

BIOGRAPHICAL SKETCH

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NAME: Liu, Chengjun

ERA COMMONS USER NAME (credential, e.g., agency login):

POSITION TITLE: Professor

EDUCATION/TRAINING (*Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.*)

INSTITUTION AND LOCATION	DEGREE (if applicable)	END DATE MM/YYYY	FIELD OF STUDY
George Mason University, Fairfax, Virginia	PHD	05/1999	Computer Science
Harbin Institute of Technology, Harbin, Not Applicable, N/A	MS	05/1993	Computer Science
Harbin Institute of Technology, Harbin, Not Applicable, N/A	BS	05/1990	Computer Science

A. Personal Statement

Prof. Liu's research is in AI, Pattern Recognition and Machine Learning, Computer Vision, and Security. His current research focused on four areas: (i) AI/ML for Smart Energy; (ii) AI/ML for Smart Health; (iii) Video Analytics for Reducing Traffic Congestion, Improving Traffic Safety, Home Security, Smart UAS/Drones, and Autonomous Driving; and (iv) Facial Recognition for Enhancing Security and Public Safety.

AI/ML for Smart Energy, such as preventing wildfires in energy transmission by automatic power line defects detection using machine learning and AI, and machine learning and AI for optimizing and safeguarding energy transmission in storms by automatic inspection of electrical wires.

AI/ML for Smart Health, like AI Doctor & Digital Assistant by capitalizing on a mixture of AI medical systems for providing the best care for anyone, anywhere, and anytime. The AI medical systems include AI Rosacea Detection, Laparoscopic Image Desmoking, AI Medical Systems for breast cancer detection, Automatic Brain Tumor Detection, Parkinson's Disease Detection, and Alzheimer's Disease Detection.

Advanced Video Analytics for Reducing Traffic Congestion, Improving Traffic Safety, Home Security, Smart UAS/Drones, and Autonomous Driving have attracted fundings from NSF, NJDOT, USDOT SBIR I. Advanced Video Analytics for Smart Unmanned Aircraft Systems (UAS)/Drones have won NIST Enhancing Computer Vision for Public Safety Challenge 2020; NIST First Responder UAS Triple Challenge – FastFind: UAS Search Optimized (UAS 3.1); and US Ignite: AI for IoT Information (AI3) Prize Competition.

Facial Recognition for Enhancing Security and Public Safety have won the best performance on the FRGC competition. The Bayes classifier design leads to the development of the Bayesian Discriminating Features (BDF) method that achieves the optimal target detection performance, and the application of the BDF method to face detection wins a patent on face detection.

B. Positions, Scientific Appointments and Honors

Positions and Scientific Appointments

- 2015 - Professor, New Jersey Institute of Technology, Newark, NJ
- 2006 - 2015 Associate Professor, New Jersey Institute of Technology, Newark, NJ
- 2001 - 2006 Assistant Professor, New Jersey Institute of Technology, Newark, NJ
- 1999 - 2001 Assistant Professor, University of Missouri-St. Louis, St. Louis, Missouri

