Incorporating Predictive Analytics into an Actuarial Curriculum

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Outline

Wisconsin Actuarial Program

- Started in 1948, one of longest standing actuarial science programs in the country
- A Center of Actuarial Excellence since program inception in 2009
- Primarily resides in the Wisconsin School of Business in the Department of Risk and Insurance with 20% of students majoring in Math, Statistics, or Economics
  - Inter-connected with the Risk Management and Insurance program at UW-Madison that is consistently ranked in the top 3 in the country
  - Composed of a robust faculty team, including six full-time faculty (plus one adjunct faculty member) focused on Actuarial Science. In addition there are four full-time faculty in Risk Management and Insurance (multiple adjunct faculty) and two full-time faculty in Business Analytics
- Faculty are highly regarded for their teaching, research and their service to the profession
- Offers coursework that covers the learning objectives for all of the preliminary exams required by both the SOA and the CAS
- Offers course options to fulfill all of the Validation by Educational Experience (VEE) requirements for actuarial professional certification

Utilizing R to Promote Analytics

- At UW-Madison, research faculty are essentially applied statisticians
  - This drives our curriculum philosophy
  - We have moved from a heavy emphasis of applied probability modeling to one that emphasizes data reasoning
- To promote data analytics, we now incorporate the statistical package **R** into our first courses
  - Interest theory for us
  - At comparable programs (e.g., KU Leuven), students are required to do an online *Introduction to R* (through Datacamp) before starting the loss data sequence

Loss Data Analytics

- In anticipation of curriculum changes, beginning in 2016-17 we changed the role of *loss data*
  - Switched from an applied probability to an applied statistics course
    - Recognizing this, we now call it *Loss Data Analytics* (not *Loss Models*)
  - Switched the order between loss data and actuarial mathematics.
    - Loss data is a year-long sequence, taken in 3rd year
    - Actuarial mathematics also a year-long sequence, taken in 4th year
- For required readings, we have been working with other academics to develop a free, online text book

Open Actuarial Textbooks Vision

To have a set of actuarial texts covering the foundations of actuarial science. These texts will be an interactive, online, and freely available.

- The online version contains many interactive objects (quizzes, computer demonstrations, interactive graphs, video, and the like) to promote **deeper learning**.
- A subset of the book is available for offline reading in pdf and EPUB formats.
- The online text will be available in multiple languages to promote access to a *worldwide audience*.

To learn more, go to

`https://ewfrees.github.io/`

Analytics Core in an Actuarial Curriculum

- We hope to develop more analytics for actuarial mathematics but that represents next steps
- Now, our "analytics core" consists of a regression course and comparable course in health analytics
  - The regression class covers traditional linear and generalized linear models, with a speck of time series
  - The health analytics course also involves methods as well as healthcare policy knowledge.
- Both class use a hybrid teaching model, addressing many of the learning outcomes of the new SOA "Predictive Analytics" Exam
  - About 60% of each class period is spent on hands-on activities (using R to analyze data) where students team with one another
  - These classes require a written project
  - In some classes, students also present their projects. In other classes, students present regression/health applications.

Advanced Analytics

- We developed a *Predictive Modeling Book Series*, sponsored by the Canadian Institute of Actuaries and the Casualty Actuarial Society.
  - Although designed for practicing actuaries, some universities are using this for their masters programs
- At UW, we have been discussing introducing a course on statistical learning. Faculty are eager to teach it but we are not sure how we can get enough undergrads to this level to warrant a course
- For our doctoral program, students have many, many options for courses and interested faculty across campus

The End

Thanks for Attending!

Wisconsin Actuarial Program Statistics

- Summary of **Actuarial Science Club** from 2016 - 2017
  - Over 420 student members
  - 16 Employer-sponsored actuarial specific presentations
  - Social events including karaoke night, a SERF sports social and a Halloween pumpkin patch outing
  - Active student led mentorship program
- Department of Risk and Insurance **Co-Curricular Learning Board** (CCLB) offered their second case competition
- Sixty-one companies attended the 2016 **Risk and Insurance Career Fair** in September
- Statistics from 2016 - 2017 academic year
  - 93 actuarial graduates
  - 92% of domestic graduates found full time placement within 6 months of graduation
  - 76% of international graduates found either full time placement within 6 months of graduation or chose to further their education
  - 91% of domestic undergraduates who graduated had at least one summer internship while in school
  - 88% of last academic year's graduates had passed two or more professional actuarial science exams
  - Passed 2.8 professional exams on average by graduation
  - Over 35,000 USD awarded in scholarships to students who passed professional exams
  - Over 55,000 USD in general scholarships awarded to students
  - Over 25,000 USD awarded in experiential scholarships to students as course assistants, graders and project support

