Machine Learning In Non Stationary Environments Introduction To Covariate Shift Adaptation Adaptive Computation And Machine Learning Series

The three volume proceedings LNAI 10534 – 10536 constitutes the refereed proceedings of the European Conference on Machine Learning and Knowledge Discovery in Databases, ECML PKDD 2017, held in Skopje, Macedonia, in September 2017. The total of 101 regular papers presented in part I and part II was carefully reviewed and selected from 364 submissions; there are 47 papers in the applied data science, nectar and demo track. The contributions were organized in topical sections named as follows: Part I: anomaly detection; computer vision; ensembles and meta learning; feature selection and extraction; kernel methods; learning and optimization, matrix and tensor factorization; networks and graphs; neural networks and deep learning. Part II: pattern and sequence mining; privacy and security; probabilistic models and methods; recommendation; regression; reinforcement learning; subgroup discovery; time series and streams; transfer and multi-task learning; unsupervised and semisupervised learning. Part III: applied data science track; nectar track; and demo track.

This book provides readers with a snapshot of recent methods for non-stationary vibration analysis of machinery. It covers a broad range of advanced techniques in condition monitoring of machinery, such as mathematical models, signal processing and pattern recognition methods and artificial intelligence methods, and their practical applications to the analysis of nonstationarities. Each chapter, accepted after a rigorous peer-review process, reports on a selected, original piece of work presented and discussed at the International Conference on Condition Monitoring of Machinery in Non-Stationary Operations, CMMNO'2016, held on September 12 – 16, 2016, in Gliwice, Poland. The contributions cover advances in both theory and practice in a variety of subfields, such as: smart materials and structures; fluid-structure interaction; structural acoustics as well as computational vibro-acoustics and numerical methods. Further topics include: engines control, noise identification, robust design, flow-induced vibration and many others. By presenting state-of-the-art in predictive maintenance solutions and discussing important industrial issues the book offers a valuable resource to both academics and professionals and is expected to facilitate communication and collaboration between the two groups.

This book focuses on two challenges posed in robot control by the increasing adoption of robots in the everyday human environment: uncertainty and networked communication. Part I of the book describes learning control to address environmental uncertainty. Part II discusses state estimation, active sensing, and complex scenario perception to tackle sensing uncertainty. Part III completes the book with control of networked robots and multi-robot teams. Each chapter features in-depth technical coverage and case studies highlighting the applicability of the techniques, with real robots or in simulation. Platforms include mobile ground, aerial, and underwater robots, as well as humanoid robots and robot arms. Source code and experimental data are available at http://extras.springer.com. The text gathers contributions from academic and industry experts, and offers a valuable resource for

researchers or graduate students in robot control and perception. It also benefits researchers in related areas, such as computer vision, nonlinear and learning control, and multi-agent systems.

This book covers applications of machine learning in artificial intelligence. The specific topics covered include human language, heterogeneous and streaming data, unmanned systems, neural information processing, marketing and the social sciences, bioinformatics and robotics, etc. It also provides a broad range of techniques that can be successfully applied and adopted in different areas. Accordingly, the book offers an interesting and insightful read for scholars in the areas of computer vision, speech recognition, healthcare, business, marketing, and bioinformatics.

This two volume set (LNCS 6791 and LNCS 6792) constitutes the refereed proceedings of the 21th International Conference on Artificial Neural Networks, ICANN 2011, held in Espoo, Finland, in June 2011. The 106 revised full or poster papers presented were carefully reviewed and selected from numerous submissions. ICANN 2011 had two basic tracks: brain-inspired computing and machine learning research, with strong cross-disciplinary interactions and applications.

The multi-volume set LNAI 12975 until 12979 constitutes the refereed proceedings of the European Conference on Machine Learning and Knowledge Discovery in Databases, ECML PKDD 2021, which was held during September 13-17, 2021. The conference was originally planned to take place in Bilbao, Spain, but changed to an online event due to the COVID-19 pandemic. The 210 full papers presented in these proceedings were carefully reviewed and selected from a total of 869 submissions. The volumes are organized in topical sections as follows: Research Track: Part I: Online learning; reinforcement learning; time series, streams, and sequence models; transfer and multi-task learning; semi-supervised and few-shot learning; learning algorithms and applications. Part II: Generative models; algorithms and learning theory; graphs and networks; interpretation, explainability, transparency, safety. Part III: Generative models; search and optimization; supervised learning; text mining and natural language processing; image processing, computer vision and visual analytics. Applied Data Science Track: Part IV: Anomaly detection and malware; spatio-temporal data; e-commerce and finance; healthcare and medical applications (including Covid); mobility and transportation. Part V: Automating machine learning, optimization, and feature engineering; machine learning based simulations and knowledge discovery; recommender systems and behavior modeling; natural language processing; remote sensing, image and video processing; social media.

