Assignment 2: Agent-based competition modelling

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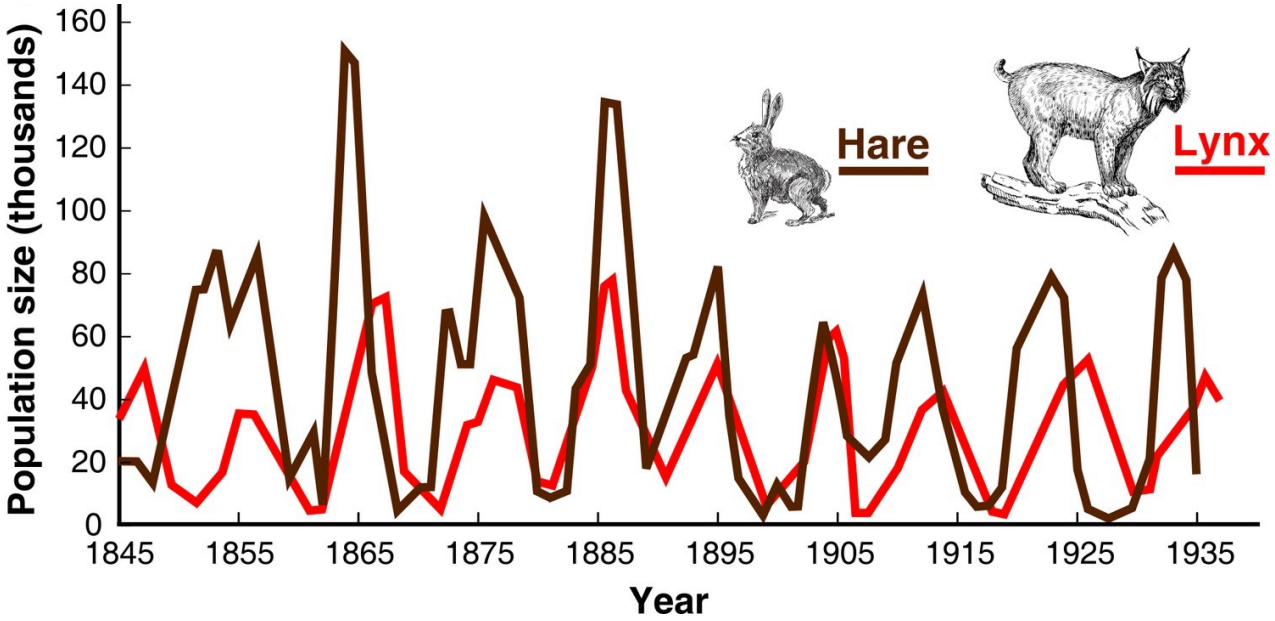
Predator-prey interaction is cyclical



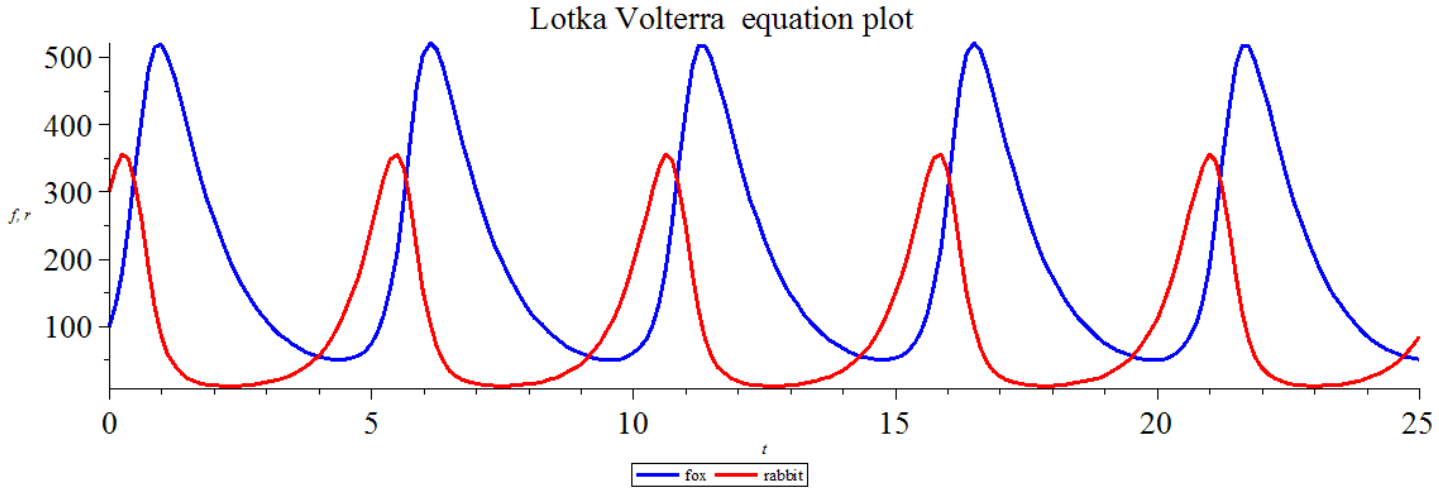
Source: Leeson et al., n.d.

