

The method of file encryption using the property of cyclic attractors in the Game of Life

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Abstract

The game of life proposed by John H. Conway is well-known example of two dimensional cellular automata whose dynamics is pretty complicated but fascinated instead of its simple rule. Theoretical or mathematical analysis of its complex dynamics in the system of the Game of Life has been actively carried out in the former studies.

The glider is famous cyclic attractor in the two dimensional game of life which progresses repeatedly in the cycle of four discrete time steps. In this study, we propose the file (binary data file) encryption algorithm using the property of cyclic attractors (especially glider) in the Game of Life.

Figure 1 shows glider of initial state(left) and one time step advance (right). Comparing these two states, the value of cells #20,23,27,28 are varied between two time steps.

The target file of encryption is divided into several segments whose size is 36 bytes. Bytes of the file whose number is decided by the state of glider is reversed according to the state of gliders in fig.1, In this case, #20,23,27,28 byte from the head of file correspond. These operation will be performed to whole divided file segments repeatedly. The advantage of our proposed method is that it can encrypt the whole kind of file regardless of the type of file format because binary digits of file are directly operated. The example of file encryption (Bitmap and Text file) is shown in fig.2 and 3. Using our method, several kinds of files are effectively encrypted and decoded successfully.

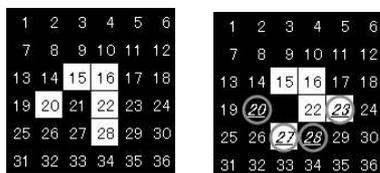


Figure1. Glider of initial state (left) and one time step advance (right)



Figure2. Bitmap file encryption. Original file (left) and encoded file (right).

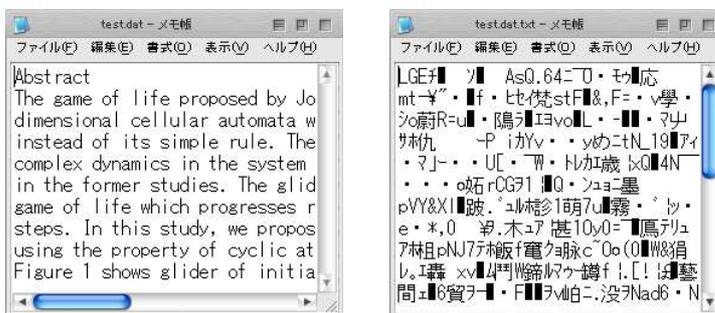


Figure3. Text file encryption. Original file (left) and encoded file (right)

Reference

[1] Elwyn Berlekamp , John Conway , Richard Guy Winning Ways, Vol.2 Academic Press, New York , 1982

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