This three-volume set LNAI 6911, LNAI 6912, and LNAI 6913 constitutes the refereed proceedings of the European conference on Machine Learning and Knowledge Discovery in Databases: ECML PKDD 2011, held in Athens, Greece, in September 2011. The 121 revised full papers presented together with 10 invited talks and 11 demos in the three volumes, were carefully reviewed and selected from about 600 paper submissions. The papers address all areas related to machine learning and knowledge discovery in databases as well as other innovative application domains such as supervised and unsupervised learning with some innovative contributions in fundamental issues; dimensionality reduction, distance and similarity learning, model learning and matrix/tensor analysis; graph mining, graphical models, hidden markov models, kernel methods, active and ensemble learning, semi-supervised

and transductive learning, mining sparse representations, model learning, inductive logic programming, and statistical learning. a significant part of the papers covers novel and timely applications of data mining and machine learning in industrial domains.

The work presents new approaches to Machine Learning for Cyber Physical Systems, experiences and visions. It contains some selected papers from the international Conference ML4CPS – Machine Learning for Cyber Physical Systems, which was held in Lemgo, October 25th-26th, 2017. Cyber Physical Systems are characterized by their ability to adapt and to learn: They analyze their environment and, based on observations, they learn patterns, correlations and predictive models. Typical applications are condition monitoring, predictive maintenance, image processing and diagnosis. Machine Learning is the key technology for these developments.

This book constitutes the refereed proceedings of the Third International Conference on Security and Privacy in New Computing Environments, SPNCE 2020, held in August 2020. Due to COVID-19 pandemic the conference was held virtually. The 31 full papers were selected from 63 submissions and are grouped into topics on network security; system security; machine learning; authentication and access control; cloud security; cryptography; applied cryptography.

This book constitutes the refereed proceedings of the 14th Ibero-American Conference on Artificial Intelligence, IBERAMIA 2014, held in Santiago de Chile, Chile, in November 2014. The 64 papers presented were carefully reviewed and selected from 136 submissions. The papers are organized in the following topical sections: knowledge engineering, knowledge representation and probabilistic reasoning; planning and scheduling; natural language processing; machine learning; fuzzy systems; knowledge discovery and data mining; bio-inspired computing; robotics; vision; multi-agent systems; agent-based modeling and simulation; AI in education, affective computing, and human-computer interaction; applications of AI; and ambient intelligence.

The training process has been analyzed as a Markov process in a finite state machine. A vector representation of machine inputs and outputs is developed and a method of determining the transi tion matrix using this representation is pre sented. Methods are presented for calculating the mean learning time from the transition matrix. Using characteristics of the transition matrix, a theorem is proved which establishes the cri terion for a stationary probability distribution of states. A method is also presented for reduc ing the size of a transition matrix by combining equivalent states. Criteria for identifying equivalent states are defined. The training process is investigated with both stationary and non-stationary environments. With the stationary environment attention is focused on stability and organizability requirements in the training proc ess. An algebraic formulation of machine-environ ment interaction in a non-stationary environment is also presented. Numerous examples of training with different types of building blocks and dif ferent goal criteria are provided and various building blocks are evaluated as to their ef ficiency in forming logical connectives. Simula tion of human

depth perception using size and retinal disparity cues demonstrated the ability of the network to organize so as to make optional use of available information. (Author).

This book constitutes the refereed proceedings of the 8th International Workshop on Multiple Classifier Systems, MCS 2009, held in Reykjavik, Iceland, in June 2009. The 52 revised full papers presented together with 2 invited papers were carefully reviewed and selected from more than 70 initial submissions. The papers are organized in topical sections on ECOC boosting and bagging, MCS in remote sensing, unbalanced data and decision templates, stacked generalization and active learning, concept drift, missing values and random forest, SVM ensembles, fusion of graphics, concepts and categorical data, clustering, and finally theory, methods and applications of MCS.

