matching based technique

Ear recognition

- Latent ear recognition based on morphological features (government funding proposal)

Technology validation

- Iris recognition algorithm validation test - preparing for participating NIST's Iris recognition competition
- Validation of open source (Alize) as well as commercial speaker recognition algorithms (technology analysis for higher level manager's roadmap planning)
- Statistical evaluation method for biometrics applications (all kinds of statistical curves, including CMC, DET, ROC, FAR, etc in evaluating recognition performance)

Award, patent filing and funding proposal

- Product/Technology Innovation Award 2013 (for the work of human upper body segmentation)
- One granted patent and several patent applications and funding proposals

Sr algorithm engineer | Carestream Health Inc, 10/2007 - 05/2012

Worked on machine learning models for computer vision, medical image processing

- Computer aided breast cancer detection in mammography (MammoCAD, got FDA approval for digitized film)
- 3D Tomosynthesis image reconstruction and enhancement (CUDA based parallel processing for faster reconstruction speed, prototype, validate and delivered to product, US patent No: 9,311,740)
- Dense (fibroglandular) tissue segmentation in mammography images (statistical model of dense tissue to discriminate it from fatty tissue in mammogram)
- Architectural distortion detection algorithm in mammography (boost breast cancer detection accuracy by 8%, 1st algorithm in detecting architectural distortion in MammoCAD industry)
- Pneumothorax enhancement in X-ray images
- Carina detection in chest x-ray images (feature extraction + linear classification)
- Collimation segmentation in X-ray images (feature extraction/selection + decision tree, delivered to product)
- Chest X-ray image enhancement (US Patent No.: 8,861,886)
- Author of 3 granted patents and more filed patent applications

Sr research investigator | University of Pennsylvania, 07/2002 -

10/2007

Worked on machine learning and computational neuroscience

- Morphological feature based central nerves disorders detection in brain MRI (NeuroImage publication)
- Segmentation of diabetes, ischemic and white matter lesion in 3D brain MRI
- Statistical analysis of various control vs pathology populations
- Medical image enhancement
- VBM (voxel-based morphometry) based analysis of brain tissue volume change
- Participation in several large-scale clinical studies

Postdoc | Johns Hopkins University, 09/2000 - 06/2002

Worked on machine learning and computational neuroscience

- Statistical modeling of prostate cancer distribution
- Skull strip in brain MRI images
- Analysis of brain tissue longitudinal changes using brain MRI

Research fellow | Nanyang Technological University, Singapore,

10/1998 - 08/2000

Worked on machine learning and computer vision

- Ill-posed inverse problem-solving based 3D human posture estimation using human motion video
- Model-based approach to human recognition using human motion video
- Object tracking in video

Affiliations

- Institute of Electrical and Electronics Engineering (IEEE)
- International Society for Optics and Photonics (SPIE)

Services to external academic communities

Reviewer for

- International Conference of Pattern Recognition (ICPR) – 2012-2018
- International Conference of Computer Vision (ICIP), 2018 – 2023
- Asian Conference on Computer Vision (ACCV) – 2010, 2012
- IJCARS (International Journal of Computer Assisted Radiology and Surgery)

- IEEE Transaction on Biomedical Engineering
- Mathematics and Computers in Simulation
- International Journal of Computer Graphics
- Journal of Data Acquisition and Processing
- Journal of Zhejiang University
- Specially invited reviewer for Press of Zhejiang University
- Journal of Zhejiang Chemical Industry
- NeuroImage
- AJNR (American Journal of Neuroradiology)

EDUCATION

- University of Pennsylvania, Postdoc, machine learning and computational neuroscience, 2002 - 2003
- Johns Hopkins University, Postdoc, machine learning and computational neuroscience, 2000 - 2002
- Zhejiang University, PR China, Ph.D., computer vision and artificial intelligence, 1994 - 1997

Publications

Journal papers

1. M Bilello, ***Z Lao***, J Krejza, AE Hillis, EH Herskovits, Atlas-based classification of hyperintense regions from MR diffusion-weighted images of the brain: preliminary results, the neuroradiology journal 25 (1), pp.112-120, 2012.
2. LH Coker, PE Hogan, NR Bryan, LH Kuller, KL Margolis, K Bettermann, RB Wallace, ***Z Lao***, R Freeman, ML Stefanick, SA Shumaker, Postmenopausal hormone therapy and subclinical cerebrovascular disease: the WHIMS-MRI Study, Neurology, 2009 Jan 13; 72(2): 125-34.
3. ***Z Lao***, D Shen, DF Liu, AF Jawad, ER Melhem, LJ Launer, NR Bryan, C. Davatzikos, Computer-Assisted Segmentation of White Matter Lesions in 3D MR Images, Using Support Vector Machine, Academic Radiology, Volume 15, Issue 3, Pages 300-313, 2008.
4. M Bilello, ***Z Lao***, J Krejza, AE Hillis, EH Herskovits, Statistical atlas for acute stroke MR diffusion-weighted-images of the brain, Neuroinformatics Vol 4, No 3, pp.235-242, 2007.
5. ***Z Lao***, D Shen, et al, “Morphological Classification of brains via high-dimensional shape transformations and machine learning methods”, NeuroImage, Vol 21(1), pp 46-57, 2004
6. D Shen, ***Z Lao***, J. Zeng, W. Zhang et al, Optimizing of biopsy strategy by a statistical atlas of prostate cancer distribution, Medical Image Analysis, 8(2): 139-150, 2004

