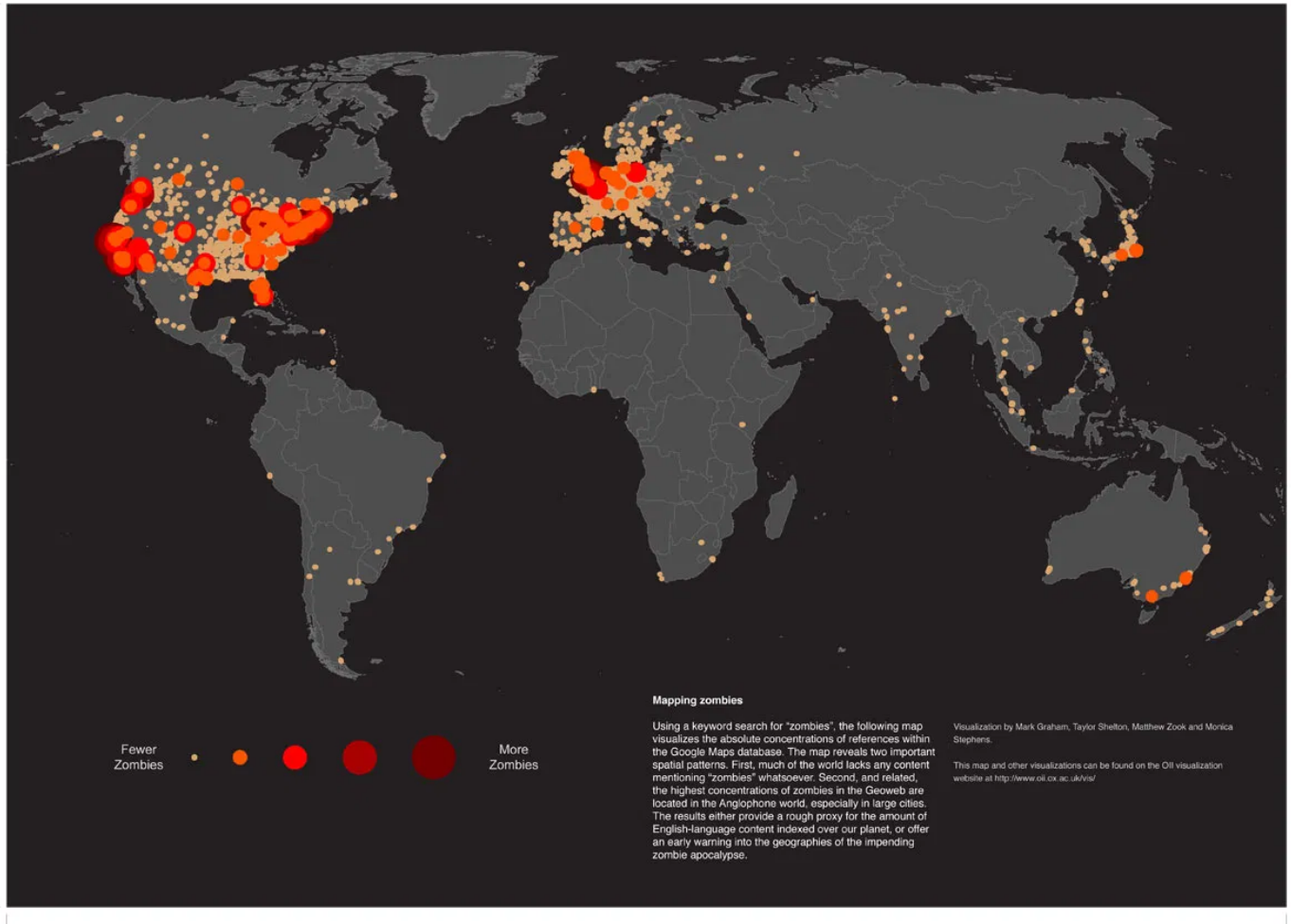
OpenMOLE an essential software to face Zombie outbreaks

