

Ton J. Cleophas
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Machine Learning in Medicine— Cookbook Three



Springer

Machine Learning In Medicine Cookbook Three Springerbriefs In Statistics

**Jason Abaluck, Leila Agha, David C.
Chan Jr, Daniel Singer, Diana Zhu**



Machine Learning In Medicine Cookbook Three Springerbriefs In Statistics:

Machine Learning in Medicine - Cookbook Three Ton J. Cleophas, Aeilko H. Zwinderman, 2014-10-29 Unique features of the book involve the following

- 1 This book is the third volume of a three volume series of cookbooks entitled Machine Learning in Medicine Cookbooks One Two and Three No other self assessment works for the medical and health care community covering the field of machine learning have been published to date
- 2 Each chapter of the book can be studied without the need to consult other chapters and can for the readership s convenience be downloaded from the internet Self assessment examples are available at extras.springer.com
- 3 An adequate command of machine learning methodologies is a requirement for physicians and other health workers particularly now because the amount of medical computer data files currently doubles every 20 months and because soon it will be impossible for them to take proper data based health decisions without the help of machine learning
- 4 Given the importance of knowledge of machine learning in the medical and health care community and the current lack of knowledge of it the readership will consist of any physician and health worker
- 5 The book was written in a simple language in order to enhance readability not only for the advanced but also for the novices
- 6 The book is multipurpose it is an introduction for ignorant a primer for the inexperienced and a self assessment handbook for the advanced
- 7 The book was particularly written for jaded physicians and any other health care professionals lacking time to read the entire series of three textbooks
- 8 Like the other two cookbooks it contains technical descriptions and self assessment examples of 20 important computer methodologies for medical data analysis and it largely skips the theoretical and mathematical background
- 9 Information of theoretical and mathematical background of the methods described are displayed in a notes section at the end of each chapter
- 10 Unlike traditional statistical methods the machine learning methodologies are able to analyze big data including thousands of cases and hundreds of variables
- 11 The medical and health care community is little aware of the multidimensional nature of current medical data files and experimental clinical studies are not helpful to that aim either because these studies usually assume that subgroup characteristics are unimportant as long as the study is randomized This is of course untrue because any subgroup characteristic may be vital to an individual at risk
- 12 To date except for a three volume introductory series on the subject entitled Machine Learning in Medicine Part One Two and Three 2013 Springer Heidelberg Germany from the same authors and the current cookbook series no books on machine learning in medicine have been published
- 13 Another unique feature of the cookbooks is that it was jointly written by two authors from different disciplines one being a clinician clinical pharmacologist one being a mathematician biostatistician
- 14 The authors have also jointly been teaching at universities and institutions throughout Europe and the USA for the past 20 years
- 15 The authors have managed to cover the field of medical data analysis in a nonmathematical way for the benefit of medical and health workers
- 16 The authors already successfully published many statistics textbooks and self assessment books e.g. the 67 chapter textbook entitled Statistics Applied to Clinical Studies 5th Edition 2012 Springer Heidelberg

Germany with downloads of 62 826 copies 17 The current cookbook makes use in addition to SPSS statistical software of various free calculators from the internet as well as the Konstanz Information Miner Knime a widely approved free machine learning package and the free Weka Data Mining package from New Zealand 18 The above software packages with hundreds of nodes the basic processing units including virtually all of the statistical and data mining methods can be used not only for data analyses but also for appropriate data storage 19 The current cookbook shows particularly for those with little affinity to value tables that data mining in the form of a visualization process is very well feasible and often more revealing than traditional statistics 20 The Knime and Weka data miners uses widely available excel data files 21 In current clinical research prospective cohort studies are increasingly replacing the costly controlled clinical trials and modern machine learning methodologies like probit and tobit regressions as well as neural networks Bayesian networks and support vector machines prove to better fit their analysis than traditional statistical methods do 22 The current cookbook not only includes concise descriptions of standard machine learning methods but also of more recent methods like the linear machine learning models using ordinal and loglinear regression 23 Machine learning tends to increasingly use evolutionary operation methodologies Also this subject has been covered 24 All of the methods described have been applied in the authors own research prior to this publication

