introduction to machine learning second edition

Introduction to Machine Learning Second Edition: A Fresh Perspective on AI Fundamentals

introduction to machine learning second edition offers readers an updated and comprehensive guide to one of the most transformative fields in technology today. Whether you're a beginner eager to understand how machines learn from data or a professional seeking to deepen your knowledge, this edition serves as an essential resource. It bridges foundational concepts with practical applications, making the complex world of machine learning accessible and engaging.

What Makes the Introduction to Machine Learning Second Edition Stand Out?

The rapidly evolving landscape of artificial intelligence demands resources that not only explain key theories but also reflect modern practices. The second edition of this seminal work accomplishes exactly that by integrating the latest advancements and methodologies in machine learning.

Unlike its predecessor, this updated version delves into contemporary topics such as deep learning architectures, reinforcement learning nuances, and ethical considerations in AI deployment. It balances theoretical depth with practical coding examples, making it suitable for a wide audience—from students and educators to industry professionals.

Updated Content Reflecting Modern Machine Learning Trends

One of the standout features in the second edition is the inclusion of chapters dedicated to deep neural networks and unsupervised learning techniques. These topics have seen explosive growth and are critical for anyone looking to work with real-world data.

Additionally, you'll find enhanced coverage of:

- Model evaluation metrics beyond accuracy, such as precision, recall, and F1 score
- Regularization methods to prevent overfitting
- Advanced optimization algorithms like Adam and RMSProp
- Practical tips for handling imbalanced datasets

These additions provide a richer understanding of how machine learning models function and how to fine-tune them for better performance.

Practical Examples and Hands-On Exercises

The second edition doesn't just focus on theory; it encourages learning by doing. Throughout the book, readers encounter carefully designed exercises and projects that reinforce concepts. Many of these examples leverage popular machine learning libraries such as scikit-learn and TensorFlow, helping readers gain confidence with the tools commonly used in the industry.

This hands-on approach is invaluable because it allows readers to:

- Experiment with algorithms directly
- Understand the impact of parameter tuning
- Visualize data patterns and model behaviors

By engaging with these practical elements, learners transition from passive readers to active practitioners.

Understanding Key Concepts Through the Lens of the Second Edition

Machine learning can sometimes feel overwhelming due to its mathematical complexity and vast array of algorithms. However, the introduction to machine learning second edition breaks down these barriers by explaining concepts in a conversational and approachable manner.

Supervised Learning Demystified

At its core, supervised learning involves training a model on labeled data to make predictions. The second edition explains this foundational concept with clarity, covering algorithms such as:

- Linear regression
- Logistic regression
- Decision trees
- Support vector machines (SVM)

Each algorithm is accompanied by intuitive explanations and real-world use cases, making it easier to grasp when and why you might choose one over another.

Unsupervised Learning and Clustering Techniques

Moving beyond labeled data, the second edition explores unsupervised learning methods that help uncover hidden patterns without explicit guidance. Topics like k-means clustering, hierarchical clustering, and dimensionality reduction techniques like PCA are explained with practical examples.

This knowledge is crucial for tasks like customer segmentation, anomaly detection, and data visualization, which are increasingly important in business analytics.

Reinforcement Learning: Teaching Machines to Learn from Interaction

While reinforcement learning is a more advanced topic, the book introduces it in an accessible way, highlighting how agents learn optimal behaviors through rewards and penalties. This section touches on Markov decision processes and Q-learning, providing a glimpse into how machine learning powers applications such as robotics, gaming, and autonomous vehicles.

Why This Edition Is Ideal for Both Beginners and Experienced Learners

One of the challenges in machine learning education is catering to diverse audiences. The introduction to machine learning second edition succeeds by striking a balance between depth and readability.

Clear Explanations with Minimal Jargon

The authors are mindful of readers who may be new to the field, avoiding unnecessary technical jargon and instead focusing on analogies and clear language. This approach helps demystify complex topics without oversimplifying them.

Advanced Topics for Deeper Exploration

For those with some background in machine learning, the book offers advanced sections that dive into neural networks, ensemble methods like random forests and boosting, and model interpretability techniques. This layered content structure allows readers to build knowledge progressively.

