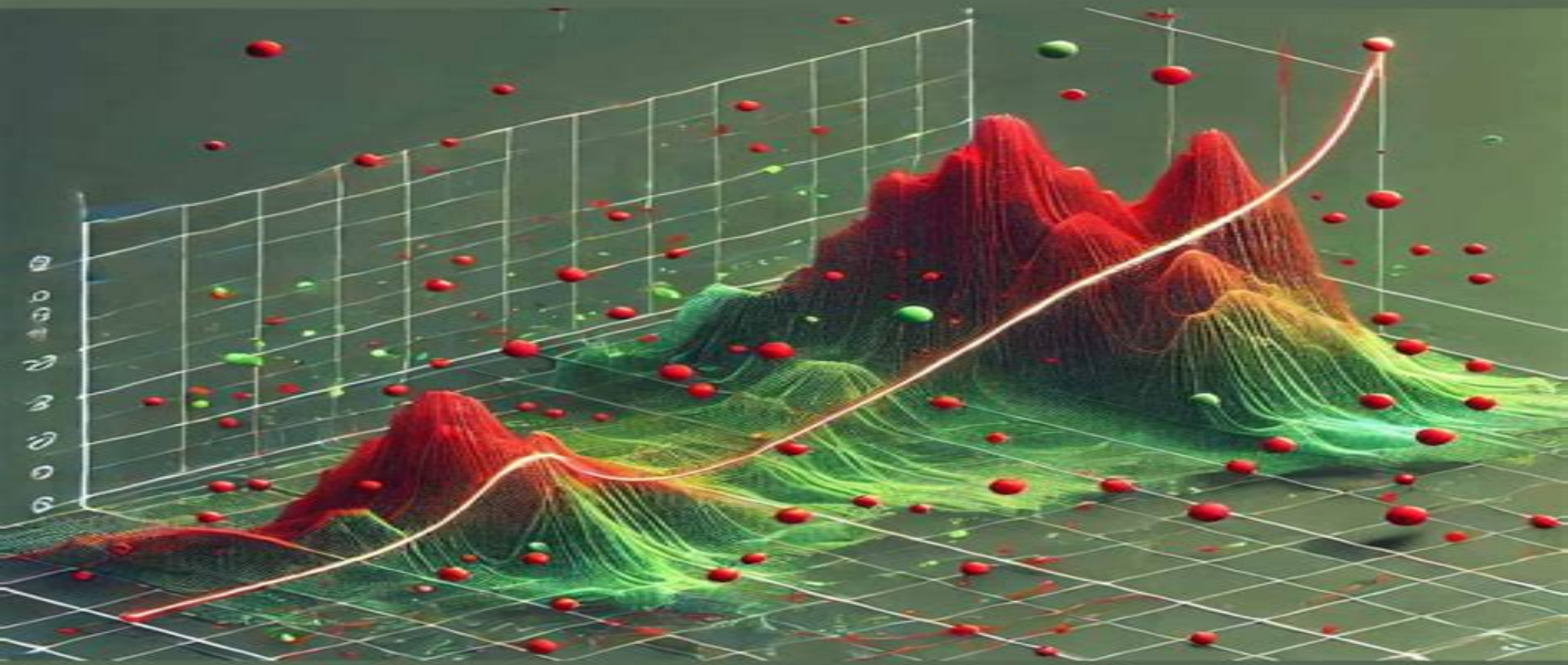


# Bayesian Modeling

## And Computation in

# Python



# Bayesian Semiparametric Methods For Joint Modeling

**Eduardo Gil, Eva Gil, Juan Gil, María  
Ángeles Gil**



## **Bayesian Semiparametric Methods For Joint Modeling:**

### **Bayesian Semiparametric Joint Modeling of Longitudinal Predictors and Discrete Outcomes** Woobeen Lim,2021

Many prospective biomedical studies collect data on longitudinal variables that are predictive of a discrete outcome and oftentimes primary interest lies in the association between the outcome and the values of the longitudinal measurements at a specific time point A common problem in these longitudinal studies is inconsistency in timing of measurements and missing follow ups since few subjects have values close to the time of interest Another difficulty arises from the fact that numerous studies collect longitudinal measurements with different scales as there is no known multivariate distribution that is capable of accommodating variables of mixed scale simultaneously These challenges are well demonstrated in our motivating data example the Life and Longevity After Cancer LILAC a cohort study of cancer survivors who participated in the Women s Health Initiative WHI One research area of interest in these studies is to determine the relationship between lifestyle or health measures recorded in the WHI with treatment related outcomes measured in LILAC For instance a researcher may want to examine if sleep related factors measured prior to initial cancer treatment such as insomnia rating scale a continuous variable sleep duration ordinal and depression binary imputed at the time of cancer diagnosis can predict the incidence of adverse effects of cancer treatment Despite the multitude of such applications in biostatistical areas no previous methods exist that are able to tackle these challenges In this work we propose a new class of Bayesian joint models for a discrete outcome and longitudinal predictors of mixed scale Our model consists of two submodels 1 a longitudinal submodel which uses a latent normal random variable construction with regression splines to model time dependent trends with a Dirichlet Process prior assigned to random effects to relax distribution assumptions and 2 an outcome submodel which standardizes timing of the predictors by relating the discrete outcome to the imputed longitudinal values at a set time point We present two outcome models that will accommodate either a binary or count outcome which will be used to model the incidence of insomnia and the number of symptoms after initial cancer treatment in LILAC respectively The proposed models will be evaluated via simulation studies to demonstrate their performance in comparison with other competing models