C. Contribution to Science

1. Prof. Liu has recently developed innovative AI (e.g., statistical learning, deep learning) and advanced image/video analysis methodologies that achieve the state-of-the-art performance for Improving Traffic Safety, Home Security, Smart Unmanned Aircraft System (UAS)/Drones, and Autonomous Driving. For example, for reducing traffic congestion and improving traffic safety research, Prof. Liu has been sponsored by NSF, NJDOT, and USDOT SBIR grants detailed by the following grants. For traffic accidents detection, wrong-way driving detection, and dilemma zone conflicts detection at signal-controlled intersection, the demos on our webpage (www.cs.njit.edu/liu) with 100 videos show the state-of-the-art performance.
 - [1] "US Ignite: Focus Area 1: Fast Autonomic Traffic Congestion Monitoring and Incident Detection through Advanced Networking, Edge Computing, and Video Analytics", NSF, \$600k, 2017~2022, Co-PI.
 - [2] "Intelligent Transportation Systems Resource Center", FHWA/NJDOT, \$12m, 2017-2020, co-PI.
 - [3] "Innovative AI Video Analysis of Dilemma Zone Conflicts at Signal-Controlled Intersections using Edge Computing and 5G", US Department of Transportation (USDOT) SBIR I, \$150k, 2022~2023, subaward to NJIT, PI @ NJIT.
 - a. H. Ghahremannezhad, H. Shi and C. Liu, "Object Detection in Traffic Videos: A Survey", *IEEE Transactions on Intelligent Transportation Systems*, vol. 24, issue 7, pp. 6780-6799, 2023.
 - b. G. Liu, H. Shi, A. Kiani, A. Khreichah, J. Lee, N. Ansari, C. Liu, and M. Yousef, "Smart Traffic Monitoring System Using Computer Vision and Edge Computing", *IEEE Transactions on Intelligent Transportation Systems*, vol. 23, issue 8, pp. 12027-12038, DOI: 10.1109/TITS.2021.3109481, 2022.
 - c. Q. Liu and C. Liu, "A Novel Locally Linear KNN Method with Application to Visual Recognition", *IEEE Transactions on Neural Networks and Learning Systems*, vol. 28, no. 9, pp. 2010-2021, 2017.
 - d. A. Puthenputhussery, Q. Liu, and C. Liu, "A Sparse Representation Model Using the Complete Marginal Fisher Analysis Framework And Its Applications to Visual Recognition", *IEEE Transactions on Multimedia*, vol. 19, pp. 1757-1770, 2017.
2. Prof. Liu has developed novel and advanced kernel methods like Gabor-based kernel PCA and multiclass Kernel Fisher Analysis (KFA) method. The statistical learning theory indicates that the risk functional consists of two terms: the empirical risk and the structure risk defined by the VC dimension. To minimize the overall risk, Prof. Liu has developed the multiclass KFA method, which when applied to the Face Recognition Grand Challenge (FRGC) competition organized by NIST and participated by top universities and companies, won the Best Performance on the most challenging FRGC experiment (see A. OToole, P. Phillips, et al., "Face recognition algorithms surpass humans matching faces across changes in illumination", *IEEE Transactions on Pattern Analysis and Machine Intelligence*, vol. 29, no. 9, pp. 1642-1646, 2007.) Note that another participating team from CMU proposed a filtering approach that rests on the convolution operation. Convolution was later incorporated into the convolutional neural network or CNN/LeCun that underlies much of the modern deep learning technology (DeepBlue/Chess, DeepQA/Watson, DeepMind/AlphaGo, DeepLearning/ChatGPT, DeepSeek/LLMs...), which inflames the current AI frenzy.
 - [4] "NJ MarketShift", DOD, \$5.6m, 2014~2016, Faculty Team Lead.
 - [5] "Facial and Iris-Based Biometric System", NIJ/DOJ, \$320k, 2006~2008, PI.
 - [6] "Facial Surveillance System Based on Dimensionality-Increasing Techniques", DOD, \$151k, 2004~2005, PI.
 - [7] "Identifying Faces in Video Images", DOD, \$140k, 2003~2004, PI.

