Empirical robustness evaluation of DNA-based clustering methods

Rohani Binti Abu Bakar[abc] *; Junzo Watada*[ac]
[a]Graduate School of Information, Production and Systems, Waseda University, Japan
[b]Faculty of Computer Systems and Software Engineering, University Malaysia Pahang, Malaysia
[c]2-7 Hibikino, Wakamatsu-Ku, Kitakyushu-Shi, Fukuoka-Ken, 808-0135, Japan

ABSTRACT
DNA-based computation is one of the latest computation paradigms. Compared to conventional methods that obtain their end results via electronic processes, aDNA-based approach obtains its result from bio-chemical reactions. It is essential in this approach for all experimental processes to be performed without fault. However, some errors may occur while carrying out these bio-chemical experiments. Consequently, it is necessary to overcome their weaknesses. The aim of this study is to examine the robustness of DNA-based techniques in solving a clustering problem. In the broadest sense, robustness can be defined as being able to withstand stresses, pressures, or changes in procedure or circumstance. To examine the robustness of the approach, this research examined the impact of error or added noise on DNA-based procedure results. Comparative studies of different error sets are also provided here. Additionally, two well-known conventional clustering algorithms (Fuzzy C-means and k-means) were applied to the same error sets, to study the reliability and validity of results when comparing DNA-based clustering.

KEYWORDS:
DNA-based computation; Clustering; DNA-based clustering; Fuzzy C-Means; K-means; Clustering robustness

REFERENCES

1. Adleman, L.M., “Molecular Computation of Solutions to Combinatorial Problems,” Science, vol. 266, no. 11: pp. 1021–1024, 1994

2. Henkel, C.V. and Kok, J.N., “Towards Evolutionary DNA Computing,” LNCS 3561, pp. 242–257, Springer 2005

3. Deaton, R. et al., “Reliability and Efficiency of a DNA-Based Computation,” Physical Review Letters, vol. 80, no. 2, pp. 417–420, 1998

4. Rfiedland, P. and Kedes, L.H., “Discovering the Secrets of DNA,” Communication of the ACM, Vol. 28, no. 11, pp. 1164–11686, 1985

5. Raghavan, V.V. and Ip, M.Y.L, “Techniques for Measuring the Stability of Clustering: A Comparative Study,” Proceedings of the 5˜’ Annual ACM Conference on Research and Development in Information Retrieval, Annual ACM Conference on Research and Development in Information Retrieval. West Berlin, Germany, pp. 209–237, 1982