Investigation and Application of Skeletonization Methods for Image Processing

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***Abstract*—This thesis investigates various methods for skeletonization in image processing, focusing on sequential and parallel algorithms. It covers the basic concepts of image processing, including thinning methodologies and their applications. The author proposes improvements to existing algorithms, such as adding smoothing steps to the Hilditch algorithm to reduce excess branches. The work also explores the implementation and evaluation of several skeletonization algorithms, highlighting their performance and limitations. The thesis concludes with suggestions for further research and potential applications, such as electronic signature recognition. The author also discusses the strengths and weaknesses of the evaluated algorithms, emphasizing the need for further research to optimize their performance.**

***Index Terms*—image processing, skeletonization, thinning algorithms, parallel algorithms, Hilditch algorithm, Zang-Suen algorithm**

I. Introduction

The thesis provides an overview of image processing, including the concepts of digital images, image processing, and image representation. It then delves into the methods of skeletonization, discussing the requirements and characteristics of these methods. The author also evaluates several sequential and parallel skeletonization algorithms, proposing modifications to enhance their performance. The work covers the basic concepts of image processing, such as the representation of digital images, the thinning methodologies, and the applications of skeletonization algorithms. The author highlights the importance of understanding the underlying algorithms for practical implementation, especially in the context of electronic signature recognition. [1]

II. Methods

The thesis examines various sequential and parallel skeletonization algorithms, including the Hilditch, Yakei, Zang-Suen, Stentiford, Holt, and Rutovitz algorithms. The author proposes improvements to these algorithms, such as adding a smoothing step to the Hilditch algorithm to reduce excess branches. The methods are evaluated through experimental implementations and performance analysis. The author also discusses the implementation details of each algorithm, including the specific steps and conditions required for their execution. The evaluation focuses on the effectiveness and speed of each algorithm, providing a comprehensive comparison of their performance. [1]

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III. Results

The thesis reports the successful implementation and evaluation of several skeletonization algorithms, including the Hilditch, Zang-Suen, Stentiford, Holt, and Rutovitz algorithms. The results show the effectiveness and limitations of each algorithm in terms of performance and speed. The author also proposes modifications to existing algorithms to improve their performance. For instance, the Hilditch algorithm was modified by adding a smoothing step to reduce excess branches, while the Holt algorithm was enhanced by incorporating a step to remove staircases. These modifications significantly improved the quality of the resulting skeletons, reducing noise and improving accuracy. [1]

IV. Discussion

The author discusses the strengths and weaknesses of the evaluated algorithms, highlighting the need for further research to optimize their performance. The thesis suggests potential applications, such as electronic signature recognition, and emphasizes the importance of understanding the underlying algorithms for practical implementation. The author notes that while the evaluated algorithms have varying levels of effectiveness, they provide a solid foundation for further development. The proposed modifications, such as adding smoothing steps, demonstrate the potential for improving the performance of existing algorithms. The author hopes that the knowledge gained from this study can be applied to develop practical applications, such as electronic signature recognition. [1]

V. Conclusion

The thesis concludes that the evaluated algorithms have varying levels of effectiveness, and the author proposes further research to improve their performance. The author hopes that the knowledge gained from this study can be applied to develop practical applications, such as electronic signature recognition. The work highlights the importance of understanding the underlying algorithms for practical implementation and suggests that further research is needed to optimize the performance of these algorithms. The author believes that the proposed modifications, such as adding smoothing steps, can significantly improve the quality of the resulting skeletons, reducing noise and improving accuracy. [1]

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