### **A New Class of Bayesian Semi-Parametric Joint Longitudinal-Survival Models for Biomarker Discovery** Sepehr Akhavan

Masouleh,2016 In studying the progression of a disease and to better predict time to death survival data investigators often collect repeated measures over time longitudinal data and are interested in testing the association between risk factors including collected repeated measures and time to death One such example is testing the association between the biomarker serum albumin that is measured repeatedly on end stage renal disease ESRD patients A modeling framework that is capable of modeling longitudinal and survival outcomes simultaneously is called a joint longitudinal survival model Joint longitudinal survival models have received a great deal of attention over the past years where many different joint models have been proposed Joint models commonly make parametric assumptions on either the functional form of the repeated measures or on

the distribution of survival times In this dissertation we are interested in joint models that are robust to common parametric and semi parameteric survival and longitudinal assumptions We propose a flexible Bayesian joint longitudinal survival framework that avoids common parametric and semi parameteric assumptions More specifically our modeling framework incorporates a flexible longitudinal component by utilizing Gaussian process GP technique This technique avoids any explicit functional assumption on the trajectory of the repeated measures Our modeling framework also uses Dirichlet process DP prior to avoid explicit distributional assumptions on survival times We further extend our framework to modeling multiple longitudinal processes simultaneously We propose a multivariate joint longitudinal survival technique to jointly model the association between multiple longitudinal processes with survival outcomes Our proposed technique is capable of taking correlation between longitudinal processes into account This is particularly useful when observed measures from different longitudinal processes are taken at different frequencies That means some longitudinal processes are observed less frequently compared to other longitudinal processes By jointly modeling these processes one can take the correlation between the processes into account and hence better estimate the trajectory of the processes including those less frequent ones Our proposed joint modeling frameworks use Dirichlet process techniques Therefore understanding parameter estimation in these models is vital Using synthetic longitudinal and survival data we compare parameter estimation under DPM models as opposed to commonly used parametric techniques We are particularly interested in evaluation of the performance of the model in parameter estimation when a population consists of sub populations with latent features that are different across subgroups We propose a Dirichlet process mixture survival model that is capable of detecting latent subpopulations characterized by differing baseline risks for mortality Our proposed technique is particularly useful when interest lies in estimation of the conditional effect of covariates as opposed to estimates that are marginalized across all subpopulations Throughout our work is motivated by data on patients with end stage renal disease ESRD a condition where the kidneys are no longer capable of cleaning blood sufficiently enough to sustain life In this context a modeling framework capable of finding mortality related biomarkers which are measured longitudinally over time can significantly help physicians and practitioners to lower mortality among these patients

