Guest Editorial >>>

Special Topic on Achievements of ZTE's Industry-University-Institute Cooperation Projects

Guest Editor

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The relentless evolution of Information and Communication Technology (ICT) stands as a testament to the synergistic power of collaboration. It thrives at the dynamic intersection of industrial insight, academic rigor, and dedicated research. This special issue, "Achievements of ZTE's Industry-University-Institute Cooperation Projects," presents a curated collection of cutting-edge research that embodies the fruitful outcomes of deep collaboration, addressing some of the most pressing challenges across wireless communications, artificial intelligence (AI), software engineering, and industrial digitization.

Opening the issue, the paper "Deep CSI Compression and Feedback for Massive MIMO: A Survey" provides a comprehensive overview of deep learning-based Channel State Information (CSI) compression for massive Multiple-Input Multiple-Output (MIMO) in 5G-Advanced and future 6G systems, thereby framing a key research direction for the community.

Pushing the boundaries of physical-layer communication, the second paper "Low-Complexity OTFS Channel Equalization Based on CLU-MMSE" introduces a novel algorithm that significantly reduces the computational complexity of equalization for Orthogonal Time Frequency Space (OTFS) modulation. This work is pivotal for making OTFS, a promising waveform for high-mobility scenarios, more practical and implementable in next-generation wireless systems.

DOI:10.12142/ZTECOM.202601002
Citation: (Format 1): Xu C Z. Editorial: achievements of ZTE's industry-university-institute cooperation projects [J]. ZTE Communications, 2026, 24(1): 2–3. DOI: 10.12142/ZTECOM.202601002
Citation: (Format 2): C. Z. Xu, "Editorial: achievements of ZTE's industry-university-institute cooperation projects," *ZTE Communications*, vol. 24, no. 1, pp. 2–3, Mar. 2026. doi: 10.12142/ZTECOM.202601002.

Enhancing security at the hardware level, the third paper "Carrier Frequency Offset Based Robust Radio Frequency Fingerprint for OFDM Communication in Time-Varying Channels" proposes a robust radio frequency fingerprinting method using Carrier Frequency Offset (CFO), offering a novel layer of physical-layer authentication for securing IoT and other massive device networks.

Addressing a fundamental AI operational challenge, the fourth paper "Key Technologies for AI-Driven Network Traffic Classification Workflow and Data Distribution Shift" delves into the critical issue of model performance degradation when traffic patterns evolve. By proposing a systematic workflow and countermeasures for data distribution shift, this paper provides essential methodologies for deploying sustainable and adaptive AI in dynamic network environments.

Securing collaborative industrial ecosystems, the fifth paper "Efficient and Secure Data Storage in 5G Industrial Internet Collaborative Systems" presents a novel solution that integrates data confidentiality with attribute-based access control. This work tackles the dual challenge of protecting sensitive industrial data while enabling flexible, policy-driven data sharing among multiple entities within a 5G-enabled industrial framework.

Driving the evolution of broadband access, the sixth paper "Complexity-Reduced Equalization for 200 Gbit/s PON Downstream Systems Based on SSB Modulation and Direct Detection" presents a low-complexity equalization scheme for a 200 Gbit/s passive optical network (PON), achieving a 29 dB power budget over 20 km fiber, demonstrating its readiness for metro-access deployment.

Transforming software development practices, the seventh paper "Enhancing Code Quality with LLM in Software Static Analysis" demonstrates a pioneering application of large lan-

guage models. By integrating an AI-powered detection and patching microservice directly into the developer's workflow, this research enables a significant shift-left in software quality and security assurance, showcasing AI's role in augmenting developer productivity and code robustness.

Advancing digital human technology, the eighth paper "AED-NeRF: Audio-Driven and Emotion-Editing Dynamic Neural Radiance Fields for Expressive Talking Face Avatar" advances the state of expressive avatar generation by seamlessly integrating audio-driven lip synchronization with explicit emotion control. This work enables real-time, photorealistic talking faces whose expressions can be intuitively edited, addressing a key limitation in current virtual communication systems.

Empowering intelligent industrial inspection, the ninth paper "Steel Surface Anomaly Detection Using 3D Depth and 2D RGB Features" presents a robust multi-stage visual detection system. By effectively fusing 2D texture and 3D geometric features, this method achieves high accuracy in defect classification and localization, offering a practical and reliable AI solution for quality control in complex industrial manufacturing environments.

Innovating at the component level, the tenth paper "Synthesis and Design of Generalized Strongly Coupled Resonator Quartet Combline Filters with Redundant Resonance" contributes a novel filter synthesis theory and design. This work enables the realization of high-performance filters with desirable transmission zeros using simplified inductive coupling structures, an important advancement for the front-end hardware of compact communication devices.

Finally, rethinking system-level design, the paper "Modern Graphics APIs: Design Principles, A Use Case, and New Perspectives" provides a deep architectural analysis of the evolution of graphics APIs. Through principle elucidation and a concrete rendering engine case study, it offers valuable insights into the design trends that drive efficiency and performance in modern computing systems, a foundational concern for all computationally intensive applications.

Collectively, these contributions exemplify how targeted collaboration turns industrial challenges into research frontiers and translates academic innovation into practical solutions. They move beyond isolated theoretical pursuits, firmly grounding innovation in real-world requirements such as complexity reduction, security hardening, cost efficiency, and adaptability. The works on OTFS equalization, RF fingerprinting, and PON systems directly address the performance and economic constraints of future networks. The explorations into AI for code quality, traffic classification, and industrial inspection tackle scalability and reliability challenges in software and automation. The advancements in filters, graphics APIs, and emotional AI avatars highlight the continuous drive for better performance and more natural interfaces. We hope this special issue inspires continued and deepened collaboration across the industry-academia-research spectrum to meet the exciting challenges that lie ahead.

Biography

Xu Chengzhong received his PhD from the University of Hong Kong, China in 1993. He is Chair Professor of Computer Science at University of Macau, China. Previously, he held faculty positions at Wayne State University, USA and Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences (CAS). His recent research focuses on cloud and edge for AI, autonomous driving, and intelligent transportation. Dr. Xu has authored two research monographs and over 600 journal and conference papers, garnering more than 25 000 citations and an H-index of 83. Notably, his work has been cited in 370 international patents, including 240 US patents. He is a co-inventor of more than 200 PCT and China patents and a co-founder of Shenzhen Institute of Beidou Applied Technology. His research has earned him best paper awards or nominations at conferences including SoCC'2021, HPCA'2013, HPDC'2013, and ICPP'2015. He has served on the editorial boards of several journals, including *IEEE TC*, *IEEE TCC*, *IEEE TPDS*, *JPDC*, *Science China*, and *ZTE Communications*. Dr. Xu formerly chaired IEEE Technical Committee on Distributed Processing (2015 to 2020). He is an IEEE Fellow due to contributions in resource management in parallel and distributed computing.