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Solving multiple sequence alignment problem utilizing integer linear programming

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Abstrak

One of the dominant problems in computational molecular biology is multiple sequence alignment (MSA) of DNA. Many methods have been proposed to solve MSA problem such as dynamic programming and heuristic. A method has been proposed by Althaus et al. to solve MSA problem which is based on integer linear programming (ILP). The general ILP formulation of the MSA is derived from the graph representation of the MSA problem. Although we have the general ILP formulation of the MSA problem, constructing the ILP model of an MSA that can be solved directly using an ILP solver is not straightforward. We develop a MATLAB program that can generate and solve the ILP model of an MSA problem. The method that is used to solve the ILP model is branch-and-bound. The constructed program can generate the ILP model of any given MSA problem but can only solve an MSA problem of a small number of short DNA sequences. The result of the program is the aligned sequences of the MSA problem.