

Autómata Celular Off-Lattice

Bandadas de agentes autopropulsados

Grupo 4:

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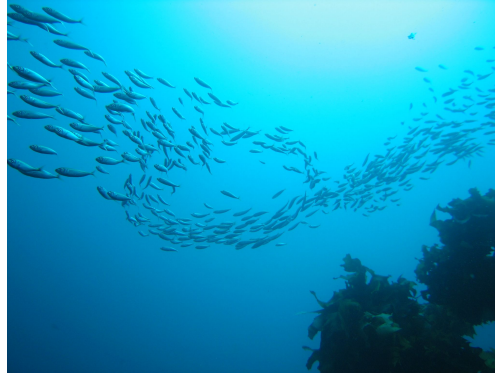
72.25 - Simulación de Sistemas

30 de agosto, 2024

Instituto Tecnológico de Buenos Aires

Introducción

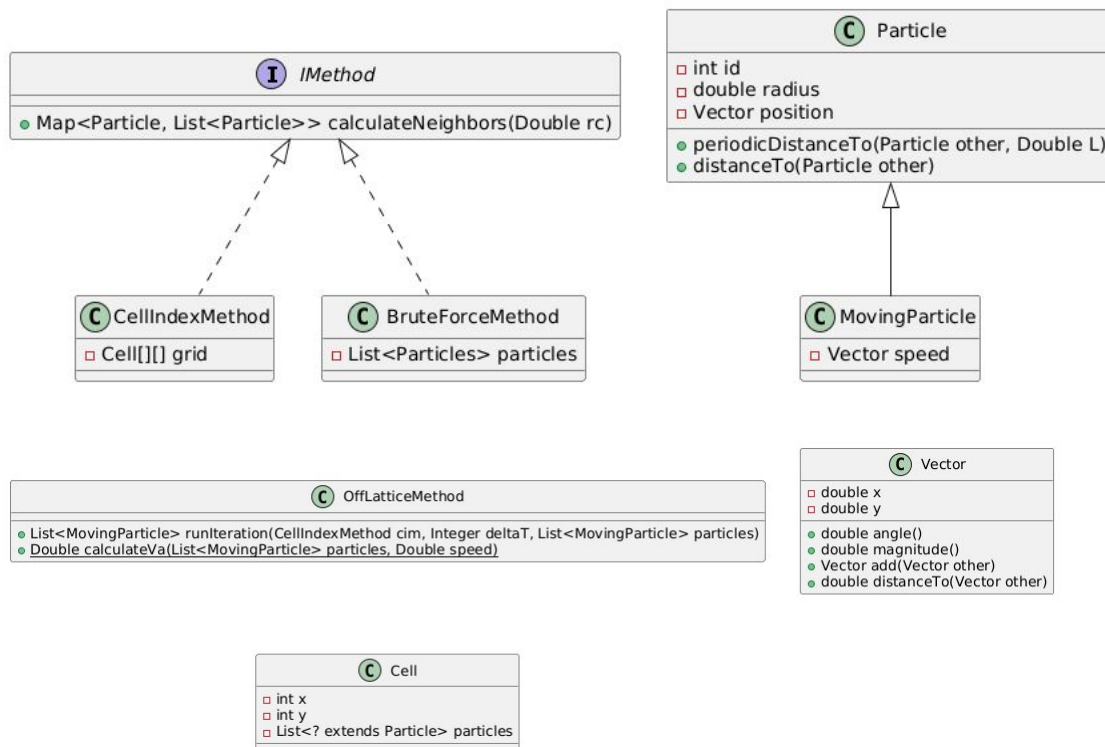
Sistemas biológicos



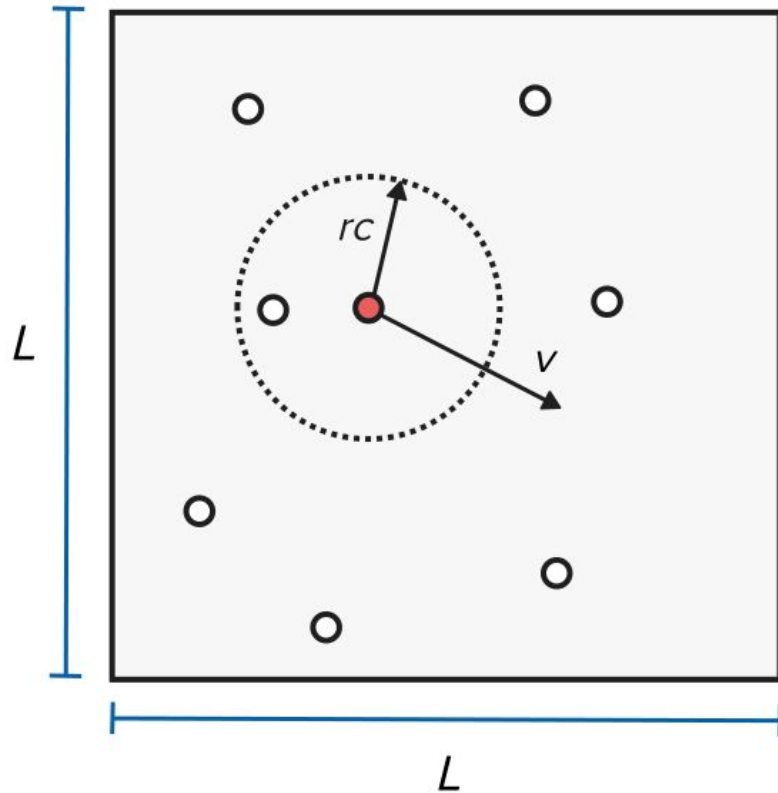
- $x_i(t + 1) = x_i(t) + v_i(t)\Delta t$
- $\theta(t + 1) = \langle \theta(t) \rangle_{rc} + \Delta\theta$
con $\Delta\theta \in [-\eta/2, \eta/2]$
- $\langle \theta(t) \rangle_{rc} = \arctan(\langle \sin(\theta(t)) \rangle_{rc} / \langle \cos(\theta(t)) \rangle_{rc})$

