Grid Cellular Automaton:

Documentation

Parameter space exploration

The following may be trivial for most of those who already are familiar with parameter exploration. In which case this entire section can be skipped.

The file `wrapper.c` calculates the number of simulations necessary to explore every unique combination of parameter values. The possible values for a parameter are specified by the user through the maximum (i_{max}), the minimum (i_{min}) and the increment in value (i_{step}) of that parameter. The number of total simulations to perform, N , is simply the product of the cardinal of each parameter that the user wants to vary in the simulations, i.e. the cardinal is the total number of distinct values a parameter can take.

$$N = \prod_{i}^{P} \frac{i_{max} - i_{min}}{i_{step}} + 1$$

With P the number of variable parameters to include in the simulations and $i_{max} \geq i_{min}, i_{step} \neq 0$.

The value N only provides us with the total number of simulations necessary to explore the entire parameter space, however it does not provide us with a method to list the parameter values so that all combinations are presented only once. Before presenting in details the method adopted here I explicit in which sense I use certain words. To explore the cardinal of one parameter, all of its possible value, as defined by its maximum (i_{max}), the minimum (i_{min}) and the increment in value (i_{step}); we proceed as following:
• The first value is i_{min}.
• All the posterior values are obtained by adding i_{step} to the current value (incrementing) until i_{max} is reached.
The above will be further referred as the *ordered cardinal* of a parameter.

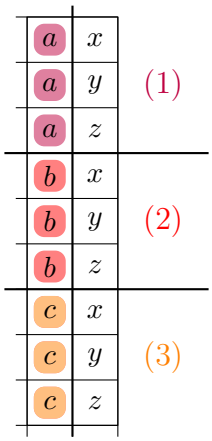

Figure 1: vevzV

To explore the total parameter space the method orders all the variable parameters in a table and increments a parameter each time the next one has completely explored its cardinal once. This method is illustrated for two parameters, which are the two columns in Figure below. Both parameters haves three possible values a, b and c for the first parameter, and x, y and z for the second parameter. The total number of necessary simulations is thus, $N = 3 \cdot 3 = 9$, which corresponds to the number of lines in Figure . The parameter's cardinal are explored from the last column to the first. In Figure the first parameter's value is incremented only once the second parameter has completely explored its cardinal. The latter process is highligthed in the Figure with a different color code for each exploration of the second parameter's cardinal and the subsequent increment of the first parameter: in purple, red and orange for the first , second and third increment respectively.

This method can be generalised for P parameters with any finite cardinal. The value for a given parameter in the table described above depends on the state of the cardinal exploration of the parameters in the following columns. For example, in Figure the first parameter is incremented every $C_2 = 3$, C_2 being the cardinal of the second parameter. More generally, the value for a parameter on column j at line i in the table can be otained from its *ordered cardinal*. The position of the value in the *ordered cardinal* of the parameter is calculated as follows:

$$mod(\frac{i}{\prod_{k=j+1}^{P}(C_k)}, C_j)$$

with i and j the current line and column in the table, C_j the cardinal of

parameter j, and k all the parameters in the columns to the right of column j, from $j+1$ to P.