Xiaomin Liu

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EDUCATION

•	Shanghai Jiao Tong University	Ph.D. candidate	Information and communication engineering 2020.09- 2025.06 Expected
•	Shanghai Jiao Tong University	B.S.	Information engineering 2016.09-2020.06

RESEARCH INTERESTS

My research focus on the modeling, monitoring, and optimization for the long-haul WDM optical networks (especially the Backbone networks), aim at building self-driving optical networks with the assistance of data-driven machine learning techniques. I am also working on the control and optimization for the multi-band optical system.

- > Physical layer modeling: Fiber nonlinearity, Optical amplifier (EDFA and Raman amplifier)
- > Physical layer monitoring: Fiber nonlinearity, Soft failures, Filtering effect, etc.
- > Network optimization: Power optimization in C and C&L band

ACADEMIC ACTIVITIES

- Invited talk, "Fusion of physics and AI for building self-driving optical networks" *Advanced Photonics Congress* (APC), *Photonic Networks and Devices Conference* (NETWORKS), Maastricht, The Netherlands, 2022. (The only student invited speaker)
- **Invited talk**, "Combining AI and physics for digital-twin optical networks", *Optoelectronics Global Conference* (OGC 2022), Shenzhen, China, 2022.
- **Invited talk**, "Design and deployment of the data-driven fiber nonlinearity estimation for dynamics optical networks", *Optoelectronics Global Conference* (OGC 2021), Shenzhen, China, 2021.

• Journal reviewer

Journal of Lightwave Technology/Journal of Optical Communications and Networking

PROJECT EXPERIENCE

- *TENCENT* QoT planning tool design and deployment (Student leader)
 - ♦ Established a QoT model for network service quality in Tencent's controlling platform.
 - ♦ The platform can achieve different levels of accuracy and computational speed.
 - \diamond The work was reported by one of the Tencent's official accounts.

HONORS AND AWARDS

- 2024. Corning Woman Scholar (3 in worldwide each year) (awarded in OFC 2024)
- 2023. SPIE Optics and Photonics Education Scholarship (6 in China and 72 around the world [link])
- 2022. Intel Scholarship (5 in Shanghai Jiao Tong University and 65 in China)
- 2022. First Prize of the Outstanding Ph.D. Student of State Key Laboratory of Advanced Optical Communication Systems and Networks
- 2021. Best Student Paper Award of Asia Communications and Photonics Conference
- 2020, 2021. National PhD Scholarship (2 Times, Top 2%)
- 2020. Excellent Bachelor Thesis of Shanghai Jiao Tong University (Top 1%)
- 2020. Shanghai Outstanding Graduates (Top 5%)
- 2017-2020. The Academic Scholarship of Shanghai Jiao Tong University

FIRST-AUTHORED PUBLICATIONS

Journal papers

[1] Qunbi Zhuge*, **Xiaomin Liu**, Yihao Zhang, Meng Cai, Meng Cai, Yichen Liu, Qizhi Qiu, Xueying Zhong, Jiaping Wu, Ruoxuan Gao, Lilin Yi, and Weisheng Hu, "Building a digital twin for intelligent optical networks [invited tutorial]", *Journal of Optical Communications and Networking*, Vol. 15, no. 8, pp. C242-260, 2023. (Joint first authors)

2020-2022

2019.07-2020.06

- [2] Xiaomin Liu, Yunyun Fan, Yihao Zhang, Meng Cai, Lei Liu, Lilin Yi, Weisheng Hu, and Qunbi Zhuge*, "Fusing physics to fiber nonlinearity model for optical networks based on physics-guided neural networks," *IEEE/OSA Journal of Lightwave Technology*, vol. 40, no. 17, pp. 5793-5802, 2022.
- [3] Xiaomin Liu, Huazhi Lun, Lei Liu, Yihao Zhang, Yicheng Liu, Lilin Yi, Weisheng Hu, and Qunbi Zhuge*, "A meta-learningassisted training framework for physical layer modeling in optical networks," *IEEE/OSA Journal of Lightwave Technology*, vol. 40, no. 9, pp. 2684-2695, 2022.
- [4] Xiaomin Liu, Huazhi Lun, Ruoxuan Gao, Meng Cai, Lilin Yi, Weisheng Hu, and Qunbi Zhuge*, "A data-fusion-assisted telemetry layer for autonomous optical networks," *IEEE/OSA Journal of Lightwave Technology*, vol. 39, no. 11, pp. 3400-3411, 2021. (Invited paper)
- [5] Xiaomin Liu, Huazhi Lun, Mengfan Fu, Yunyun Fan, Lilin Yi, Weisheng Hu and Qunbi Zhuge*, "AI-based modeling and monitoring techniques for future intelligent elastic optical networks," *Applied Sciences*, vol. 10, no. 1, pp. 363-380, 2020. (Invited paper) (Highly-cited paper)
- [6] Xiaomin Liu, Yihao Zhang, Yichen Liu, Meng Cai, Lilin Yi, Weisheng Hu, and Qunbi Zhuge "SMOF: Online simultaneous modeling and gain profile optimization for multi-pump Raman amplifiers in C+L-band optical networks", *Journal of Lightwave technology*.
- [7] Xiaomin Liu, Yihao Zhang, Yuli Chen, Yicheng Liu, Meng Cai, Qizhi Qiu, Mengfan Fu, Lilin Yi, Weisheng Hu, and Qunbi Zhuge*, "Digital twin modeling and controlling of optical power evolution enabling autonomous-driving optical networks: a Bayesian approach", Advanced Photonics, 2024.