Implementación

Diagrama UML



Simulaciones



Parámetros Fijos

$$r = 0$$

$$rc = 1$$

$$\Delta t = 1$$

$$v = 0.03$$

Parámetros Variables

$$\left\{ \begin{array}{l} N = 40 \\ L = 3.1 \\ \eta \in \{0; 2; 4\} \\ \rho = 4 \end{array} \right.$$

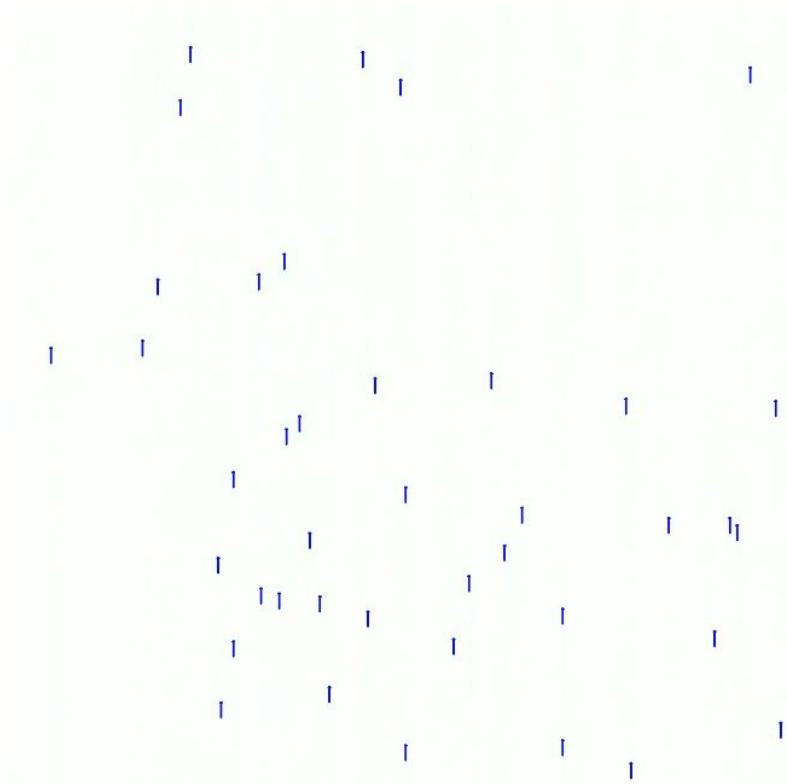
$$\left\{ \begin{array}{l} N \in \{500; 1000; \dots; 9500; 10000\} \\ L = 31.6 \\ \eta = 2 \\ \rho \in \{0.5; 1; \dots; 9.5; 10\} \end{array} \right.$$

$$\left\{ \begin{array}{l} N \in \{25; 50; \dots; 975; 1000\} \\ L = 10 \\ \eta \in \{0; 2; 4\} \\ \rho \in \{0,25; 0,5; \dots; 9,75; 10\} \end{array} \right.$$

$$v_a = \frac{1}{Nv} \left| \sum_{i=1}^N v_i \right| \quad \text{donde } v_a \in [0; 1]$$

