Summary of example:

The input data file (ca3_pc_v2_4.csv) contains 4 voltage traces, corresponding to the responses of a CA3 pyramidal neuron to current steps of different amplitudes. The traces are 1100 ms long, the step starts at 100ms and lasts for 900 ms. The amplitudes are the following:

0.30 nA

0.35 nA

0.40 nA

0.45 nA

The sampling frequency was 5 kHz.

The model to be optimized is an adaptive exponential integrate-and-fire (AdExpIF) neuron. The model is implemented using the Python interface to the NEST simulator (see teststeps_optim5.py), and is handled as a black box by Optimizer. Specifically, the following 10 parameters are the subject of optimization, and are passed to the Python script (along with an extra parameter corresponding to the index of the stimulus) through the file "params.param":

g_L

tau_m

E_L

t_ref

V_reset

V_th

a

b

delta

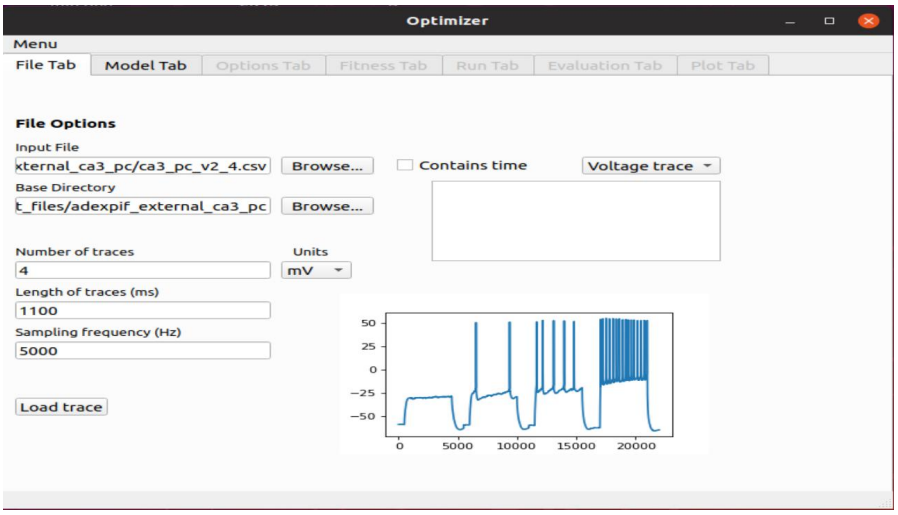
tau_w

Some additional parameters (C_m and V_peak) of the model are calculated from these parameters in the Python script.

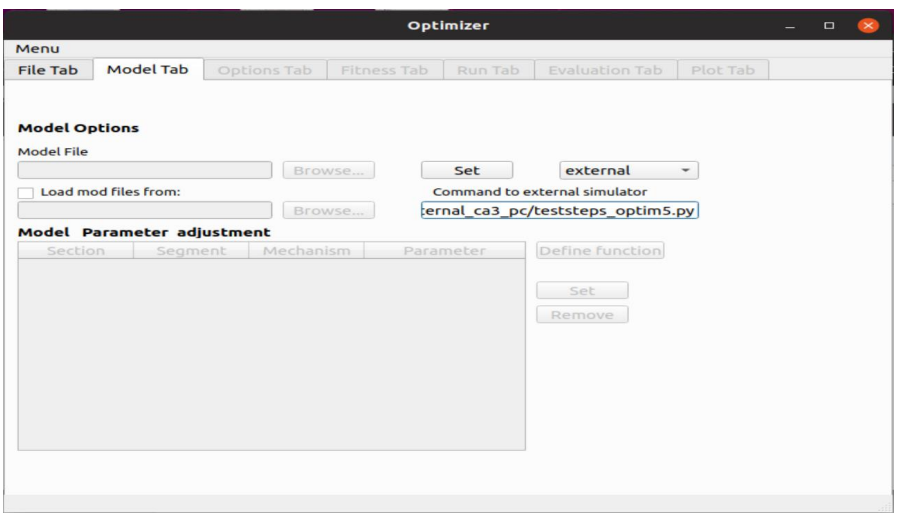
The model script saves the results of the simulation in the files trace.dat (containing the voltage trace) and spike.dat (containg explicit spike times from the same run), which are then used by Optimizer to compute the corresponding cost (fitness) value.