Supplementary Resources and Online Support

To complement the text, the second edition often points readers toward online repositories and code samples. These resources enable learners to practice and experiment beyond the pages of the book, fostering a more interactive learning experience.

Integrating the Second Edition into Your Learning Journey

If you are considering diving into machine learning, adopting the introduction to machine learning second edition as a study companion can be highly beneficial. Here are some tips to maximize your learning:

- **Start with the basics:** Even if you have some programming experience, begin with the introductory chapters to build a strong foundation.
- **Practice coding exercises:** Try replicating the examples using Python libraries to reinforce theoretical concepts.
- **Experiment with datasets:** Use publicly available datasets to apply algorithms and see their real-world impact.
- **Join communities:** Engage with online forums or study groups to discuss challenges and share insights.

Machine learning is as much about curiosity and experimentation as it is about theory, and this edition encourages that mindset throughout.

The Broader Impact of Learning Machine Learning Today

Understanding machine learning opens doors to numerous career paths and innovations. From healthcare diagnostics and personalized recommendations to autonomous systems and financial modeling, the skills covered in this book are highly sought after.

The introduction to machine learning second edition not only equips readers with technical knowledge but also fosters an appreciation for the ethical and societal implications of AI technologies. As machine learning models increasingly influence decision-making, a responsible approach guided by informed practitioners becomes critical.

Through updated examples and discussions, this edition highlights challenges such as bias in data, privacy concerns, and the importance of transparency, reminding learners that technology development comes with societal responsibilities.

By exploring the updated and enriched content of the introduction to machine learning second edition, you are stepping into a world where data-driven intelligence shapes the future. Whether your goal is academic, professional, or purely out of curiosity, this resource offers a meaningful path to understanding and mastering the essentials of machine learning.

Frequently Asked Questions

What are the key updates in the second edition of 'Introduction to Machine Learning'?

The second edition includes updated content on deep learning techniques, expanded chapters on reinforcement learning, new case studies, and additional exercises to reflect the latest advancements in machine learning.

Who is the target audience for 'Introduction to Machine Learning, Second Edition'?

The book is designed for beginners and intermediate learners in machine learning, including students, data scientists, and professionals seeking a comprehensive introduction to fundamental concepts and practical applications.

Does the second edition cover practical machine learning tools and libraries?

Yes, the second edition incorporates examples and tutorials using popular machine learning libraries such as scikit-learn, TensorFlow, and PyTorch to provide hands-on experience.

How does the second edition address the ethical considerations in machine learning?

It includes a dedicated section discussing ethical issues like bias, fairness, privacy, and the societal impact of machine learning algorithms, encouraging responsible AI development.

Are there any new exercises or projects in the second edition to enhance learning?

The second edition features additional exercises, real-world projects, and programming assignments that help readers apply theoretical knowledge to practical problems.

Additional Resources

Introduction to Machine Learning Second Edition: A Definitive Review and Analysis

introduction to machine learning second edition marks a significant milestone in the rapidly evolving field of artificial intelligence and data science. As machine learning continues to permeate various sectors—from healthcare and finance to autonomous systems and natural language processing—the demand for comprehensive, accessible, and authoritative resources grows exponentially. This updated edition offers not only foundational theories but also practical insights that reflect the latest advancements and methodologies, making it an indispensable guide for students, researchers, and professionals alike.

In-depth Analysis of Introduction to Machine Learning Second Edition

The second edition of Introduction to Machine Learning arrives at a pivotal moment when machine learning paradigms are shifting from classical algorithms to more sophisticated deep learning architectures and hybrid models. This edition manages to bridge the gap between theoretical underpinnings and real-world applications, delivering content that is both academically rigorous and industry-relevant.

One of the standout features of this edition is its expanded coverage of supervised, unsupervised, and reinforcement learning techniques. The authors meticulously update algorithmic explanations, emphasizing clarity and intuition without sacrificing mathematical rigor. This approach supports a diverse range of readers—from those new to the subject to experienced practitioners seeking to deepen their understanding.

Compared to its predecessor, the second edition integrates more contemporary datasets and case studies, reflecting current trends in the machine learning landscape. It addresses practical challenges such as overfitting, model interpretability, and scalability, which are critical considerations in enterprise-level deployments.