Machine Learning in Medicine - Cookbook Ton J. Cleophas, Aeilko H. Zwinderman, 2014-01-03 The amount of data in medical databases doubles every 20 months and physicians are at a loss to analyze them Also traditional methods of data analysis have difficulty to identify outliers and patterns in big data and data with multiple exposure outcome variables and analysis rules for surveys and questionnaires currently common methods of data collection are essentially missing Obviously it is time that medical and health professionals mastered their reluctance to use machine learning and the current 100 page cookbook should be helpful to that aim It covers in a condensed form the subjects reviewed in the 750 page three volume textbook by the same authors entitled Machine Learning in Medicine I III ed by Springer Heidelberg Germany 2013 and was written as a hand hold presentation and must read publication It was written not only to investigators and students in the fields but also to jaded clinicians new to the methods and lacking time to read the entire textbooks General purposes and scientific questions of the methods are only briefly mentioned but full attention is given to the technical details The two authors a statistician and current president of the International Association of Biostatistics and a clinician and past president of the American College of Angiology provide plenty of step by step analyses from their own research and data files for self assessment are available at extras.springer.com From their experience the authors demonstrate that machine learning performs sometimes better than traditional statistics does Machine learning may have little options for adjusting confounding and interaction but you can add propensity scores and interaction variables to almost any machine learning method

Machine Learning in Medicine - Cookbook Two Ton J. Cleophas, Aeilko H. Zwinderman, 2014-05-27 The amount of data medical databases doubles every 20 months and physicians are at a loss to analyze them Also traditional data analysis

has difficulty to identify outliers and patterns in big data and data with multiple exposure outcome variables and analysis rules for surveys and questionnaires currently common methods of data collection are essentially missing Consequently proper data based health decisions will soon be impossible Obviously it is time that medical and health professionals mastered their reluctance to use machine learning methods and this was the main incentive for the authors to complete a series of three textbooks entitled Machine Learning in Medicine Part One Two and Three Springer Heidelberg Germany 2012 2013 describing in a nonmathematical way over sixty machine learning methodologies as available in SPSS statistical software and other major software programs Although well received it came to our attention that physicians and students often lacked time to read the entire books and requested a small book without background information and theoretical discussions and highlighting technical details For this reason we produced a 100 page cookbook entitled Machine Learning in Medicine Cookbook One with data examples available at extras.springer.com for self assessment and with reference to the above textbooks for background information Already at the completion of this cookbook we came to realize that many essential methods were not covered The current volume entitled Machine Learning in Medicine Cookbook Two is complementary to the first and also intended for providing a more balanced view of the field and thus as a must read not only for physicians and students but also for any one involved in the process and progress of health and health care Similarly to Machine Learning in Medicine Cookbook One the current work will describe stepwise analyses of over twenty machine learning methods that are likewise based on the three major machine learning methodologies Cluster methodologies Chaps 1 3 Linear methodologies Chaps 4 11 Rules methodologies Chaps 12 20 In extras.springer.com the data files of the examples are given as well as XML Extended Mark up Language SPS Syntax and ZIP compressed files for outcome predictions in future patients In addition to condensed versions of the methods fully described in the above three textbooks an introduction is given to SPSS Modeler SPSS data mining workbench in the Chaps 15 18 19 while improved statistical methods like various automated analyses and Monte Carlo simulation models are in the Chaps 1 5 7 and 8 We should emphasize that all of the methods described have been successfully applied in practice by the authors both of them professors in applied statistics and machine learning at the European Community College of Pharmaceutical Medicine in Lyon France We recommend the current work not only as a training companion to investigators and students because of plenty of step by step analyses given but also as a brief introductory text to jaded clinicians new to the methods For the latter purpose background and theoretical information have been replaced with the appropriate references to the above textbooks while single sections addressing general purposes main scientific questions and conclusions are given in place Finally we will demonstrate that modern machine learning performs sometimes better than traditional statistics does Machine learning may have little options for adjusting confounding and interaction but you can add propensity scores and interaction variables to almost any machine learning method

Machine Learning in Medicine – A Complete Overview Ton J. Cleophas, Aeilko H.