Step-by-step instructions to run the example from the Optimizer GUI:

Run „python3 optimizer.py -g” to start the GUI



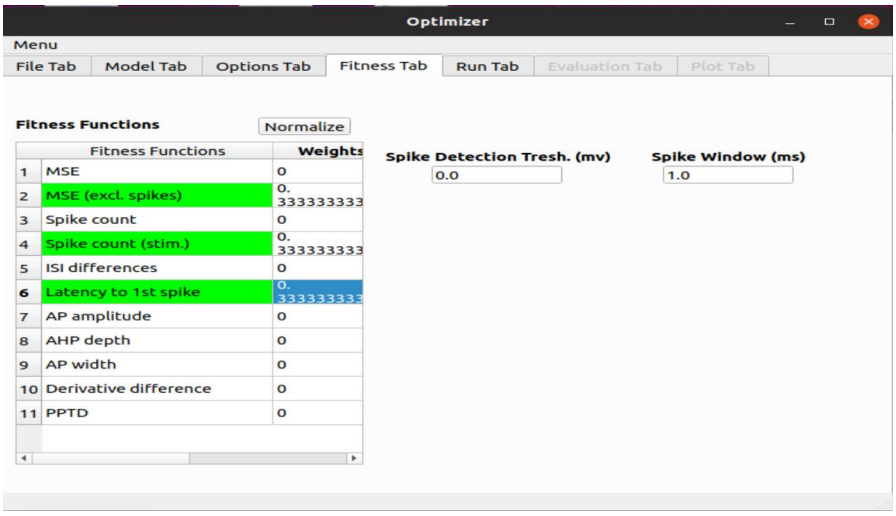
At ’Input File’ load the target data, at ’Base Directory’ choose the directory where you wan’t to save the results. Fill out all the cells and press ’Load trace’. Go on by pressing the Model Tab.



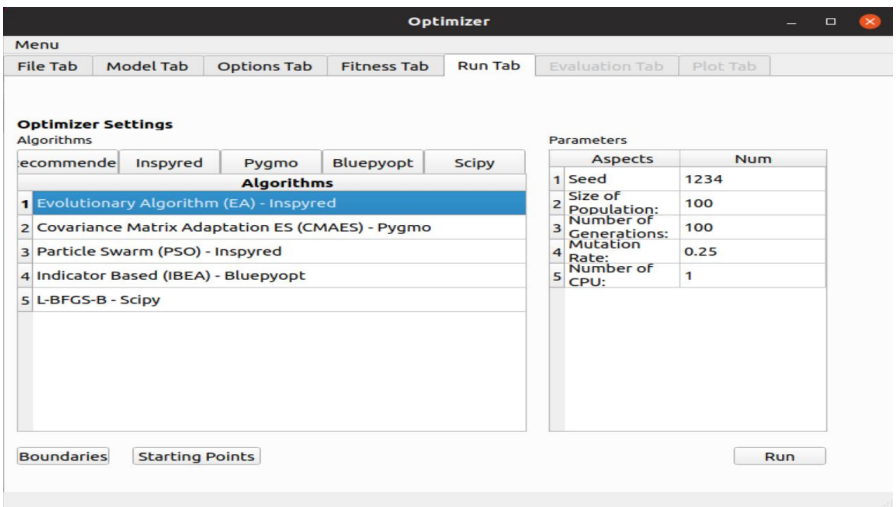
For model type choose 'external'. To 'Command to external simulator' type: "python3 /FULL/PATH/TO/MODEL/SCRIPT 10", where /FULL/PATH/TO/MODEL/SCRIPT points to the location of the Python script implementing the model

(for example: " python3 /home/parallels/Desktop/optimization/test/ca3_pc_v2_1/teststeps_optim5.py 10", where 10 is the number of parameters subject to optimization)

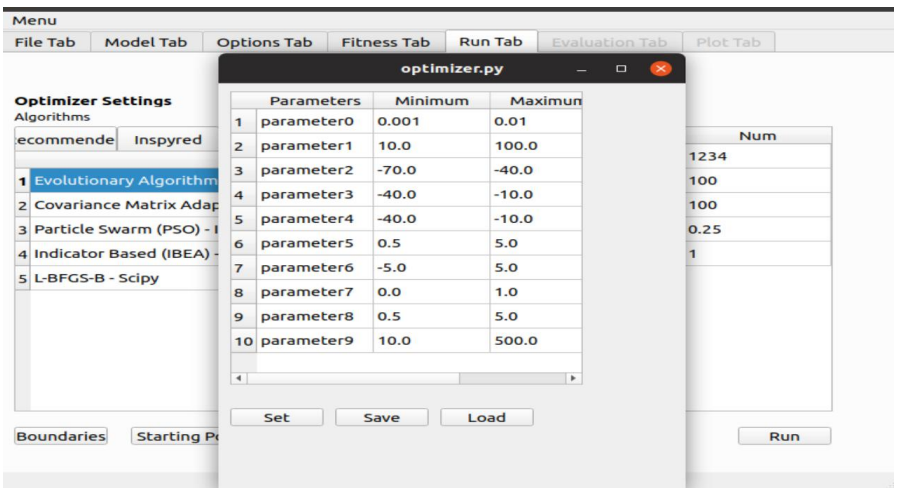
Press 'Set' and go on by pressing the Fitness Tab.



Choose fitness function(s), and define their weights. Go on by pressing the Run Tab.



Select an algorithm, and press the ’Boundaries’ button to define the boundaries of the parameters to be optimized:



Boundaries can be loaded from the file boundaries3.txt

Press ’Set’.

Start the optimization pressing the ’Run’ button.