*The Mathematics of the Uncertain* Eduardo Gil, Eva Gil, Juan Gil, María Ángeles Gil, 2018-02-28 This book is a tribute to Professor Pedro Gil who created the Department of Statistics OR and TM at the University of Oviedo and a former President of the Spanish Society of Statistics and OR SEIO In more than eighty original contributions it illustrates the extent to which Mathematics can help manage uncertainty a factor that is inherent to real life Today it goes without saying that in order to model experiments and systems and to analyze related outcomes and data it is necessary to consider formal ideas and develop scientific approaches and techniques for dealing with uncertainty Mathematics is crucial in this endeavor as this book demonstrates As Professor Pedro Gil highlighted twenty years ago there are several well known mathematical branches for this purpose including Mathematics of chance Probability

and Statistics Mathematics of communication Information Theory and Mathematics of imprecision Fuzzy Sets Theory and others These branches often intertwine since different sources of uncertainty can coexist and they are not exhaustive While most of the papers presented here address the three aforementioned fields some hail from other Mathematical disciplines such as Operations Research others in turn put the spotlight on real world studies and applications The intended audience of this book is mainly statisticians mathematicians and computer scientists but practitioners in these areas will certainly also find the book a very interesting read

**Emerging Topics in Modeling Interval-Censored Survival Data** Jianguo

Sun,Ding-Geng Chen,2022-11-29 This book primarily aims to discuss emerging topics in statistical methods and to booster research education and training to advance statistical modeling on interval censored survival data Commonly collected from public health and biomedical research among other sources interval censored survival data can easily be mistaken for typical right censored survival data which can result in erroneous statistical inference due to the complexity of this type of data The book invites a group of internationally leading researchers to systematically discuss and explore the historical development of the associated methods and their computational implementations as well as emerging topics related to interval censored data It covers a variety of topics including univariate interval censored data multivariate interval censored data clustered interval censored data competing risk interval censored data data with interval censored covariates interval censored data from electric medical records and misclassified interval censored data Researchers students and practitioners can directly make use of the state of the art methods covered in the book to tackle their problems in research education training and consultation

**Frontiers of Biostatistical Methods and Applications in Clinical Oncology** Shigeyuki Matsui,John

Crowley,2017-10-03 This book presents the state of the art of biostatistical methods and their applications in clinical oncology Many methodologies established today in biostatistics have been brought about through its applications to the design and analysis of oncology clinical studies This field of oncology now in the midst of evolution owing to rapid advances in biotechnologies and cancer genomics is becoming one of the most promising disease fields in the shift toward personalized medicine Modern developments of diagnosis and therapeutics of cancer have also been continuously fueled by recent progress in establishing the infrastructure for conducting more complex large scale clinical trials and observational studies The field of cancer clinical studies therefore will continue to provide many new statistical challenges that warrant further progress in the methodology and practice of biostatistics This book provides a systematic coverage of various stages of cancer clinical studies Topics from modern cancer clinical trials include phase I clinical trials for combination therapies exploratory phase II trials with multiple endpoints treatments and confirmative biomarker based phase III trials with interim monitoring and adaptation It also covers important areas of cancer screening prognostic analysis and the analysis of large scale molecular data in the era of big data

**Statistical Modelling for Evidence-Based Public Health** Lawrence N.

Kazembe,Tsirizani M. Kaombe,2025-09-26 This book presents a selection of statistical techniques and methods applied to

analyze data arising from HIV AIDS epidemiology as well as child and maternal health Evidence based decision making in public health interventions requires appropriate techniques applied to solve relevant statistical and epidemiological questions which would in turn bring out relevant outputs for action The different chapters assembled in this book address various methodological challenges when analyzing HIV AIDS child and maternal health data These include data issues for handling correlated outcomes and repeated measurements generated through longitudinal or follow up processes spatial temporal correlation measurement error missingness co morbidity survival analysis detection of outlying health outcomes and joint occurrences of outcomes Essential approaches that enhance statistical science are presented when dealing with variable and model selection Each chapter motivates the problem provides details of the relevant bio statistical methods used to tackle the problem applies the methods to the data and offers some epidemiological or public health recommendations Readers can replicate the methods to their data and R command codes are supplied at the end of each chapter

