Springer Actuarial Lecture Notes

Michel Denuit
Donatien Hainaut
Julien Trufin

Effective Statistical Learning Methods for Actuaries II

Tree-Based Methods and Extensions

Springer

Springer Actuarial

Springer Actuarial Lecture Notes

This subseries of Springer Actuarial includes books with the character of lecture notes. Typically these are research monographs on new, cutting-edge developments in actuarial science; sometimes they may be a glimpse of a new field of research activity, or presentations of a new angle in a more classical field.

In the established tradition of Lecture Notes, the timeliness of a manuscript can be more important than its form, which may be informal, preliminary or tentative.

More information about this subseries at http://www.springer.com/series/15682

Michel Denuit · Donatien Hainaut ·
Julien Trufin

Effective Statistical Learning Methods for Actuaries II

Tree-Based Methods and Extensions

Springer

Michel Denuit
Institut de Statistique, Biostatistique et Sciences Actuarielles (ISBA)
Université Catholique Louvain
Louvain-la-Neuve, Belgium

Donatien Hainaut
Institut de Statistique, Biostatistique et Sciences Actuarielles (ISBA)
Université Catholique Louvain
Louvain-la-Neuve, Belgium

Julien Trufin
Département de Mathématiques
Université Libre de Bruxelles
Brussels, Belgium

ISSN 2523-3262 ISSN 2523-3270 (electronic)
Springer Actuarial
ISSN 2523-3289 ISSN 2523-3297 (electronic)
Springer Actuarial Lecture Notes
ISBN 978-3-030-57555-7 ISBN 978-3-030-57556-4 (eBook)
https://doi.org/10.1007/978-3-030-57556-4

Mathematics Subject Classification: 62P05, 62-XX, 68-XX, 62M45

Preface

The present material is written for students enrolled in actuarial master programs and practicing actuaries, who would like to gain a better understanding of insurance data analytics. It is built in three volumes, starting from the celebrated Generalized Linear Models, or GLMs and continuing with tree-based methods and neural networks.

This second volume summarizes the state of the art using regression trees and their various combinations such as random forests and boosting trees. This second volume also goes through tools enabling to assess the predictive accuracy of regression models. Throughout this book, we alternate between methodological aspects and numerical illustrations or case studies to demonstrate practical applications of the proposed techniques. The `R` statistical software has been found convenient to perform the analyses throughout this book. It is a free language and environment for statistical computing and graphics. In addition to our own R code, we have benefited from many `R` packages contributed by the members of the very active community of `R`-users. The open-source statistical software `R` is freely available from https://www.r-project.org/.

The technical requirements to understand the material are kept at a reasonable level so that this text is meant for a broad readership. We refrain from proving all results but rather favor an intuitive approach with supportive numerical illustrations, providing the reader with relevant references where all justifications can be found, as well as more advanced material. These references are gathered in a dedicated section at the end of each chapter.

The three authors are professors of actuarial mathematics at the universities of Brussels and Louvain-la-Neuve, Belgium. Together, they accumulate decades of teaching experience related to the topics treated in the three books, in Belgium and throughout Europe and Canada. They are also scientific directors at Detralytics, a consulting office based in Brussels.

Within Detralytics as well as on behalf of actuarial associations, the authors have had the opportunity to teach the material contained in the three volumes of "Effective Statistical Learning Methods for Actuaries" to various audiences of practitioners. The feedback received from the participants to these short courses

greatly helped to improve the exposition of the topic. Throughout their contacts with the industry, the authors also implemented these techniques in a variety of consulting and R&D projects. This makes the three volumes of "Effective Statistical Learning Methods for Actuaries" the ideal support for teaching students and CPD events for professionals.

Louvain-la-Neuve, Belgium — Michel Denuit
Louvain-la-Neuve, Belgium — Donatien Hainaut
Brussels, Belgium — Julien Trufin
September 2020

Contents