IMPRS
INTERNATIONAL MAX PLANCK RESEARCH SCHOOL
population. health. data science.

MAX PLANCK INSTITUTE
FOR DEMOGRAPHIC RESEARCH

IDEM 117
Advances in Mortality Forecasting

Carlo Giovanni Camarda & Ugofilippo Basellini

Start: 28 June 2021
End: 02 July 2021
Location: Online course. Link tba.

Instructors:

- Carlo Giovanni Camarda
- Ugofilippo Basellini

Course description

This course provides an advanced introduction to an ample range of modern statistical techniques to forecast mortality. Stochastic methods to predict the future course of mortality have flourished in the last three decades, improving on previous deterministic and expert-based approaches. In this course, you will learn to master well-established models as well as some recent innovations in mortality forecasting from both theoretical and applied perspectives.

Accurate forecasts of mortality are essential for various reasons. In addition to being an important input for population projections, mortality forecasts can inform researchers, governments and policymakers about our future longevity, the extent of population ageing and the sustainability of pension schemes and social security systems. Several approaches to forecast mortality have been recently proposed, each with their own advantages and limitations. Instead of discussing a broad list of models, the course will provide an exhaustive explanation of the theoretical framework and assumptions underpinning selected approaches. This will be of paramount importance to employ and compare forecasting models on solid bases as well as to handle alternative options.

The course will start by introducing the statistical foundations for all models covered in the course. These include, among others, Generalized Linear and Nonlinear Models, Singular Value Decomposition, Newton-Raphson method, ARIMA time-series models and bootstrap techniques. Next, three main methodologies will be presented in great detail: the Lee-Carter model and several of its extensions, the smoothing *P*-splines model and its constrained extension, and the Segmented Transformation Age-at-death Distributions model. Finally, approaches to coherently forecast mortality for a group of populations will be introduced and discussed.

Handouts and routines to reproduce all outcomes presented in the course will be provided to students, who will be expected to solve related exercises and present their results to the class. The statistical software R will be used throughout the course on publicly available demographic datasets. By the end of the course, students will have acquired both theoretical and practical skills in mortality forecasting.

Organization

Each of the five course days will consist of

- 1 hour of pre-recorded video lecture (available before the start of the course).
- 1 hour of live session for discussions, questions and answers, presentation of solution to exercises assigned to participants. The live sessions will be held each day at 15:00-16:00 CEST.
- 90 minutes of optional office hours for smaller meetings with instructors. One session will be from 10:00 to 10:45 CEST, the second one from 18:00 to 18:45 CEST.

Course prerequisites

The course is rather advanced and it is targeted to students and researchers with a preliminary knowledge of statistics and demography. All concepts will be introduced from the basics, but elementary knowledge of demographic analysis (i.e. construction of a life-table) and statistics (i.e. linear models) is required. Preliminary knowledge of mortality forecasting and familiarity with basic concepts in matrix algebra (transposing and inverting a matrix) are helpful but not essential. Participants are expected to have a working knowledge of R because handouts and solutions to exercises will require its use. Prior to each class, participants are expected to watch pre-recorded video lectures, read slides and work on the handouts with R and an associated editor (e.g. RStudio).

Examination

Participants will be evaluated on the basis of class participation and the presentation of the solution to exercises provided at the beginning of the course.

General readings

A reading list will be provided as well as pre-recorded videos and slides from the lectures, and handouts for reproducing all examples. All materials will be provided to participants on Thursday, June 24, four days before the course.

Tuition

There is no tuition fee for this course, which will be held online.

Recruitment of students

- Applicants should either be enrolled in a PhD program or have received their PhD.
- A maximum of 20 students will be admitted.

- The selection will be made by the MPIDR based on the applicants' scientific qualifications.

How to apply

Please apply via https://survey.demogr.mpg.de/index.php/995788 and include as *single pdf file* (max. 10 MB), in English:

1. A curriculum vitae, including a list of your scholarly publications (max. 2 pages).
2. A one-page statement of your research and how it relates to the course. Please include a paragraph about how you meet the prerequisites for this course.

- Application deadline is 26 May 2021.
- Applicants will be informed of their acceptance by 8 June 2021.
- Applications submitted after the deadline will be considered only if space is available.
- Email inquiries about the course and the application process should be sent to phds@demogr.mpg.de.