Semiparametric Bayesian Joint Modeling with Applications in Toxicological Risk Assessment Beom Seuk Hwang,2013  
Abstract Many dose response studies collect data on correlated outcomes For example in developmental toxicity studies uterine weight and presence of malformed pups are measured on the same dam Joint modeling can result in more efficient inferences than independent models for each outcome Most methods for joint modeling assume standard parametric response distributions However in toxicity studies it is possible that response distributions vary in location and shape with dose which may not be easily captured by standard models To address this issue we propose a semiparametric Bayesian joint model for a binary and continuous response In our model a kernel stick breaking process KSBP prior is assigned to the distribution of a random effect shared across outcomes which allows flexible changes in distribution shape with dose shared across outcomes The model also includes outcome specific fixed effects to allow different location effects **Handbook of Survival Analysis** John P. Klein,Hans C. van Houwelingen,Joseph G. Ibrahim,Thomas H. Scheike,2016-04-19 Handbook of Survival Analysis presents modern techniques and research problems in lifetime data analysis This area of statistics deals with time to event data that is complicated by censoring and the dynamic nature of events occurring in time With chapters written by leading researchers in the field the handbook focuses on advances in survival analysis techniques covering classical and Bayesian approaches It gives a complete overview of the current status of survival analysis and should inspire further research in the field Accessible to a wide range of readers the book provides An introduction to various areas in survival analysis for graduate students and novices A reference to modern investigations into survival analysis for more established researchers A text or supplement for a second or advanced course in survival analysis A useful guide to statistical methods for analyzing survival data experiments for practicing statisticians **A General Joint Model for Longitudinal Measurements and Competing Risks Survival Data with Heterogenous Random Effects** Xin Huang,2008 *Journal of the American Statistical Association* ,2009 **Joint Longitudinal-survival-cure Model with Application in Prostate**

**Cancer Studies** Menggang Yu,2004      **Bayesian Semi-parametric Methods for Non-ignorable Dropout** Camille Marie Moore,2016 Dropout is a common problem in longitudinal studies when the probability of dropout depends on unobserved outcomes even after conditioning on available data data may be missing not at random and dropout is not ignorable Selection frailty and mixture model frameworks have been proposed to adjust for dropout however most methods rely on parametric assumptions about the distribution of dropout times and the relationship between the outcome and dropout time We propose two Bayesian semi parametric frameworks to account for dropout including a natural cubic B spline varying coefficient model and a Dirichlet process mixture model These methods can model longitudinal Gaussian outcomes as well as non normal outcomes in the exponential family while relaxing common parametric assumptions and making inference more robust These methods are extended to the joint modeling of two correlated longitudinal outcomes in the presence of dropout We apply these methods to investigate longitudinal changes in CD4 T cell count viral load and viral load suppression in two HIV cohort studies      **Joint Analysis of Longitudinal Data and Competing Risks Failure Time Data** Wenhua Hu,2007      Joint Modelling of Time-to-event and Longitudinal Data Yi-Kuan Tseng,2005      Statistica ,2006      **Bayesian Nonparametric Methods for Emulation, Sensitivity Analysis, and Calibration of Computer Simulators** Marian Farah,2011      **A New Framework for Bayesian Analysis of Dose-response Studies Through Dependent Nonparametric Modeling for Categorical Responses** Kassandra M. Fronczyk,2011      AMSTAT News American Statistical Association,2009

**Bayesian Statistics and Its Applications** Satyanshu K. Upadhyay,Umesh Singh,Dipak Dey,2007 In the last two decades Bayesian Statistics has acquired immense importance and has penetrated almost every area including those where the application of statistics appeared to be a remote possibility This volume provides both theoretical and practical insights into the subject with detailed up to date material on various aspects It serves two important objectives to offer a thorough background material for theoreticians and gives a variety of applications for applied statisticians and practitioners Consisting of 33 chapters it covers topics on biostatistics econometrics reliability image analysis Bayesian computation neural networks prior elicitation objective Bayesian methodologies role of randomisation in Bayesian analysis spatial data analysis nonparametrics and a lot more The book will serve as an excellent reference work for updating knowledge and for developing new methodologies in a wide variety of areas It will become an invaluable tool for statisticians and the practitioners of Bayesian paradigm      *Dissertation Abstracts International* ,2008

Reviewing **Bayesian Semiparametric Methods For Joint Modeling**: Unlocking the Spellbinding Force of Linguistics

In a fast-paced world fueled by information and interconnectivity, the spellbinding force of linguistics has acquired newfound prominence. Its capacity to evoke emotions, stimulate contemplation, and stimulate metamorphosis is really astonishing. Within the pages of "**Bayesian Semiparametric Methods For Joint Modeling**," an enthralling opus penned by a highly acclaimed wordsmith, readers set about an immersive expedition to unravel the intricate significance of language and its indelible imprint on our lives. Throughout this assessment, we shall delve to the book is central motifs, appraise its distinctive narrative style, and gauge its overarching influence on the minds of its readers.

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### **Bayesian Semiparametric Methods For Joint Modeling Introduction**

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