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Audience

- Society of Actuaries (2016 Annual Report)
  - 27,000 members, 15% located outside of North America
  - 37,000 candidates, 22% located outside of North America
- Casualty Actuarial Society
  - 7,600 members
- Institute and Faculty of Actuaries
  - 29,000 members (December 2016)
  - 46% of members are based outside the UK, 52% of members are students
- Japanese Institute of Actuaries (2015 Annual Report)
  - 1,600 Fellows, 1,300 Associates, 2,000 students
- Institute of Actuaries of Australia (2016 Annual Report)
  - 2,200 Fellows, 700 Associates, 1,700 students

International Actuarial Association

- "The IAA represents more than 60,000 actuaries worldwide"
- 70 Full members, e.g.,
  - **Egyptian Society of Actuaries (Egypt)**
  - Asociación Centroamericana de Actuarios (ACEA)
  - Caribbean Actuarial Association
  - Consejo Profesional de Ciencias Económicas de la Ciudad Autónoma de Buenos Aires (Argentina)
  - Actuaries Institute Australia (Australia)
  - Aktuarvereinigung Österreichs (AVÖ) (Austria)
  - Institut des Actuaires en Belgique (Belgique)
  - Aktuarsko Drustvo U Bosni I Hercegovini (Bosnia and Herzegovina)
  - Instituto Brasileiro de Atuária (IBA) (Brazil)
  - Bulgarian Actuarial Society (Bulgaria)
  - Canadian Institute of Actuaries/Institut Canadien des Actuaires (Canada) , ...
- 28 Associate members, e.g.,
  - Channel Islands Actuarial Association ()
  - Albanian Actuarial Association (Albania)
  - Instituto Actuarial Argentino (Argentina)
  - Actuarial Society of Armenia (Armenia)
  - Actuarial Association of Azerbaijan (Azerbaijan)
  - Actuarial Society of Bangladesh (Bangladesh)
  - Association des Actuaires Beninois (Benin)
  - Actuarial Association of the Republic of Srpska (Bosnia and Herzegovina)
  - Instituto de Actuarios Matemáticos de Chile (Chile), ...

Open Educational Resources

- An online text is a type of open educational resource (OER)
- Benefits of OERs
  - It equalizes access to knowledge, thus permitting a broader community to learn about the actuarial profession.
  - Has the capacity to engage viewers through active learning that deepens the learning process, producing analysts more capable of solid actuarial work.
- This movement is analogous to the development by the statistical community of the open-source statistical package **R**
  - Vision – An actuarial community that will work collaboratively in developing actuarial textbooks of the future

OER Examples

- Many terrific examples of online texts
  - Online stats book, available on the web (`http://onlinestatbook.com/`) and in IBook format
  - The American *Yawp* is a free and online collaboratively built textbook on American History (`http://www.americanyawp.com/`).
  - A library of OERs at the OpenStax College (`https://cnx.org/`) initiative sponsored by Rice University
- For *Loss Data*, see
  - Marcel B. Finan, *An Introductory Guide in the Construction of Actuarial Models* (2013) (`http://faculty.atu.edu/mfinan/actuarieshall/CGUIDE.pdf`).
  - Mario Wütrich, *Non-Life Insurance: Mathematics & Statistics* (2017) (`https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2319328`)
- Overview of online resources at a page by Myron Hlynka, `http://web2.uwindsor.ca/math/hlynka/`.

R Bookdown and GitHub

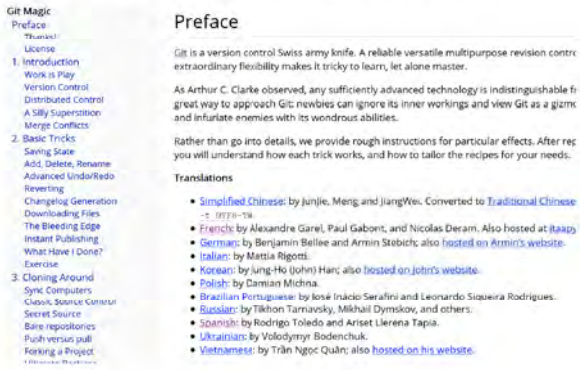
- **R** and **R-Studio** have recently implemented a new package called **Bookdown**
  - Allows one to author books and technical documents using R's version of *markdown*.
  - This package allows us to create .html, .pdf, and .EPUB versions of the same file.
- **GitHub** provides a platform for developing computer software code collaboratively. We use it for developing textbooks.
  - Provides an easy way to upload, store, and download versions of the book
  - Provides a straightforward method for keeping track of changes using the *git* software

