ARTIFICIAL INTELLIGENCE

FOUNDATIONS AND FRONTIERS

Edited by
Dr. Sulakshana Banerjee Mukherjee

Sultan Chand & Sons

Artificial Intelligence
Foundations and Frontiers

Dedicated to

This book is lovingly dedicated to my beloved parents –
My Baba, **Late Kanchan Kumar Banerjee** and
My Maa, **Mrs. Prativa Banerjee**

Without their unconditional love, blessings, and support, it would not have been possible for me to transform my thoughts into reality.

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Foundations and Frontiers

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Foreword

Dr. N.L. Mitra
Former Chancellor, KIIT University
Former Director, NLSIU, Bangalore
Founding Vice Chancellor, NLU, Jodhpur

There has been a radical change in handling any matter relating to technology between my generation and this, my grandchildren's generation. We used to hesitate to talk about or deal with any issue of technology without having knowledge about technology from a Technology Institute. Technology was completely left to technologists passing out of IIT, as if we have nothing to do with it. The young India is charged with the technology as their daily schedule without being a technologist. They can extensively talk on, and dare write about a lot of things about technology, the sociological impact, historical development, economic direction of sustainable development and a lot of technology application in daily chorus of life and its consequences. Application of 'Artificial Intelligence', popularly and fashionably termed as AI, in all walks of life has attracted young generation of all professions. Law and justice are now very popular fields of application of AI in all fact research and law identification. When Sulakshana, whose grandfather was like my elder brother, approached me to write a Foreword for her compilation, *Artificial Intelligence – Foundations and Frontiers*

I was really taken aback due to its daunting challenge, her generation throwing against my generation. As I said in our generation relation between 'law' and 'technology' was just like a newly wedded Hindu wife and husband, wife following seven steps behind the husband with a long *ghoonghat* covering her face. In many cases in rural India thousands of brides of the age of 14 or below would not have recognized their Groom while returning home after the marriage. So, one can easily understand my position.

I thought why not take the help of AI in writing a foreword in a book on artificial intelligence. But my friend from Times of India warned me suggesting some of the AI now started thinking that they can work like OI, original intelligence. Recently, a senior advocate used AI in his research to find out earlier case laws on a very popular issue relating to environment. AI produced a document of about fifty pages well researched and documented with a lot of case studies and references. The senior advocate with a deep confidence submitted the research product suggesting precedents. But unfortunately, My Lord was from old generation and insisted hard copies of the judgment of a case directly pointing to be the precedent. The senior advocate was ashamed in the opened court when it was found ultimately that AI used its original intelligence instead, of an expert senior advocate to construct the fact of the case to suit to be precedent. So, being afraid of the AI using its OI skills, I preferred to scribble a few words of my own, which no knowledgeable AI expert would consider to be an attempt to show 'Law' marching with the 'technology', at par, *kadam kadam badhaya ja*!

Dr. Sulakshana B. Mukherjee collected a young scholarly group from technology, law, and justice professionals to provide a fairly good coverage on matters in which AI may take significant role. This has been a right choice to raise all relevant issues of developing and applying AI in management of law and justice. The group has the very young law and legal research face in technology in Mohona and Sathia, and technology face in law in Dr. Srivastava and Dr. Dharmendra. In one side there are core technology to be represented by Dr. Sudipto and Dr. Kalpana and on the other, there are Dr. Shyamtanu and Dr. Somnath representing legal academicians. The AI presently has come up very closely and effectively in three fields of administration of justice. In case analysis & legal research,

locating & application of proportionate law on legal principles, and in documentation & court process management – these three areas are now having several AI appliances. In two other areas AI can play a significant role to make law and justice more effective with better time management. The two areas are investigation and prosecution. Both these fields are related to criminal administration of justice. Both these fields are diversified and involves data analytics and data preservation & management. Both these areas require effective data processing and presentation. In civil matters, AI is used in all legal documentations, land records and land data and tax management, GST assessment and collection and IT returns and assessments. Corporate sector uses AI tools in most of the legal, secretarial and financial compliances.

Legal education is now in the process of seriously to be taken over substantially by AI. I have noticed that one very good change over the recent years is that the teachers and students are using AI in developing class-room teaching materials and information sharing. My only advice to the young faculty is that collect your study and instruction materials from AI generated research and then try to lift up your personal and professional skills to top up that AI generated materials signifying your 'add values.' AI generated lessons are expressed in monotonous use of uniform language and with similar copybook expressions. Often the robotic manifestation causes frustration. Notwithstanding all these AI is a step forward to bring perfection in the operation of all the three branches of law and justice: education, advocacy and judicial expertise.

I am sure the compilation would benefit the general public to better appreciate AI and its positive impact on development. This will make Sulakshana's effort a success.

Dr. N.L. Mitra
Former Chancellor, KIIT University
Former Director, NLSIU, Bangalore
Founding Vice Chancellor, NLU, Jodhpur

Preface

It is with great pleasure that I present *Artificial Intelligence: Foundations and Frontiers*, a curated volume that brings together leading academicians, scholars and practitioners to explore the foundational principles and emerging frontiers of Artificial Intelligence (AI). As AI continues to reshape our world, this book aims to serve as both a reflection on the field's core underpinnings and a forward-looking exploration of its evolving boundaries.