Conference papers

- [1] Xiaomin Liu, Qizhi Qiu, Yihao Zhang, Meng Cai, Yichen Liu, Lilin Yi, Weisheng Hu, and Qunbi Zhuge, "Auto-DTWave: Digital Twin-Aided Autonomous Optical Network Operation with Continuous Wavelength Loading", *Optical Fiber Communications (OFC) Conference*, 2024 (Submitted)
- [2] Xiaomin Liu, Yihaozhang, Yichen Liu, Meng Cai, Lilin Yi, Weisheng Hu, and Qunbi Zhuge, "Online simultaneous modeling and gain profile optimization for multi-pump Raman amplifiers in C+L-band optical systems," *European Conference on Optical Communication (ECOC)*, 2023. (Oral presentation)
- [3] Xiaomin Liu, Yihao Zhang, Meng Cai, Lilin Yi, Weisheng Hu, Qunbi Zhuge*, "Fusion of physics and AI for building selfdriving optical networks, Advanced Photonics Congress (APC), Photonic Networks and Devices (NETWORKS)Conference, Paper NeW2D.1, 2022. (Invited)
- [4] Xiaomin Liu, Lei Liu, Huazhi Lun, Yihao Zhang, Lilin Yi, Weisheng Hu, and Qunbi Zhuge*, "A gray-box model for estimating nonlinear SNR in optical networks based on physics-guided neural networks," *Asia Communications and Photonics Conference (ACP)*, Paper M51.1, 2021. (Best Student Paper Award)
- [5] Xiaomin Liu, Huazhi Lun, Mengfan Fu, Qizhi Qiu, Lilin Yi, Weisheng Hu, and Qunbi Zhuge*, "A meta-learning-assisted training framework for application deployment to optical networks," *European Conference on Optical Communication (ECOC)*, Mo1k.3, 2020. (Oral presentation)
- [6] Xiaomin Liu, Huazhi Lun, Mengfan Fu, Yunyun Fan, Lilin Yi, Weisheng Hu, and Qunbi Zhuge*, "A three-stage framework for customizing link models for optical networks," *Optical Fiber Communications (OFC) Conference*, Paper Th3D.6, 2020. (Oral presentation)
- [7] Xiaomin Liu, Huazhi Lun, Mengfan Fu, Lilin Yi, Weisheng Hu, and Qunbi Zhuge*, "Machine learning based fiber nonlinear noise monitoring for subcarrier-multiplexing systems," *Optical Fiber Communications (OFC) Conference*, Paper M2J.6, 2020. (Oral presentation)

CO-AUTHORED PUBLICATIONS

Contributed journal papers

- [1] Yicheng Liu, Xiaomin Liu, Yihao Zhang, Meng Cai, Mengfan Fu, Xueying Zhong, Lilin Yi, Weisheng Hu, and Qunbi Zhuge*, "Building a digital twin of an EDFA for optical networks: a gray-box modeling approach," *IEEE/OSA Journal of Optical Communications and Networking*, vol. 15, no. 11, pp. 830-838, 2023.
- [2] Yihao Zhang, Xiaomin Liu, Ruoxuan Gao, Lilin Yi, Weisheng Hu, and Qunbi Zhuge*, "Raman pump optimization for maximizing capacity of C+L optical transmission systems," *IEEE/OSA Journal of Lightwave Technology*, vol. 40, no. 24, pp. 7814-7825, Spe.1, 2022.
- [3] Yunyun Fan, Xiaomin Liu, Mengfan Fu, Yicheng Xu, Qiaoya Liu, Xiaobo Zeng, Lilin Yi, Weisheng Hu, and Qunbi Zhuge*, "Asymmetric point-to-multipoint coherent architecture with frequency aliasing recovery algorithm for cost-constraint shortreach access networks," *Optics Express*, vol. 30, Np. 18, pp. 33124-33135, Aug. 27, 2022.
- [4] Ruoxuan Gao, Yihao Zhang, Xiaomin Liu, Minggang Chen, Fangchao Li, Xiang Li, Lilin Yi, Weisheng Hu, and Qunbi Zhuge*, "A heuristic-based optimization framework for customizable design of data center optical networks," *IEEE/OSA Journal of Optical Communications and Networking*, vol. 14, No. 11, pp. 924-933, Nov. 22, 2022.

