



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

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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.



Perspective	Insurance Risk Modelling	Standard Machine Learning
Foundation	Distribution and uncertainty	Point estimate and algorithm
Mathematical foundation	Statistical model	Numerical optimization
Data foundation	Small and medium; structured data	Big; unstructured data
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"> • Predictability • Stability and robustness (long-term) • Smoothness • Parsimony • Interpretability / explainability • - • - 	<ul style="list-style-type: none"> • Predictability • Stability and robustness (short-term) • - • Anti-parsimony • Black-box • Computability • Calibration
Non-mathematical model selection «criteria»	<ul style="list-style-type: none"> • Causality / truth between predictors and predictant • Inclusion of expert knowledge • Human adjustability of models 	<ul style="list-style-type: none"> • Correlation • - • -
Non-technical considerations	<ul style="list-style-type: none"> • Regulatory framework • Political and social aspects 	<ul style="list-style-type: none"> • Ethics and fairness • Accountability and transparency
Professional associations	<ul style="list-style-type: none"> • Professional standards 	<ul style="list-style-type: none"> • Ethical codes of conduct

*still a hypothesis, additional research needed



Links

www.actuarialdatascience.org

<https://www.youtube.com/watch?v=uHGICi9jOWY>



Appendix




References

1. B. Efron (2020) Prediction, Estimation, and Attribution. *Journal of the American Statistical Association* **115:539**, 636-655
2. G. Shmueli (2010) To explain or to Predict? *Statistical Science* **25/3**, 289-310
3. L. Breimann (2001) Statistical Modeling: The Two Cultures. *Statistical Science* **16/3**, 199-215



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An initiative of the Swiss Association of Actuaries

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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 (SAAV) 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"> • ADS Tutorials: 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. • ADS Strategy: We have worked out a strategy for the Swiss Association of 	<p>Below, we provide the most recent changes to the website:</p> <ul style="list-style-type: none"> • 19th July 20: Publication of our ninth tutorial: Convolutional neural network studies. (1) anomalies in mortality rates. (2) image recognition (incl. code) • 7th May: Publication of our eighth tutorial: Peeking into the Black Box: An
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3		How to embed a GLM into a neural networks explore additional structure	9		Convolution Neural Networks (CNN) to detect anomalies in mortality rates
4	<ul style="list-style-type: none"> ▪ AdaBoost <ul style="list-style-type: none"> ○ AdaBoost.M1 ○ LogitBoost ○ SAMME.R ▪ GradientBoost ▪ XGBoost 	Overview of boosting algorithms	10		LocalGLMnet : a deep learning architecture for actuaries, allowing variable selection and nice interpretations
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6		Recurrent neural networks (RNNs) are used on a mortality rate prediction problem	12		Two actuarial case studies which demonstrate the use Natural Language Processing Using Transformers .