

**Book Title** : **Principles of Hybrid Intelligent Systems**

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**Imprint /Series** : **GSE Publications**

**Book Category** : Edited Volume

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**First Edition** : 20 January, 2026

**Book Size** : A4

**Product Form** : Paperback / Softback/Online

**Price** : Rs.499/-

**Publisher Website** : [www.gsepublications.in](http://www.gsepublications.in)

**DOI** : [www.doi.org/10.58599/9788199496910.20012026](http://www.doi.org/10.58599/9788199496910.20012026)

**ISBN Number (s)** : 978-81-994969-7-2 (Print);978-81-994969-1-0 (Online)

*Published by*

**GSE Publications Private Limited, India.**

**GSE Publications** is an imprint publication series of **GSE Publications Private Limited, India.**

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## PREFACE

This edited volume, **Principles of Hybrid Intelligent Systems**, is conceived in response to the growing need for intelligent solutions that transcend the limitations of single-model artificial intelligence approaches. As real-world problems become increasingly complex, dynamic, and data-rich, hybrid intelligent systems-integrating machine learning, deep learning, classical AI, signal processing, optimization, and domain expertise-have emerged as a powerful and practical paradigm. This book brings together contributions from researchers and academicians across diverse application domains to present both foundational principles and real-world implementations of hybrid intelligence. The chapters collectively demonstrate how synergistic model integration enhances robustness, interpretability, and decision-making capability, while also addressing societal, industrial, and technological challenges. It is our hope that this volume will serve as a valuable reference for researchers, educators, postgraduate students, and practitioners, and will inspire further innovation and research in the rapidly evolving field of hybrid intelligent systems.

## ACKNOWLEDGMENTS

We express our sincere gratitude to all the chapter authors whose scholarly contributions, dedication, and timely efforts made this edited volume possible. We extend heartfelt appreciation to the reviewers for their constructive insights, which greatly enriched the quality and clarity of the chapters. Our thanks also go to the academic and research institutions that supported the authors in their work, and to the broader AI research community for providing continual inspiration through its rapid advancements. We are grateful to GSE Publications for their commitment, guidance, and seamless coordination throughout the publication process. Finally, we acknowledge all readers, researchers, and educators who engage with this book, and we hope that it serves as a valuable resource for advancing knowledge, fostering innovation, and promoting meaningful applications of next-generation Artificial Intelligence.

## ABOUT THIS BOOK

**Principles of Hybrid Intelligent Systems** is an edited research volume that presents a coherent and application-oriented view of hybrid intelligence—an emerging paradigm that integrates machine learning, deep learning, classical artificial intelligence, signal processing, optimization techniques, and domain knowledge to address complex real-world challenges. As isolated AI models often struggle with issues of robustness, interpretability, and generalization, hybrid intelligent systems provide a principled framework by combining complementary methodologies. This volume establishes the foundational principles of hybrid intelligence while emphasizing its capability to deliver reliable, scalable, and context-aware decision-making in data-intensive and dynamic environments.

The edited volume brings together contributions spanning a wide range of contemporary domains, including medical image understanding and clinical decision support, biomedical signal interpretation and health monitoring, smart agriculture and precision farming, industrial IoT monitoring and predictive maintenance, financial risk assessment and fraud detection, autonomous mobility and traffic prediction, remote sensing and environmental change detection, natural language understanding for low-resource languages, emotion recognition using multimodal human signals, cybersecurity and intrusion detection, smart education and personalized learning systems, energy management and smart grid optimization, vision–language models for robotics and human–machine interaction, sustainable development and decision support, and AI-enabled tools for software automation and intelligent code analysis. Intended for researchers, academicians, postgraduate students, and industry professionals, this book serves as a comprehensive reference on the principles, architectures, and practical deployments of hybrid intelligent systems, while also outlining future research directions in this rapidly evolving field.