- [5] Hexun Jiang, Mengfan Fu, Xiaobo Zeng, Xiaomin Liu, Huazhi Lun, Lilin Yi, Weisheng Hu, and Qunbi Zhuge*, "Aggressive look-up table compression by principal component analysis for digital pre-distortion in optical communication," *IEEE/OSA Journal of Lightwave Technology*, vol. 40, No. 24, pp. 7718-7726, Dec. 15, 2022.
- [6] Meng Cai, Xiaomin Liu, Lei Liu, Huazhi Lun, Lilin Yi, Weisheng Hu, and Qunbi Zhuge*, "Optical filtering impairment monitoring based on model fusion for optical networks," *Optics Express*, vol. 30, No. 14, pp. 24639-24654, Jul. 4, 2022.
- [7] Yunyun Fan, Mengfan Fu, Hexun jiang, Xiaomin Liu, Qiaoya Liu, Yicheng Xu, Lilin Yi, Weisheng Hu, and Qunbi Zhuge*, "Point-to-multipoint coherent architecture with joint source allocation for B5G/6G fronthaul," *IEEE Wireless Communications*, vol. 29, no. 2, pp100-106, Apr., 2022.
- [8] Yicheng Liu, Xiaomin Liu, Lei Liu, Yihao Zhang, Meng Cai, Lilin Yi, Weisheng Hu, and Qunbi Zhuge*, "Modeling EDFA gain: approaches and challenges," *Photonics*, vol. 8, no. 10, pp. 417:1-9, 2021.
- [9] Mengfan Fu, Qiaoya Liu, Huazhi Lun, Mengfan Fu, Yiwen Wu, Xiaomin Liu, Z. Yang, Lilin Yi, Weisheng Hu, and Qunbi Zhuge*, "Parallel bisection-based distribution matching for nonlinearity-tolerant probabilistic shaping in coherent optical communication systems," *IEEE/OSA Journal of Lightwave Technology*, vol. 39, no. 20, pp. 6459-6469, 2021.
- [10] Huazhi Lun, Xiaomin Liu, Meng Cai, Yihao Zhang, Ruoxuan Gao, Weisheng Hu, Lilin Yi and Qunbi Zhuge*, "Machinelearning-based telemetry for monitoring long-haul optical transmission impairments: methodologies and challenges," *IEEE/OSA Journal of Optical Communications and Networking*, vol. 13, no. 10, pp. E94-E108, 2021. (Invited paper)
- [11] Huazhi Lun, Yiwen Wu, Meng Cai, Xiaomin Liu, Ruoxuan Gao, Mengfan Fu, Lilin Yi, Weisheng Hu, and Qunbi Zhuge*, "ROADM-induced anomaly localization and evaluation for optical links based on receiver DSP and ML," *IEEE/OSA Journal of Lightwave Technology*, vol. 39, no. 9, pp. 2696-2703, 2021.
- [12] Ruoxuan Gao, Lei Liu, Xiaomin Liu, Huazhi Lun, Lilin Yi, Weisheng Hu, and Qunbi Zhuge*, "An overview of ML-based applications for next generation optical networks," *Information Sciences*, vol. 63, pp. 160302:1-160302:16, 2020.
- [13] Huazhi Lun, Mengfan Fu, Xiaomin Liu, Yiwen Wu, Lilin Yi, Weisheng Hu, and Qunbi Zhuge*, "Soft failure identification for long-haul optical communication systems based on one-dimensional convolutional neural network," *IEEE/OSA Journal* of Lightwave Technology, vol. 38, no. 11, pp. 2992-2999, 2020.
- [14] Yiwen Wu, Huazhi Lun, Mengfan Fu, Xiaobo Zeng, Xiaomin Liu, Qiaoya Liu, Lilin Yi, Weisheng Hu, and Qunbi Zhuge*, "Degenerated look-up table-based perturbative fiber nonlinearity compensation algorithm for probabilistically shaped signals," *Optics Express*, vol. 28, no. 9, pp. 13401-13413, 2020.
- [15] Qunbi Zhuge*, Xiaobo Zeng, Huazhi Lun, Meng Cai, Xiaomin Liu, Lilin Yi, and Weisheng Hu, "Application of machine learning in fiber nonlinearity modeling and monitoring for elastic optical networks," *IEEE/OSA Journal of Lightwave Technology*, vol. 37, no. 13, pp. 3055-3063, 2019.