22/11/2021

Romain Reuillon

Zombies infections



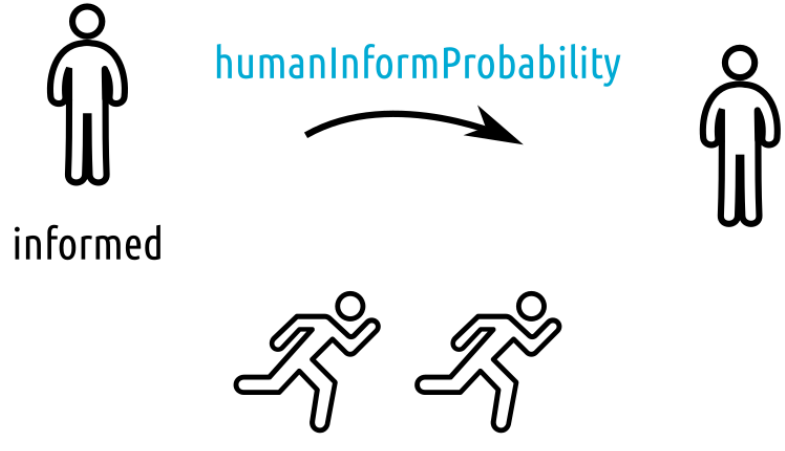
A Zombie model

https://zombieland.openmole.org/

Human communication is unknown

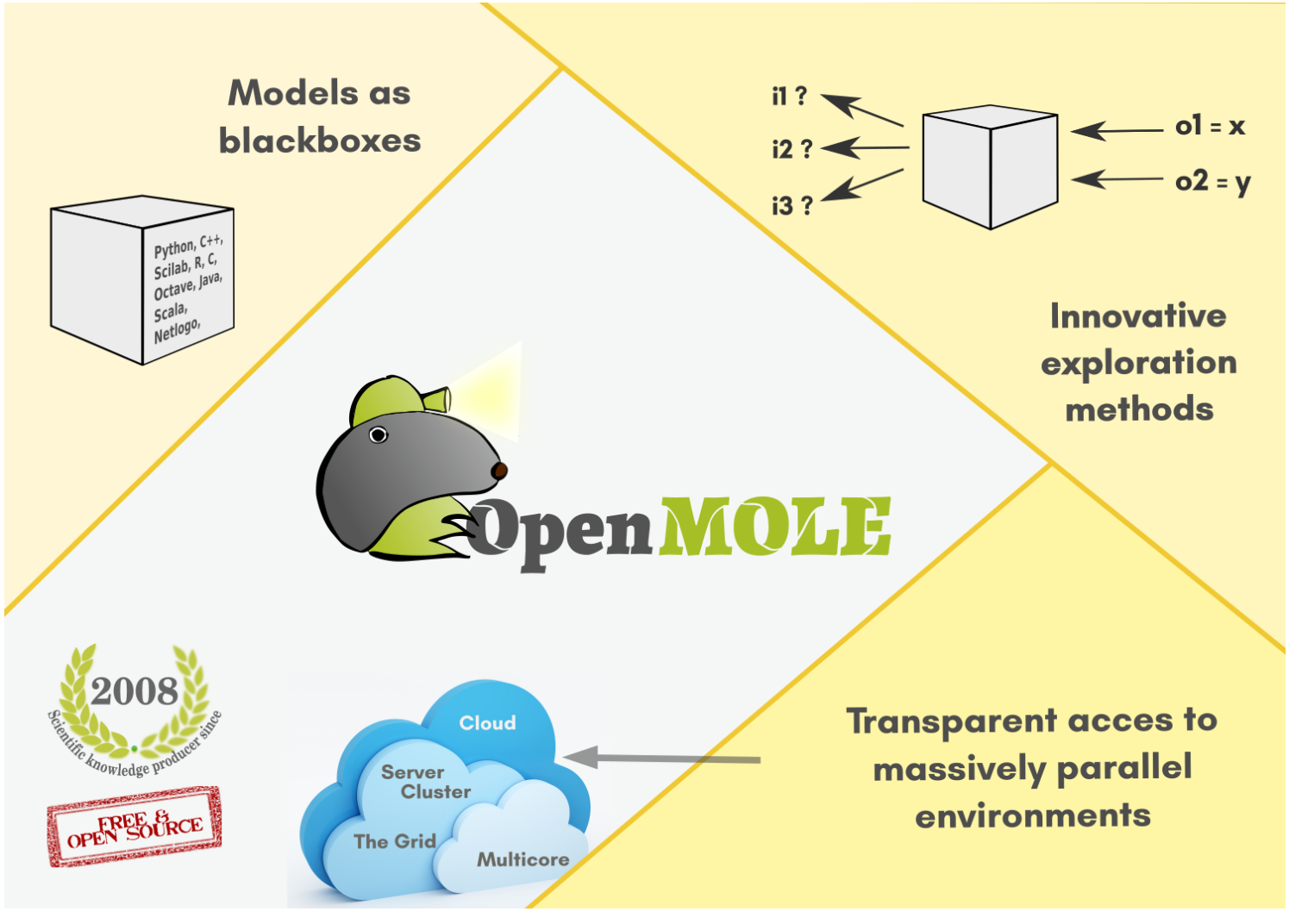
During a simulation, the humans can communicate about the *location of rescue zone*s. Zombies do not communicate.

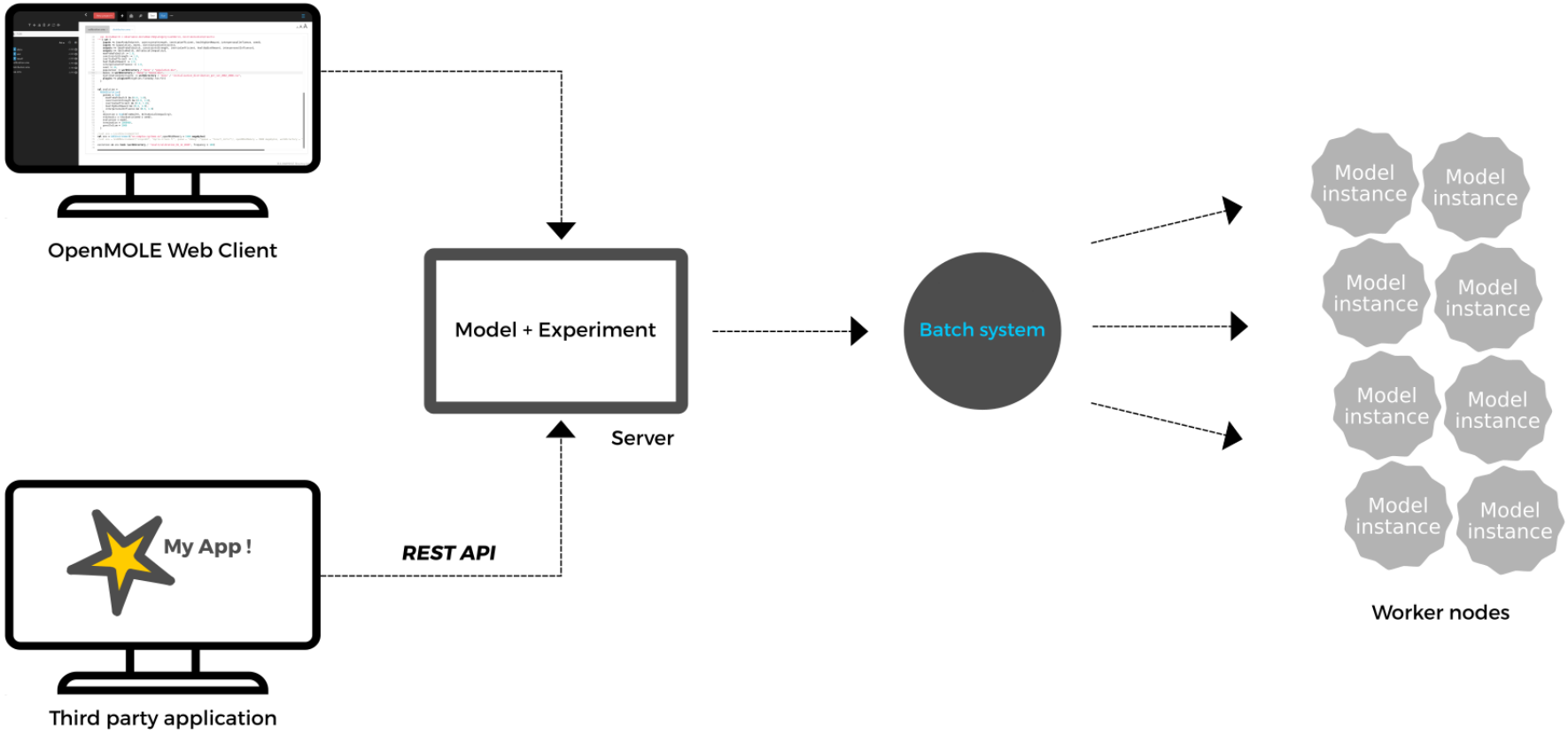
At the begining of the simulation, informedRatio of the human population is informed.