- a. Liu C. Capitalize on dimensionality increasing techniques for improving Face Recognition Grand Challenge performance. *IEEE Trans Pattern Anal Mach Intell.* 2006 May;28(5):725-37. PubMed PMID: 16640259.
 - b. Liu C. Gabor-based kernel PCA with fractional power polynomial models for face recognition. *IEEE Trans Pattern Anal Mach Intell.* 2004 May;26(5):572-81. PubMed PMID: 15460279.
 - c. Liu C, Wechsler H. Gabor feature based classification using the enhanced fisher linear discriminant model for face recognition. *IEEE Trans Image Process.* 2002;11(4):467-76. PubMed PMID: 18244647.
 - d. Liu C, Wechsler H. Evolutionary pursuit and its application to face recognition. *IEEE Transactions on Pattern Analysis and Machine Intelligence.* 2002; 22(6):570-582.
3. For achieving the optimal target detection performance, Prof. Liu has developed the Bayes classifier with the minimum classification error in the sense of the Bayes error. Specifically, the Bayesian Discriminating Features (BDF) method achieves the optimal target detection performance, and the application of the BDF method to face detection wins a patent on face detection. His research has been published in the major journals and conferences in his field, such as the IEEE Transactions journals and the IEEE conferences. The Google Scholar webpage shows that his papers have been cited more than 11,000 times.
- a. Z. Liu, J. Yang, and C. Liu, "Extracting Multiple Features in the CID Color Space for Face Recognition", *IEEE Transactions on Image Processing*, vol. 19, no. 9, pp. 2502-2509, 2010.
 - b. Liu C, Yang J. ICA color space for pattern recognition. *IEEE Trans Neural Netw.* 2009 Feb;20(2):248-57. PubMed PMID: 19150790.
 - c. Yang J, Liu C. Color image discriminant models and algorithms for face recognition. *IEEE Trans Neural Netw.* 2008 Dec;19(12):2088-98. PubMed PMID: 19054733.
 - d. Liu C. The Bayes decision rule induced similarity measures. *IEEE Trans Pattern Anal Mach Intell.* 2007 Jun;29(6):1086-90. PubMed PMID: 17431305.

D. Research Support

- [1] NJIT, "Toward Increased Rosacea Awareness among Population Using Advanced AI: Explainable AI Automatic Rosacea Diagnosis and Region of Interest Detection", \$50k, 2025~2026, PI.
- [2] USDOT SBIR I, "Innovative AI Video Analysis of Dilemma Zone Conflicts at Signal-Controlled Intersections using Edge Computing and 5G", \$150k, 2022~2023, subaward to NJIT, PI @ NJIT.
- [3] NSF, "US Ignite: Focus Area 1: Fast Autonomic Traffic Congestion Monitoring and Incident Detection through Advanced Networking, Edge Computing, and Video Analytics", \$600k, 2017~2022, Co-PI.
- [4] FHWA/NJDOT, "Intelligent Transportation Systems Resource Center", \$12m, 2017-2020, co-PI.
- [5] DOD, "NJ MarketShift", \$5.6m, 2014~2016, Faculty Team Lead.
- [6] NIJ/DOJ, "Facial and Iris-Based Biometric System", \$320k, 2006~2008, PI.
- [7] DOD, "Facial Surveillance System Based on Dimensionality-Increasing Techniques", \$151k, 2004~2005, PI.
- [8] DOD, "Identifying Faces in Video Images", \$140k, 2003~2004, PI.

Bibliography

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2. C. Yang, R. Yesgari, and C. Liu, "Privacy-Preserving Automated Rosacea Detection Based on Medically Inspired Region of Interest Selection", *IEEE International Conference on Electrical and Computer Engineering Researches*, 06-08 December 2025, Antananarivo, MADAGASCAR