This book attempts to provide a unified overview of the broad field of Machine Learning and its Practical implementation. This book is a survey of the state of art. It breaks this massive subject into comprehensible parts piece by piece. The objective is to focus on basic principles of machine learning with some leading edge topics. This book addresses a full spectrum of machine learning programming. The emphasis is to solve lot many programming examples using step-by step practical implementation of machine learning algorithms. To facilitate easy understanding of machine learning, this book has been written in such a simple style that a student thinks as if a teacher is sitting behind him and guiding him. This book is written as per the new syllabus of different Universities of India. It also Cover the syllabus of B.Tech.(CSE/IT), MCA, BCA of Delhi University, Delhi. GGSIPU, MDU, RGTU, Nagpur University, UTU, APJ Abdul Kalam University so on. The book is intended for both academic and professional audience.

This book constitutes selected papers from the First International Workshop on Deployable Machine Learning for Security Defense, MLHat 2020, held in August 2020. Due to the COVID-19 pandemic the conference was held online. The 8 full papers were thoroughly reviewed and selected from 13 qualified submissions. The papers are organized in the following topical sections: understanding the adversaries; adversarial ML for better security; threats on networks.

This is a comprehensive book on the theories of artificial intelligence with an emphasis on their applications. It combines fuzzy logic and neural networks, as well as hidden Markov models and genetic algorithm, describes advancements and applications of these machine learning techniques and describes the problem of causality. This book should serves as a useful reference for practitioners in artificial intelligence.

This book constitutes the refereed proceedings of the 5th International Symposium on Cyber Security Cryptography and Machine Learning, CSCML 2021, held in Be'er Sheva, Israel, in July 2021. The 22 full and 13 short papers presented together with a keynote paper in this volume were carefully reviewed and selected from 48 submissions. They deal with the theory, design, analysis, implementation, or application of cyber security, cryptography and machine learning systems

and networks, and conceptually innovative topics in these research areas.

Machine learning (ML) is changing virtually every aspect of our lives. Today ML algorithms accomplish tasks that until recently only expert humans could perform. As it relates to finance, this is the most exciting time to adopt a disruptive technology that will transform how everyone invests for generations. Readers will learn how to structure Big data in a way that is amenable to ML algorithms; how to conduct research with ML algorithms on that data; how to use supercomputing methods; how to backtest your discoveries while avoiding false positives. The book addresses real-life problems faced by practitioners on a daily basis, and explains scientifically sound solutions using math, supported by code and examples. Readers become active users who can test the proposed solutions in their particular setting. Written by a recognized expert and portfolio manager, this book will equip investment professionals with the groundbreaking tools needed to succeed in modern finance.

The two-volume set LNCS 7552 + 7553 constitutes the proceedings of the 22nd International Conference on Artificial Neural Networks, ICANN 2012, held in Lausanne, Switzerland, in September 2012. The 162 papers included in the proceedings were carefully reviewed and selected from 247 submissions. They are organized in topical sections named: theoretical neural computation; information and optimization; from neurons to neuromorphism; spiking dynamics; from single neurons to networks; complex firing patterns; movement and motion; from sensation to perception; object and face recognition; reinforcement learning; bayesian and echo state networks; recurrent neural networks and reservoir computing; coding architectures; interacting with the brain; swarm intelligence and decision-making; mulitlayer perceptrons and kernel networks; training and learning; inference and recognition; support vector machines; self-organizing maps and clustering; clustering, mining and exploratory analysis; bioinformatics; and time weries and forecasting.

Get to know the 'why' and 'how' of machine learning and big data in quantitative investment Big Data and Machine Learning in Quantitative Investment is not just about demonstrating the maths or the coding. Instead, it's a book by practitioners for practitioners, covering the questions of why and how of applying machine learning and big data to quantitative finance. The book is split into 13 chapters, each of which is written by a different author on a specific case. The chapters are ordered according to the level of complexity; beginning with the big picture and taxonomy, moving onto practical applications of machine learning and finally finishing with innovative approaches using deep learning. • Gain a solid reason to use machine learning • Frame your question using financial markets laws • Know your data • Understand how machine learning is becoming ever more sophisticated Machine learning and big data are not a magical solution, but appropriately applied, they are extremely effective tools for quantitative investment — and this book shows you how.

