Case-based Scenario Simulation: A Quick Introduction

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Case-based microsimulation is one of the key tabs in the R Shiny, COMPLEX-IT. Here we provide a quick overview of its function. For more on COMPLEX-IT, visit our website: https://www.art-sciencefactory.com/complexit.html.

A case-based microsimulation model is an ex-ante evaluation tool, based on real or artificial data, used to produce realistic future projections of "status quo" trends and to test "what if" scenarios related to some potential set of real or imagined interventions. These interventions can be, for example, a policy, a programme, or a set of individual or community-level goals.

The main advantages offered by case-based microsimulation are the ability to:

- use the latest advances in topographical artificial nets to create the 2-dimensional grid on which its microsimulations are based;
- simplify the population of study by using k-means cluster analysis to identify the most important major and minor groups/trends around which the cases self-organise.
- identify differences in outcome by exploring different cluster specific interventions, thereby allowing for the analysis of multiple possible solutions for a given population, including the analysis of unintended, unusable or impractical outcomes;
- ground these different interventions (and their relative effectiveness) in changes to the complex set of factors (cluster profiles) upon which they are based, including their complex, nonlinear and (in terms of longitudinal data) dynamic interactions;
- examine counterfactuals relative to a cluster-based solution;
- assess both short- and long-run effects of an intervention;
- run and test the sensitivity of a set of interventions using Monte Carlo simulations.

Figure 1: Toolbar, with Sensitivity Analysis

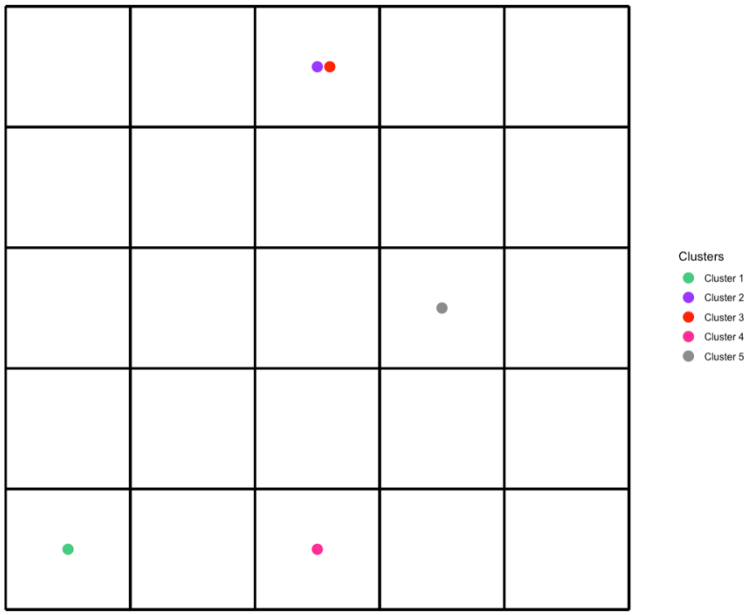

Figure 2: SOM Grid on which clusters are placed

	Include	Income2014	Income2016	Employ2014	Employ2016	BirthWeight2014	BirthWeight2016	ZDeath2014	ZDeath20
1	☑	13.75	13.00	10.25	8.00	4.95	4.85	-1.10	-1.10
2	☑	18.40	17.80	15.00	12.20	5.62	5.52	0.67	0.67
3	☑	17.75	17.00	12.75	10.25	5.73	5.58	-0.02	0.00
4	☑	16.33	16.33	13.00	10.33	5.60	5.47	-0.39	-0.35
5	☑	17.67	16.83	14.33	11.50	5.85	5.82	0.38	0.35

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Figure 3: Variable Profiles for Clusters, which can be changed to explore various interventions

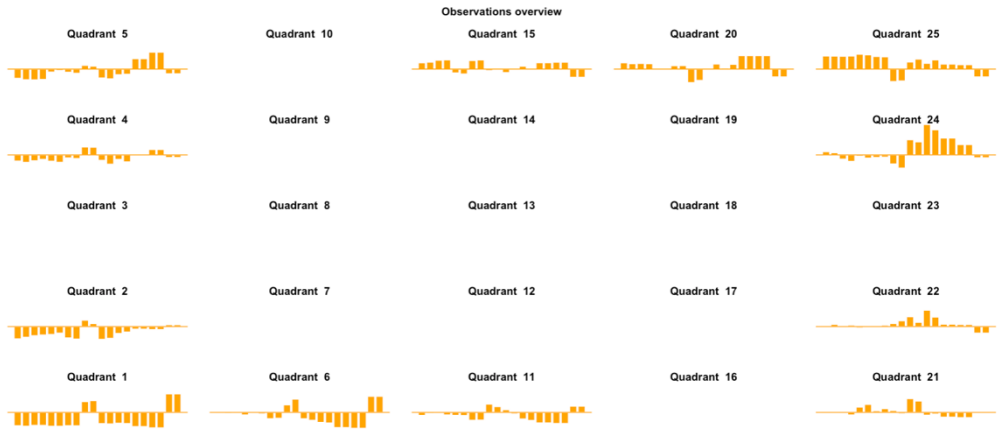

Figure 4: All possible variable combinations for the clusters for each position on the SOM grid

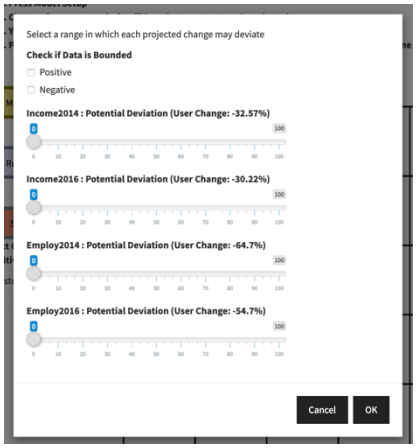

Figure 5: Example of a sensitivity (Monte Carlo) analysis

Also, in terms of issues of complexity and different, case-based microsimulation can account for population heterogeneity by focusing on the major and minor case-based clusters around which the cases in a population (or sample) group. And, it can also maintain the complexity of the model, given that its k-dimensional SOM solution preserves, on the 2-dimensional grid of study, knowledge of every individual case's location; as well knowledge of each and every possible combination of the factors of study relative to each position on the grid.

Given its strengths, case-based microsimulation is useful for (1) examining policies and interventions for different communities or groups; (2) projecting or estimating the short-term or long-term costs and benefits of an intervention; (3) identifying nonlinear tipping points, or nonlinear or nonobvious ways out of wicked problems or poverty traps; as well as (4) analysing the distributional effects of different policies or the burden (or potential alleviation) of some situation.