

# What are the basic similarities and differences between insurance risk modelling and standard machine learning techniques? – An Overview

EAA e-Conference on Data Science & Data Ethics

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Dr. Jürg Schelldorfer, Actuary SAA

Senior Actuarial Data Scientist, Swiss Re

Chair of the «Data Science» working group of the Swiss Association of Actuaries (SAA)

# Disclaimer

The opinions expressed in this presentation are those of the author only. They are inspired by the work that the author is doing for both Swiss Re and the SAA, but they do not necessarily reflect any official view of either Swiss Re or the SAA.

# Insurance risk modelling and machine learning


	Insurance Risk Modelling	Standard Machine Learning
Foundation	Distribution and uncertainty	Point estimate and algorithm
Mathematical foundation	Statistical model	Numerical optimization
Modelling target	Probabilistic forecast	Point forecast
Statistical distributions	Non-Gaussian (asymmetric, skewed)	Gaussian (symmetric)
Signal-to-noise (SNR) ratio	Small	High
Mathematical model selection «criteria»	<ul style="list-style-type: none"> <li>• Predictability (in-sample)</li> <li>• Stability and robustness (long-term)</li> <li>• Smoothness</li> <li>• Parsimony</li> <li>• Interpretability / explainability</li> <li>• -</li> <li>• -</li> </ul>	<ul style="list-style-type: none"> <li>• Predictability (out-of-sample)</li> <li>• Stability and robustness (short-term)</li> <li>• -</li> <li>• Anti-parsimony</li> <li>• Black-box</li> <li>• Computability</li> <li>• Calibration</li> </ul>
Non-mathematical model selection «criteria»	<ul style="list-style-type: none"> <li>• Causality / truth between predictors and predictant</li> <li>• Inclusion of expert knowledge</li> <li>• Human adjustability of models</li> </ul>	<ul style="list-style-type: none"> <li>• Correlation, train/test paradigm</li> <li>• -</li> <li>• -</li> </ul>
Non-technical considerations	<ul style="list-style-type: none"> <li>• Regulatory framework</li> <li>• Political and social aspects</li> </ul>	<ul style="list-style-type: none"> <li>• Ethics and fairness</li> <li>• Accountability and transparency</li> </ul>
Professional associations	<ul style="list-style-type: none"> <li>• Professional standards</li> </ul>	<ul style="list-style-type: none"> <li>• Ethical codes of conduct</li> </ul>

# Appendix

# SAA Data Science Working Party (1/2)



[www.actuarialdatascience.org](http://www.actuarialdatascience.org)



**Actuarial Data Science**  
An initiative of the Swiss Association of Actuaries

Home	Home	Updates
ADS Tutorials	<p>The main purpose of this website is to make the work and results of the working group "Data Science" of the Swiss Association of Actuaries (SAA) / Schweizerische Aktuarvereinigung (SÄV) easily available to interested people. Actuarial Data Science (ADS) is defined to be the intersection of Actuarial Science (AS) and Data Science (DS).</p> <p>The core targets are:</p> <ul style="list-style-type: none"><li>• <b>ADS Tutorials:</b> Writing tutorials for actuaries which provide a thorough and yet easy introduction to various methods from Data Science. We provide methodological papers together with the code, such that everyone can easily learn the methods on his own data.</li><li>• <b>ADS Strategy:</b> We have worked out a strategy for the Swiss Association of</li></ul>	<p>Below, we provide the most recent changes to the website:</p> <ul style="list-style-type: none"><li>• 19th July 20: Publication of our ninth tutorial: <a href="#">Convolutional neural network studies. (1) anomalies in mortality rates. (2) image recognition (incl. code)</a></li><li>• 7th May: Publication of our eighth tutorial: <a href="#">Peeking into the Black Box: An</a></li></ul>
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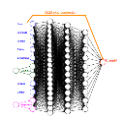


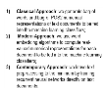

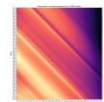
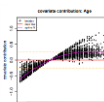
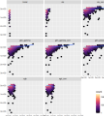


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An initiative of the Swiss Association of Actuaries and its Data Science Working Group.

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# SAA Data Science Working Party (2/2)

-  1 Recap of GLM's, introduction to **regression trees** and **neural networks**
-  2 **Best practice** step-by-step guide to fit **neural networks for actuarial applications**
-  3 How to embed a GLM into a neural networks explore additional structure
- AdaBoost
    - AdaBoost.M1
    - LogitBoost
    - SAMME.R
  - GradientBoost
  - XGBoost 4 Overview of **boosting algorithms**
-  5 **Unsupervised learning:** Clustering data into homogeneous groups
-  6 Recurrent neural networks (RNNs) are used use on a **mortality rate prediction problem**
-  7 Overview of the three **approaches to preprocess text data with NLP**
-  8 Overview of **tools for explaining and interpreting black box machine learning models** like boosted trees or deep neural networks for P&C pricing
-  9 **Convolution Neural Networks (CNN)** to detect anomalies **in mortality rates**
-  10 **LocalGLMnet:** a deep learning architecture for actuaries, allowing variable selection and nice interpretations
-  11 Revisiting and clarifying (i) statistical techniques to assess the calibration of a model, and (ii) how to compare and rank different models.