

Lekshmi S. Raveendran, Minu Susan Jacob, R. Sathyabama Krishna

# Machine Learning Tools & Techniques

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## Product Description

"Machine Learning Tools and Techniques" serves as a thorough and approachable guide, offering a comprehensive overview of essential ML concepts, tools, and methodologies crucial for navigating the modern era of artificial intelligence and big data. The book is purposefully structured to bridge the gap between theoretical foundations and practical implementation, making it a critical resource for developing intelligent systems.

The learning journey begins with core data mining principles, exploring the process, fielded applications across industries like finance and healthcare, and the foundational relationship between machine learning and statistics. It systematically builds expertise through detailed discussions on knowledge representation (including trees, linear models, and rules) and the crucial concepts of model credibility and evaluation, covering rigorous techniques like cross-validation, hyperparameter tuning, and the Minimum Description Length (MDL) principle. A strong emphasis is placed on essential data preprocessing and transformation methods, such as attribute selection and data cleansing.

Crucially, the book introduces a versatile ML tool-kit, providing hands-on application demonstrations for industry-standard platforms and libraries, including Scikit-Learn, TensorFlow, PyTorch, KNIME, and IBM Watson. This text is an ideal resource for students, researchers, and professionals seeking to gain hands-on expertise in applying cutting-edge ML solutions to develop real-world applications and contribute meaningfully to the field of AI and data analytics.

Salient Features:

• Foundational Concepts: Covers the complete data mining process, the core relationship between machine learning and statistics, and essential ethical considerations for responsible AI deployment.

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• Knowledge Representation: Detailed explanation of diverse representation methods, including decision trees, linear and rule-based models, instance-based learning, and unsupervised clustering techniques.

• Credibility and Validation: Focuses on rigorous model evaluation using techniques like cross-validation and hyperparameter selection, alongside the Minimum Description Length (MDL) principle to prevent overfitting.

• Data Transformation Methods: Explores crucial data preprocessing steps such as attribute selection, feature engineering, data cleansing, and techniques for handling multi-class data for binary classifiers.

• Algorithmic Techniques: Deep dive into predictive modeling using advanced Decision Trees, Classification and Association Rules, along with extending instance-based and local linear models.

• Practical ML Tool-Kit: Hands-on introduction to widely adopted machine learning platforms and libraries, including TensorFlow, Scikit-Learn, PyTorch, and visual tools like KNIME and WEKA.

• Real-World Applications: Features numerous fielded applications across healthcare, finance, e-commerce, and cybersecurity, including practical case studies for conceptual reinforcement.

• Refining Predictions: Discusses advanced concepts for enhancing model trustworthiness, such as evaluating numeric prediction models and calibrating class probabilities for reliable decision-making.

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# Artificial Intelligence Search Methods & Reasoning

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## Product Description

Artificial Intelligence Search Methods and Reasoning serves as an essential guide to the foundational principles and core algorithmic strategies that power modern intelligent systems. This book uniquely blends the basic cognitive science behind AI—exploring concepts of intelligence, memory, computation, and learning—with the practical, rigorous algorithms used for problem-solving in complex environments. Its core theme is to demystify how intelligent agents perceive, reason, and act by systematically searching for optimal solutions.

The primary purpose of this resource is to equip learners with a deep, practical understanding of both uninformed (e.g., BFS, DFS) and informed search techniques (e.g., A*, Greedy Best-First Search), adversarial search, and constraint satisfaction problems (CSPs). The text further extends into crucial domains like knowledge representation using logical agents (propositional and first-order logic) and probabilistic reasoning (Bayesian networks, Hidden Markov Models). It culminates in a detailed examination of various learning algorithms, including supervised, unsupervised, reinforcement, and ensemble methods.

The target audience for this book includes undergraduate and graduate students in Computer Science, Artificial Intelligence, and Electrical Engineering, as well as researchers and professionals seeking a robust, algorithm-focused foundation in AI theory and implementation. It offers practical value through numerous case studies, such as the N-Queens Problem, the Wumpus World, and the application of Nature-Inspired Computation like Ant Colony Optimization for the Traveling Salesman Problem. It is a vital resource for building intelligent systems capable of autonomous decision-making.

Salient Features:

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• Foundational AI Concepts: Provides a unique introduction to the cognitive roots of AI, detailing the science behind intelligence, human memory models, and their translation into computational systems.

• Exhaustive Search Algorithms: Offers comprehensive coverage of Uninformed Search methods (BFS, DFS, IDDFS, UCS, Bidirectional Search) & advanced Informed Search strategies, including heuristics & A*.

• Logic and Reasoning: Systematically explores the role of knowledge and its representation using propositional and First-Order Logic, enabling agents to perform complex inference via Forward and Backward Chaining.

• Probabilistic Approaches: Dedicated unit on planning and reasoning under uncertainty, covering essential topics like Bayes' Rule, Bayesian Networks, Hidden Markov Models, and Kalman Filters.

• Constraint Solving & Games: Detailed breakdown of Constraint Satisfaction Problems (CSPs), including a case study on the N-Queens problem, alongside an exploration of Adversarial Search strategies for competitive environments.

• Modern Learning Paradigms: Includes extensive chapters on learning intelligence, covering Supervised, Unsupervised, and Ensemble Learning techniques (e.g., Boosting/AdaBoost), vital for contemporary AI applications.

• Real-World Case Studies: Features practical application examples like solving the Wumpus World problem and a special unit on Nature-Inspired Computation, demonstrating Ant Colony Optimization for the Traveling Salesman Problem (TSP).

• Intelligent Agent Design: Focuses on the Rational Agent approach, detailing the PEAS framework (Performance, Environment, Actuators, Sensors) and exploring agent rationality, learning, and autonomy.

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## Table Of Contents


- Foundations of Artificial Intelligence
- Searching Towards Solution
- Knowledge: Role and Representation
- Approaches Behind Planning and Reasoning
- Learning an Communication


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