A Genetic Algorithm using an Entropy based Selection Scheme

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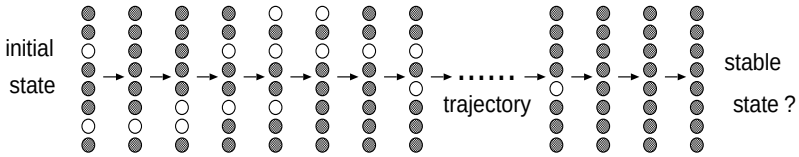
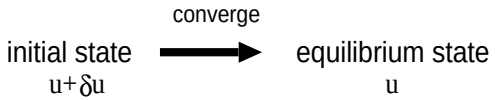
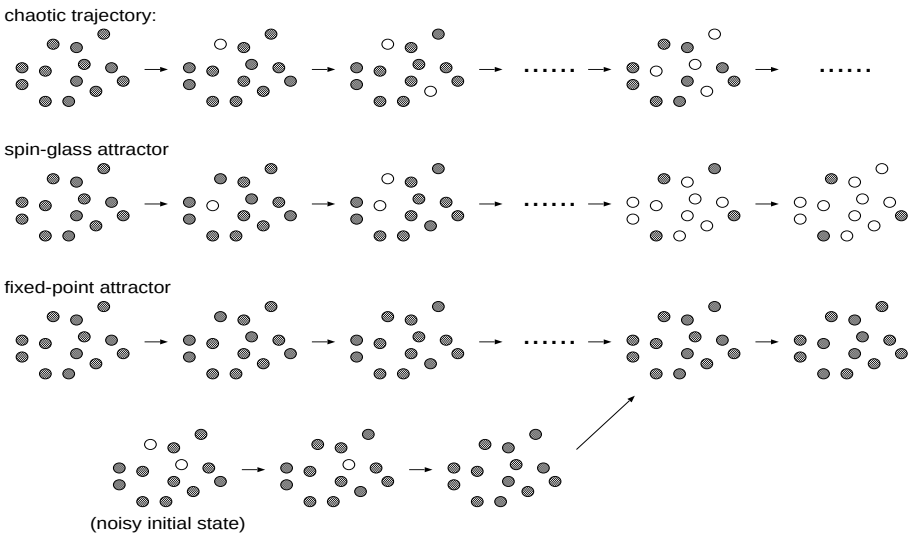
associative memory = dynamical system





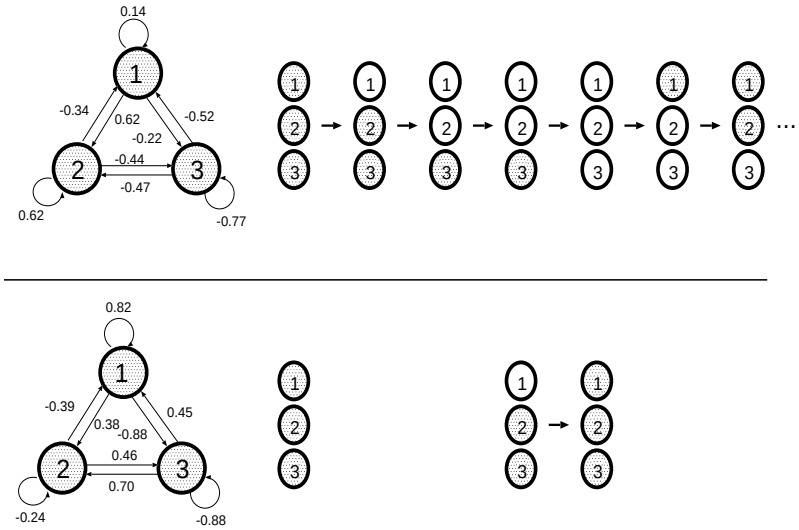
□ Introduction:

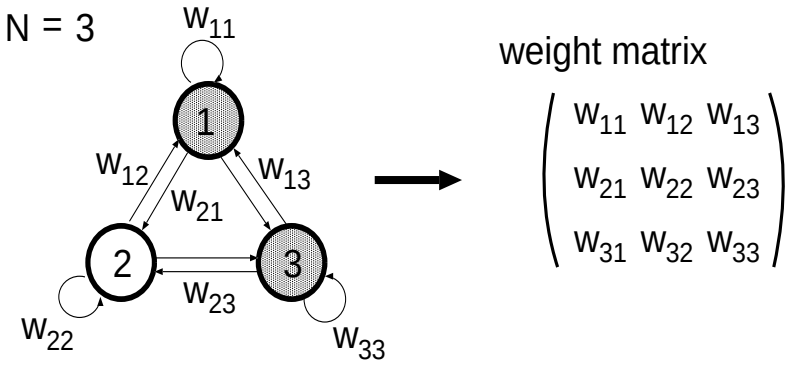
- We apply
  - ECs to neural network model of Associative Memory.
- We study
  - basic behaviors of the model under simple evolutionary processes.
- Here,
  - we use a selection scheme based on entropy of the population. (Lee and Han, 1997)



