EDITORIAL

Editorial: Large Language Models: Concept and Future Perspectives

Gaurav Dhiman[1,*]

[1] School of Sciences and Emerging Technologies, Jagat Guru Nanak Dev Punjab State Open University, Patiala, Punjab, India

The rapid evolution of artificial intelligence (AI) has ushered in a new era of language processing, with Large Language Models (LLMs) at the forefront of this transformation. These models, built on deep learning architectures and vast datasets, have demonstrated unprecedented capabilities in understanding, generating, and reasoning with human language. As the field progresses, the implications of LLMs extend beyond their technical prowess, influencing industries, societies, and the very fabric of human-machine interaction.

1 Foundations of Large Language Models

Large Language Models, such as GPT, BERT, and T5, have revolutionized natural language processing (NLP) by enabling contextual understanding at a scale previously unimaginable [1]. The core of these advancements lies in:

1. *Transformer Architectures*: Utilizing self-attention mechanisms to capture long-range dependencies in text.
2. *Self-Supervised Learning*: Leveraging massive unlabeled datasets to learn complex language patterns.
3. *Massive Parameter Scaling*: Increasing the depth and width of neural networks to enhance generalization.

These elements have empowered LLMs to perform a wide range of tasks, from text completion and translation to code generation [2] and content synthesis. However, their impact transcends traditional NLP applications, extending into healthcare, education, legal analysis, and creative arts.

2 Applications, Challenges, and Future Perspectives of Large Language Models

Large Language Models (LLMs) have demonstrated transformative potential across a wide range of domains. In healthcare, LLMs increasingly support clinical decision-making by enabling predictive diagnostics, assisting clinicians with the interpretation of complex biomedical data, and enhancing medical transcription through automated summarization and error reduction. They further facilitate drug discovery by rapidly mining and synthesizing insights from large-scale biomedical literature, thereby accelerating hypothesis generation and experimental design. In the field of education, LLMs contribute to personalized learning through intelligent tutoring systems that adapt instructional content to individual learner needs.

Submitted: 24 September 2025
Accepted: 25 September 2025
Published: 16 November 2025

Vol. 1, **No.** 1, 2025.
10.62762/TLLM.2025.429987

***Corresponding author:**
✉ Gaurav Dhiman
gdhiman0001@gmail.com

Citation
Dhiman, G. (2025). Editorial: Large Language Models: Concept and Future Perspectives. *ICCK Transactions on Large Language Models*, 1(1), 1–3.

They also automate grading and provide structured, formative feedback while enabling real-time language translation and content generation, thus supporting multilingual and inclusive learning environments. Within business and industry, corporations deploy LLM-driven customer service agents to enhance responsiveness and user satisfaction, employ automated content generation tools for marketing and communication, and leverage advanced analytical capabilities of LLMs to strengthen financial modeling, risk assessment, and market forecasting. In the creative arts, LLMs foster new forms of human–AI collaboration by generating literature, poetry, and narrative content; augmenting design workflows; and enabling automated scriptwriting and multimedia production, all of which expand creative possibilities and reshape digital content creation practices.

Despite these advances, the deployment of LLMs is accompanied by significant challenges and ethical considerations [3]. Model bias remains a critical concern, as LLMs trained on imbalanced datasets may inadvertently reinforce social inequities, necessitating ongoing efforts to ensure fairness and representational inclusiveness. The environmental impact associated with large-scale model training also raises sustainability issues, particularly regarding energy consumption and carbon footprint. Moreover, LLMs can contribute to the spread of misinformation or be exploited for generating deceptive content such as deepfakes, posing substantial risks to information security and public trust. Another persistent challenge is the limited interpretability of these models, which complicates accountability and hinders transparent decision-making in high-stakes applications.

Looking forward, the evolution of LLMs is projected to be shaped by breakthroughs in multimodal integration, efficiency optimization, and governance frameworks [4–6]. The next generation of models will increasingly combine text, vision, speech, and other modalities, enabling richer and more natural human–AI interactions. At the architectural level, emerging techniques such as sparse computation, mixture-of-experts models, and modular neural systems will enhance computational efficiency and reduce the environmental burden associated with training and inference. Equally important are advances in AI governance and regulatory structures, which will guide responsible deployment and ensure that ethical principles—such as transparency, accountability, and privacy protection—are properly upheld. These governance mechanisms will play a decisive role in shaping how LLMs are integrated into societal, industrial, and scientific ecosystems. As these technological and institutional developments unfold, LLMs are expected to become increasingly capable, sustainable, and trustworthy, reinforcing their role as foundational components of future intelligent systems.

3 Conclusion

The launch of *ICCK Transactions on Large Language Models* comes at a pivotal moment in AI research, offering a dedicated platform for scholars, practitioners, and industry leaders to contribute to the advancement of LLMs. This journal aspires to foster discussions on fundamental research, novel applications, and ethical considerations, paving the way for a future where language models augment human potential responsibly and effectively. I, on behalf of the editorial team, invite researchers, engineers, and policymakers to engage with this journal, driving forward the innovation and responsible use of Large Language Models. Together, as a community, we can shape the trajectory of AI for the betterment of society and technological progress.

Data Availability Statement

Not applicable.

Funding

This work was supported without any funding.

Conflicts of Interest

The author declares no conflicts of interest.

Ethical Approval and Consent to Participate

Not applicable.

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Dr. Gaurav Dhiman is a highly accomplished academician and researcher with an impressive track record of excellence in computer science. He holds a Ph.D. in Computer Engineering from Thapar Institute of Engineering & Technology, Patiala, and has also completed his Master Degree of Computer Applications from the same institute. Currently, he is serving as an Assistant Professor in the School of Sciences and Emerging Technologies, Jagat Guru Nanak Dev Punjab State Open University, Patiala. His research has been recognized at the highest level, as he has been named one of the world's top researchers by Clarivate Analytics as world's top 1% and by Stanford University, USA list of world's top 2% scientists prepared by Elsevier. He is the senior member of IEEE. He has also received accolades for his outstanding reviewer work from Knowledge-Based Systems (Elsevier). He has authored over 300 peer-reviewed research papers, all of which are indexed in SCI-SCIE, and 10 international books. He is currently serving as a guest editor for more than forty special issues in various peer-reviewed journals. He is an Editor-in-Chief of the ICCK Transactions on Machine Intelligence, ICCK Transactions on Large Language Models, and International Journal of Modern Research (IJMORE). He is an Associate Editor of IEEE Transactions on Industrial Informatics, IEEE Transactions on Consumer Electronics, IEEE Transactions on Computational Social Systems, IET Software (Wiley), Expert Systems (Wiley), IEEE Systems, Man, and Cybernetics Magazine, Spatial Information Research (Springer), and many more. He is also an Academic Editor of Computational and Mathematical Methods in Medicine (Hindawi), Scientific Programming (Hindawi), Mobile Information Systems (Hindawi), and Review Editor of Frontiers in Energy Research - Fuel Cells, Frontiers in High-Performance Computing - Parallel and Distributed Software, Frontiers in Artificial Intelligence - Pattern Recognition, and more. His research interests span a wide range of topics including Generative Artificial Intelligence, Large Language Modles, Internet of Things, Machine-learning, Deep-learning, Single-, Multi-, Many-objective optimization (Bio-inspired, Evolutionary, and Quantum), Soft computing (Type-1 and Type-2 fuzzy sets), Power systems, and Change detection using remotely sensed high-resolution satellite data. He has published his research in various reputed journals, including IEEE, Elsevier, Springer, Wiley, Taylor and Francis, among others.