Mathematical Methods and Models in Biosciences
June 15–20, 2025, Sofia, Bulgaria
https://biomath.math.bas.bg/biomath/index.php/bmcs

From guesswork to groundwork: A tool to quantify disease upscaling decisions

Afonso Dimas Martins[1], Frits Vlaanderen[1], Lapo Mughini Gras[1,2]

[1]Rijksinstituut voor Volksgezondheid en Milieu (National Institute for Public Health and the Environment), The Netherlands
afonso.moreira.dimas.martins@rivm.nl

[2]Faculty of Veterinary Medicine, Utrecht University, The Netherlands

When a disease outbreak is first detected, experts must decide whether that disease should be *upscaled* – that is, if it should be promoted to a higher priority ranking. This means more resources should be invested into containing this outbreak and in many cases it could also mean alerting the general public. All of this is resource-intensive so making sure that we correctly capture the true positives is vital. Experts have regular meetings and collectively assess factors such as how many people have tested positive, whether transmission between animals has been detected, and other variables. The issue is that, at the moment, this is done relying heavily on guesswork: the final decisions come down to qualitative judgment, and may be subject to unconscious biases. We adapt classifier models such as random forests and XGBoost models to turn this decision-making more quantitative, by taking into account several intrinsic factors of each disease and historical information of previous upscalings. With this ongoing project, we aim to develop a systematic data-driven groundwork to estimate the probability of scaling up a disease, and create a user-friendly tool to guide evidence-based decisions in public health.

Keywords: machine learning, public health, outbreak prioritization, data-driven decision-making