Forecasting: Theory and Practice II

Prof. Dr. Tilmann Gneiting

Summer Semester 2021

Lecture: Tuesday 14:00–15:30, live via Zoom (Tilmann Gneiting)
Problem classes: Wednesday 16:00–17:30, live via Zoom (Johannes Resin)

Classes will be held online at the scheduled time. Participation is via Zoom and voluntary. Lectures will take place weekly April 13 through July 20, except for May 25. The problem class will take place every second week starting April 21. Meeting IDs and passwords will be shared on ILIAS; please sign up there.

Course contents

A common desire of all humankind is to make predictions for the future. As the future is inherently uncertain, forecasts ought to be probabilistic, i.e., they ought to take the form of probability distributions over future quantities or events. In this class, which comprises Part II of a two semester sequence, we will continue to study the probabilistic and statistical foundations of the science of forecasting.

The goal in probabilistic forecasting is to maximize the sharpness of the predictive distributions subject to calibration, based on the information set at hand. Proper scoring rules such as the logarithmic score and the continuous ranked probability score serve to assess calibration and sharpness simultaneously, and relate to information theory and convex analysis. As a special case, consistent scoring functions provide decision-theoretically coherent tools for evaluating point forecasts.

In Part II we will focus attention on tests of predictive performance, distributional regression techniques, and methods for combining predictive distributions. Throughout, concepts and methodologies will be illustrated in data examples and case studies.

Prerequisites

A firm understanding of the contents of Part I is essential.

Exams

There will be oral exams (30 minutes, in person or online, depending on current regulations) covering both Part I and Part II at dates announced toward the end of summer semester [MATHST28: 8 ECTS in total].

Statistical software for forecasting

The problem sets will frequently require the use of a suitable statistical programming language. Any code discussed in class meetings will be in the R language. While you are encouraged to also use R, feel free to work with your standard language if it is suitable.

Literature

Non-technical overviews of the topics covered are available in an editorial (Gneiting 2008) and a review paper (Gneiting and Katzfuss 2014). Key technical references include the papers by Gneiting and Raftery (2007), Gneiting (2011), Gneiting and Ranjan (2013) and Henzi, Ziegel and Gneiting (2019).

Gneiting, T. (2008). Editorial: Probabilistic forecasting. *Journal of the Royal Statistical Society Series A: Statistics in Society*, **171**, 319–321.

Gneiting, T. (2011). Making and evaluating point forecasts. *Journal of the American Statistical Association*, **106**, 746–762.

Gneiting, T. and Katzfuss, M. (2014). Probabilistic forecasting. *Annual Review of Statistics and its Application*, **1**, 125–151.

Gneiting, T. and Raftery, A. E. (2007). Strictly proper scoring rules, prediction, and estimation. *Journal of the American Statistical Association*, **102**, 359–378.

Gneiting, T. and Ranjan, R. (2013). Combining predictive distributions. *Electronic Journal of Statistics*, **7**, 1747–1782.

Henzi, A., Ziegel, J. F. and Gneiting, T. (2019). Isotonic distributional regression. Preprint, `https://arxiv.org/abs/1909.03725`.