Resultados

<https://www.youtube.com/watch?v=ZoKRWDdxIDk>

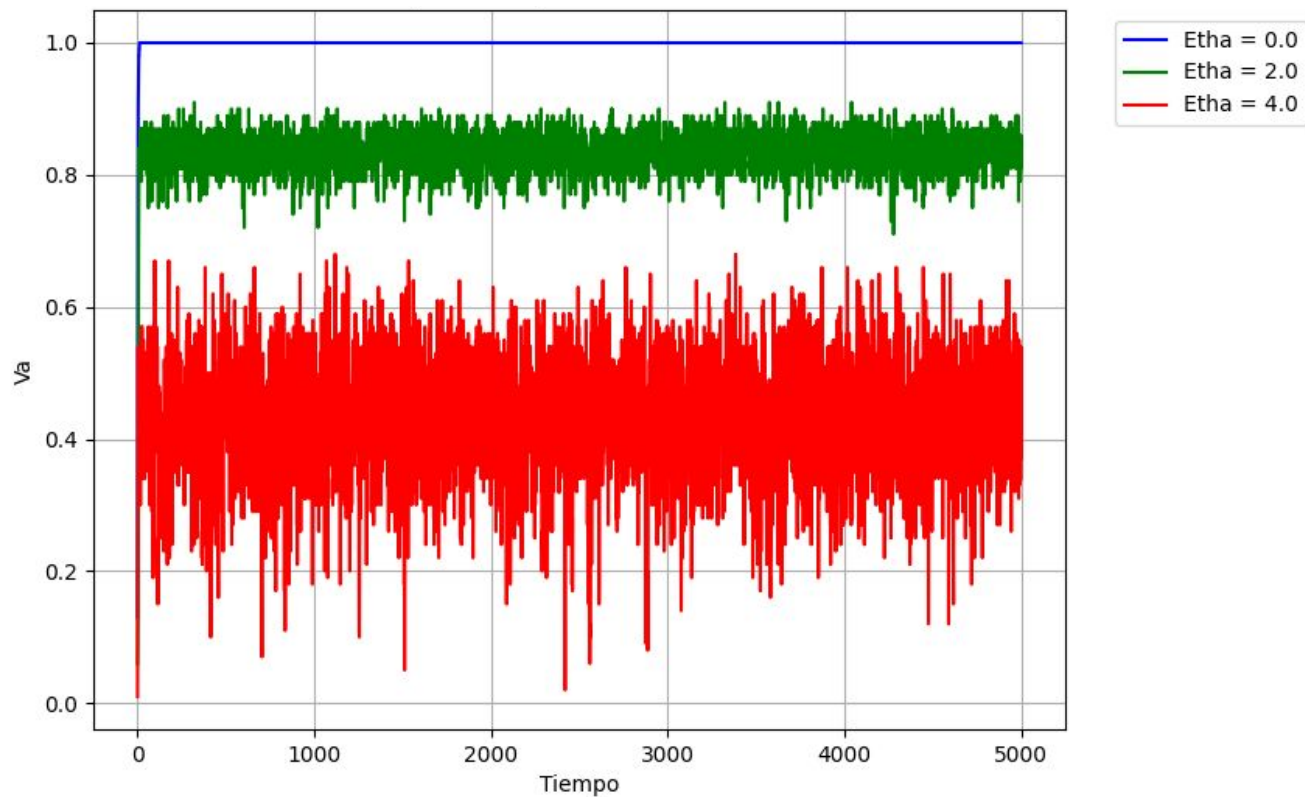


$$\eta = 0.25$$
$$N = 40$$
$$L = 3.1$$

https://www.youtube.com/watch?v=_hoF1cnrxmQ

