Genetic Algorithms for Network Routing

ICTU Student 196
Thai Nguyen University of Information and Communication Technology
Thai Nguyen University, Thai Nguyen, Vietnam
student196@ictu.edu.vn

***Abstract*—This thesis explores the application of genetic algorithms (GAs) in network routing, focusing on the analysis of GA operators and their implementation in MATLAB. The work covers the basic concepts of GA, including its operators and structure, and applies GAs to solve optimization problems in network routing, such as finding the shortest path. The thesis also discusses the limitations and challenges of implementing GAs, emphasizing the need for appropriate parameter settings for specific problems. The author implemented GAs to find the shortest path in network routing, indicating the potential for finding optimal solutions. However, the thesis does not report specific numerical results from simulations or experiments, focusing instead on the theoretical aspects and potential applications of GAs in network routing.**

***Index Terms*—genetic algorithm, network routing, optimization, MATLAB, shortest path**

I. Introduction

The thesis aims to provide an overview of genetic algorithms and their application in network routing. It highlights the importance of finding optimal solutions in complex search spaces and the potential of GAs in addressing large-scale optimization problems in network routing. The work covers the basic concepts of GA, including its operators and structure, and applies GAs to solve optimization problems in network routing, such as finding the shortest path. The thesis also discusses the limitations and challenges of implementing GAs, emphasizing the need for appropriate parameter settings for specific problems. The author implemented GAs to find the shortest path in network routing, indicating the potential for finding optimal solutions [1]. Related earlier ICTU undergraduate theses provide context for this English summary [5], [6], [7]. Published articles on the methods and subject of this project provide context for this English summary [8], [9], [10], [11].

II. Methods

The methods section describes the analysis of genetic algorithms, their operators, and the implementation of GAs in MATLAB. The thesis uses MATLAB's Genetic Algorithm and Direct Search Toolbox and M-file functions to solve optimization problems related to network routing. The author implemented GAs to find the shortest path in network routing, using the toolbox and M-file functions to simulate and test the algorithms. The implementation involved setting up the initial population, defining the fitness function, and applying the genetic operators such as crossover and mutation [1].

Supervisor: ICTU Teacher 132, Thai Nguyen University of Information and Communication Technology.

III. Results

The thesis does not report specific numerical results from simulations or experiments. However, it mentions the application of genetic algorithms to find the shortest path in network routing, indicating the potential for finding optimal solutions. The author implemented GAs to find the shortest path in network routing, but the results are not quantitatively reported. The thesis suggests that the GA approach could be effective in solving complex network routing problems, but no empirical evidence is provided to support this claim [1].

IV. Discussion

The discussion section explains the principles of genetic algorithms and their application in network routing. It emphasizes the importance of parameter tuning for specific problems and the potential benefits of using GAs in network routing compared to other algorithms. The author implemented GAs to find the shortest path in network routing, but the results are not quantitatively reported. The thesis suggests that the GA approach could be effective in solving complex network routing problems, but no empirical evidence is provided to support this claim. The discussion highlights the need for careful parameter tuning and the potential benefits of using GAs in network routing [1]. Earlier ICTU undergraduate work by La Ngọc Tùng addressed genetic algorithm applied to optimization [4].

V. Conclusion

The conclusion reiterates the importance of genetic algorithms in solving complex optimization problems in network routing. It acknowledges the limitations and challenges in implementing GAs and suggests areas for future research. The author implemented GAs to find the shortest path in network routing, but the results are not quantitatively reported. The thesis suggests that the GA approach could be effective in solving complex network routing problems, but no empirical evidence is provided to support this claim. The conclusion emphasizes the need for further research to validate the effectiveness of GAs in network routing [1].

References

[1] ICTU Student 196, ”Genetic Algorithms for Network Routing,” internal undergraduate thesis (original in Vietnamese), Thai Nguyen University of Information and Communication Technology, 2010.

[2] Đinh Mạnh Tường (2002), Trí tuệ nhân tạo, NXB Khoa học kỹ thuật

[3] Nguyễn Đình Thúc (2001), Lập trình tiến hóa, NXB Giáo dục

[4] La Ngọc Tùng, ”Application of Genetic Algorithm in Transportation Problem,” internal undergraduate thesis, Thai Nguyen University of Information and Communication Technology, 2008.

[5] ICTU Student 40, ”Genetic Algorithms and Their Application to the Scheduling Problem,” internal undergraduate thesis, Thai Nguyen University of Information and Communication Technology, 2008.

[6] ICTU Student 66, ”An Investigation of Genetic Algorithms and Their Applications,” internal undergraduate thesis, Thai Nguyen University of Information and Communication Technology, 2008.

[7] ICTU Student 41, ”Multi-parent Crossover Operators in Real-Coded Genetic Algorithms,” internal undergraduate thesis, Thai Nguyen University of Information and Communication Technology, 2008.

[8] Hong-bin XIA, Wen-bo XU, Yuan LIU, ”Dynamic network routing algorithm combining AntNet with genetic algorithm,” Journal of Computer Applications, vol. 29, no. 4, pp. 1048-1051, 2009. DOI: 10.3724/sp.j.1087.2009.01048.

[9] Ji-liang ZHOU, Cai-xia LI, Qi-ying CAO, ”Multi-path routing optimization for wireless sensor networks based on genetic algorithm,” Journal of Computer Applications, vol. 29, no. 2, pp. 521-524, 2009. DOI: 10.3724/sp.j.1087.2009.00521.

[10] Marek Pilski, Franciszek Seredyński, ”An energy efficient routing algorithm based on genetic algorithm for ad hoc networks,” Annales UMCS, Informatica, vol. 8, no. 1, 2008. DOI: 10.2478/v10065-008-0004-6.

[11] M. Ericsson, M.G.C. Resende, P.M. Pardalos, ”A Genetic Algorithm for the Weight Setting Problem in OSPF Routing,” Journal of Combinatorial Optimization, vol. 6, no. 3, pp. 299-333, 2002. DOI: 10.1023/a:1014852026591.