Zwinderman,2020-03-03 Adequate health and health care is no longer possible without proper data supervision from modern machine learning methodologies like cluster models neural networks and other data mining methodologies The current book is the first publication of a complete overview of machine learning methodologies for the medical and health sector and it was written as a training companion and as a must read not only for physicians and students but also for any one involved in the process and progress of health and health care In this second edition the authors have removed the textual errors from the first edition Also the improved tables from the first edition have been replaced with the original tables from the software programs as applied This is because unlike the former the latter were without error and readers were better familiar with them The main purpose of the first edition was to provide stepwise analyses of the novel methods from data examples but background information and clinical relevance information may have been somewhat lacking Therefore each chapter now contains a section entitled Background Information Machine learning may be more informative and may provide better sensitivity of testing than traditional analytic methods may do In the second edition a place has been given for the use of machine learning not only to the analysis of observational clinical data but also to that of controlled clinical trials Unlike the first edition the second edition has drawings in full color providing a helpful extra dimension to the data analysis Several machine learning methodologies not yet covered in the first edition but increasingly important today have been included in this updated edition for example negative binomial and Poisson regressions sparse canonical analysis Firth's bias adjusted logistic analysis omics research eigenvalues and eigenvectors

Machine Learning in Medicine - a Complete Overview

Ton J. Cleophas,Aeilko H. Zwinderman,2015-04-10 The current book is the first publication of a complete overview of machine learning methodologies for the medical and health sector It was written as a training companion and as a must read not only for physicians and students but also for any one involved in the process and progress of health and health care In eighty chapters eighty different machine learning methodologies are reviewed in combination with data examples for self assessment Each chapter can be studied without the need to consult other chapters The amount of data stored in the world's databases doubles every 20 months and clinicians familiar with traditional statistical methods are at a loss to analyze them Traditional methods have indeed difficulty to identify outliers in large datasets and to find patterns in big data and data with multiple exposure outcome variables In addition analysis rules for surveys and questionnaires which are currently common methods of data collection are essentially missing Fortunately the new discipline machine learning is able to cover all of these limitations So far medical professionals have been rather reluctant to use machine learning Also in the field of diagnosis making few doctors may want a computer checking them are interested in collaboration with a computer or with computer engineers Adequate health and health care will however soon be impossible without proper data supervision from modern machine learning methodologies like cluster models neural networks and other data mining methodologies Each chapter starts with purposes and scientific questions Then step by step analyses using data examples are given Finally a

paragraph with conclusion and references to the corresponding sites of three introductory textbooks previously written by the same authors is given

Machine Learning in Medicine Ton J. Cleophas, Aeilko H. Zwinderman, 2013-11-26 Machine learning is concerned with the analysis of large data and multiple variables. It is also often more sensitive than traditional statistical methods to analyze small data. The first and second volumes reviewed subjects like optimal scaling, neural networks, factor analysis, partial least squares, discriminant analysis, canonical analysis, fuzzy modeling, various clustering models, support vector machines, Bayesian networks, discrete wavelet analysis, association rule learning, anomaly detection, and correspondence analysis. This third volume addresses more advanced methods and includes subjects like evolutionary programming, stochastic methods, complex sampling, optional binning, Newton's methods, decision trees, and other subjects. Both the theoretical bases and the step-by-step analyses are described for the benefit of non-mathematical readers. Each chapter can be studied without the need to consult other chapters. Traditional statistical tests are sometimes priors to machine learning methods, and they are also sometimes used as contrast tests. To those wishing to obtain more knowledge of them, we recommend to additionally study 1. Statistics Applied to Clinical Studies 5th Edition 2012, 2. SPSS for Starters Part One and Two 2012, and 3. Statistical Analysis of Clinical Data on a Pocket Calculator Part One and Two 2012, written by the same authors and edited by Springer New York.

Explainable Machine Learning in Medicine Karol Przystalski, Rohit M. Thanki, 2023-11-26 This book covers a variety of advanced communications technologies that can be used to analyze medical data and can be used to diagnose diseases in clinic centers. The book is a primer of methods for medicine providing an overview of explainable artificial intelligence (AI) techniques that can be applied in different medical challenges. The authors discuss how to select and apply the proper technology depending on the provided data and the analysis desired. Because a variety of data can be used in the medical field, the book explains how to deal with challenges connected with each type. A number of scenarios are introduced that can happen in real-time environments with each paired with a type of machine learning that can be used to solve it.