Source: Momeni et al., 2017

ODEs capture cyclicality: Lotka–Volterra

$$\frac{dr}{dt} = \alpha r - \beta r f$$

$$\frac{df}{dt} = \delta r f - \gamma f$$



Parameters:

α - natural reproduction rate of rabbits in the absence of predation

β - death rate per encounter of rabbits due to predation

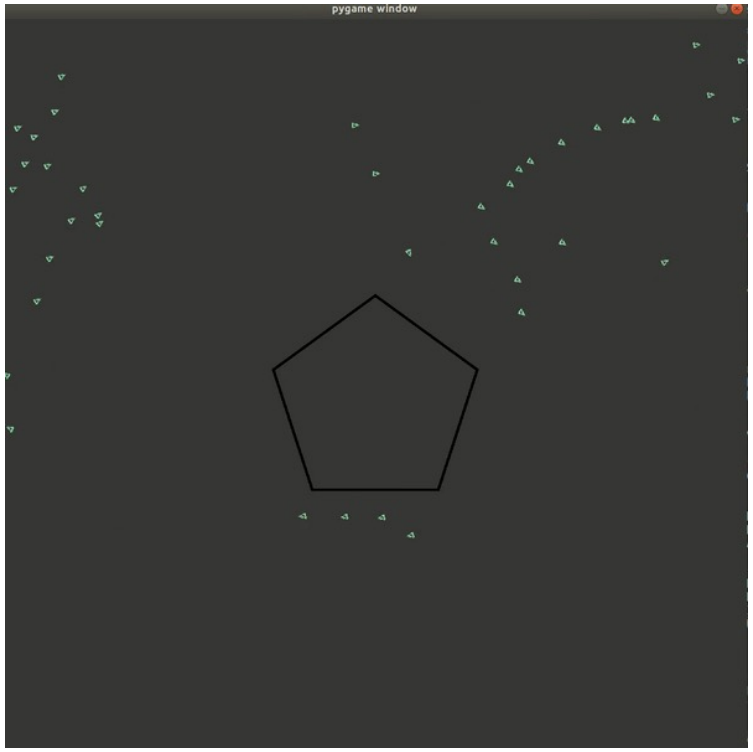
δ - the efficiency of turning predated rabbits into new foxes

γ - natural death rate of foxes in the absence of food (rabbits)

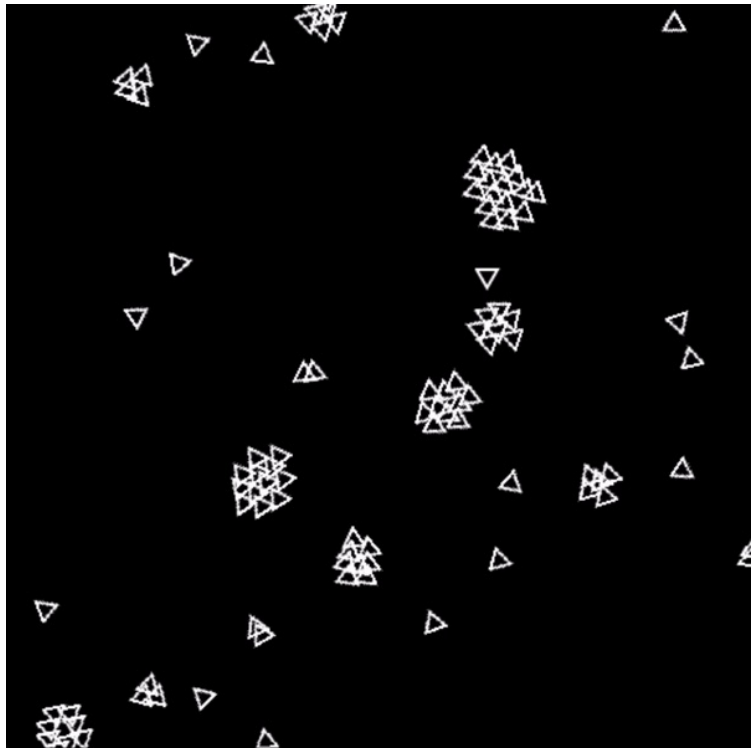
Source: Forrest, n.d.