Humans can follow a running human with a humanFollowPobability

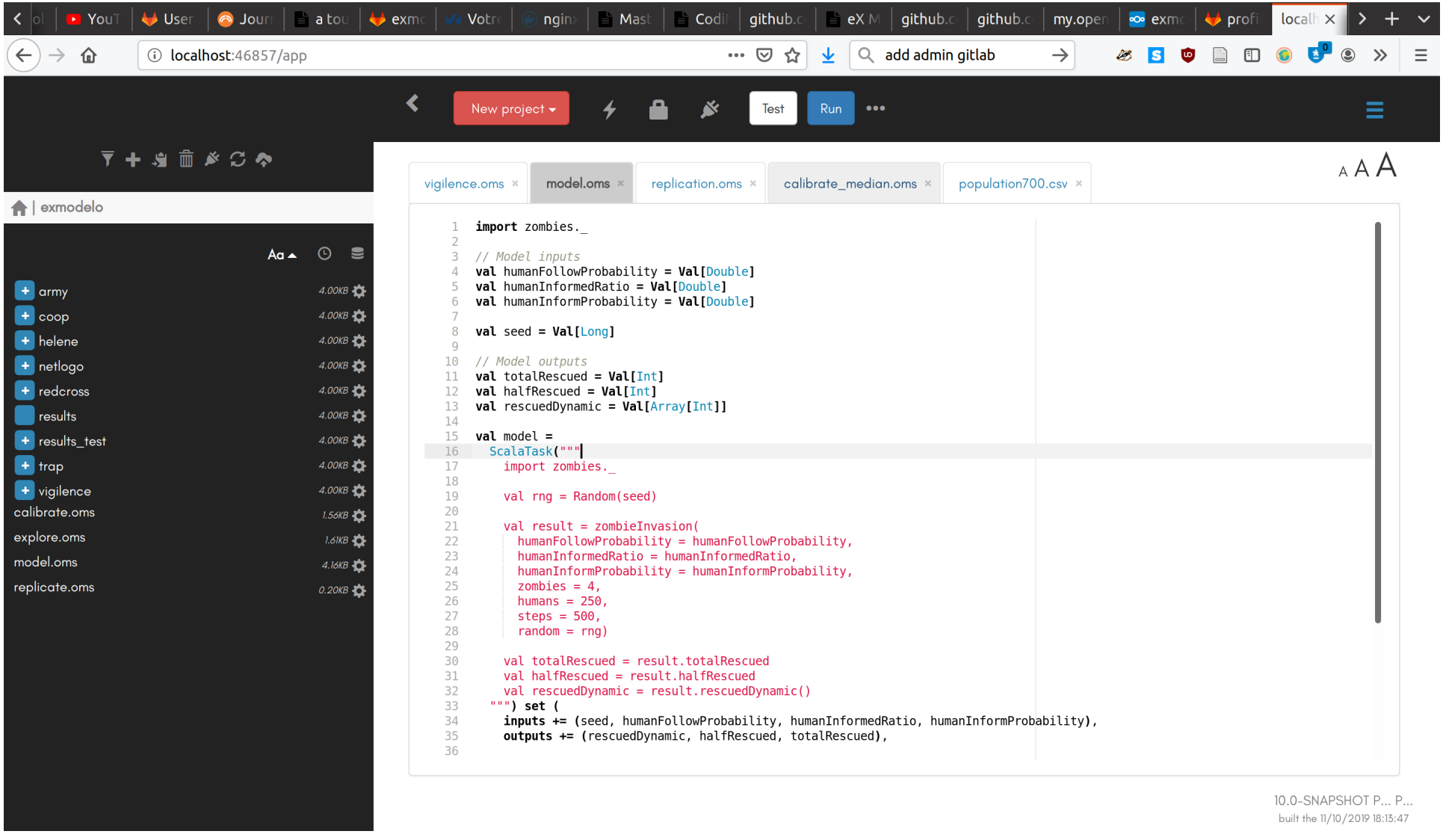
OpenMOLE to the rescue



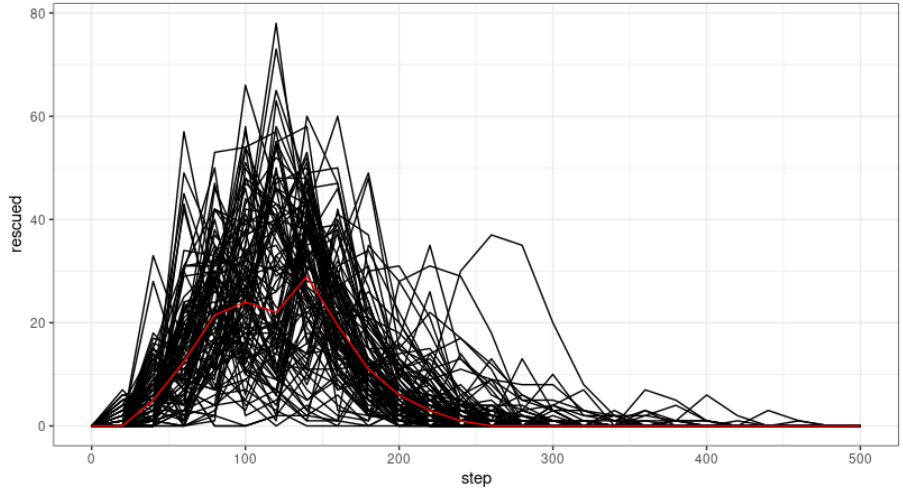


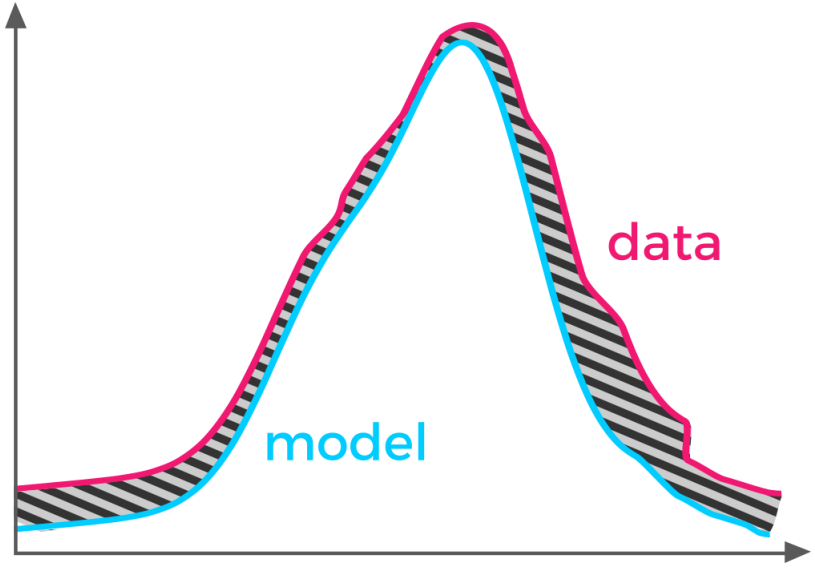
OpenMOLE
the model exploration software

OpenMOLE for real

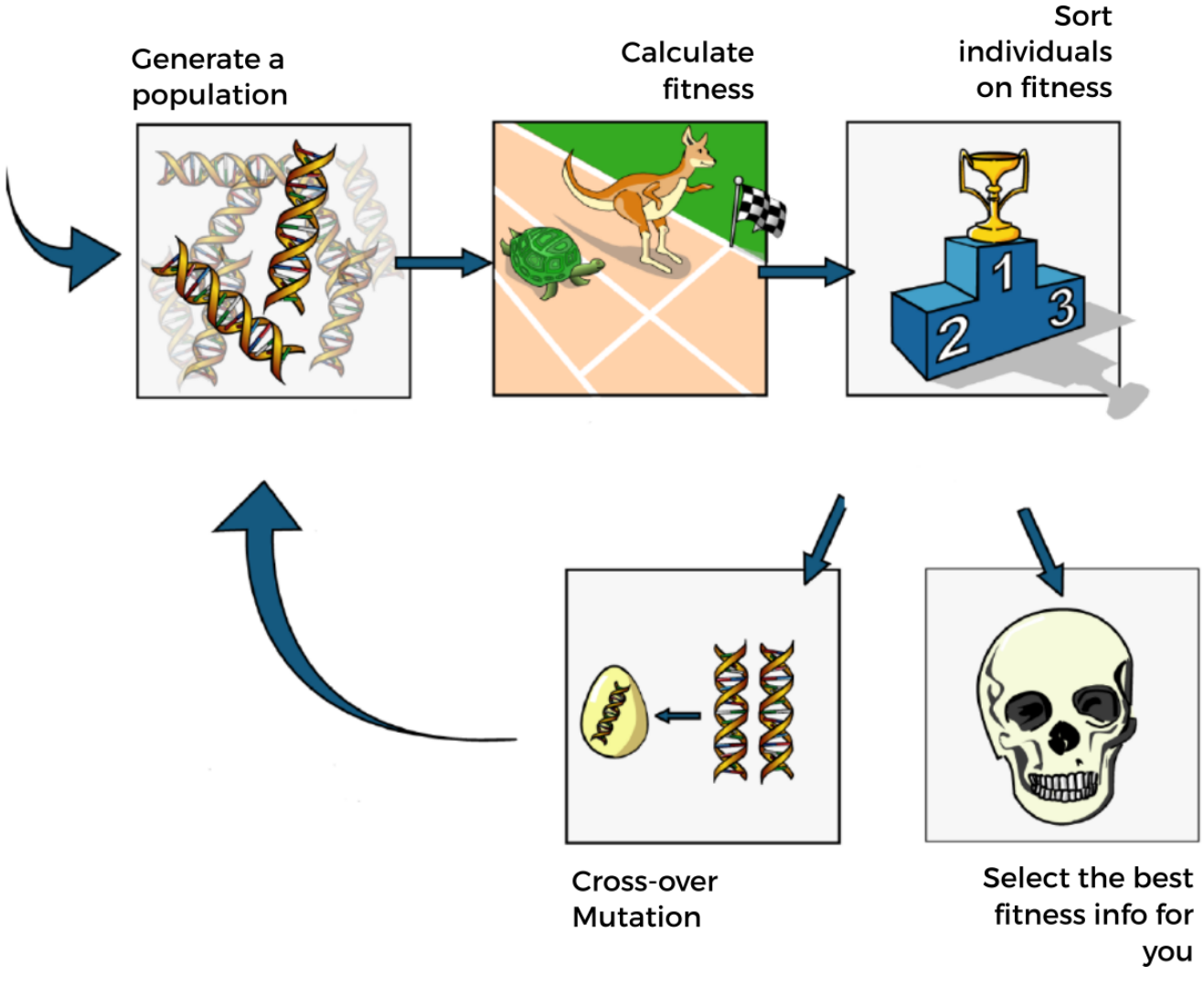


Calibration





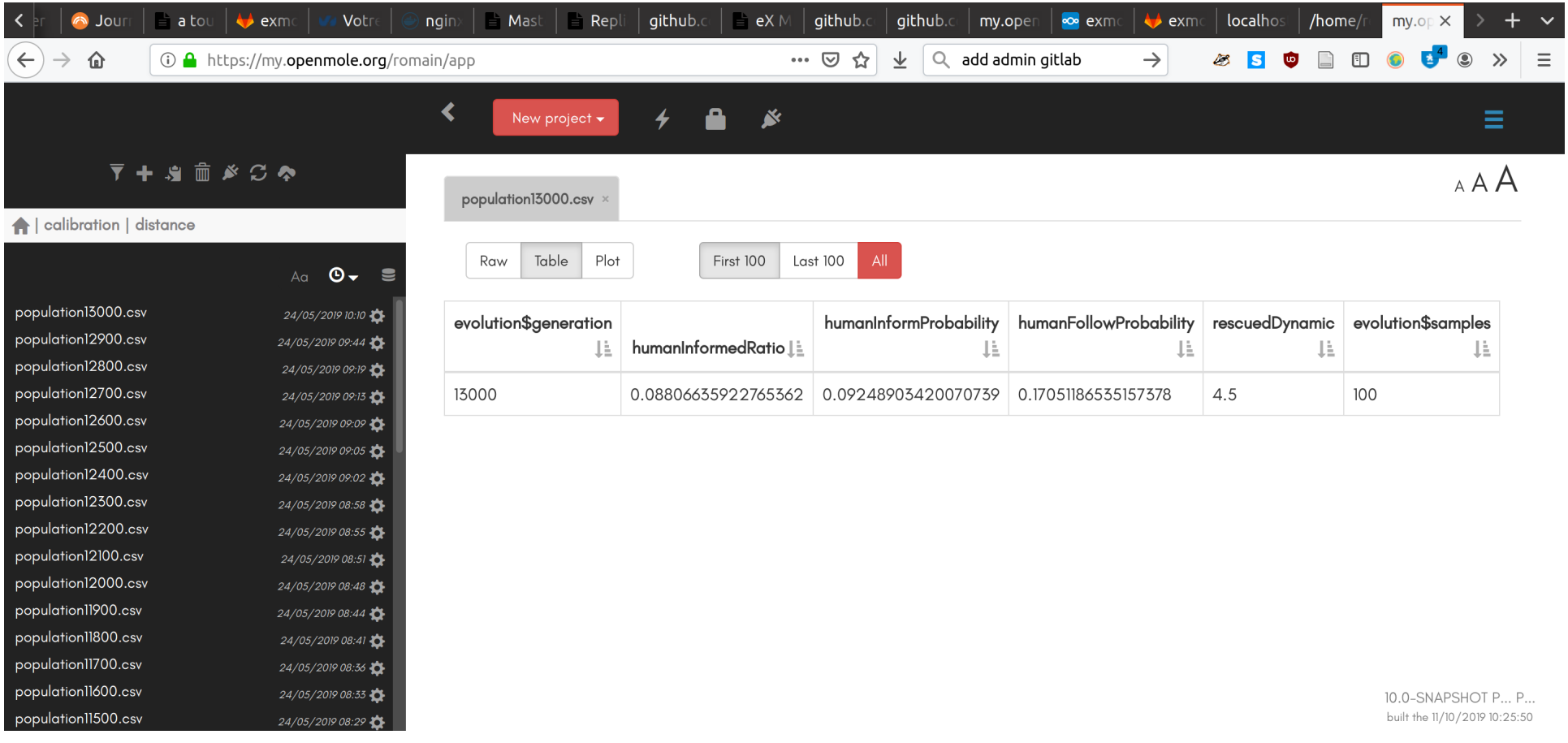
Seek for the fitest parameter sets



Some OpenMOLE code

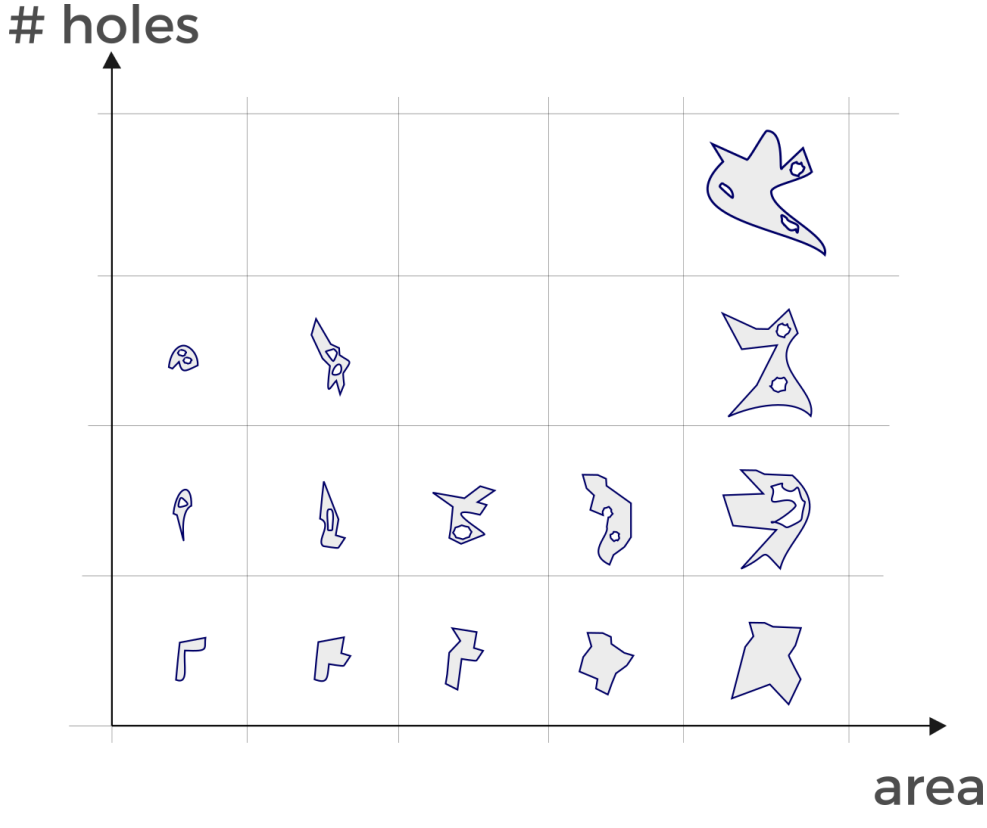
```
NSGA2Evolution(
  evaluation = model,
  genome = Seq(
    humanInformedRatio in (0.0, 1.0),
    humanInformProbability in (0.0, 1.0),