This book investigates the application of promising machine learning techniques to address two problems: (i) how to find profitable pairs while constraining the search space and (ii) how to avoid long decline periods due to prolonged divergent pairs. It also proposes the integration of an unsupervised learning algorithm, OPTICS, to handle problem (i), and demonstrates that the suggested technique can outperform the common pairs search methods, achieving an average portfolio Sharpe ratio of 3.79, in comparison to 3.58 and 2.59 obtained using standard approaches. For problem (ii), the authors introduce a forecasting-based trading model capable of reducing the periods of portfolio decline by 75%. However, this comes at the expense of decreasing overall profitability. The authors also test the proposed strategy using an ARMA model, an LSTM and an LSTM encoder-decoder.

This book addresses the problems of modeling, prediction, classification, data understanding and processing in non-stationary and

unpredictable environments. It presents major and well-known methods and approaches for the design of systems able to learn and to fully adapt its structure and to adjust its parameters according to the changes in their environments. Also presents the problem of learning in non-stationary environments, its interests, its applications and challenges and studies the complementarities and the links between the different methods and techniques of learning in evolving and non-stationary environments.

This book presents the processing of the third edition of the Condition Monitoring of Machinery in Non-Stationary Operations (CMMNO13), which was held in Ferrara, Italy. This yearly event merges an international community of researchers who met – in 2011 in Wroclaw (Poland) and in 2012 in Hammamet (Tunisia) – to discuss issues of diagnostics of rotating machines operating in complex motion and/or load conditions. The growing interest of the industrial world on the topics covered by the CMMNO13 involves the fields of packaging, automotive, agricultural, mining, processing and wind machines in addition to that of the systems for data acquisition. The participation of speakers and visitors from industry makes the event an opportunity for immediate assessment of the potential applications of advanced methodologies for the signal analysis. Signals acquired from machines often contain contributions from several different components as well as noise. Therefore, the major challenge of condition monitoring is to point out the signal content that is related to the state of the monitored component particularly in non-stationary conditions.

Machine learning is increasingly applied to time series data, as it constitutes an attractive alternative to forecasts based on traditional time series models. For independent and identically distributed observations, cross-validation is the prevalent scheme for estimating out-of-sample performance in both model selection and assessment. For time series data, however, it is unclear whether forwardvalidation schemes, i.e., schemes that keep the temporal order of observations, should be preferred. In this paper, we perform a comprehensive empirical study of eight common validation schemes. We introduce a study design that perturbs global stationarity by introducing a slow evolution of the underlying data-generating process. Our results demonstrate that, even for relatively small perturbations, commonly used cross-validation schemes often yield estimates with the largest bias and variance, and forward-validation schemes yield better estimates of the out-of-sample error. We provide an interpretation of these results in terms of an additional evolution-induced bias and the sample-size dependent estimation error. Using a large-scale financial data set, we demonstrate the practical significance in a replication study of a statistical arbitrage problem. We conclude with some general guidelines on the selection of suitable validation schemes for time series data.

This book constitutes the refereed proceedings of the 15th European Conference on Machine Learning, ECML 2004, held in Pisa, Italy, in September 2004, jointly with PKDD 2004. The 45 revised full papers and 6 revised short papers presented together with abstracts of 5 invited talks were carefully reviewed and selected from 280 papers submitted to ECML and 107 papers submitted to both, ECML and PKDD. The papers present a wealth of new results in the area and address all current issues in machine learning.

This book presents the proceedings of the 24th European Conference on Artificial Intelligence (ECAI 2020), held in Santiago de Compostela, Spain, from 29 August to 8 September 2020. The conference was postponed from June, and much of it conducted online due to the COVID-19 restrictions. The conference is one of the principal occasions for researchers and practitioners of AI to meet and discuss the latest trends and challenges in all fields of AI and to demonstrate innovative applications and uses of advanced AI technology. The book also includes the proceedings of the 10th Conference on Prestigious Applications of Artificial Intelligence (PAIS 2020) held at the same time. A record number of more than 1,700 submissions was received for ECAI 2020, of which 1,443 were reviewed. Of these, 361 full-papers and 36 highlight papers were accepted (an acceptance rate of 25% for full-papers and 45% for highlight papers). The book is divided into three