Updated Content Reflecting Current Trends

The rapid evolution of machine learning frameworks like TensorFlow, PyTorch, and scikit-learn necessitates that educational materials keep pace. Introduction to Machine Learning Second Edition includes updated programming examples implemented with the latest versions of these libraries, enabling learners to experiment with code that mirrors real-world scenarios. This practical orientation is crucial for those aiming to transition from theoretical knowledge to hands-on expertise.

Moreover, the book expands its discussion on deep learning, a subfield that has dramatically transformed the AI landscape. It introduces neural network architectures such as convolutional and recurrent networks with greater depth and clarity, making complex concepts more approachable. Additionally, ethical considerations, including algorithmic bias and data privacy, receive increased attention, reflecting the growing societal impact of machine learning technologies.

Comprehensive Coverage of Core Machine Learning Concepts

A key strength of the Introduction to Machine Learning Second Edition is its methodical presentation of fundamental concepts. Chapters dedicated to probability theory, statistical learning, and optimization techniques lay a solid foundation upon which more advanced topics are built. The inclusion of rigorous mathematical derivations, complemented by intuitive explanations, caters to both quantitative learners and those seeking conceptual clarity.

The book also delves into essential algorithms such as decision trees, support vector machines, k-nearest neighbors, and ensemble methods. Each algorithm is dissected with respect to its assumptions, strengths, and limitations, enabling readers to make informed decisions when selecting models for specific tasks. The comparative analysis of these algorithms, enriched with performance metrics and visualizations, enhances the reader’s ability to critically evaluate machine learning solutions.

Practical Applications and Learning Resources

Introduction to Machine Learning Second Edition distinguishes itself by coupling theory with practice. The authors provide numerous exercises, quizzes, and programming assignments that reinforce learning and encourage experimentation. These resources are vital for mastering concepts and developing the problem-solving skills necessary in the machine learning industry.

Case Studies and Real-World Examples

The text integrates case studies drawn from various domains such as image recognition, natural language processing, and predictive analytics. These examples demonstrate how theoretical models translate into tangible outcomes, offering insights into implementation challenges and mitigation strategies. For instance, the discussion on using machine learning for medical diagnosis not only covers algorithm selection but also addresses data quality and ethical concerns.

Accessible Yet Rigorous Pedagogy

While the book does not shy away from complex mathematical content, it employs a pedagogical style that is accessible. The use of diagrams, pseudo-code, and step-by-step explanations helps demystify challenging topics. This balance between accessibility and depth makes it suitable for both self-learners and academic courses.

Comparative Perspective: How Does the Second Edition Stand Out?

When compared to other popular machine learning textbooks, Introduction to Machine Learning Second Edition offers a unique blend of theoretical depth and practical applicability. Unlike some texts that heavily favor deep learning or focus narrowly on specific algorithms, this edition maintains a broad perspective. It equips readers with a holistic understanding of the field, preparing them to adapt to future developments.

Additionally, the inclusion of ethical considerations and discussions on fairness in machine learning models positions the book as a forward-thinking resource. This aligns well with the increasing emphasis on responsible AI in industry and academia.

Pros and Cons of Introduction to Machine Learning Second Edition

- **Pros:**
    - Comprehensive coverage of both foundational and advanced topics
    - Updated content reflecting recent advances and tools

- Integration of practical examples and programming exercises
- Balanced approach suitable for diverse audiences
- Inclusion of ethical and societal implications of machine learning

- **Cons:**
  - Mathematical rigor may be challenging for absolute beginners without prior background
  - Some sections could benefit from more visual aids to complement dense material
  - Focus remains primarily on classical machine learning with less emphasis on cutting-edge research topics

Final Thoughts on Introduction to Machine Learning Second Edition

As machine learning continues to shape the technological landscape, possessing a robust and updated knowledge base becomes imperative. Introduction to Machine Learning Second Edition fulfills this need by providing a thorough, well-structured, and insightful exploration of the field. Its careful balance of theory and practice, combined with contemporary updates and ethical considerations, ensures its relevance for years to come.

For anyone embarking on a machine learning journey—whether as a novice, student, or industry professional—this edition stands out as a reliable and enriching resource that fosters both understanding and innovation.