    humanFollowProbability in (0.0, 1.0)
  ),
  objective = Seq(rescuedDynamic aggregate distanceMedian),
  stochastic = Stochastic(seed = mySeed, sample = 100),
  ...
)
```

Result

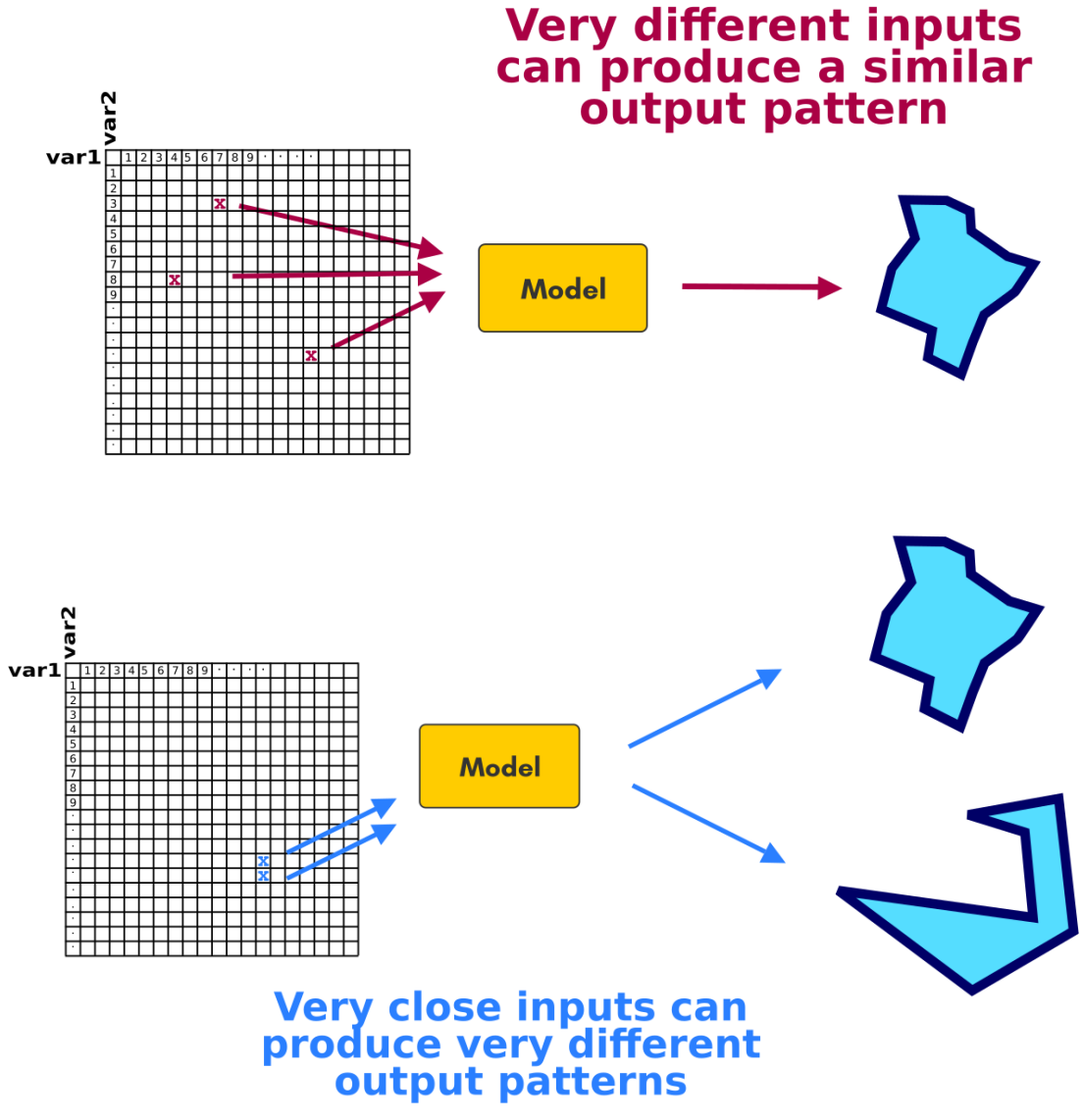

https://my.openmole.org/romain/app
add admin gitlab
New project
calibration | distance
population13000.csv 24/05/2019 10:10
population12900.csv 24/05/2019 09:44
population12800.csv 24/05/2019 09:19
population12700.csv 24/05/2019 09:13
population12600.csv 24/05/2019 09:09
population12500.csv 24/05/2019 09:05
population12400.csv 24/05/2019 09:02
population12300.csv 24/05/2019 08:58
population12200.csv 24/05/2019 08:55
population12100.csv 24/05/2019 08:51
population12000.csv 24/05/2019 08:48
population11900.csv 24/05/2019 08:44
population11800.csv 24/05/2019 08:41
population11700.csv 24/05/2019 08:36
population11600.csv 24/05/2019 08:33
population11500.csv 24/05/2019 08:29
population13000.csv
Raw
Table
Plot
First 100
Last 100
All
evolution$generation
humanInformedRatio
humanInformProbability
humanFollowProbability
rescuedDynamic
evolution$samples
13000
0.08806635922765362
0.09248903420070739
0.17051186535157378
4.5
100
10.0-SNAPSHOT P... P...
built the 11/10/2019 10:25:50