sections: ECAI full papers; ECAI highlight papers; and PAIS papers. The topics of these papers cover all aspects of AI, including Agent-based and Multi-agent Systems; Computational Intelligence; Constraints and Satisfiability; Games and Virtual Environments; Heuristic Search; Human Aspects in AI; Information Retrieval and Filtering; Knowledge Representation and Reasoning; Machine Learning; Multidisciplinary Topics and Applications; Natural Language Processing; Planning and Scheduling; Robotics; Safe, Explainable, and Trustworthy AI; Semantic Technologies; Uncertainty in AI; and Vision. The book will be of interest to all those whose work involves the use of AI technology.

This Special Issue focused on novel vision-based approaches, mainly related to computer vision and machine learning, for the automatic analysis of human behaviour. We solicited submissions on the following topics: information theory-based pattern classification, biometric recognition, multimodal human analysis, low resolution human activity analysis, face analysis, abnormal behaviour analysis, unsupervised human analysis scenarios, 3D/4D human pose and shape estimation, human analysis in virtual/augmented reality, affective computing, social signal processing, personality computing, activity recognition, human tracking in the wild, and application of information-theoretic concepts for human behaviour analysis. In the end, 15 papers were accepted for this special issue. These papers, that are reviewed in this editorial, analyse human behaviour from the aforementioned perspectives, defining in most of the cases the state of the art in their corresponding field.

This book constitutes the proceedings of the 14th International Conference on Principles and Practice in Multi-Agent Systems, PRIMA 2011, held in Wollongong, Australia, in November 2011. The 39 papers presented together with 3 invited talks were carefully reviewed and selected from numerous submissions. They focus on practical aspects of multiagent systems and are organised in topical sections on coalitions and teamwork, learning, mechanisms and voting, modeling and simulation, negotiation and coalitions, optimization, sustainability, agent societies and frameworks, argumentation, and applications.

The proceedings set LNCS 12891, LNCS 12892, LNCS 12893, LNCS 12894 and LNCS 12895 constitute the proceedings of the 30th International Conference on Artificial Neural Networks, ICANN 2021, held in Bratislava, Slovakia, in September 2021.* The total of 265 full papers presented in these proceedings was carefully reviewed and selected from 496 submissions, and organized in 5 volumes. In this volume, the papers focus on topics such as computer vision and object detection, convolutional neural networks and kernel methods, deep learning and optimization, distributed and continual learning, explainable methods, few-shot learning and generative adversarial networks. *The conference was held online 2021 due to the COVID-19 pandemic.

The book provides readers with a snapshot of recent research and technological trends in the field of condition monitoring of machinery working under a broad range of operating conditions. Each chapter, accepted after a rigorous peer-review process, reports on an original piece of work presented and discussed at the 4th International Conference on Condition Monitoring of Machinery in Non-stationary Operations, CMMNO 2014, held on December 15-16, 2014, in Lyon, France. The contributions have been grouped into three different sections according to the main subfield (signal processing, data mining or condition monitoring techniques) they are related to. The book includes both theoretical developments as well as a number of industrial case studies, in different areas including, but not limited to: noise and vibration; vibro-acoustic diagnosis; signal processing techniques; diagnostic data analysis; instantaneous speed identification; monitoring and diagnostic systems; and dynamic and fault modeling. This book not only provides a valuable resource for both academics and professionals in the field of condition monitoring, it also aims at facilitating communication and collaboration between the two groups.

Machine Learning in Non-stationary EnvironmentsIntroduction to Covariate Shift AdaptationMIT Press

The three volume proceedings LNAI 11906 – 11908 constitutes the refereed proceedings of the European Conference on Machine Learning and Knowledge Discovery in Databases, ECML PKDD 2019, held in Würzburg, Germany, in September 2019. The total of 130 regular papers presented in these volumes was carefully reviewed and selected from 733 submissions; there are 10 papers in the demo track. The contributions were organized in topical sections named as follows: Part I: pattern mining; clustering, anomaly and outlier detection, and autoencoders; dimensionality reduction and feature selection; social networks and graphs; decision trees, interpretability, and causality; strings and streams; privacy and security; optimization. Part II: supervised learning; multi-label learning; large-scale learning; deep learning; probabilistic models; natural language processing. Part III: reinforcement learning and bandits; ranking; applied data science: computer vision and explanation; applied data science: healthcare; applied data science: e-commerce, finance, and advertising; applied data science: rich data; applied data science: applications; demo track. Chapter "Incorporating Dependencies in Spectral Kernels for Gaussian Processes" is available open access under a Creative Commons Attribution 4.0 International License via link.springer.com.

