An Investigation of Genetic Algorithms and Their Applications

ICTU Student 66
Thai Nguyen University of Information and Communication Technology
Thai Nguyen University, Thai Nguyen, Vietnam
student66@ictu.edu.vn

***Abstract*—This thesis provides an in-depth overview of genetic algorithms and their application in multi-objective optimization problems. The author discusses the general optimization problem and mathematical modeling, the history and structure of classical genetic algorithms, and various improvements to these algorithms. The work also covers evolutionary strategies and genetic programming. The author concludes that while the thesis covers a wide range of topics, it still has limitations, such as a lack of in-depth exploration of genetic algorithm applications and an unattractive user interface. The author hopes to further explore genetic algorithms and their applications in the future, using more appropriate programming languages.**

***Index Terms*—genetic algorithms, optimization, multi-objective, evolutionary strategies, TSP, programming**

I. Introduction

The thesis begins with an introduction to general optimization problems and mathematical modeling, followed by a detailed exploration of classical genetic algorithms, including their history, structure, and comparisons with traditional algorithms. The author also discusses improvements to classical genetic algorithms, such as selection methods, crossover techniques, and hybrid algorithms. The introduction sets the stage for the subsequent chapters, which delve into the intricacies of genetic algorithms and their applications [1]. Published books on the methods and subject of this project provide context for this English summary [9].

II. Methods

The methods section covers evolutionary strategies and genetic programming, including binary and real-valued evolutionary algorithms. The author applies genetic algorithms to solve the Traveling Salesman Problem (TSP), highlighting the challenges and solutions in the process. The author discusses the implementation of these algorithms, focusing on the selection of appropriate parameters and the design of the fitness function. The TSP problem is chosen as a practical example to demonstrate the effectiveness of genetic algorithms in solving complex optimization problems [1].

III. Results

The results show that the genetic algorithm successfully generated a near-optimal solution for the TSP problem. The author notes that the algorithm was able to find a solution that was close to the optimal path, but the process was time-consuming and required careful parameter tuning. The author also mentions that the implementation of the genetic algorithm was straightforward, but the user interface was not well-designed, which could affect the usability of the software [1].

Supervisor: ICTU Teacher 45, Thai Nguyen University of Information and Communication Technology.

IV. Discussion

The discussion section reflects on the knowledge gained during the study of genetic algorithms and their applications. The author acknowledges the limitations of the thesis, such as the lack of in-depth exploration of genetic algorithm applications and the unattractive user interface. The author expresses a desire to explore genetic algorithms and their applications further in the future, using more appropriate programming languages. The discussion highlights the need for more rigorous testing and validation of genetic algorithms in real-world scenarios [1].

V. Conclusion

The author concludes that the thesis covers a wide range of topics related to genetic algorithms and their applications, but still has limitations. The author hopes to receive feedback from teachers and colleagues to improve the thesis and address the remaining shortcomings. The conclusion emphasizes the importance of continued research and development in the field of genetic algorithms. The source also records the traveling-salesman application and notes limits of the user interface and available development time. These observations support further parameter testing and interface refinement rather than a claim of general optimality [1].

References

[1] ICTU Student 66, "An Investigation of Genetic Algorithms and Their Applications," internal undergraduate thesis (original in Vietnamese), Thai Nguyen University of Information and Communication Technology, 2008.
[2] Nguyễn Đình Thúc, Trí tuệ nhân tạo: Lập trình tiến hoá, Nhà xuất bản giáo dục thành phố Hồ chí Minh, 2001
[3] Hoàng Kiếm và Nguyễn Đình Thúc, về sự hội tụ quy hồi di truyền, Hội nghị khoa học trường ĐHKHTN lần 2, 2000
[4] Hoàng Kiếm, Lê Hoàng Thái, Giải thuật di truyền: Cách giải tự nhiên các bài toán trên máy tính, Nhà xuất bản giáo dục
[5] Võ Huỳnh Trâm, Trần Ngân Bình, Giáo trình trí tuệ nhân tạo, nhà xuất bản giáo dục
[6] Nguyễn Thị Thương, Khóa luận tốt nghiệp, 2005
[7] Hoàng Đình Hạnh, Luận văn thạc sĩ khoa học, 2006
[8] J.R.GOLDBERG - D.E.FOGEL, Genetic programming 1996 proceeding of the first annual conference, Cambrige, MA Mit press

[9] T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C. Stein, Introduction to Algorithms, 2nd ed. MIT Press, 2001. ISBN 9780262032933.