

Title

Using Generative Adversarial Networks for Multi-Dimensional Risk Factor Modeling and Model Validation

Speaker

Dr Mario Hörig, Oliver Wyman

Abstract

Neural networks can be used for a variety of applications, among others to explain complex (functional) relationships between variables or to discriminate. However, a particularly interesting feature of neural networks is their ability to be used in a generative fashion, i.e. they can be used to draw samples from an arbitrary probability distribution which is not known analytically but where empirical realizations are available for training purposes of the neural network.

Generative adversarial models (GAN), which are a certain class of neural networks and have been invented by Ian Goodfellow in 2014, serve exactly this purpose. A GAN formally consists of two neural networks, a generator and a discriminator. While the generator network is ultimately used for the generation of random samples from the target distribution, the discriminator network is used as a highly innovative training tool for the generator – the latter aims at generating samples which are so realistic that the discriminator cannot tell whether they are from the set of original samples or “fakes” from the generator. During the iterative training process both networks are contesting with each other which leads to a continuous improvement of their abilities.

GAN are highly powerful and very popular tools for the generation of highly realistic (but completely “random”) images and an important ingredient for well-known “deepfakes”. In our talk we present how GAN can be used in the context of multi-dimensional risk factor modelling or the validation of such models in the context of market and credit models. Here, their key strength of generating highly realistic realizations of high-dimensional data without using any material assumptions on the risk factor’s marginal distributions and/or copula for joining them plays a key role in their success and offers new applications in risk management applications in the actuarial field.

The talk will introduce GAN in a general way and explore their application to high-dimensional risk factor modelling based on a case study using historical capital market data.

Biography

Mario Hörig is a Partner with Oliver Wyman Actuarial services, co-leading the actuarial services offering in the German speaking markets. Mario focuses on quantitative modelling under Solvency II (economic scenario generators for risk-neutral and real-world purposes, ALM studies, risk factor modelling for Solvency II, risk aggregation, economic capital and capital

management) and advises some of the largest insurance companies in Europe on these topics. In the recent years, Mario has worked on applications of deep learning to tackle classical problems and challenges from the actuarial risk management field, such as the analysis and optimization of the strategic asset allocation using neural networks or the generation and validation of risk factor models using generative adversarial networks.

Mario holds a PhD in Mathematics and a Diploma in Business Mathematics, both obtained from the University of Karlsruhe/Karlsruhe Institute of Technology. He is a qualified member of the German Actuarial Society (DAV) where he is a member in the Investment Committee and heads two working groups on economic scenario generators. Mario is a frequent speaker at actuarial seminars and conventions and regularly publishes on cutting-edge methods in risk management and risk modelling within the actuarial field.