PSE: seek for diversity

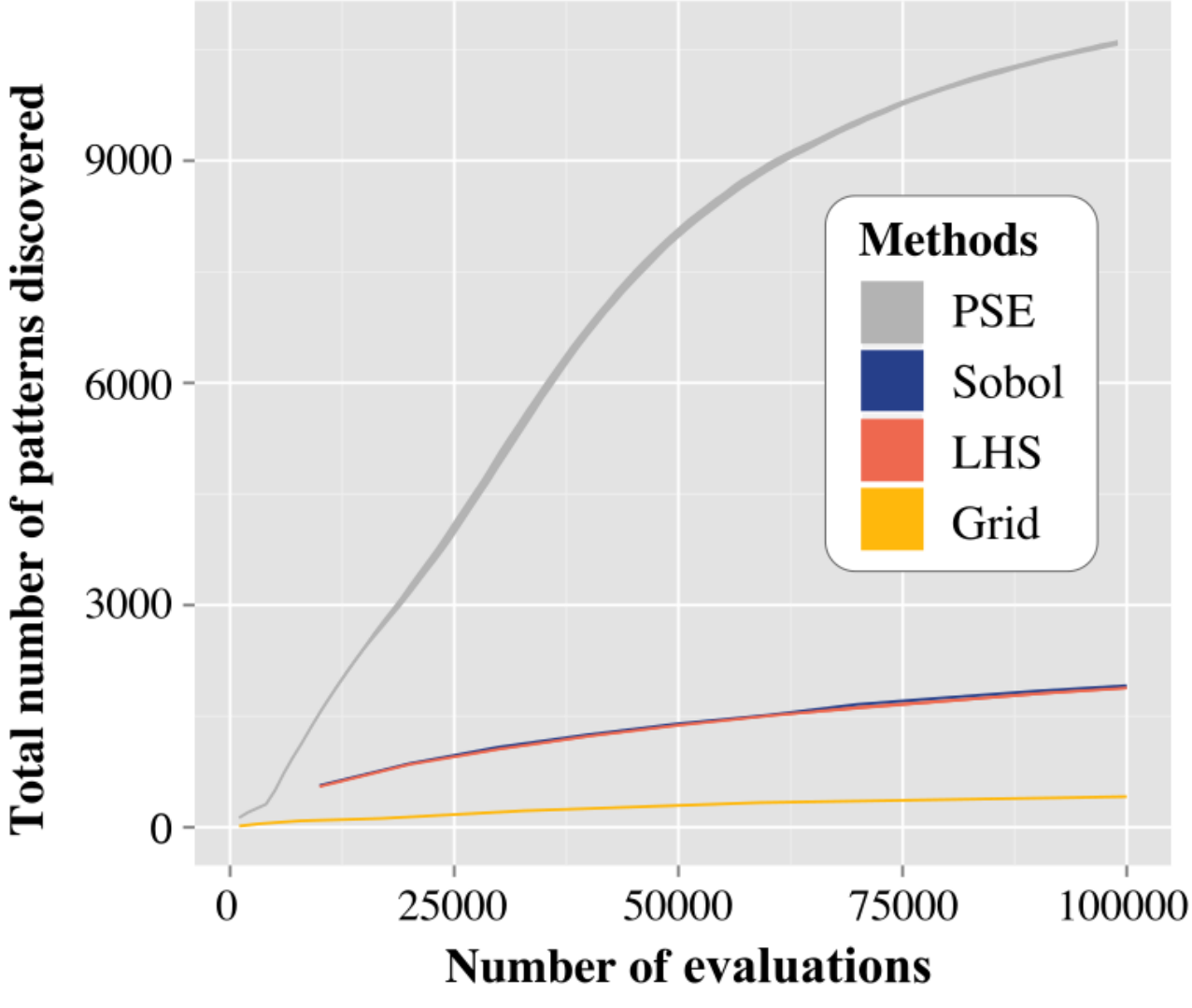
Deversity metrics



Sampling for diversity search



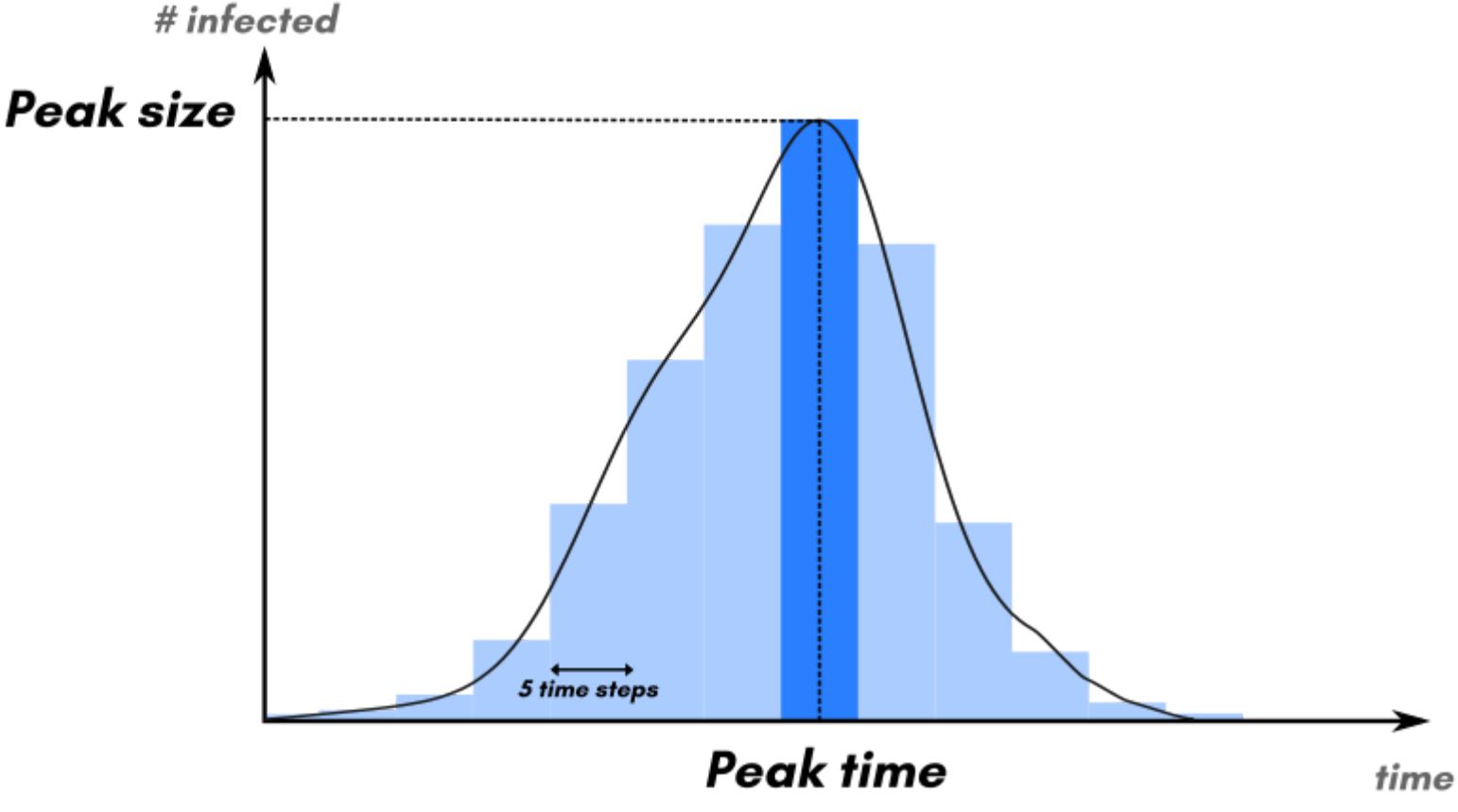
PSE performances