Machine Learning in Medicine Ton J. Cleophas, Aeilko H. Zwinderman, 2015-06-13 Machine learning is concerned with the analysis of large data and multiple variables. However, it is also often more sensitive than traditional statistical methods to analyze small data. The first volume reviewed subjects like optimal scaling, neural networks, factor analysis, partial least squares, discriminant analysis, canonical analysis, and fuzzy modeling. This second volume includes various clustering models, support vector machines, Bayesian networks, discrete wavelet analysis, genetic programming, association rule learning, anomaly detection, correspondence analysis, and other subjects. Both the theoretical bases and the step-by-step analyses are described for the benefit of non-mathematical readers. Each chapter can be studied without the need to consult other chapters. Traditional statistical tests are sometimes priors to machine learning methods, and they are also sometimes used as contrast tests. To those wishing to obtain more knowledge of them, we recommend to additionally study 1. Statistics Applied to Clinical Studies 5th Edition 2012, 2. SPSS for Starters Part One and Two 2012, and 3.

Statistical Analysis of Clinical Data on a Pocket Calculator Part One and Two 2012 written by the same authors and edited by Springer New York

Mastering the Art of Cookbook Medicine Jason T. Abaluck, Leila Agha, David C. Chan (Jr.), Daniel E. Singer, Diana Zhu, 2020 The application of machine learning ML to randomized controlled trials RCTs can quantify and improve misallocation in healthcare We study the decision to prescribe anticoagulants for atrial fibrillation patients anticoagulation reduces stroke risk but increases hemorrhage risk We combine observational data on treatment choice and guideline use with ML estimates of heterogeneous treatment effects from eight RCTs When physicians adopt a clinical guideline treatment decisions shift towards the recommendation but adherence remains far from perfect Improving guideline adherence would produce larger gains than informing physicians about guidelines Adherence to an optimal rule would prevent 47% more strokes without increasing hemorrhages

Mastering the Art of Cookbook Medicine Jason Abaluck, Leila Agha, David C. Chan Jr, Daniel Singer, Diana Zhu, 2020 The application of machine learning ML to randomized controlled trials RCTs can quantify and improve misallocation in healthcare We study the decision to prescribe anticoagulants for atrial fibrillation patients anticoagulation reduces stroke risk but increases hemorrhage risk We combine observational data on treatment choice and guideline use with ML estimates of heterogeneous treatment effects from eight RCTs When physicians adopt a clinical guideline treatment decisions shift towards the recommendation but adherence remains far from perfect Improving guideline adherence would produce larger gains than informing physicians about guidelines Adherence to an optimal rule would prevent 47% more strokes without increasing hemorrhages

Fundamentals of Machine Learning and Deep Learning in Medicine Reza Borhani, Soheila Borhani, Aggelos K. Katsaggelos, 2022-11-19 This book provides an accessible introduction to the foundations of machine learning and deep learning in medicine for medical students researchers and professionals who are not necessarily initiated in advanced mathematics but yearn for a better understanding of this disruptive technology and its impact on medicine Once an esoteric subject known to few outside of computer science and engineering departments today artificial intelligence AI is a widely popular technology used by scholars from all across the academic universe In particular recent years have seen a great deal of interest in the AI subfields of machine learning and deep learning from researchers in medicine and life sciences evidenced by the rapid growth in the number of articles published on the topic in peer reviewed medical journals over the last decade The demand for high quality educational resources in this area has never been greater than it is today and will only continue to grow at a rapid pace Expert authors remove the veil of unnecessary complexity that often surrounds machine learning and deep learning by employing a narrative style that emphasizes intuition in place of abstract mathematical formalisms allowing them to strike a delicate balance between practicality and theoretical rigor in service of facilitating the reader's learning experience Topics covered in the book include mathematical encoding of medical data linear regression and classification nonlinear feature engineering deep learning convolutional and recurrent neural networks and

reinforcement learning Each chapter ends with a collection of exercises for readers to practice and test their knowledge This is an ideal introduction for medical students professionals and researchers interested in learning more about machine learning and deep learning Readers who have taken at least one introductory mathematics course at the undergraduate level e g biostatistics or calculus will be well equipped to use this book without needing any additional prerequisites Artificial Intelligence and Machine Learning in Health Care and Medical Sciences Gyorgy J. Simon,Constantin Aliferis,2024-03-30

