About This Book

Welcome to the NeuroAI Handbook

The **NeuroAI Handbook** serves as a comprehensive resource for students, researchers, and practitioners interested in the intersection of neuroscience and artificial intelligence. This emerging interdisciplinary field combines insights from how the brain processes information with cutting-edge AI algorithms and architectures.

Purpose and Scope

This handbook aims to:

- Bridge the gap between neuroscience and artificial intelligence
- Provide a structured introduction to both fields for interdisciplinary researchers
- Explore how biological neural systems inspire AI systems
- Showcase applications where AI tools enhance neuroscience research
- Discuss future directions and ethical considerations in NeuroAI

How to Use This Book

The handbook is organized into thematic parts, starting with foundational concepts and progressing toward advanced applications:

- **Part I: Brains & Inspiration** - Core neuroscience concepts and historical connections
- **Part II: Brains Meet Math & Data** - Mathematical frameworks and data science approaches
- **Part III: Learning Machines** - Machine learning and deep learning fundamentals
- **Part IV: Frontier Models** - State-of-the-art AI models and architectures
- **Part V: Ethics & Futures** - Ethical considerations and future directions

- **Part VI: Advanced Applications** - Specialized applications and case studies

Each chapter includes practical examples, code snippets where applicable, and references to further resources. Interactive notebooks are provided for hands-on learning experiences.

Target Audience

This handbook is designed for:

- Students entering the field of computational neuroscience or AI
- Neuroscientists interested in applying AI methods to their research
- AI researchers seeking inspiration from neuroscience
- Interdisciplinary researchers working at the intersection of these fields
- Practitioners looking to understand the biological basis of AI systems

We hope this handbook serves as a valuable resource on your journey through the fascinating landscape where neurons meet algorithms.