Source: Gisling, 2013

ABM helps us capture complex interactions

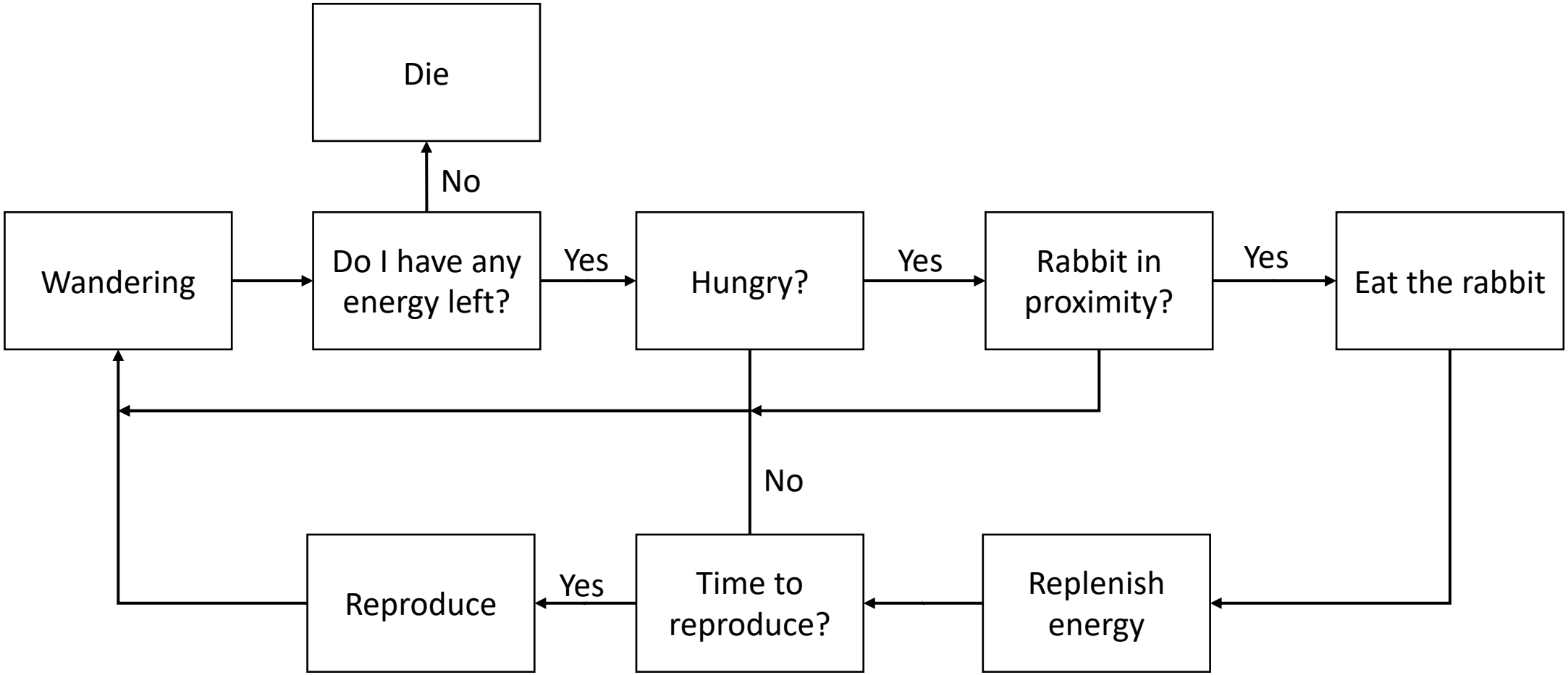


Spatial distributions - obstacles

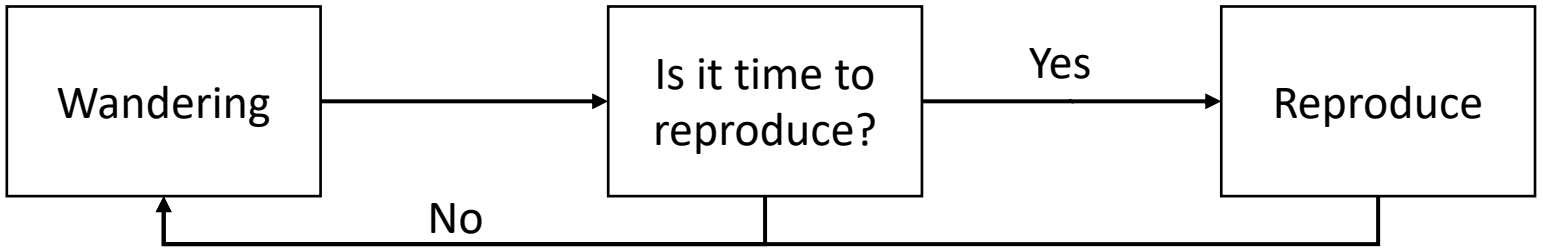


Interaction between agents - flocking

Rules of the agents - fox



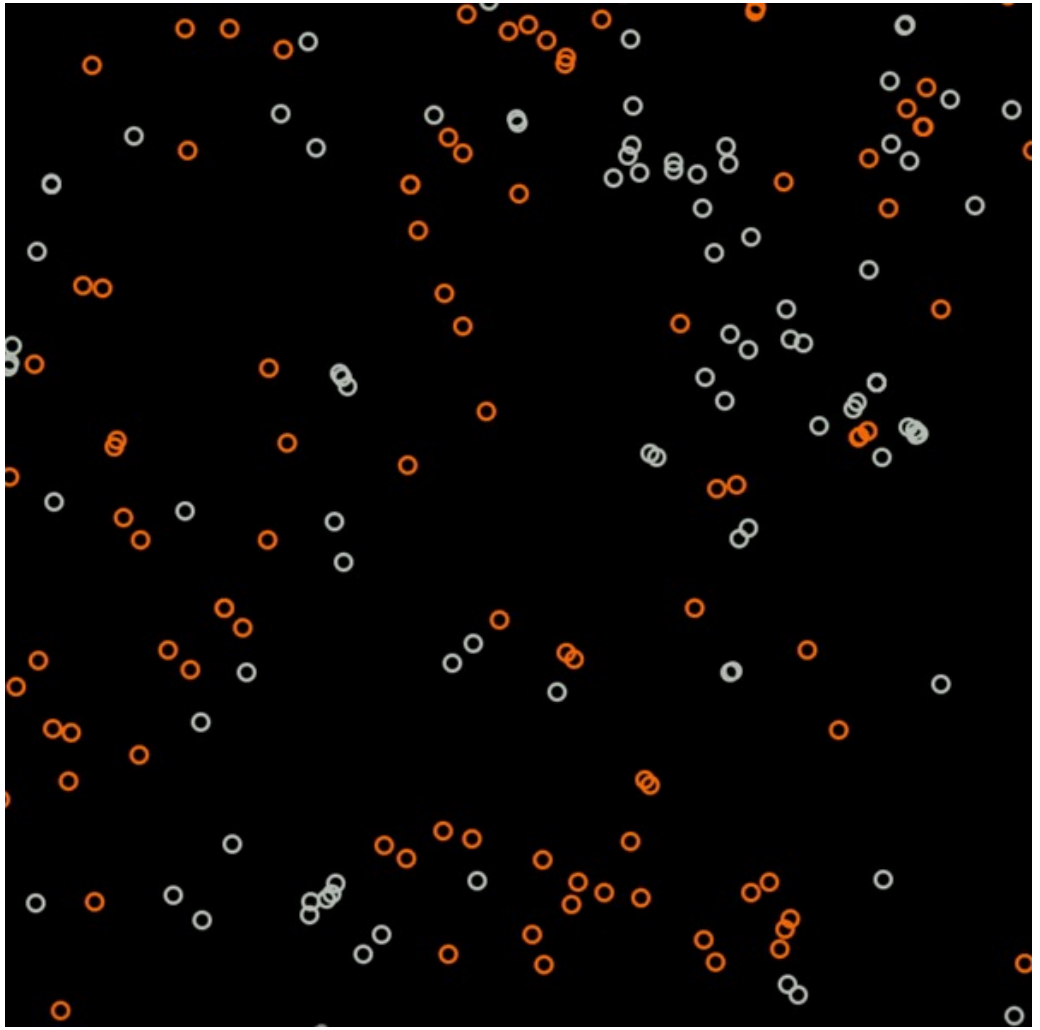
Rules of the agents - rabbits



Violet demo

- foxes

- rabbits



Violet tips

- .save_data() – check out “metrics” in Violet API documentation!
- .reproduce()
- .kill()

Adding multiple types of agents to the simulation

```
(
Simulation(
    MyConfig(
        radius = 15,
        duration=60 * 120,
        fps_limit=0,
        seed=6,
        window=Window.square(500),
    )
)
.batch_spawn_agents(25, Rabbit, images=["fox-rabbit/rabbit.png"])
.batch_spawn_agents(50, Fox, images=["fox-rabbit/fox.png"])
.run()
)
```

References

- Momeni, Babak, Li Xie, and Wenying Shou. "Lotka-Volterra pairwise modeling fails to capture diverse pairwise microbial interactions." *Elife* 6 (2017): e25051.
- Leeson, Tom and Leeson Pat. “Lynx hunting snowshoe hare” (n.d.)
- Gisling. “Lotka Volterra equation Maple plot” (2013)
- Forrest, Staphanie. “Predator-Prey Models” (n.d.)