Introduction To Machine Learning Second Edition

introduction to machine learning second edition: *Artificial Intelligence* RICHARD E.. JIANG

NEAPOLITAN (XIA.), Xia Jiang, 2020-06-30 The first edition of this popular textbook, Contemporary Artificial Intelligence, provided an accessible and student friendly introduction to AI. This fully revised and expanded update retains the same accessibility and problem-solving approach, while providing new material and methods, including neural networks and deep learning.

introduction to machine learning second edition: *Introduction to Machine Learning, second edition* Ethem Alpaydin, 2009-12-04 A new edition of an introductory text in machine learning that gives a unified treatment of machine learning problems and solutions. The goal of machine learning is to program computers to use example data or past experience to solve a given problem. Many successful applications of machine learning exist already, including systems that analyze past sales data to predict customer behavior, optimize robot behavior so that a task can be completed using minimum resources, and extract knowledge from bioinformatics data. The second edition of Introduction to Machine Learning is a comprehensive textbook on the subject, covering a broad array of topics not usually included in introductory machine learning texts. In order to present a unified treatment of machine learning problems and solutions, it discusses many methods from different fields, including statistics, pattern recognition, neural networks, artificial intelligence, signal processing, control, and data mining. All learning algorithms are explained so that the student can easily move from the equations in the book to a computer program. The text covers such topics as supervised learning, Bayesian decision theory, parametric methods, multivariate methods, multilayer perceptrons, local models, hidden Markov models, assessing and comparing classification algorithms, and reinforcement learning. New to the second edition are chapters on kernel machines, graphical models, and Bayesian estimation; expanded coverage of statistical tests in a chapter on design and analysis of machine learning experiments; case studies available on the Web (with downloadable results for instructors); and many additional exercises. All chapters have been revised and updated. Introduction to Machine Learning can be used by advanced undergraduates and graduate students who have completed courses in computer programming, probability, calculus, and linear algebra. It will also be of interest to engineers in the field who are concerned with the application of machine learning methods.

introduction to machine learning second edition: Artificial Intelligence Richard E. Neapolitan, Xia Jiang, 2018 The first edition of this popular textbook, Contemporary Artificial Intelligence, provided an accessible and student friendly introduction to AI. This fully revised and expanded update retains the same accessibility and problem-solving approach, while providing new material and methods, including neural networks and deep learning.

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platform and consider the long-term business vision for machine learning. · 14-time Microsoft MVP Dino Esposito and Francesco Esposito help you · Explore what's known about how humans learn and how intelligent software is built · Discover which problems machine learning can address · Understand the machine learning pipeline: the steps leading to a deliverable model · Use AutoML to automatically select the best pipeline for any problem and dataset · Master ML.NET, implement its pipeline, and apply its tasks and algorithms · Explore the mathematical foundations of machine learning · Make predictions, improve decision-making, and apply probabilistic methods · Group data via classification and clustering · Learn the fundamentals of deep learning, including neural network design · Leverage AI cloud services to build better real-world solutions faster About This Book · For professionals who want to build machine learning applications: both developers who need data science skills and data scientists who need relevant programming skills · Includes examples of machine learning coding scenarios built using the ML.NET library

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introduction to machine learning second edition: *Foundations of Machine Learning, second edition* Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, 2018-12-25 A new edition of a graduate-level machine learning textbook that focuses on the analysis and theory of algorithms. This book is a general introduction to machine learning that can serve as a textbook for graduate students and a reference for researchers. It covers fundamental modern topics in machine learning while providing the theoretical basis and conceptual tools needed for the discussion and justification of algorithms. It also describes several key aspects of the application of these algorithms. The authors aim to present novel theoretical tools and concepts while giving concise proofs even for relatively advanced topics. Foundations of Machine Learning is unique in its focus on the analysis and theory of algorithms. The first four chapters lay the theoretical foundation for what follows; subsequent chapters are mostly self-contained. Topics covered include the Probably Approximately Correct (PAC) learning framework; generalization bounds based on Rademacher complexity and VC-dimension; Support Vector Machines (SVMs); kernel methods; boosting; on-line learning; multi-class classification; ranking; regression; algorithmic stability; dimensionality reduction; learning automata and languages; and reinforcement learning. Each chapter ends with a set of exercises. Appendixes provide additional material including concise probability review. This second edition offers three new chapters, on model selection, maximum entropy models, and conditional entropy models. New material in the appendixes includes a major section on Fenchel duality,

expanded coverage of concentration inequalities, and an entirely new entry on information theory. More than half of the exercises are new to this edition.