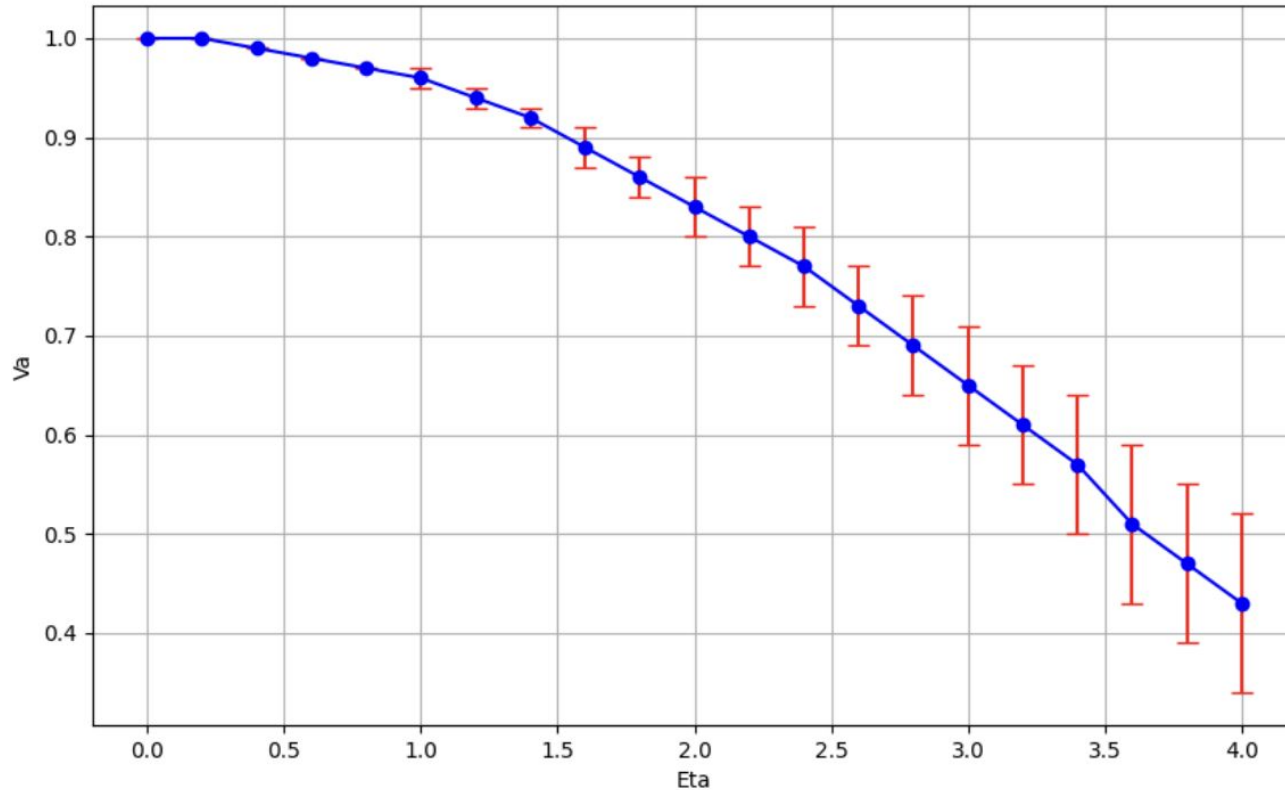


$$\eta = 4$$
$$N = 40$$
$$L = 3.1$$



$$N = 40$$

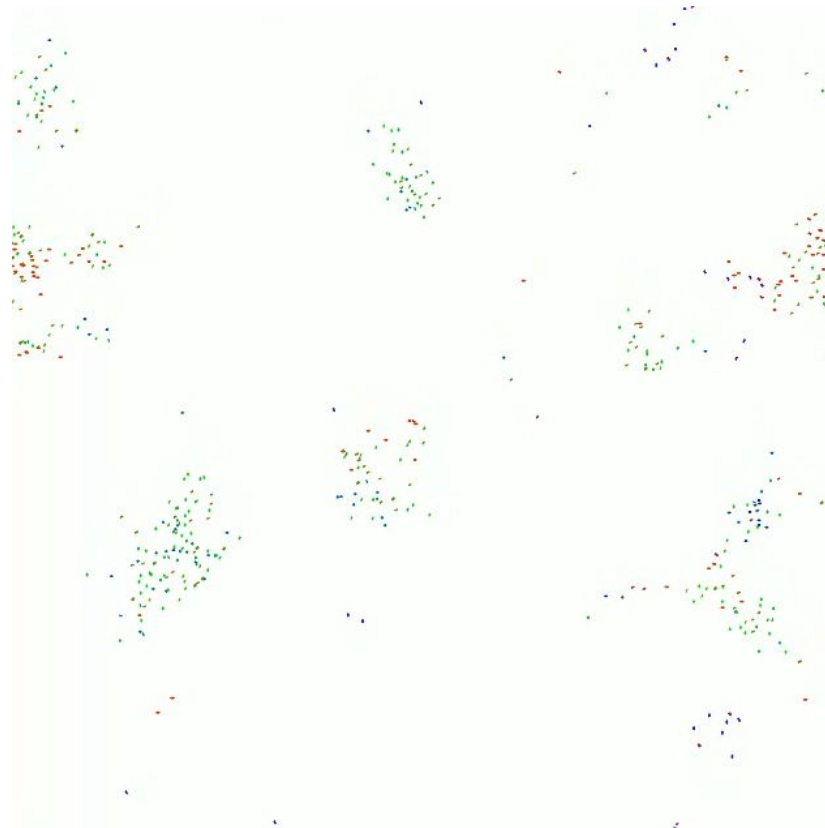
$$L = 3.1$$



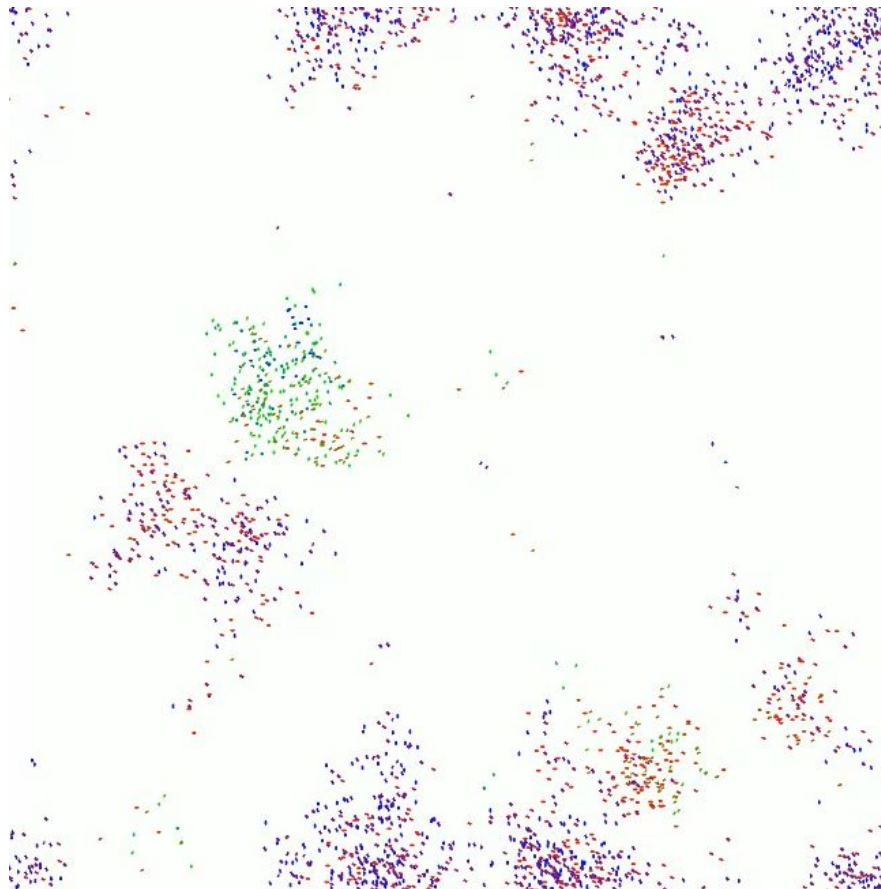
$$N = 40$$

