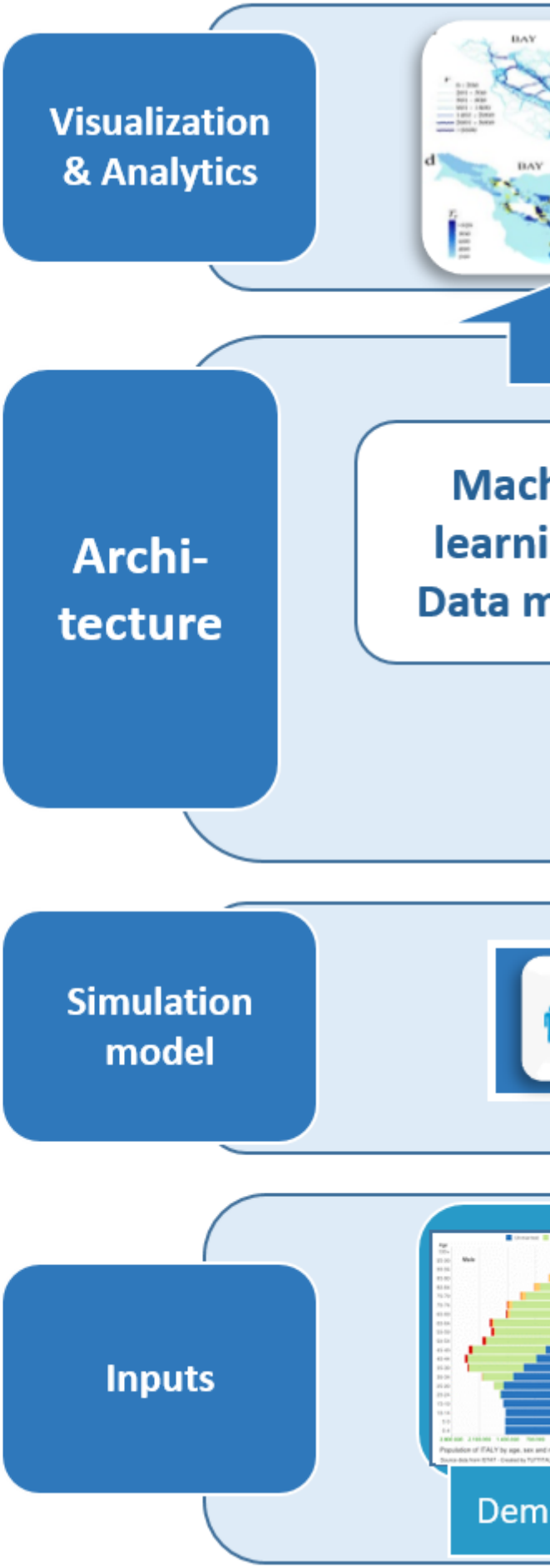
Published on *BSC-CNS* (https://www.bsc.es)

HPC modelling and simulation for Societal Challenges



Agent-Based Modelling is a bottom-up modelling approach that has gained popularity in recent years. It allows gaining insights of social complexity. ABM is particularly useful for reproducing the *activities and interactions of individuals*

(such as reproducing or exchanging goods), *social patterns* (such as segregation in neighbourhoods), and *population movements* on a local and global scale (like migrations or movements from rural areas to cities). However, in a large context these simulations can be difficult to obtain due to the number of agents and interactions involved and the complexity of those interactions among them and their environment. In such cases, parallel simulation techniques are necessary to exploit the capabilities of current large-scale parallel computers in order to support the execution of complex social simulation models.

The goal of *HPC modelling and simulation for Societal Challenges* research group is to define future challenges to answer modelling of social sciences questions. To achieve this, the group focusses his work on exploring new HPC solutions for social modelling such as data storage, load balancing, optimization of fine-grain simulations and the use of Domain Specific Languages (DSL), besides developing a generic framework for simulation agent-based social dynamics to study the implications of this methodology in application areas such as tuberculosis epidemics or territorial urban planning.

Objectives

Social planning has a high impact in our everyday life, affecting the quality of life of communities through the design of feasible and most adequate actions. To contribute to the challenges of our society, we propose to work in four main areas around the exploitation of agent-based simulation and HPC. These are:

1. Research and apply HPC technologies to offer competitive solutions to users to enhance the performance of the social agent-based simulations.
2. Explore the implications of these methodologies to the spread of diseases in the context of epidemic dispersal, offering solution to epidemiological emergencies, and proposing ways out to ageing.
3. Evaluate the impact of our developed tools in providing assistance in the territory management policies, both in the context of resilient (smart) cities and in slowing down the progressive abandon of rural areas to urban.
4. Research in Robotic Innovation in Urban Areas, jointly with UPC and CSIC-UPC Robotics Institute (IRI), to face the urban challenges proposed by European cities to offer novel robotics solutions addressed to public demand.

Barcelona Supercomputing Center - Centro Nacional de Supercomputación

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