Interactive Features of Online Version

- The online version promotes **active learning**
  - The objective is to provide **formative assessment** tools - designed to make the viewer pay attention at the first reading
- To illustrate, the current versions includes:
  - *Javascript show/hide* for **R** codes
  - *Javascript show/hide* for solutions to problems
  - Multiple choice questions to provide immediate feedback
  - Online dictionary of terms (mouse rollover)
  - Links to current topics on the web
  - Online discussion forums - comment on the book
  - Dynamic graphs
  - Video explanations of selected topics
  - More to come ....

Incorporating Alternative Languages

- Bookdown input files are text-based - in principle easy to convert to other languages
- Some test cases appear promising - we'll see



Project Status

- Go to GitHub, search for *Loss-Data-Analytics*. Go up to "ewfrees" and find four repositories
  1. *Loss-Data-Analytics* is a draft of a textbook. Many chapters are complete. Detailed notes for other chapters. The online version has several interactive components (that do not work in the .pdf and .epub versions)
  2. *LossDataAnalyticsRCode* provides illustrative R code (with data) that students can work through as they read the book
  3. *LossDataAnalyticsOverheads* provides overheads, suitable for use in classroom presentation
  4. *LifeCon* provides three sets of life contingency/actuarial mathematics lecture notes.
- At the GitHub site, you will find links to the project site as well as WordPress site

Loss Data Analytics

Why loss data analytics?

- One has to start somewhere
- Given the dramatic changes in the way that actuaries treat data, loss data seems like a natural place to start.
- The name *loss data analytics* – integrate classical loss data models from applied probability with modern analytic tools.
  - Emphasis is applications of loss analytic techniques including pricing, reserving, and claims management
  - Emphasis on *empirical* (data) aspects (not applied probability)
- Big data (e.g., social media and usage based insurance) and high speed computation are here to stay

Call for Volunteers

How to be involved

- Have your students use the materials as they develop. Critique. Suggest ways to improve.
- Comment on chapters as they develop
- Contribute problems/data/case studies
- Write a chapter yourself
- Help direct the development of the resource - give talks to interested groups
- Help to develop resources for the project
- Many other volunteer opportunities

Predictive Modeling Book Series

- We coordinated and co-authored this two volume set, published by *Cambridge University Press* and co-sponsored by the *Casualty Actuarial Society*, that provides evidence to identify our program as a leader in insurance analytics
  - I am a co-Editor, along with Glenn Meyers and Richard Derrig
  - Thirty one author teams in total (over two volumes)
  - I, Peng Shi, and Margie Rosenberg have authored chapters, along with others from 7 different countries

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- Volume I appeared in 2014 - we are pleased with the response to it
  - Japanese Institute of Actuaries purchased 760 copies and we have completed the translation
- Volume II, on case studies, appeared August 2016
- Book URL
  `http://research.bus.wisc.edu/PredModelActuaries`

WISCONSIN SCHOOL OF BUSINESS
UNIVERSITY OF WISCONSIN-MADISON
TOGETHER FORWARD

Predictive Modeling Applications in Actuarial Science

Home
- About the Book

Book Content
- Introduction
- Predictive Modeling Foundations
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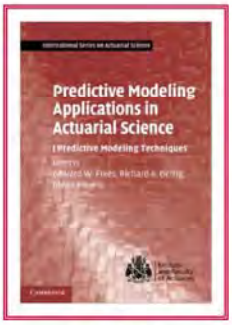
- Bayesian and Mixed Modeling
- Longitudinal Modeling

School of Business Research
Jed Frees - Research

Welcome!

This is the new website for *Predictive Modeling Applications in Actuarial Science*, a two volume series that we are creating.

This website currently focuses on Volume 1. We provide content preview, data(.txt or .csv format) and R code(.R format) for each chapter here. Contact authors for further information about data and code.



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Available Summer 2016

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