$$L = 3.1$$

<https://www.youtube.com/watch?v=3b6DsCrswbQ>

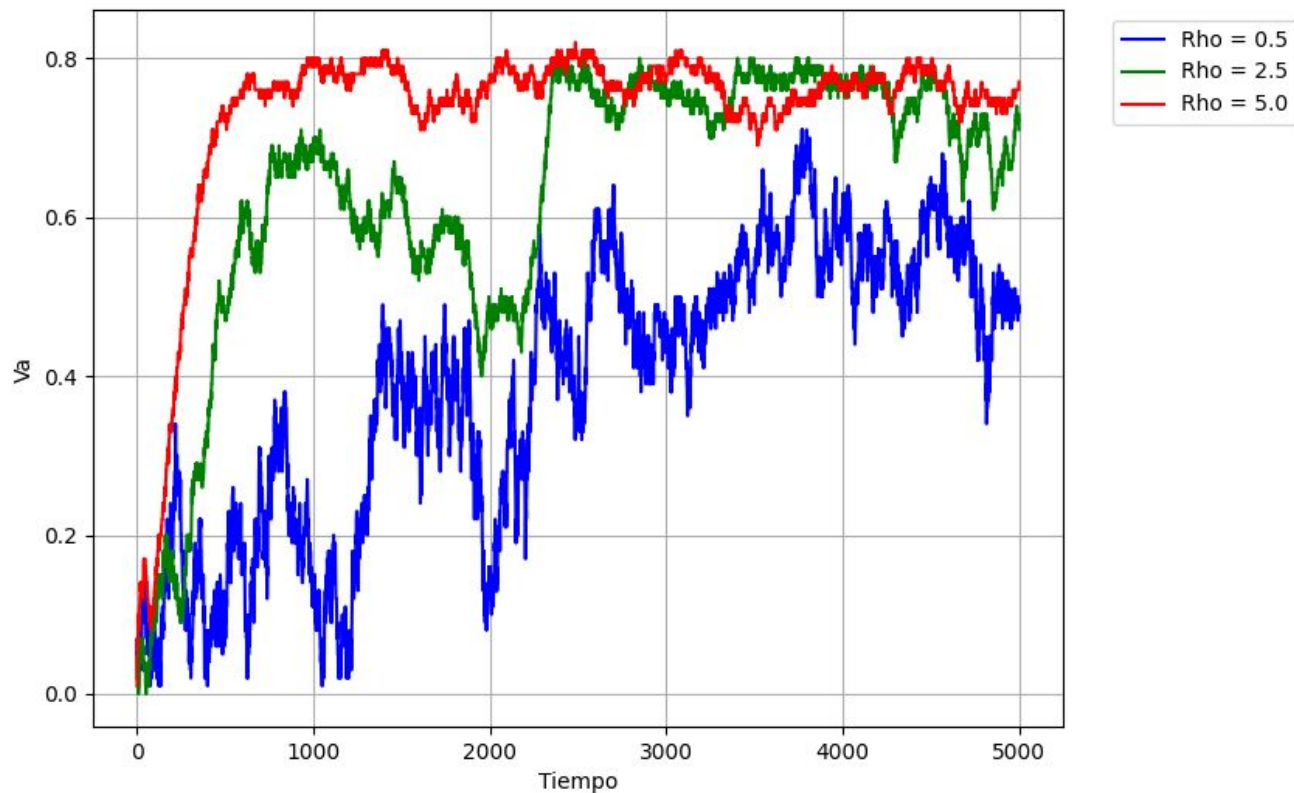


$$\begin{aligned}\eta &= 2 \\ N &= 500 \\ L &= 31.6 \\ \Rightarrow \rho &= 0.5\end{aligned}$$