Machine Learning and Deep Learning in Medical Data Analytics and Healthcare Applications Om Prakash Jena,Bharat Bhushan,Utku Kose,2022 The book incorporates the many facets of computational intelligence such as machine learning and deep learning to provide groundbreaking developments in healthcare applications It discusses theory analytical methods numerical simulation scientific techniques analytical outcomes and computational structuring **Deep Learning in Biology and Medicine** Davide Bacciu,Paulo J. G. Lisboa,Alfredo Vellido,2021 Biology medicine and biochemistry have become data centric fields for which Deep Learning methods are delivering groundbreaking results Addressing high impact challenges Deep Learning in Biology and Medicine provides an accessible and organic collection of Deep Learning essays on bioinformatics and medicine It caters for a wide readership ranging from machine learning practitioners and data scientists seeking methodological knowledge to address biomedical applications to life science specialists in search of a gentle reference for advanced data analytics With contributions from internationally renowned experts the book covers foundational methodologies in a wide spectrum of life sciences applications including electronic health record processing diagnostic imaging text processing as well as omics data processing This survey of consolidated problems is complemented by a selection of advanced applications including cheminformatics and biomedical interaction network analysis A modern and mindful approach to the use of data driven methodologies in the life sciences also requires careful consideration of the associated societal ethical legal and transparency challenges which are covered in the concluding chapters of this book

Deep Learning for Medical Decision Support Systems Utku Kose,Omer Deperlioglu,Jafar Alzubi,Bogdan Patrut,2020-06-18 This book explores various applications of deep learning oriented diagnosis leading to decision support while also outlining the future face of medical decision support systems Artificial intelligence has now become a ubiquitous aspect of modern life and especially machine learning enjoys great popularity since it offers techniques that are capable of learning from samples to solve newly encountered cases Today a recent form of machine learning deep learning is being widely used with large complex quantities of data because today s problems require detailed analyses of more data This is critical especially in fields such as medicine Accordingly the objective of this book is to provide the essentials of and highlight recent applications of deep learning architectures for medical decision support systems The target audience includes scientists experts MSc and PhD students postdocs and any readers interested in the subjects discussed The book can be used as a reference work to support courses on artificial intelligence machine deep learning medical and biomedical education

Machine Learning and AI for Healthcare Arjun Panesar, 2021 This updated second edition offers a guided tour of machine learning algorithms and architecture design It provides real world applications of intelligent systems in healthcare and covers the challenges of managing big data The book has been updated with the latest research in massive data machine learning and AI ethics It covers new topics in managing the complexities of massive data and provides examples of complex machine learning models Updated case studies from global healthcare providers showcase the use of big data and AI in the fight against chronic and novel diseases including COVID 19 The ethical implications of digital healthcare analytics and the future of AI in population health management are explored You will learn how to create a machine learning model evaluate its performance and operationalize its outcomes within your organization Case studies from leading healthcare providers cover scaling global digital services Techniques are presented to evaluate the efficacy suitability and efficiency of AI machine learning applications through case studies and best practice including the Internet of Things You will understand how machine learning can be used to develop health intelligence with the aim of improving patient health population health and facilitating significant care payer cost savings You will Understand key machine learning algorithms and their use and implementation within healthcare Implement machine learning systems such as speech recognition and enhanced deep learning AI Manage the complexities of massive data Be familiar with AI and healthcare best practices feedback loops and intelligent agents

Deep Learning for Biomedical Data Analysis Mourad Elloumi, 2021 This book is the first overview on Deep Learning DL for biomedical data analysis It surveys the most recent techniques and approaches in this field with both a broad coverage and enough depth to be of practical use to working professionals This book offers enough fundamental and technical information on these techniques approaches and the related problems without overcrowding the reader's head It presents the results of the latest investigations in the field of DL for biomedical data analysis The techniques and approaches presented in this book deal with the most important and or the newest topics encountered in this field They combine fundamental theory of Artificial Intelligence AI Machine Learning ML and DL with practical applications in Biology and Medicine Certainly the list of topics covered in this book is not exhaustive but these topics will shed light on the implications of the presented techniques and approaches on other topics in biomedical data analysis The book finds a balance between theoretical and practical coverage of a wide range of issues in the field of biomedical data analysis thanks to DL The few published books on DL for biomedical data analysis either focus on specific topics or lack technical depth The chapters presented in this book were selected for quality and relevance The book also presents experiments that provide qualitative and quantitative overviews in the field of biomedical data analysis The reader will require some familiarity with AI ML and DL and will learn about techniques and approaches that deal with the most important and or the newest topics encountered in the field of DL for biomedical data analysis He she will discover both the fundamentals behind DL techniques and approaches and their applications on biomedical data This book can also serve as a reference book for graduate courses in

Bioinformatics AI ML and DL The book aims not only at professional researchers and practitioners but also graduate students senior undergraduate students and young researchers This book will certainly show the way to new techniques and approaches to make new discoveries

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