Forecasting: Theory and Practice II

Prof. Dr. Tilmann Gneiting

Summer Semester 2023

Lecture: Tuesday 14:00–15:30, 20.30 SR 0.016 or online via Zoom (Tilmann Gneiting)
Problem class: Wednesday 14:00–15:30, 20.30 SR 2.067 (Benedikt Schulz)

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 series, 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. Throughout, concepts and methodologies will be illustrated in data examples and case studies.

Prerequisites

A firm understanding of the contents of module Probability Theory is essential.

Tentative Weekly Schedule

Classes will be held partly on site, and partly online via Zoom, but not in hybrid mode. Meeting IDs and passwords for the Zoom sessions will be shared on ILIAS; please sign up there. Feel free to use the class room during Zoom sessions.

April 18	on site
April 25	via Zoom
May 2	via Zoom
May 9	via Zoom
May 16	via Zoom
May 23	on site
May 30	vacation period; no lecture
June 6	via Zoom
June 13	via Zoom
June 20	on site
June 27	on site
July 4	via Zoom
July 11	on site (B. Schulz)
July 18	via Zoom
July 25	on site

This schedule is tentative and subject to change, possibly at short notice. Anticipated dates for the problem classes are April 26, May 10, May 24, June 14, June 21, July 5, and July 19.

Exams

There will be oral exams (30 minutes) covering both Part I and Part II at dates announced toward the end of summer semester [MATHST28: 8 ECTS in total]. However, there will be no exams prior to the end of summer semester.

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 (2021).

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. (2021). Isotonic distributional regression. *Journal of the Royal Statistical Society Series B: Statistical Methodology*, **83**, 963–993.