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LOGICAL INFERENCE BASED ON DNA

Janusz Błasiak[2], Tadeusz Krasiński[1], Łukasz Rogowski[1], Sebastian Sakowski[1] and Tomasz Popławski[2]

[1]Faculty of Mathematics and Computer Science, University of Łódź
Banacha 22, 90-238 Łódź, Poland
[2]Department of Molecular Genetics, University of Lódź
Pomorska 141/143, 90-236 Lódź, Poland,
[1]krasinsk@uni.lodz.pl, sakowski@math.uni.lodz.pl,
[1]rogowski@math.uni.lodz.pl,
[2]jblasiak@biol.uni.lodz.pl, tplas@biol.uni.lodz.pl,

ABSTRACT

In the last few years many researchers focused on construction molecular systems based on the manipulation of DNA strands. The potential of DNA as a carrier of genetic information opens the possibility of its application in computer science. The molecular properties of DNA can be utilized for the construction of computing devices, logical circuits and solve combinatorial problems. The molecular systems based on DNA may be applied in medicine and have a potential to become excellent diagnostic tools.

The first attempts of DNA application to solve some mathematical and biomedical problems, including the Hamiltonian path problem and drug dosing in dependence of the development of a disease, were successfully completed, which stimulated the advent of biomolecular informatics. In its basic form, DNA computing includes a synthesis of DNA oligonucleotides, which correspond to the input and application of a restriction enzyme, for which these DNA fragments are substrates. The action of the restriction enzyme on the input DNA molecule and subsequent cleavage and joining reactions led to the production of output DNA molecule, being the solution of the problem. In particular, one can apply these operations to implement formal logical inferences.

In the article [1], we have presented an overview of the current state of research in logical inference with the help of DNA molecule and restriction nucleases. The main objective of the article was to present the idea of using biomolecular computation to the logical inference. We have discussed in details the molecular implementation of simple logic programs along the idea given in [2]. This molecular system is able to deduce conclusions on the basis of facts and on the rule of detachment. However, this simple inference systems has drawbacks e.g. there is no negation operation. We have improved the inference system by introducing operation of negation and additional opportunity to detect the possible contradiction of the system.

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