Imperial College London

Natural Environment Research Council

2024_76_SPH_MP: Advance geospatial AI for understanding and forecasting environmental suitability for arboviruses under the effect of global climate change

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The rapid warming of the Earth has profound implications, among the others, for the expansion, control and prevention of arboviruses, which are viral diseases transmitted by living organisms, most often arthropods. Although the impact of these diseases is particularly high in tropical and subtropical areas of the world, the risk they pose in Europe and in the UK is increasing (Medlock et al. 2015, Paz et al. 2021). In particular, in the UK we assist at a growing threat from mosquitoes and ticks, which are both native and invasive nonnative vectors (POST, 2019). This is linked to a number of factors, including changes in climate, land use, and wildlife migration (Medlock et al. 2015; Ewing et al. 2021).

To face this new environmental, social and health challenge, this PhD research project aims at advancing the analytical approaches used to understand, mapping and predict the climate and environmental conditions that foster vector suitability and the risk of vector-borne diseases in the UK. The project will deploy and advance a geospatial artificial intelligence (AI) framework, which is an emerging transdisciplinary extension of AI, combining spatial statistics and AI, particularly machine learning and high-performance computing to extract meaningful information from big spatial and spatio-temporal data.

The PhD student will first assimilate multi-sourced Earth observations, including satellite-based remote sensing, in situ data, camera images, and global scale climate data (e.g. Worldclim Global Climate Data or ECMWF reanalysis of climate data) through a novel geospatial AI approach to improve mapping of environmental suitability to the expansion of arboviruses. Processing such data raises challenging problems, which require scalable algorithms and creative statistical solutions. Then, considering the interaction of environmental and climate variations, the student will probabilistically estimate the possible emergent risks, under different warming scenarios, for the West Nile virus (major vector: Culex mosquitoes) using, for example, data from the European Centre for Disease Prevention and Control, contributing to the UK preparedness. Additionally, the ongoing collaboration with the University of São Paulo (Brazil), will offer the unique opportunity of testing and validating the new methodology to a different setting, ensuring its robustness.

References

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