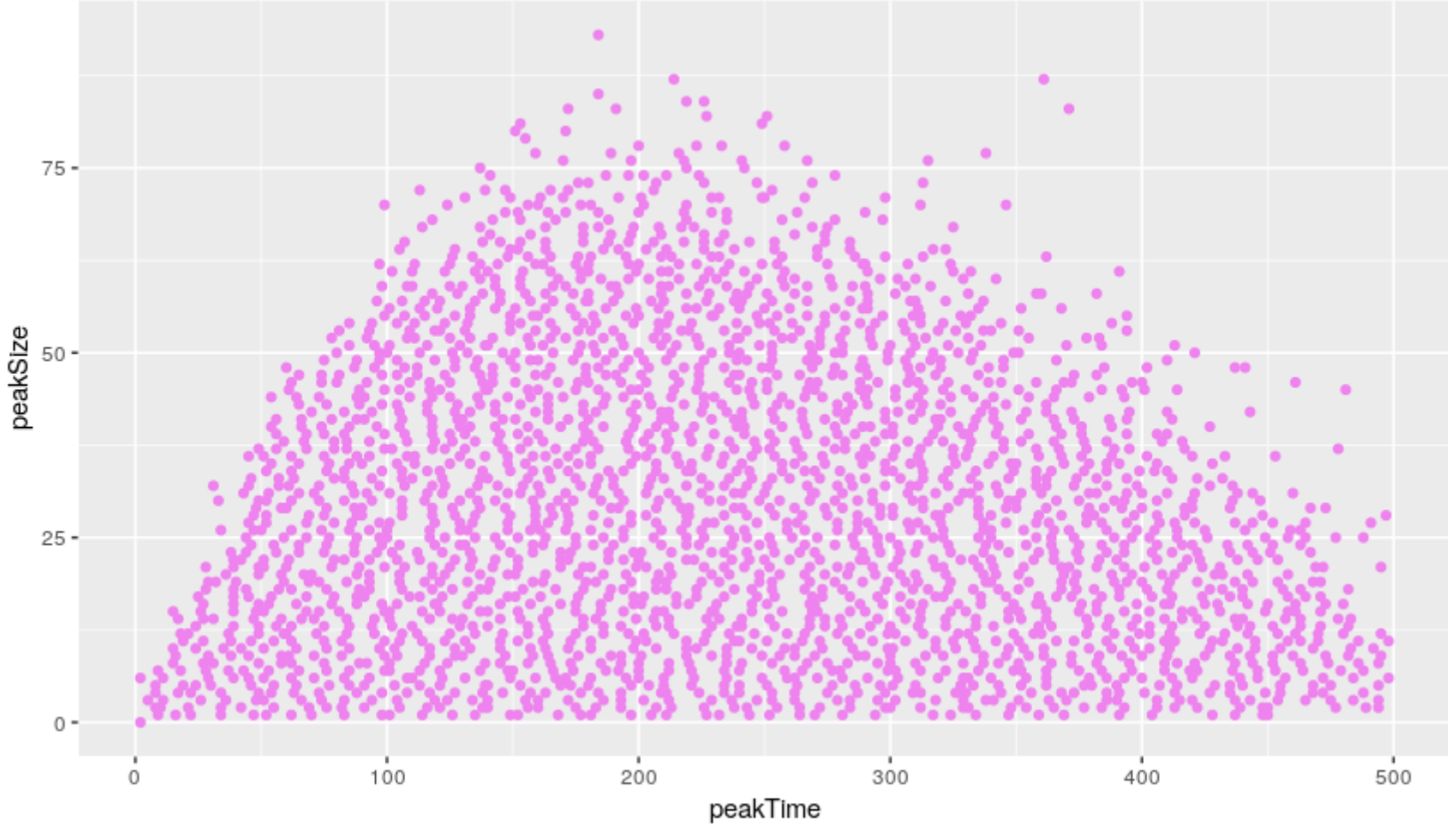
PSE for Zombies

Looking for possible:

- Peak size of infected humans over 5 time steps
- Peak time of infected humans over 5 time steps