7. ***Z Lao***, L Li, “Video-based approach to human animation”, Computer Graphics Forum, 3rd issue, vol. 19, 2000
8. ***Z Lao***, Y Pan, “A model-based approach to human animation”, Chinese Journal of Advanced Software Research, vol. 11, no. 4, pp.435-440, 2000
9. ***Z Lao***, Y Pan, “Survey of human body animation”, Chinese Journal of Computer Science, vol. 25, no. 1, 1998
10. ***Z Lao***, Y Pan, “A knowledge representation model for video-based animation”, Chinese Journal of CAD and Computer Graphics, vol. 10, no. 4, 1998, pp.367-376
11. ***Z Lao***, Y Pan, “The design and implementation of a distributed shading algorithm”, Journal of Computer Science and Technology, vol. 13 Supplement, 1998, pp.27-32
12. ***Z Lao***, Y Pan, “IFS-based fast image encoding algorithm”, Chinese Journal of Computer Research and Development, vol. 35, no. 3, March 1998, pp.280-284
13. ***Z Lao***, Y Pan, “A knowledge representation model for video-based animation”, Journal of Computer Science and Technology, vol. 13, no. 3, May 1998, pp.228-237
14. ***Z Lao***, Y Pan, “A feature-based image deformation algorithm”, Chinese Journal of CAD and Computer Graphics, 1998, 10(1), pp.1-6
15. J Dong, ***Z Lao***, “CSCW and its key techniques”, Chinese Computer Users, June 1997, pp.5-11
16. ***Z Lao***, J Shi, “The design and implementation of a distributed hidden surface removal algorithm”, Chinese Journal of Computer Aided Engineering, vol. 6, no. 4, December 1997, pp.25-29
17. ***Z Lao***, Y Pan, “A global optimization based video deformation method”, Chinese Journal of Computer Engineering, vol. 23, no. 5, September 1997, pp.60-63
18. ***Z Lao***, “Digital revolution and computer animation”, Chinese Computer Users, no. 2, Feb 1997, pp.1-3.
19. ***Z Lao***, J Shi, “A distributed shading algorithm via image space distribution”, Journal of Software, vol 8, no. 8, 1997, pp. 585-592
20. ***Z Lao***, D Xu, Y Pan, “Multisource analogy generation in video generation”, Journal of Data Acquisition of Processing, vol. 11, no. 4, 1996, pp.308-311
21. ***Z Lao***, D Xu, Y Pan, “The application of multisource analogical generation in video-stream generation”, Chinese Journal of Computer Science, vol. 24, no. 3, 1997
22. B Bai, ***Z Lao***, X Jiang, “Theory of driver design under DOS system (II)”, Journal of Kunming Metallurgy College, No. 3, 1997
23. ***Z Lao***, B Bai, X Jiang, “Theory of driver design under DOS system (I)”, Journal of Kunming Metallurgy College, No 4, 1996
24. Z Yin, Z Pan, X Ma, ***Z Lao***, “Eiffel: an object-oriented programming language and environment”, Journal of Computer Engineering and Application, No 1, 1993

