



Generalized game of life


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1. Introduction

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- Goal
 - Implement original game of life system
 - Make this system more general

 - This is achieved by using Genetic Algorithm.

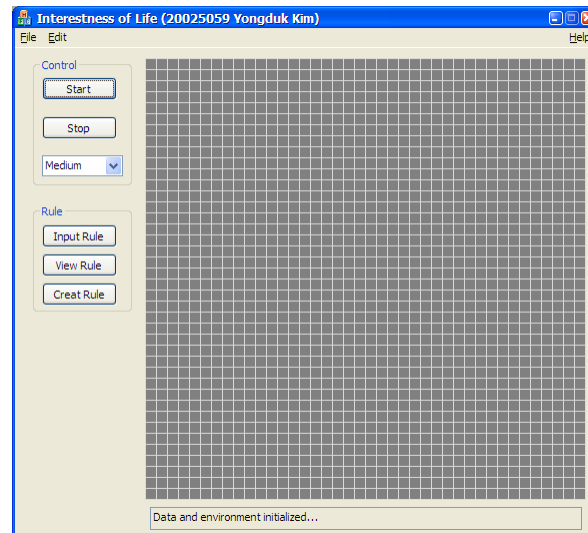
2. Original Game of Life

■ Rule

- If the number of surrounding cells is less than 2 or greater than 3, the current cell dies.
- If the number of living cells is exactly 2, or if the number of living cells is 3, maintain status.
- If the current cell is dead, but has three living cells surrounding it, it will come to life.

■ Implementation

- 40 X 40 cells
- Each bound is connected
- Using C++



3. Create Generalized game of life using GA

- GA is used to make generalized game of life.

Procedure GA

Begin

$t \leftarrow 0$

Initialize $P(t)$

Evaluate $P(t)$

While (not termination-condition) **do**

Begin

$t \leftarrow t+1$

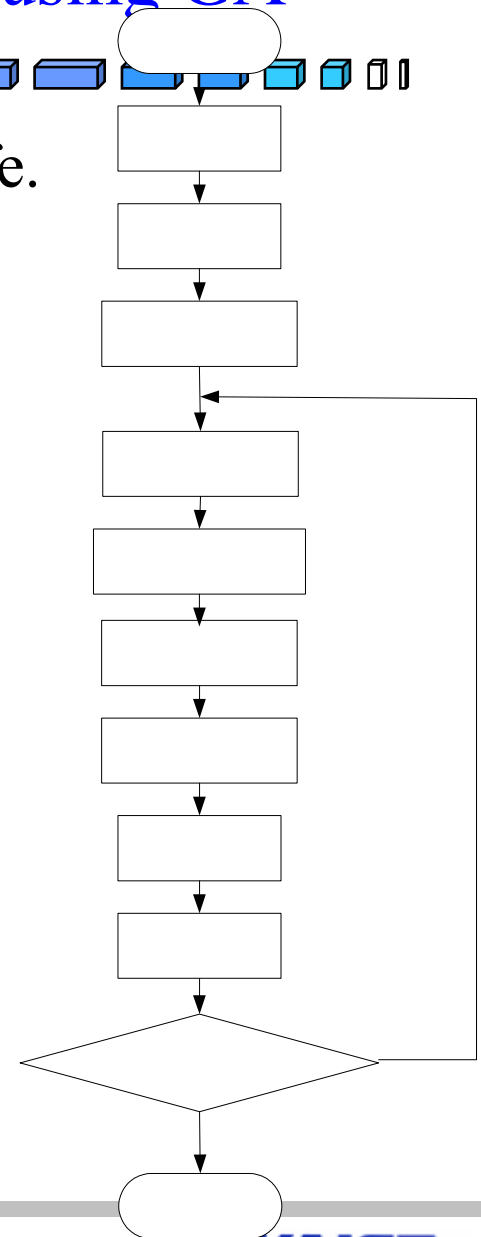
Select $P(t)$ from $P(t-1)$

Alter $P(t)$

Evaluate $P(t)$

End

end

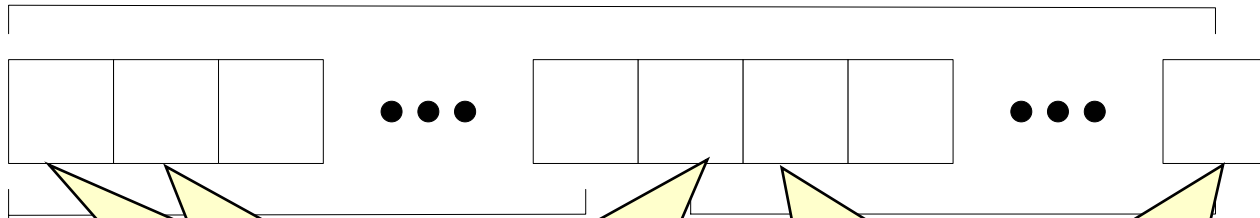


■ Components of GA

- A genetic representation
- A way to create an initial population
- Selection method
- An evaluation function
- Genetic operators

3. Create Generalized game of life using GA

- A genetic representation



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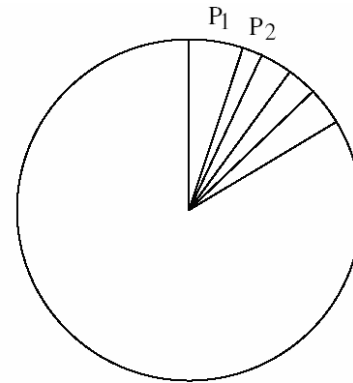
Current cell is alive and has “8” neighbors.

3. Create Generalized game of life using GA

■ Selection method

- Roulette wheel method
 - Probability of selection

$$p_i = \frac{eval(v_i)}{\sum_{i=1}^{pop_size} eval(v_i)}$$



■ Evaluation function

- Best solution has maximum fitness.
- My interest world
 - Active
 - Not crowded

3. Create Generalized game of life using GA

■ How?

- Active

- Look at 2 generations in the Game of life, then check how many cells are different.
- Let's call this fitness1.

- Not crowded

- Find a deviation from my desired number of cells.
- Then invert this deviation, because we want to maximize fitness.
- Let's call this fitness2.