The Associative Memory can be realized with:

- **fully-connected neural network model**
  (Hopfield model)
- **immune system model**
- **etc**





Fitness Landscapes on Weight Space

- all the possible configurations of w_{ij} of a network with N

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- an N^2-dimensional Euclidean space

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- a specific configuration is represented as a point in the space

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- "fitness landscape" can be defined on the space

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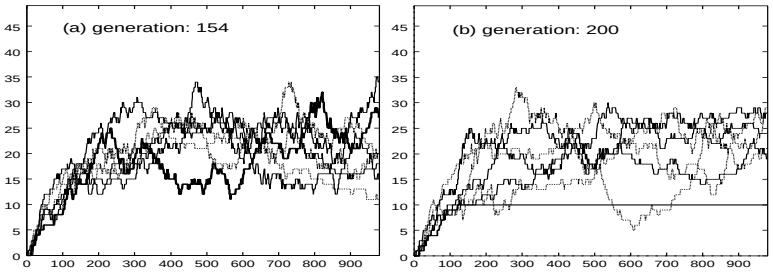
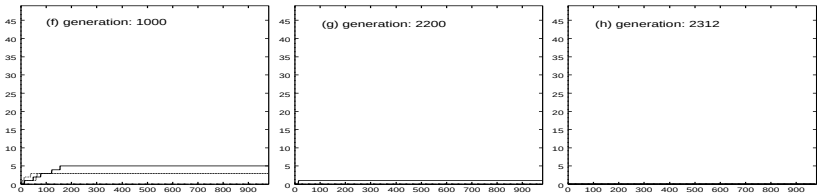
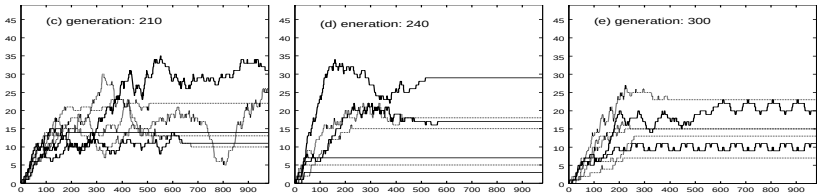
- where we can imagine the optima as peaks



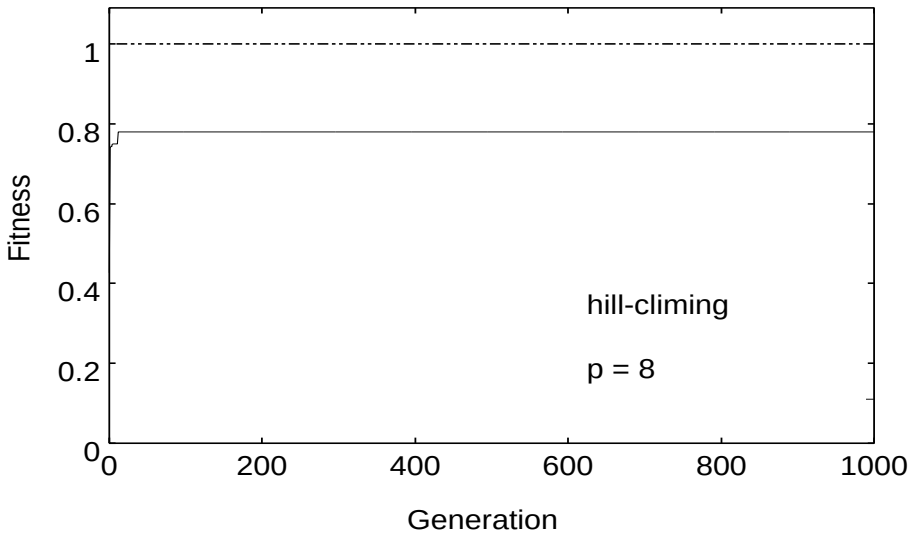




□ **Weight Space and String Space:**

- weight space
  - a given set of patterns to be memorized: fixed
  - N^2-dimensional; real-valued genes

- string space
  - a configuration of weights: fixed
  - N-dimensional; binary genes



Entropic Sampling:

- Fitness level is devided into 21 classes (from row to high).

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- The last class is only for perfect fitness.

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- The fewer the indivisuals are, the higher the probability to be selected.

(**cf.** fitness proportionate selection.)