Conference papers

1. ***Z Lao***, X Zheng, Q Zou, “Statistical representation of high-dimensional enhancement fields with application to consistent enhancement of chest x-ray images”, SPIE Medical Imaging, February 9-14, 2013, Orlando, Florida
2. ***Z Lao***, X Zheng, Q Zou, “Carina detection in ICU images via integrating geometrical and thoracic anatomy based features”, ICPR, November 11-15, 2012, Tsukba Science City, Japan
3. ***Z Lao***, X Zheng, “Multiscale quantification of tissue spiculation and distortion for detection of architectural distortion and spiculated mass in mammography”, SPIE Medical Imaging, February 12-17, 2011, Orlando, Florida
4. ***Z Lao***, Z Huo, “Quantitative assessment of breast tissue on mammograms”, ICIP 2009, November 7-10, 2009, Cairo, Egypt
5. ***Z Lao***, D. Shen, K. Bilge, ER, Melhem, NR, Bryan, C. Davatzikos, “Automated Segmentation of White Matter Lesions in 3D Brain MR Images, Using Multivariate Pattern Classification”, Third IEEE International Symposium on Biomedical Imaging (ISBI 2006), April 6-9, 2006, Arlington, VA, USA
6. C. Davatzikos, D. Shen, ***Z Lao***, Z. Xue, B. Karacali, "Morphological classification of medical images using nonlinear support vector machines", IEEE International Symposium on Biomedical Imaging (ISBI) (invited paper), Arlington, VA, April 15-18, 2004
7. ***Z Lao***, Dinggang Shen, Christos Davatzikos, “Statistical Shape Model for Automatic Skull-Stripping of Brain Images”, ISBI2002, D.C. 7-10 July 2002
8. D Shen, ***Z Lao***, J. Zeng, E.H. Herskovits, G. Fichtinger, C. Davatzikos, “A Statistical Atlas of Prostate Cancer for Optimal Biopsy”, MICCAI2001, Utrecht, The Netherlands, 14-17 October 2001
9. D. Shen, ***Z Lao***, J. Zeng, EH Herskovits, G. Fichtinger, C. Davatzikos, "Statistically Optimized Biopsy Strategy for the Diagnosis of Prostate Cancer", The Fourteenth IEEE Symposium on Computer-Based Medical Systems (CBMS 2001), 26-27 July, 2001 at the Natcher Center, 9000 Rockville Pike, Bldg. 45, Bethesda, Maryland 20892
10. ***Z Lao***, L. Li, "Video-based Approach to Human Animation", Eurographics 2000, Interlaken, Switzerland, 20-25 August 2000
11. ***Z Lao***, L. Li, "Model-based Approach to Human Recognition", International Conference on Computer Vision, Pattern Recognition and Image Processing (CVPRIP'2000), Feb. 27-Mar.3, 2000, Atlantic City, USA
12. ***Z Lao***, L. Li, "A Three-step to Object Tracking", International Conference on Computer Vision, Pattern Recognition and Image Processing (CVPRIP'2000), Feb. 27-Mar.3, 2000, Atlantic City, USA
13. ***Z Lao***, L. Li, "Multi-modal Edge Extraction from Motion Video", Proc. of 2nd International Conference on Information, Communications & Signal Processing (ICICS'99), December 7-10, 1999, Singapore

14. ***Z Lao***, Y. Pan, "The Implementation of Distributed Shading Algorithm", Proc. of 1997 Int. Workshop on Computational Science and Engineering (IWCSE'97), Hefei, P.R.China, 1997.5, pp.108-115
15. Y. Zhuge, ***Z Lao***, Y. Pan, "Knowledge Based System for Art Pattern Design", Proc. of the CJCAI'96, Changsha, P.R.China, 1996.10
16. ***Z Lao***, D. Xu, Y. Pan, "Multisource Analogy Generation based Animation", Proc. of Chinagraph'96, Hangzhou, P.R.China, 1996.10, pp.366-371
17. ***Z Lao***, Y. Zhuge, J. Shi, "Distributed Approach to Shading Based on Image Space Distribution", Proc. of the 6th National Computer Youth Conference(NCYCS'96), Hangzhou, P.R.China, 1996.10, pp.547-552
18. ***Z Lao***, J. Shi, "A Distributed Hidden-Surface-Removal Algorithm Based on Image Space Distribution", Proc. of the 6th National Computer Youth Conf.(NCYCS'96), Hangzhou, P.R.China, 1996.10, pp.602-603
19. ***Z Lao***, Z. Pan, W.Zheng, J. Shi, "DGPSL: A Distributed Graphics Processing Support Library for Graphics and Image", Proc. of IEEE TENCON'93, Beijing, 1993.10, P.R.China
20. ***Z Lao***, Z. Pan, J. Shi, "Distributed Approach to Shading in Image Space", Proc. of 3rd Int. Conf. on CAD & CG, Beijing, 1993.8, P.R.China
21. ***Z Lao***, J. Shi, "Designing and Implementation of Distributed Scan-Conversion algorithm", Proc. of the 6th National Conf. on CAD & CG, Wuxi, P.R.China, Vol.2, 1993, pp.541-545
22. ***Z Lao***, J. Shi, "Implementation of Distributed Object-Oriented Volume Rendering", Proc. of Int. Modelling & Simulation & Control Conf., ASME MSC'92, Hefei, P.R.China, Vol.2, 1992, pp.797-805

Patent grants

- Investigation of distribution graphics processing system, Chinese patent ID: CG2000022472
- Enhanced visualization for medical images (Patent #: US8861886 B2)
- Method for enhancing reconstructed 3D tomosynthesis volume image (Patent #: 9311740)
- System and method for creating a virtual backdrop (Patent #: 9286685)
- System and method for leveraging soft-biometrics in biometrics enrollment

Honors

- 2021, Spotlight Award, Futurewei Technologies Inc
- 2020, Innovation Awards, Futurewei Technologies Inc
- 2019, Innovation Awards, Futurewei Technologies Inc

- 2013, Product/Technology Innovation Award, Safran MorphoTrust USA
- 1998, Outstanding graduate of the year, Zhejiang Province, PR China
- 1997, Outstanding graduate of the year, Zhejiang University, PR China
- 1997, Ph.D. Thesis of excellence, Zhejiang University, PR China
- 1997, Excellent Ph.D. Degree Receiver of the Year, Zhejiang University, PR China
- 1996, 1st rate prize of Science and Technology of Zhejiang Province, PR China