The journey of AI has been marked by remarkable progress – from rule-based expert systems and symbolic reasoning to deep learning, generative models, and beyond. Yet, alongside these technological leaps, critical questions persist regarding the interpretability, ethics, and societal impact of intelligent systems. This volume is organized to address this dual character of AI: the enduring significance of foundational theory and the excitement and challenges of new frontiers.

The chapters in this book are written by experts from academia, industry, and interdisciplinary academic professionals. They span a wide spectrum of topics including AI and Cybersecurity, AI and Criminal Justice System, AI and Contract, AI and its legal implications, AI and ethics, intelligibility, and human-AI interaction, *etc.* Each contribution has been carefully selected to provide depth in its subject area while also being accessible to readers from adjacent disciplines.

This book is intended for researchers, students, and professionals who seek a comprehensive understanding of AI's current landscape.

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This book is intended for researchers, students, and professionals who seek a comprehensive understanding of AI's current landscape. It is also meant to encourage reflection and dialogue on how we build, evaluate, and deploy intelligent systems in service of both in innovation and human values.

I extend my sincere gratitude to all the contributors who shared their time, expertise, and insights. I am also thankful to the reviewers and collaborators who helped to shape this volume into its final form. Most importantly, I hope that readers will find in these pages both knowledge and inspiration to further the responsible development of AI.

Dr. Sulakshana Banerjee Mukherjee

Acknowledgement

First and foremost, I am deeply thankful to God, who continually watches over me, my parents, my friends, my students, and all my well-wishers. Their constant support and love have been my strength throughout this journey.

I am profoundly grateful to my husband, Mr. Ananda Mukherjee, for his steadfast support, encouragement, and kindness. His continuous assistance has played a crucial role in the completion of this book.

A special note of deep appreciation and heartfelt thanks to the most prominent figure in the field of legal fraternity in India, Dr. N.L. Mitra Sir, Former Chancellor, KIIT University, Former Director NLSIU, Bangalore and Founding Vice-Chancellor, NLU Jodhpur. I am sincerely grateful to him for graciously penning the "Foreword", thereby adding immense value and enormity to this work.

My heartfelt gratitude and appreciation go to the learned authors from diverse backgrounds who have trusted me with their valuable contributions. Their collective wisdom and insights have made this book a comprehensive and authoritative resource, and I am thankful for their active participation.

My heartfelt thanks also go to Soham Mukherjee, Aditi, and Ritam Banerjee, who are endless sources of joy and resourceful inspiration in my life.

I extend my sincere appreciation to Sultan Chand & Sons, Publishers, New Delhi, for helping me to shape my dream.

Lastly, I am thankful to every single reader who says, "You have to read this book!"

Your words are the greatest reward an author can receive.

Dr. Sulakshana Banerjee Mukherjee

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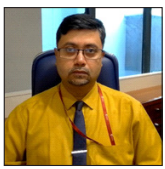

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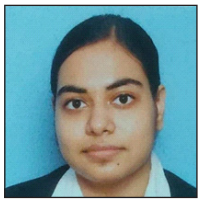

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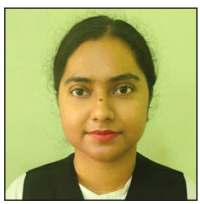

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About the Book

It explores how AI innovations are being used in contracts, criminal justice systems, intellectual property rights, *etc*. It's a comprehensive sourcebook for anyone interested in understanding the complexities of AI.

Salient Features

- Interdisciplinary Approach
- Classic and Contemporary Chapters
- Wide range of Topics

Target Audience

Researchers and Students – This book is ideal for those seeking a deep understanding of AI's foundations and its applications.

Professionals – It provides valuable insights for experts looking to expand their knowledge of AI's theoretical and practical approach.

About the Editor

Dr. Sulakshana Banerjee Mukherjee is a versatile and passionate academician, currently serving as an Associate Professor at the School of Law, Sushant University, Gurugram. With a consistently distinguished academic record, she has been recognized with multiple gold medals, scholarships, and awards throughout her educational journey – most notably receiving her gold medals from the then Governor of West Bengal, Shri Gopal Krishna Gandhi.

An active contributor to legal academia, Dr. Sulakshana has presented numerous research papers at National and International Conferences, Seminars and Workshops, *etc*. Her scholarly work is widely published in reputed journals, including Scopus and UGC CARE-listed journals, ABDC journals, *etc*., as well as edited volumes. She has also Chaired and Co-Chaired in several prestigious National and International Conferences alongside distinguished legal luminaries.

Dr. Sulakshana's achievements have been widely acknowledged with accolades such as:

- Women Empowerment Award
- National Teachers Award
- National Women Leadership Award
- Woman Innovator Award
- Outstanding Contribution Award from the Delhi State Legal Services Authority in collaboration with Bhagidari Jan Sahyog Samiti and Human Foundation.
- Certificate of Recognition from the Indus Foundation of Education, Research, and Social Welfare (UGC Recognized), for her role as Guest Editor.

She is also a published author of three books, which were featured at the World Book Fair, New Delhi, and are available on Amazon. In addition, Dr. Sulakshana holds a patent in law, showcasing her innovative contributions to legal research.

A dedicated research Supervisor, she mentors scholars from diverse professional backgrounds, including judicial officers, advocates, academicians and IAS officers. Under her guidance, Sushant University's first Ph.D Scholar of Law successfully earned her doctorate.

Beyond her academic and research commitments, Dr. Sulakshana actively contributes to institutional development through various academic and administrative roles and frequently serves as a distinguished speaker at National and International forums.

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