With the wide availability of large amounts of data and acute need for extracting useful information from such data, intelligent data analysis has attracted great attention and contributed to solving many practical tasks, ranging from scientific research, industrial process and daily life. In many cases the data evolve over time or change from one domain to another. The non-stationary nature of the data brings a new challenge for many existing learning algorithms, which are based on the stationary assumption. This dissertation addresses three crucial problems towards the effective handling of non-stationary data by investigating systematic methods for sample reweighting. Sample reweighting is a problem that infers sample-dependent weights for a data collection to match another data collection which exhibits distributional difference. It is known as the density-ratio estimation problem and the estimation results can be used in several machine learning tasks. This research proposes a set of methods for distribution matching by developing novel density-ratio methods that incorporate the characters of different non-stationary data analysis tasks. The contributions are summarized below. First, for the domain adaptation of classification problems a novel discriminative density-ratio method is proposed. This approach combines three learning objectives: minimizing generalized risk on the reweighted training data, minimizing class-wise distribution discrepancy and maximizing the separation margin on the test data. To solve the discriminative density-ratio problem, two algorithms are presented on the basis of a block coordinate update optimization scheme. Experiments conducted on different domain adaptation scenarios demonstrate the effectiveness of the proposed algorithms. Second, for detecting novel instances in the test data a locally-adaptive kernel density-ratio method is proposed. While traditional novelty detection algorithms are limited to detect either emerging novel instances which are completely new, or evolving novel instances whose distribution are different from previously-seen ones, the proposed algorithm builds on the success of the idea of using density ratio as a measure of evolving novelty and augments with structural information of each data instance's neighborhood. This makes the estimation of density ratio more reliable, and results in detection of emerging as well as evolving novelties. In addition, the proposed locally-adaptive kernel novelty detection method is applied in the social media analysis and shows favorable performance over other existing approaches. As the time continuity of social media streams, the novelty is usually characterized by the combination of emerging and evolving. One reason is the existence of large common vocabularies between different topics. Another reason is that there are high possibilities of topics being continuously discussed in sequential batch of collections, but showing different level of intensity. Thus, the presented novelty detection algorithm demonstrates its effectiveness in the social media data analysis. Lastly, an auto-tuning method for the non-parametric kernel mean matching estimator is presented. It introduces a new quality measure for evaluating the goodness of distribution matching which reflects the

normalized mean square error of estimates. The proposed quality measure does not depend on the learner in the following step and accordingly allows the model selection procedures for importance estimation and prediction model learning to be completely separated.

This volume constitutes the refereed post-conference proceedings of the Fourth International Conference on Machine Learning and Intelligent Communications, MLICOM 2019, held in Nanjing, China, in August 2019. The 65 revised full papers were carefully selected from 114 submissions. The papers are organized thematically in machine learning, intelligent positioning and navigation, intelligent multimedia processing and security, wireless mobile network and security, cognitive radio and intelligent networking, IoT, intelligent satellite communications and networking, green communication and intelligent networking, ad-hoc and sensor networks, resource allocation in wireless and cloud networks, signal processing in wireless and optical communications, and intelligent cooperative communications and networking.

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.

This book introduces machine learning methods in finance. It presents a unified treatment of machine learning and various statistical and computational disciplines in quantitative finance, such as financial econometrics and discrete time stochastic control, with an emphasis on how theory and hypothesis tests inform the choice of algorithm for financial data modeling and decision making. With the trend towards increasing computational resources and larger datasets, machine learning has grown into an important skillset for the finance industry. This book is written for advanced graduate students and academics in financial econometrics, mathematical finance and applied statistics, in addition to quants and data scientists in the field of quantitative finance. Machine Learning in Finance: From Theory to Practice is divided into three parts, each part covering theory and applications. The first presents supervised learning for cross-sectional data from

both a Bayesian and frequentist perspective. The more advanced material places a firm emphasis on neural networks, including deep learning, as well as Gaussian processes, with examples in investment management and derivative modeling. The second part presents supervised learning for time series data, arguably the most common data type used in finance with examples in trading, stochastic volatility and fixed income modeling. Finally, the third part presents reinforcement learning and its applications in trading, investment and wealth management. Python code examples are provided to support the readers' understanding of the methodologies and applications. The book also includes more than 80 mathematical and programming exercises, with worked solutions available to instructors. As a bridge to research in this emergent field, the final chapter presents the frontiers of machine learning in finance from a researcher's perspective, highlighting how many well-known concepts in statistical physics are likely to emerge as important methodologies for machine learning in finance.