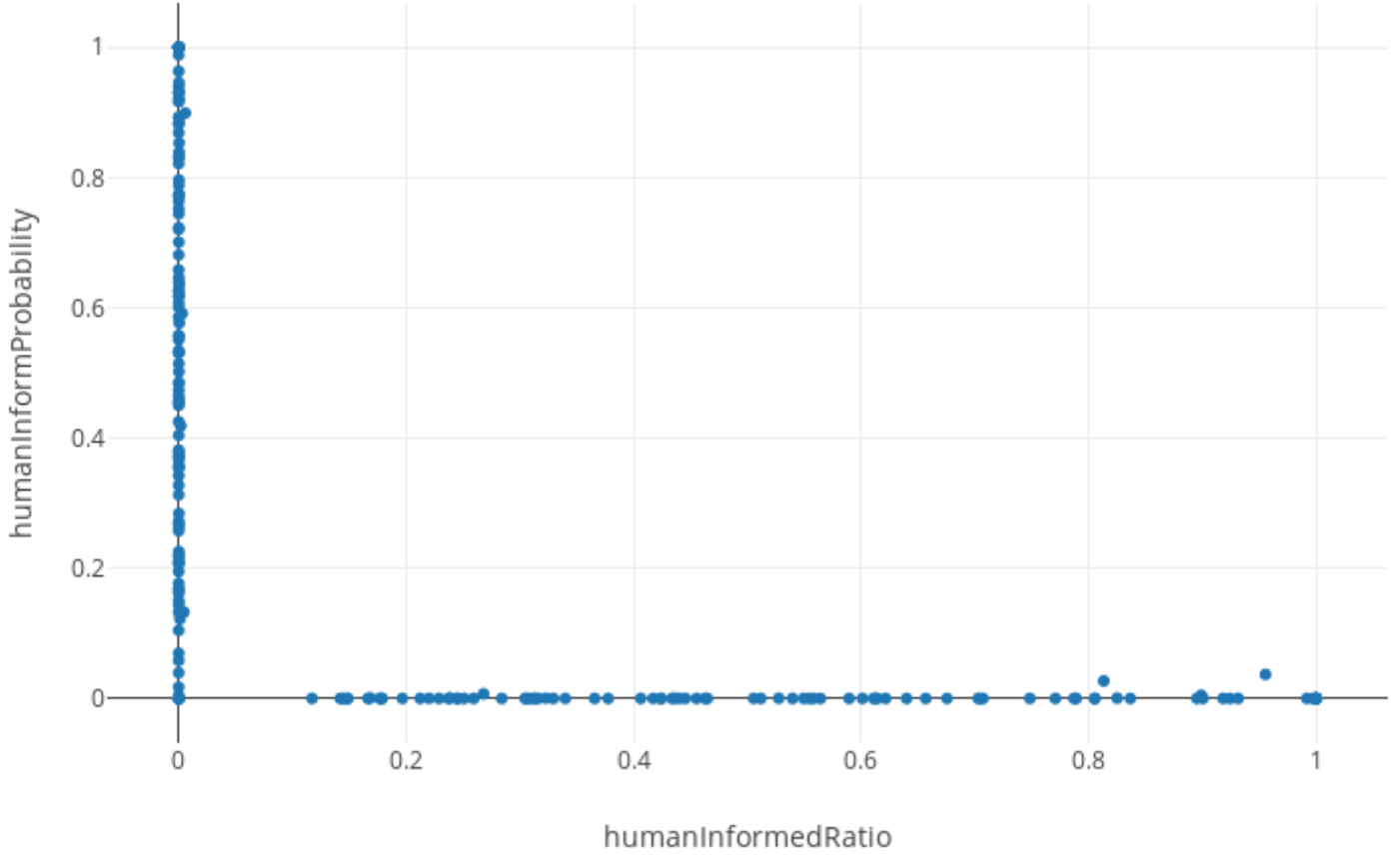
Possible patterns



OSE (Ancestor search)

Which input values may lead to a rare but terrible Zombie attack (peakSize > 50) ?

OSE Results



At least 1 informed human or a very (non-zero) low informProbability permit to avoid a terrible attack.

Is it all?

- *Direct sampling*: Grid, Sobol, LHS, One Factor at A Time, Random, CSV, Spatial
- *Sensitivity*: Morris, Saltelli
- *Evolution*: NSGA2, Profiles, PSE, OSE, NichedNSGA2
- *Bayesian*: ABC
- And more to come: NSGA3, PPSE

Is OpenMOLE crafted for Zombies only?

Of course not !

DOCUMENTATION

Plug Your Model

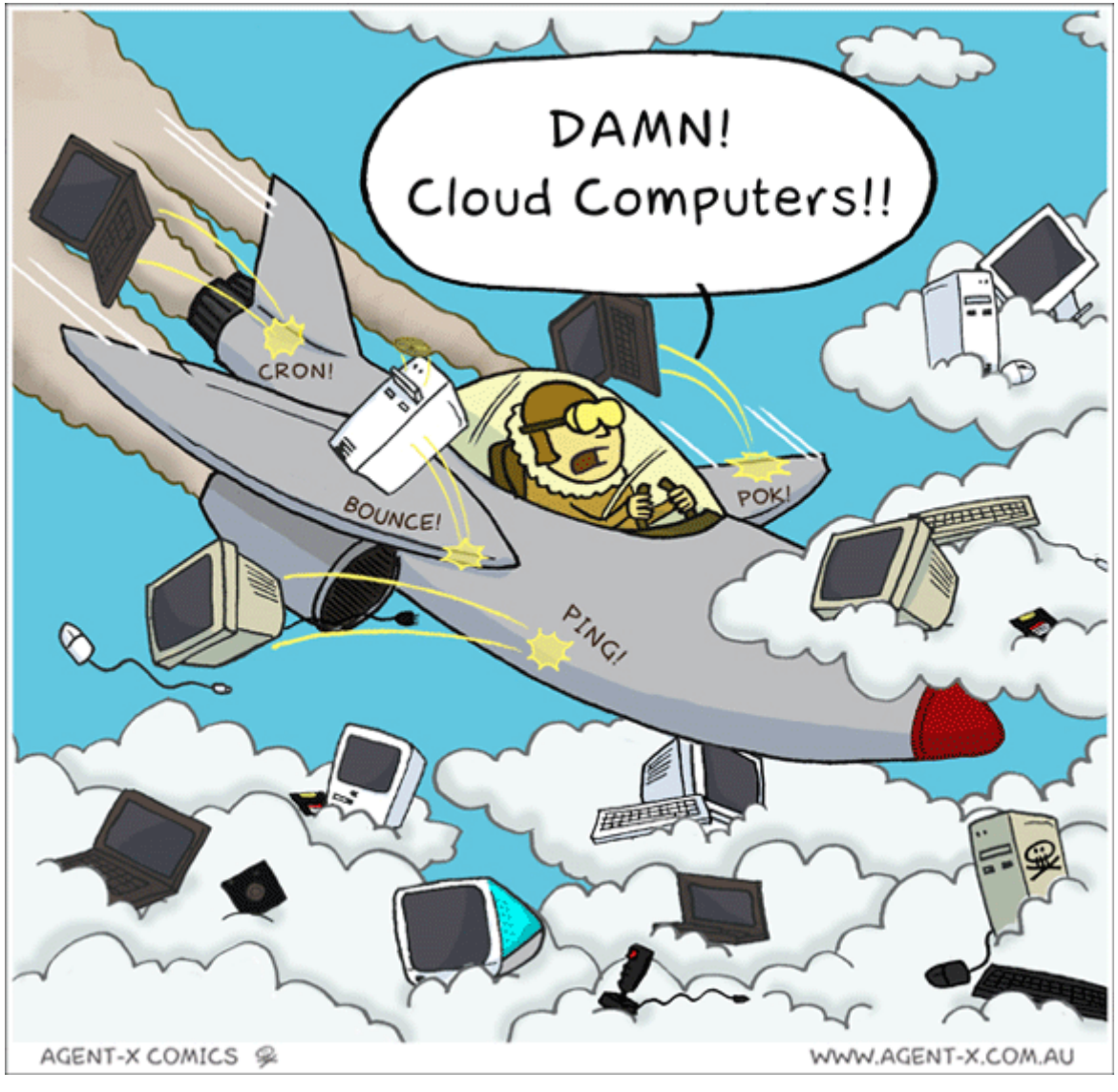
1. Scala
2. Java
3. Python
4. R
5. NetLogo
6. GAMA
7. Scilab
8. Julia
9. Any Other Executable

Explore Your Model

1. Samplings
    a. Elementary Samplings
    b. Samplings for High Dimension Spaces
    c. Uniform Sampling
    d. Sampling Over Files

Scaling

Execute anywhere



Zero deployment approach

- User code is automatically deployed at runtime
- No prior knowledge of remote environment needed
- No installation required on any machine

Distribute on your laptop ors cluster:

- PBS, Torque, Condor, SLURM, SGE, OAR, DIRAC…

Useful links

- **OpenMOLE site: openmole.org**
- **OpenMOLE chat: chat.openmole.org**

- OpenMOLE next version: next.openmole.org
- OpenMOLE github: github.com/openmole/openmole
- OpenMOLE gitlab: gitlab.openmole.org/openmole/openmole

Trempoline

https://trempoline.io