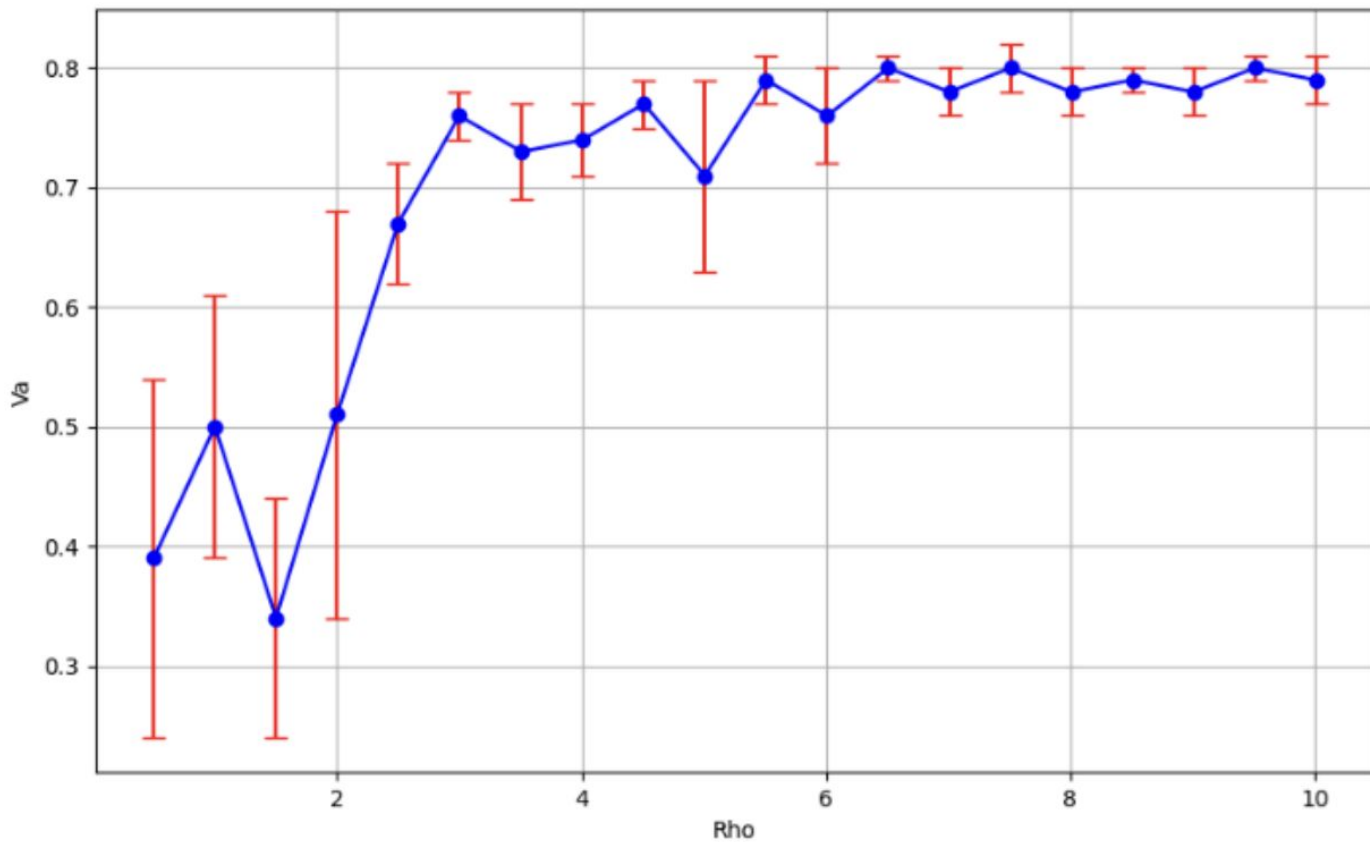
<https://www.youtube.com/watch?v=rtUGqvqKWbY>

$$\begin{aligned}\eta &= 2 \\ N &= 2500 \\ L &= 31.6 \\ \Rightarrow \rho &= 2.5\end{aligned}$$



