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# Gen\*: realistic synthetic population generation plugin for Gama

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## Keywords

Synthetic population, agent based model initialization, data integration

## Abstract

**Context:** The increasing complexity of agent-based socio-environmental models raises the issue of data integration. In fact, descriptive ABM (Edmonds & Moss, 2005) heavily rely on input data: in order to setup initial model state to mimic the targeted system, modelers have to collect, harmonize and integrate data that comes in various shape, quality and quantity. This is usually done following rules-of-thumbs and case by case methodology that limit model's reproducibility, modularity and re-usability (Kehoe, 2017).

**Problematic:** One key dimension of such realistic initialization is the synthetic population generation process: it aims at creating the attributes of agents, asses their localization and connect them to one another based on empirical, statistical or spatial data about the actual targeted population. It exists many methodologies and algorithms to generate agent attributes using statistical approaches (Müller & Axhausen, 2010), to localize synthetic entities using spatial statistics (Chapuis et al., 2018), and to build an interaction network between synthetic entities. However, except for the generation of networks, very little has been done for those tools to be readily used in generic agent-based modeling platform: in fact, most of the procedure for synthetic population generation have been developed and used in the context of a specific case study without any consideration to accessibility and usability of the proposed methodology (Chapuis & Taillandier, 2019). In other words, there is a need for consistent and re-usable guidelines, methods and tools to integrate demographic, GIS and survey data to build realistic synthetic population of agents.

**Proposal:** In this proposal, we introduce Gen\*, a dedicated tool that makes it possible to generate, localize and connect a set of synthetic entities that can be directly used within the Gama Platform. The plugin is scattered into three main components for the generation of agents based on demographic data, their localization using generated attributes as well as explicit spatial objects from any GIS files, and lastly many algorithms to connect them using all previously generated socio-spatial features. In this communication we present the generation and localization procedure enabled by the Gama plugin using sample code from other projects to illustrate the capabilities as well as the re-usability of the proposed tool.

## Additional material

Main API repository : <https://github.com/ANRGenstar/genstar>

Plugin repository : <https://github.com/ANRGenstar/genstar.gamaplugin>