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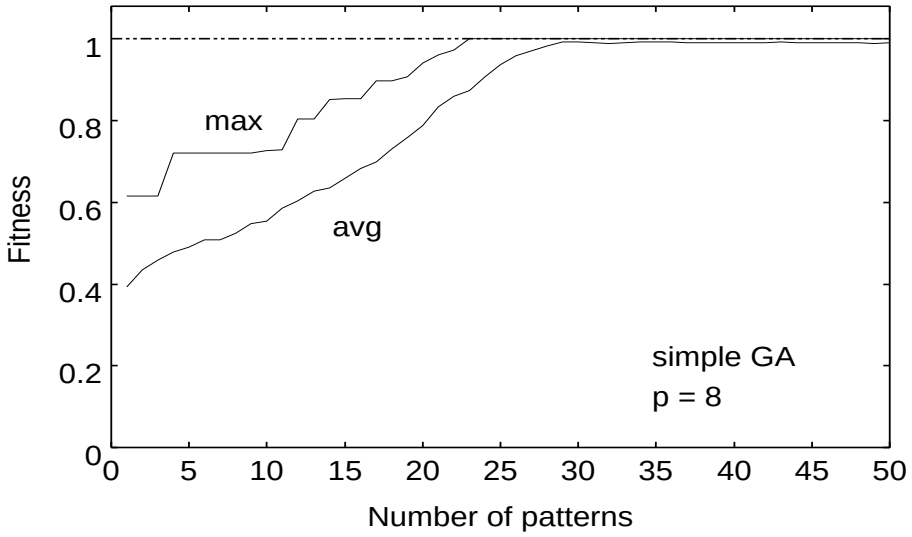
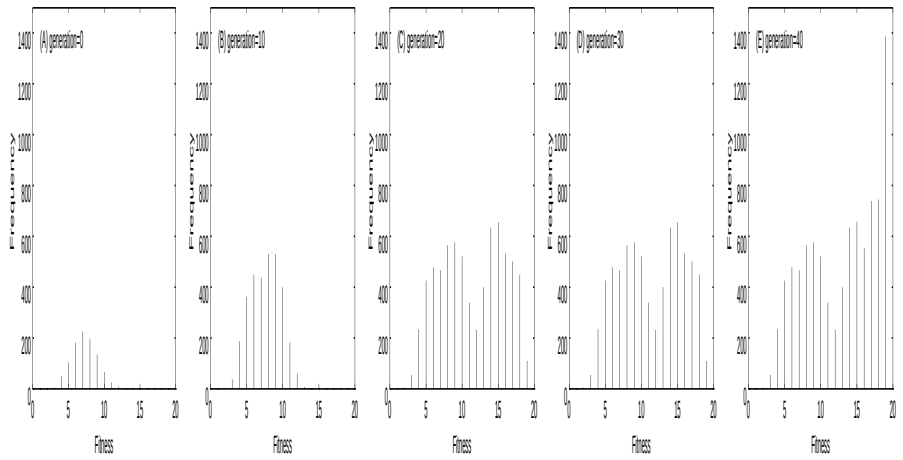
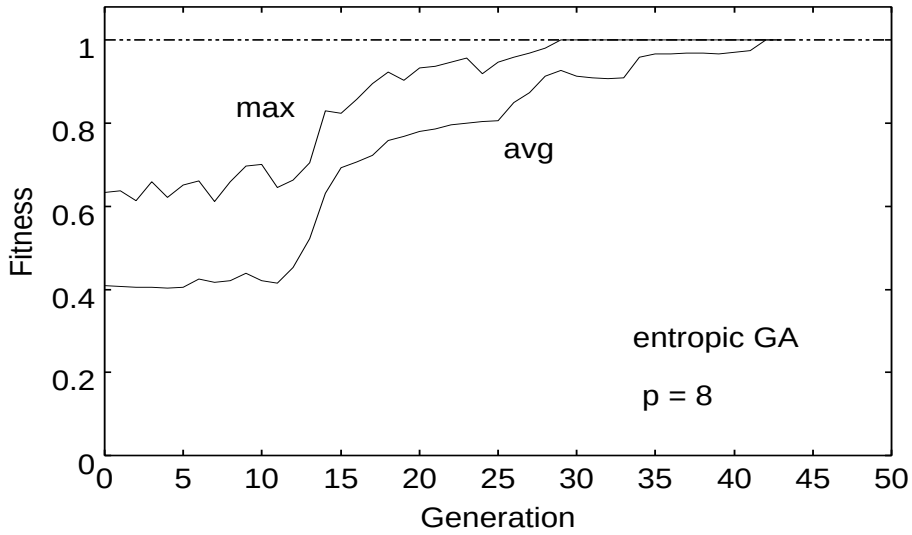
- Can we locate multiple peaks at a run?







□ **Conclusions:**

- The "entropic sampling" works as well as simple GA.
  - The more complicated landscape, the more effective?
  - Can we locate multiple solutions simultaneously?

- These studies shed new light on the analysis of the Hopfield model of associative memory.