$$L = 31.6$$

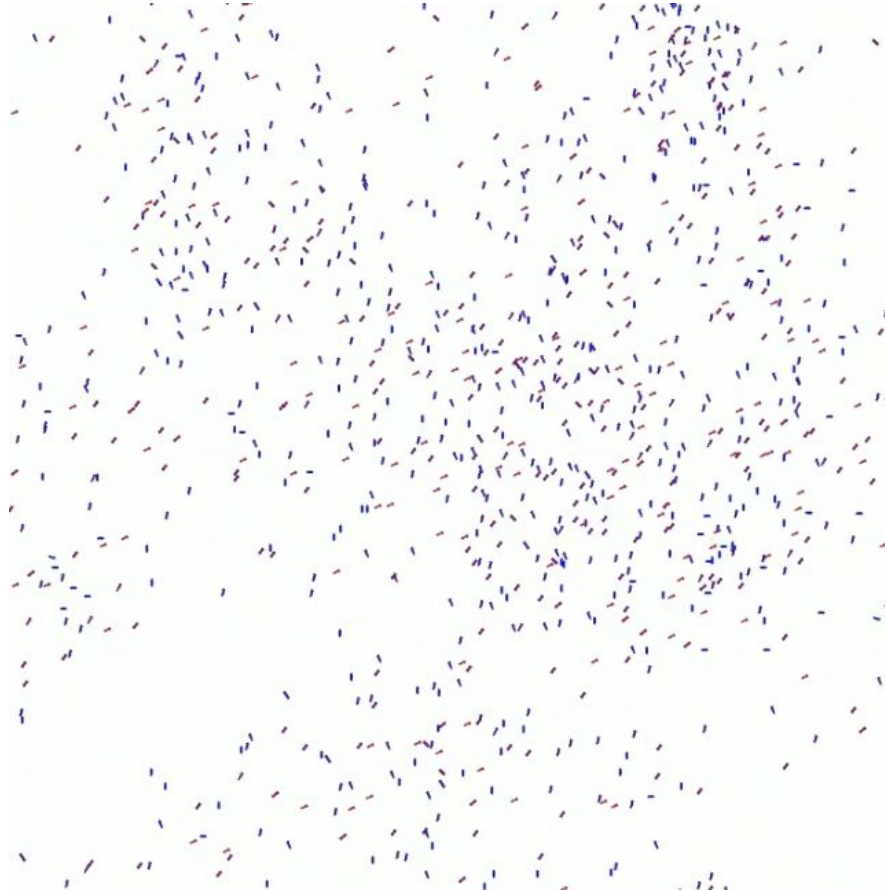
$$\eta = 2$$



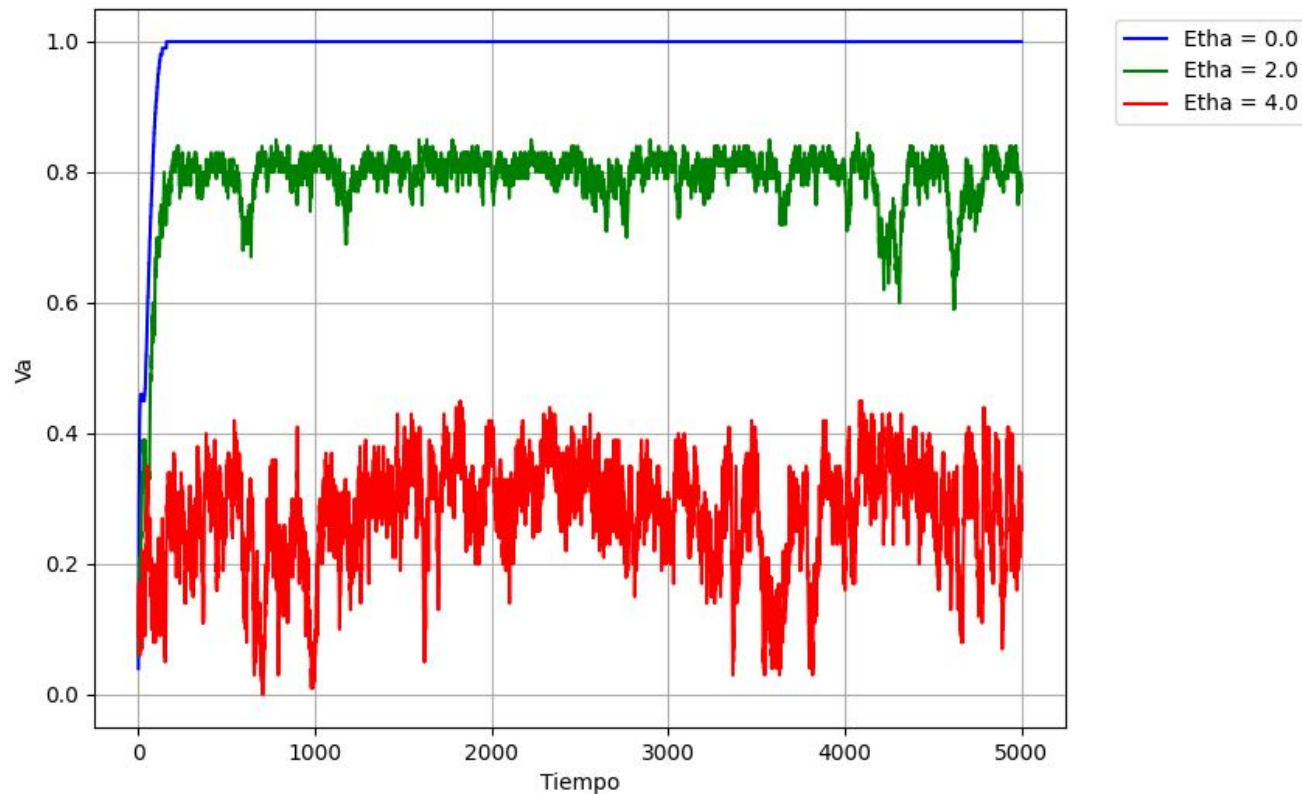
$$L = 31.6$$

$$\eta = 2$$

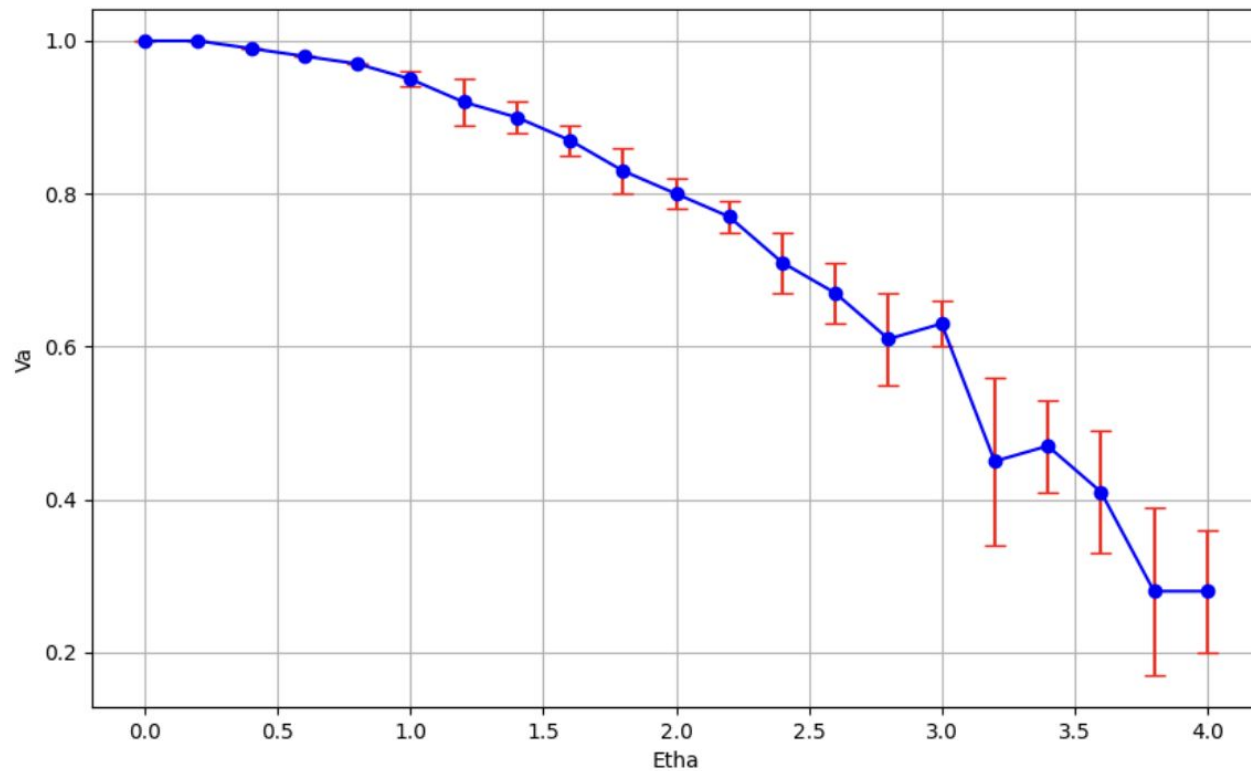
<https://www.youtube.com/watch?v=hSosxJ2Etmo>