Contributed conference papers

- [1] Ruoxuan Gao, Yihao Zhang, Xiaomin Liu, Minggang Chen, Fangchao Li, Lilin Yi, Weisheng Hu, and Qunbi Zhuge*, "Cband to Multi-band Network Upgrade by a Multi-objective Evolutionary Algorithm-based Optimization Framework," *European Conference on Optical Communication (ECOC)*, Paper We5.57, 2022.
- [2] Xueying Zhong, Huazhi Lun, Mengfan Fu, Xiaomin Liu, Lilin Yi, Weisheng Hu, and Qunbi Zhuge*, "Establishing the Relationship Between GMI and SNR in Optical Networks with Nonlinear Kerr Effect," *European Conference on Optical Communication (ECOC)*, Paper We5. 63, 2022.
- [3] Qizhi Qiu, Huazhi Lun, Xiaomin Liu, Lilin Yi, Weisheng Hu and Qunbi Zhuge*, "Fourier Neural Operator Based Fibre Channel Modelling for Optical Transmission," *European Conference on Optical Communication (ECOC)*, Paper We3B.2, 2022.
- [4] Yunyun Fan, Mengfan Fu, Xiaomin Liu, Yichen Xu, Lilin Yi, Weisheng Hu, and Qunbi Zhuge*, "Low-cost asymmetric point-to-multipoint coherent architecture for access networks," *Optical Fiber Communications (OFC) Conference*, Paper Th3E.6, 2022.
- [5] Yihao Zhang, **Xiaomin Liu**, Qizhi Qiu, Yichen Liu, Minggang Chen, Lilin Yi, Weisheng Hu, and Qunbi Zhuge*, "Multidimensional EDFA gain spectrum optimization for increasing WDM system capacity," *Photonic Networks and Devices* (*Networks*), Paper NeF1B.5, 2021.
- [6] Lei Liu, Xiaomin Liu, Z. Zhai, Yiwen Wu, Hexun Jiang, Lilin Yi, Weisheng Hu, and Qunbi Zhuge*, "FPGA-based implementation of artificial neural network for nonlinear signal-to-noise ratio estimation," *OptoElectronics and Communications Conference (OECC)*, Paper T2B.4, 2021.
- [7] Huazhi Lun, Xiaomin Liu, Meng Cai, Yiwen Wu, Mengfan Fu, Lilin Yi, Weisheng Hu, and Qunbi Zhuge*, "GAN based soft failure detection and identification for long-haul coherent transmission systems," *Optical Fiber Communications (OFC) Conference*, Paper Th4J.2, 2021.
- [8] Meng Cai, Huazhi Lun, Mengfan Fu, **Xiaomin Liu**, Lilin Yi, Weisheng Hu, and Qunbi Zhuge*, "Optical filtering impairment monitoring based on artificial neural network in coherent receiver," *Asia Communications and Photonics Conference (ACP)*, Paper T4B.6, 2020.

- [9] Mengfan Fu, Huazhi Lun, Qiaoya Liu, **Xiaomin Liu**, Meng Cai, Lilin Yi, Weisheng Hu, and Qunbi Zhuge*, "Investigation of CCDM implementation in long-haul subcarrier-multiplexing transmissions," *Signal Processing in Photonic Communications (SPPCom) Conference*, Paper SpTh31.5, 2020.
- [10] Huazhi Lun, Xiaomin Liu, Meng Cai, Mengfan Fu, Yiwen Wu, Lilin Yi, Weisheng Hu, and Qunbi Zhuge*, "Anomaly localization in optical transmissions based on receiver DSP and artificial neural network," *Optical Fiber Communications* (OFC) Conference, Paper W1K.4, 2020.

Chinese Patents

- [1] Chinese patent (No.CN202210520242.8), "The measurement method for optical amplifiers", Xiaomin Liu, Qunbi Zhuge. (granted)
- [2] Chinese patent (No.CN202210825349.3), "The power optimization strategies for optical communication systems", Xiaomin Liu, Qunbi Zhuge. (in progress, published, disclosed)
- [3] Chinese patent (No. CN202310273684.1), "Continues modeling and optimization strategies for Raman amplifiers", **Xiaomin** Liu, Qunbi Zhuge. (in progress, published, disclosed)

SKILLS

- Programming: Python, MATLAB
- Languages: Mandarin (Native), English (Fluent, TOEFL 103)
- Debater: Debate Team of Shanghai Jiao Tong University ME college | Leader, Judge, Coach & Debater