3. C. Yang and C. Liu, "Investigating the Impact of Various Loss Functions and Learnable Wiener Filter for Laparoscopic Image Desmoking", *the 6th International Conference on Medical Imaging and Computer-Aided Diagnosis*, Nov. 19-21, 2025, London, UK
4. C. Yang, R. Yesgari, and C. Liu, "Patch-based Automatic Rosacea Detection Using the ResNet Deep Learning Framework", *the 6th International Conference on Medical Imaging and Computer-Aided Diagnosis*, Nov. 19-21, 2025, London, UK
5. C. Yang and C. Liu, "Laparoscopic Image Desmoking Using the U-Net with New Loss Function and Integrated Differentiable Wiener Filter", *IEEE the 11th International Conference on Big Data Computing Service and Machine Learning Applications*, July 21-24, 2025, Tucson, Arizona
6. C. Yang and C. Liu, "Interpretable Automatic Rosacea Detection with Whitened Cosine Similarity", *IEEE the 17th International Conference on Computer Research and Development*, January 17-19, 2025, Jiangxi, China
7. C. Yang and C. Liu, "Increasing Rosacea Awareness Among Population Using Deep Learning and Statistical Approaches", *The 5th International Conference on Medical Imaging and Computer-Aided Diagnosis*, Nov. 19-21, 2024, Manchester, UK
8. H. Ghahremannezhad, H. Shi and C. Liu, "Object Detection in Traffic Videos: A Survey", *IEEE Transactions on Intelligent Transportation Systems*, vol. 24, issue 7, pp. 6780-6799, 2023.
9. G. Liu, N. Furth, H. Shi, A. Khreichah, J. Lee, N. Ansari, C. Liu, and Y. Jararweh, "Federated Learning Aided Deep Convolutional Neural Network Solution for Smart Traffic Management", *IEEE/IFIP Network Operations and Management Symposium*, 8-12 May, 2023, Miami, FL, USA
10. G. Liu, H. Shi, A. Kiani, A. Khreichah, J. Lee, N. Ansari, C. Liu, and M. Yousef, "Smart Traffic Monitoring System Using Computer Vision and Edge Computing", *IEEE Transactions on Intelligent Transportation Systems*, vol. 23, issue 8, pp. 12027-12038, DOI: 10.1109/TITS.2021.3109481, 2022.
11. H. Shi, H. Ghahremannezhad, and C. Liu, "Unsupervised Anomaly Detection in Traffic Surveillance Based on Global Foreground Modeling", *the 2022 IEEE International Conference on Imaging Systems and Techniques*, IST 2022, June 21-23, 2022, Virtual.
12. H. Ghahremannezhad, H. Shi and C. Liu, "Real-Time Hysteresis Foreground Detection in Video Captured by Moving Cameras", *the 2022 IEEE International Conference on Imaging Systems and Techniques*, IST 2022, June 21-23, 2022, Virtual.
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14. H. Ghahremannezhad, H. Shi and C. Liu, "Illumination-Aware Image Segmentation for Real-Time Moving Cast Shadow Suppression", *the 2022 IEEE International Conference on Imaging Systems and Techniques*, IST 2022, June 21-23, 2022, Virtual.
15. H. Ghahremannezhad, C. Liu and H. Shi, "Ammunition Component Classification Using Deep Learning", *the 18th International Conference on Machine Learning and Data Mining*, MLDM 2022, July 16-21, 2022, New York, USA.
16. H. Shi, H. Ghahremannezhad and C. Liu, "Anomalous Driving Detection for Traffic Surveillance Video Analysis", *the 2021 IEEE International Conference on Imaging Systems and Techniques*, IST 2021, August 24-26, 2021, New York, USA.
17. H. Shi and C. Liu, "An Innovative Video Quality Assessment Method and An Impairment Video Dataset", *the 2021 IEEE International Conference on Imaging Systems and Techniques*, IST 2021, August 24-26, 2021, New York, USA.
18. H. Ghahremannezhad, H. Shi and C. Liu, "A New Online Approach for Moving Cast Shadow Suppression in Traffic Videos", *the 24th IEEE International Conference on Intelligent Transportation Systems*, ITSC 2021, September 19-22, 2021, Indianapolis, IN, United States.
19. H. Shi and C. Liu, "A New Cast Shadow Detection Method for Traffic Surveillance Video Analysis Using Color and Statistical Modeling", *Image and Vision Computing*, 94, 103863, 2020.
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22. S. Chen and C. Liu, "Eye detection using discriminatory Haar features and a new efficient SVM", *Image and Vision Computing*, vol. 33, pp. 68-77, 2015.

23. S. Chen and C. Liu, "Clustering-based Discriminant Analysis for Eye Detection", *IEEE Transactions on Image Processing*, vol. 23, no. 4, pp. 1629-1638, 2014.
24. C. Liu, "Discriminant Analysis and Similarity Measure", *Pattern Recognition*, vol. 47, no. 1, pp. 359-367, 2014.
25. A. Sinha, S. Banerji, and C. Liu, "New Color GPHOG Descriptors for Object and Scene Image Classification", *Machine Vision and Applications*, vol. 25, no. 2, pp. 361-375, 2014.
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