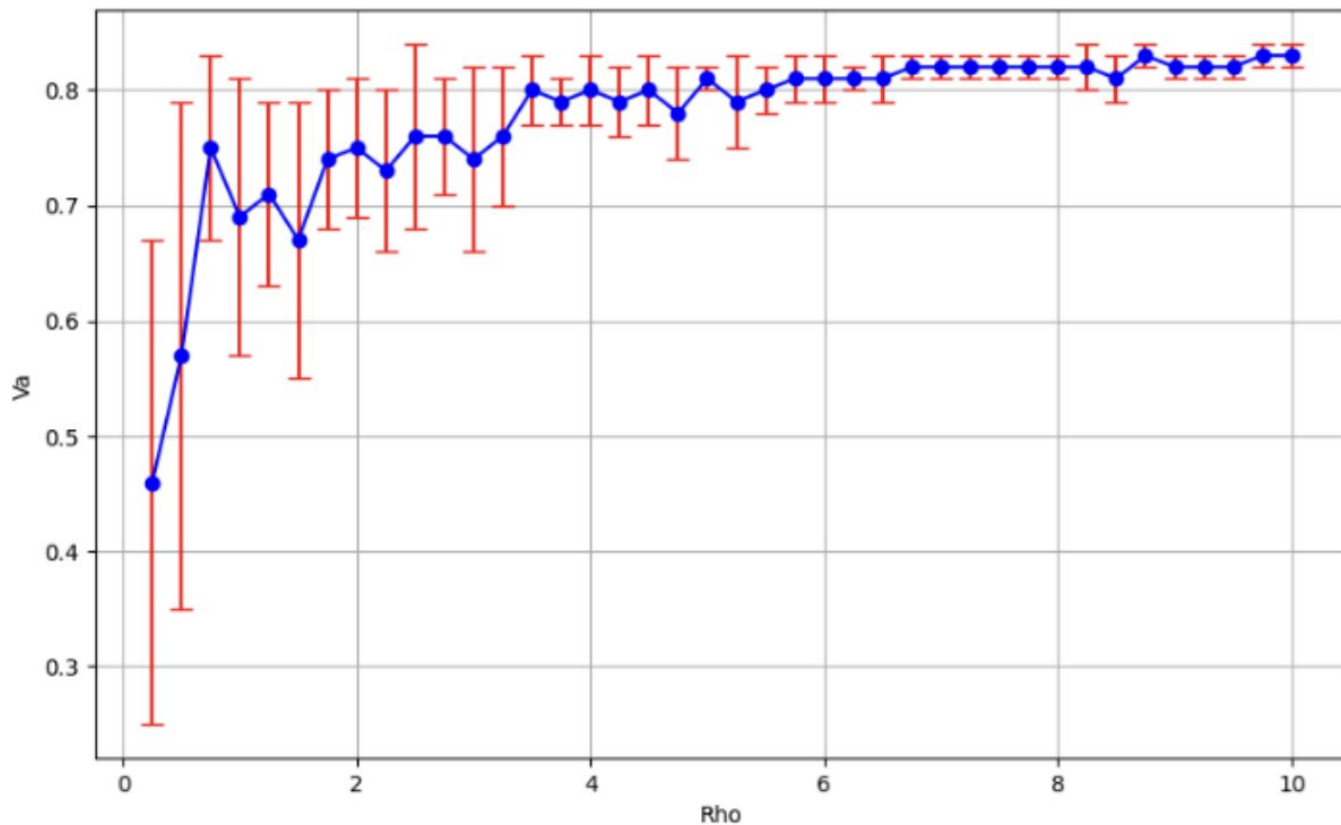
$$\begin{aligned}\eta &= 2 \\ N &= 400 \\ L &= 10 \\ \Rightarrow \rho &= 4\end{aligned}$$



$$N = 400$$
$$L = 10$$



$N = 400$
 $L = 10$



$$L = 10$$

$$\eta = 2$$

Conclusiones

- El comportamiento colectivo depende de la densidad (ρ) y el ruido (η).
- Mayor $\rho \Rightarrow Va$ aumenta
- Mayor $\eta \Rightarrow Va$ disminuye

¡Gracias por su atención!