introduction to machine learning second edition: An Introduction to Machine Learning Gopinath Rebala, Ajay Ravi, Sanjay Churiwala, 2019-05-07 Just like electricity, Machine Learning will revolutionize our life in many ways – some of which are not even conceivable today. This book provides a thorough conceptual understanding of Machine Learning techniques and algorithms. Many of the mathematical concepts are explained in an intuitive manner. The book starts with an overview of machine learning and the underlying Mathematical and Statistical concepts before moving onto machine learning topics. It gradually builds up the depth, covering many of the present day machine learning algorithms, ending in Deep Learning and Reinforcement Learning algorithms. The book also covers some of the popular Machine Learning applications. The material in this book is agnostic to any specific programming language or hardware so that readers can try these concepts on whichever platforms they are already familiar with. Offers a comprehensive introduction to Machine Learning, while not assuming any priorknowledge of the topic; Provides a complete overview of available techniques and algorithms in conceptual terms, covering various application domains of machine learning; Not tied to any specific software language or hardware implementation.

introduction to machine learning second edition: An Introduction to Machine Learning Miroslav Kubat, 2021-09-25 This textbook offers a comprehensive introduction to Machine Learning techniques and algorithms. This Third Edition covers newer approaches that have become highly topical, including deep learning, and auto-encoding, introductory information about temporal learning and hidden Markov models, and a much more detailed treatment of reinforcement learning. The book is written in an easy-to-understand manner with many examples and pictures, and with a lot of practical advice and discussions of simple applications. The main topics include Bayesian classifiers, nearest-neighbor classifiers, linear and polynomial classifiers, decision trees, rule-induction programs, artificial neural networks, support vector machines, boosting algorithms, unsupervised learning (including Kohonen networks and auto-encoding), deep learning, reinforcement learning, temporal learning (including long short-term memory), hidden Markov models, and the genetic algorithm. Special attention is devoted to performance evaluation, statistical assessment, and to many practical issues ranging from feature selection and feature construction to bias, context, multi-label domains, and the problem of imbalanced classes.

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algorithms with TensorBoard Sharing results with collaborators Running models in Docker About the reader Requires intermediate Python skills and knowledge of general algebraic concepts like vectors and matrices. Examples use the super-stable 1.15.x branch of TensorFlow and TensorFlow 2.x. About the author Chris Mattmann is the Division Manager of the Artificial Intelligence, Analytics, and Innovation Organization at NASA Jet Propulsion Lab. The first edition of this book was written by Nishant Shukla with Kenneth Fricklas. Table of Contents PART 1 - YOUR MACHINE-LEARNING RIG 1 A machine-learning odyssey 2 TensorFlow essentials PART 2 - CORE LEARNING ALGORITHMS 3 Linear regression and beyond 4 Using regression for call-center volume prediction 5 A gentle introduction to classification 6 Sentiment classification: Large movie-review dataset 7 Automatically clustering data 8 Inferring user activity from Android accelerometer data 9 Hidden Markov models 10 Part-of-speech tagging and word-sense disambiguation PART 3 - THE NEURAL NETWORK PARADIGM 11 A peek into autoencoders 12 Applying autoencoders: The CIFAR-10 image dataset 13 Reinforcement learning 14 Convolutional neural networks 15 Building a real-world CNN: VGG-Face ad VGG-Face Lite 16 Recurrent neural networks 17 LSTMs and automatic speech recognition 18 Sequence-to-sequence models for chatbots 19 Utility landscape

