Molecular Computational Modeling of Human Anagram Solving

Hyo-Sun Chun[1], Ji-Hoon Lee[2], Je-Hwan Ryu[3], Christina Baek[3], Eun Seok Lee[4], Byoung-Tak Zhang[1234*]

[1]School of Computer Science and Engineering, Seoul National University, Republic of Korea
[2]Graduate Program in Bioinformatics, Seoul National University, Republic of Korea
[3]Brain Science Program, Seoul National University, Republic of Korea
[4]Cognitive Science Program, Seoul National University, Republic of Korea
{hschun, jhlee, jhryu, dsbaek, eslee, btzhang}@bi.snu.ac.kr

An anagram is a wordplay which produces new words using all the given alphabets exactly once. An anagram can be solved in two strategies: search and pop-out [1]. Search is a serial process which tests all the possible arrangements of the given alphabets. On the other hand, pop-out is a parallel constraint satisfaction process, which is commonly used by good solvers. Taking advantages of molecular computing, we simulated the solving process for good solvers (i.e., the pop-out process) [2]. We encoded alphabets, bigrams and words into DNA sequences. We performed DNA hybridization using the alphabet and bigram strands. Each alphabet strand binds to its complementary bigram strand in parallel during this process. The matched bigram strands were used to perform DNA hybridization with the word strands. Once again, each matched bigram strand binds to its complementary word strand in parallel. Our experimental results show that we can identify the correct answers and incorrect answers. Our work proposes a new application for molecular computing which simulates cognitive and parallel thinking process of human.

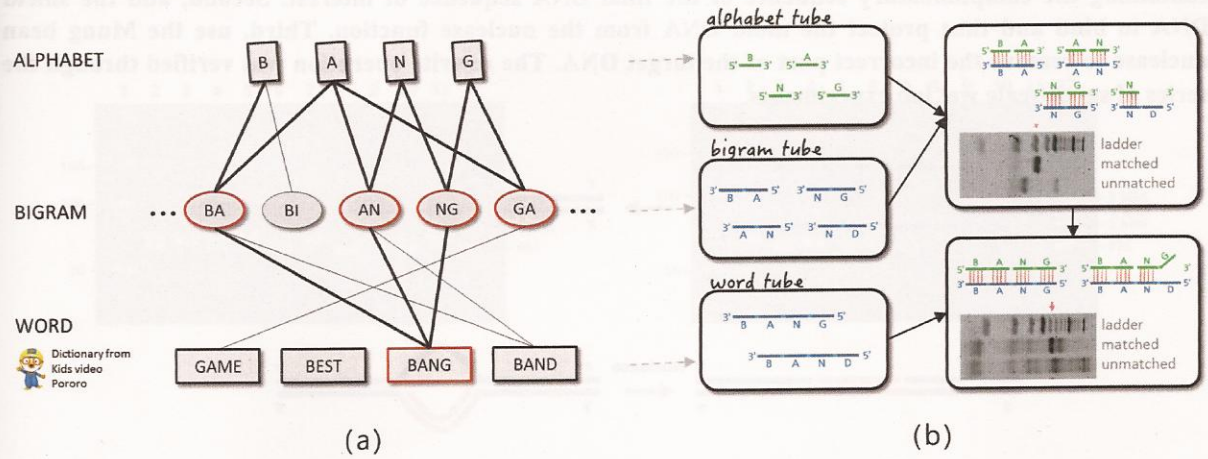

Figure1. (a) Cognitive anagram solving process (b) molecular computational simulation

Reference

1. Novick, L. R., & Sherman, S. J. The effects of superficial and structural information on online problem solving for good versus poor anagram solvers. *The Quarterly Journal of Experimental Psychology*, 61 (7), 1098-1120 (2008).

2. J.-H. Lee, E. S. Lee, J.-H. Ryu, H.-S. Chun and B.-T. Zhang (2013). Molecular computational simulation of cognitive processes for anagram solving. *International Conference on DNA Computing and Molecular Programming* (DNA 19), poster (2013)

Acknowledgment

This work was supported by the Air Force Research Laboratory (AFOSR, FA2386-12-1-4087), Samsung *Research Funding Center of Samsung Electronics (SRFC-1401-12)*, and the National Research Foundation of Korea (NRF) grant funded by the Korea government (MSIP) (NRF-2010-0017734-Videome). The Seoul National University Institute of Computer Technology provides research facilities for this study.