Recent decades have seen rapid advances in automatization processes, supported by modern machines and computers. The result is significant increases in system complexity and state changes, information sources, the need for faster data handling and the integration of environmental influences. Intelligent systems, equipped with a taxonomy of data-driven system identification and machine learning algorithms, can handle these problems partially. Conventional learning algorithms in a batch off-line setting fail whenever dynamic changes of the process appear due to non-stationary environments and external influences. Learning in Non-Stationary Environments: Methods and Applications offers a wide-ranging, comprehensive review of recent developments and important methodologies in the field. The coverage focuses on dynamic learning in unsupervised problems, dynamic learning in supervised classification and dynamic learning in supervised regression problems. A later section is dedicated to applications in which dynamic learning methods serve as keystones for achieving models with high accuracy. Rather than rely on a mathematical theorem/proof style, the editors highlight numerous figures, tables, examples and applications, together with their explanations. This approach offers a useful basis for further investigation and fresh ideas and motivates and inspires newcomers to explore this promising and still emerging field of research.

Theory, algorithms, and applications of machine learning techniques to overcome "covariate shift" non-stationarity. As the power of computing has grown over the past few decades, the field of machine learning has advanced rapidly in both theory and practice. Machine learning methods are usually based on the assumption that the data generation mechanism does not change over time. Yet real-world applications of machine learning, including image recognition, natural language processing, speech recognition, robot control, and bioinformatics, often violate this common assumption. Dealing with non-stationarity is one of modern machine learning's greatest challenges. This book focuses on a specific

non-stationary environment known as covariate shift, in which the distributions of inputs (queries) change but the conditional distribution of outputs (answers) is unchanged, and presents machine learning theory, algorithms, and applications to overcome this variety of non-stationarity. After reviewing the state-of-the-art research in the field, the authors discuss topics that include learning under covariate shift, model selection, importance estimation, and active learning. They describe such real world applications of covariate shift adaption as brain-computer interface, speaker identification, and age prediction from facial images. With this book, they aim to encourage future research in machine learning, statistics, and engineering that strives to create truly autonomous learning machines able to learn under non-stationarity.

This book presents a wealth of deep-learning algorithms and demonstrates their design process. It also highlights the need for a prudent alignment with the essential characteristics of the nature of learning encountered in the practical problems being tackled. Intended for readers interested in acquiring practical knowledge of analysis, design, and deployment of deep learning solutions to real-world problems, it covers a wide range of the paradigm's algorithms and their applications in diverse areas including imaging, seismic tomography, smart grids, surveillance and security, and health care, among others. Featuring systematic and comprehensive discussions on the development processes, their evaluation, and relevance, the book offers insights into fundamental design strategies for algorithms of deep learning.

Theory, algorithms, and applications of machine learning techniques to overcome "covariate shift" non-stationarity. Reinforcement learning is a mathematical framework for developing computer agents that can learn an optimal behavior by relating generic reward signals with its past actions. With numerous successful applications in business intelligence, plant control, and gaming, the RL framework is ideal for decision making in unknown environments with large amounts of data. Supplying an up-to-date and accessible introduction to the field, Statistical Reinforcement Learning: Modern Machine Learning Approaches presents fundamental concepts and practical algorithms of statistical reinforcement learning from the modern machine learning viewpoint. It covers various types of RL approaches, including model-based and model-free approaches, policy iteration, and policy search methods. The book covers approaches recently introduced in the data mining and machine learning fields to provide a systematic bridge between RL and data mining/machine learning researchers. It presents state-of-the-art results, including dimensionality reduction in RL and risk-sensitive RL. Numerous illustrative examples are included to help readers understand the intuition and usefulness of reinforcement learning techniques. Book jacket.

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