introduction to machine learning second edition: *Introduction to Machine Learning* Ethem Alpaydin, 2014 The goal of machine learning is to program computers to use example data or past experience to solve a given problem. Many successful applications of machine learning exist already, including systems that analyze past sales data to predict customer behavior, optimize robot behavior so that a task can be completed using minimum resources, and extract knowledge from bioinformatics data. Introduction to Machine Learning is a comprehensive textbook on the subject, covering a broad array of topics not usually included in introductory machine learning texts. Subjects include supervised learning; Bayesian decision theory; parametric, semi-parametric, and nonparametric methods; multivariate analysis; hidden Markov models; reinforcement learning; kernel machines; graphical models; Bayesian estimation; and statistical testing. Machine learning is rapidly becoming a skill that computer science students must master before graduation. The third edition of Introduction to Machine Learning reflects this shift, with added support for beginners, including selected solutions for exercises and additional example data sets (with code available online). Other substantial changes include discussions of outlier detection; ranking algorithms for perceptrons and support vector machines; matrix decomposition and spectral methods; distance estimation; new kernel algorithms; deep learning in multilayered perceptrons; and the nonparametric approach to Bayesian methods. All learning algorithms are explained so that students can easily move from the equations in the book to a computer program. The book can be used by both advanced undergraduates and graduate students. It will also be of interest to professionals who are concerned with the application of machine learning methods.

introduction to machine learning second edition: *Machine Learning, second edition* Kevin P. Murphy, 2020 The second and expanded edition of a comprehensive introduction to machine learning that uses probabilistic models and inference as a unifying approach. This textbook offers a comprehensive and self-contained introduction to the field of machine learning, including deep learning, viewed through the lens of probabilistic modeling and Bayesian decision theory. This second edition has been substantially expanded and revised, incorporating many recent developments in the field. It has new chapters on linear algebra, optimization, implicit generative models, reinforcement learning, and causality; and other chapters on such topics as variational inference and graphical models have been significantly updated. The software for the book (hosted on github) is now implemented in Python rather than MATLAB, and uses state-of-the-art libraries including as scikit-learn, Tensorflow 2, and JAX.

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learning algorithm on the dataset to produce a model that is then used in its intended application. It makes no attempt to retain the learned knowledge and use it in subsequent learning. Unlike this isolated system, humans learn effectively with only a few examples precisely because our learning is very knowledge-driven: the knowledge learned in the past helps us learn new things with little data or effort. Lifelong learning aims to emulate this capability, because without it, an AI system cannot be considered truly intelligent. Research in lifelong learning has developed significantly in the relatively short time since the first edition of this book was published. The purpose of this second edition is to expand the definition of lifelong learning, update the content of several chapters, and add a new chapter about continual learning in deep neural networks—which has been actively researched over the past two or three years. A few chapters have also been reorganized to make each of them more coherent for the reader. Moreover, the authors want to propose a unified framework for the research area. Currently, there are several research topics in machine learning that are closely related to lifelong learning—most notably, multi-task learning, transfer learning, and meta-learning—because they also employ the idea of knowledge sharing and transfer. This book brings all these topics under one roof and discusses their similarities and differences. Its goal is to introduce this emerging machine learning paradigm and present a comprehensive survey and review of the important research results and latest ideas in the area. This book is thus suitable for students, researchers, and practitioners who are interested in machine learning, data mining, natural language processing, or pattern recognition. Lecturers can readily use the book for courses in any of these related fields.

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introduction to machine learning second edition: Foundations of Machine Learning, second edition Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, 2018-12-25 A new edition of a graduate-level machine learning textbook that focuses on the analysis and theory of algorithms. This book is a general introduction to machine learning that can serve as a textbook for graduate students and a reference for researchers. It covers fundamental modern topics in machine learning while providing the theoretical basis and conceptual tools needed for the discussion and justification of algorithms. It also describes several key aspects of the application of these algorithms. The authors aim to present novel theoretical tools and concepts while giving concise proofs even for relatively advanced topics. Foundations of Machine Learning is unique in its focus on the analysis

and theory of algorithms. The first four chapters lay the theoretical foundation for what follows; subsequent chapters are mostly self-contained. Topics covered include the Probably Approximately Correct (PAC) learning framework; generalization bounds based on Rademacher complexity and VC-dimension; Support Vector Machines (SVMs); kernel methods; boosting; on-line learning; multi-class classification; ranking; regression; algorithmic stability; dimensionality reduction; learning automata and languages; and reinforcement learning. Each chapter ends with a set of exercises. Appendixes provide additional material including concise probability review. This second edition offers three new chapters, on model selection, maximum entropy models, and conditional entropy models. New material in the appendixes includes a major section on Fenchel duality, expanded coverage of concentration inequalities, and an entirely new entry on information theory. More than half of the exercises are new to this edition.

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