Development of a Content-Based Image Retrieval System Based on Region

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***Abstract*—This thesis focuses on developing a content-based image retrieval system, specifically addressing the region-based approach. The author provides an overview of content-based image retrieval methods, emphasizing the region-based method and detailing its components such as color and structural features. The system uses the HSV color space to enhance search efficiency. The author reports the successful implementation of the system, noting that it achieves good search results. However, no specific numerical evaluations are provided. The author acknowledges the limitations and seeks feedback for future improvements, including potential applications in real-world scenarios such as supermarket product search and online image retrieval.**

***Index Terms*—content-based image retrieval, region-based, HSV color space, image search, structure-based, color-based**

I. Introduction

The thesis begins with an overview of content-based image retrieval methods, including keyword-based, content-based, semantic-based, and graph-based approaches. The author then emphasizes the region-based method, detailing its components such as color and structural features, and the evaluation of similarity measures and interaction with users. The author discusses the importance of region-based methods in image retrieval, highlighting their ability to capture the essence of images through color and structure. The author also mentions the challenges of implementing such a system, such as the need for efficient color space representation and the complexity of region segmentation [1].

II. Methods

The methods section describes the design and implementation of a content-based image retrieval system. The system includes modules for region-based, color-based, and structure-based image search. The author focuses on implementing the region-based search using the HSV color space, which is designed to improve search efficiency. The author explains the process of region segmentation, including the use of K-means clustering and Mean Shift algorithms. The author also discusses the evaluation of similarity measures, such as the Hausdorff distance and Earth Mover's Distance (EMD), to assess the effectiveness of the system [1].

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III. Results

The author reports the successful implementation of the system, noting that it achieves good search results. The system was tested using a dataset of images, and the author observed that the region-based search using the HSV color space provided accurate and relevant results. However, no specific numerical evaluations are provided. The author also mentions that the system was able to handle a variety of image types, including those with complex structures and colors. The author acknowledges that the system's performance could be further improved by expanding the dataset and applying it in real-world scenarios such as supermarket product search and online image retrieval [1].

IV. Discussion

The author discusses the limitations of the current implementation and suggests potential improvements, such as expanding the system to handle large numbers of images and applying it in real-world scenarios like supermarket product search and online image retrieval. The author also mentions the need for further research in the area of region-based image retrieval, particularly in the development of more efficient algorithms for region segmentation and similarity measures. The author acknowledges the need for user interaction and feedback to improve the system's performance and usability [1].

V. Conclusion

The thesis concludes that the developed system is effective for image retrieval based on the region, color, and structure. The author acknowledges the need for further development and improvement, particularly in handling large datasets and real-world applications. The author also emphasizes the potential of the system in practical applications such as supermarket product search and online image retrieval.

References

[1] ICTU Student 183, "Development of a Content-Based Image Retrieval System Based on Region," internal undergraduate thesis (original in Vietnamese), Thai Nguyen University of Information and Communication Technology, 2010.
[2] D.P.Huttenlocher,G.A.Klanderman and W.J.Ruck-lidge. Comparing images using the Hausdorff distance, IEEE Transactions on Pattern Analysis and Machine Intelligence,vol. 15, no. 9, pp. 850–863, 1993
[3] B. Yates, R. Neto. Modern Information Retrieval, Addison Wesley, 1999

[4] Phạm Việt Bình, (2007). Phát triển kỹ thuật dò biên, phát hiện biên và ứng dụng, Luận án tiến sỹ ngành Bảo đảm toán học cho máy tính và hệ thống tính toán, Viện Công nghệ thông tin – Viện Khoa học và Công nghệ Việt Nam
[5] Đặng Văn Đức. Hệ quản trị CSDL đa phương tiện, Giáo trình dành cho lớp Cao học - Khoa Công nghệ thông tin - Đại học Thái Nguyên
[6] Nguyễn Hữu Quỳnh, Ngô Quốc Tạo. (2007), Sử dụng đặc tính cục bộ của vùng phục vụ tra cứu ảnh phong cảnh. Kỷ yếu Hội thảo quốc gia "Một số vấn đề chọn lọc của Công nghệ Thông tin và Truyền thông", Đại Lải 14-15/9/2007, trang 608-616
[7] Đỗ Năng Toàn, Nguyễn Văn Tới, Nguyễn Thị Thu Hiền, (2008). Áp dụng thuật toán Octrees cho bước lượng tử trong quá trình phân đoạn ảnh màu bằng thuật toán Jseg, Tạp chí Khoa học và Công nghệ, Đại học Thái Nguyên, Tập 2(1), trang 80-84
[8] Nguyễn Văn Tới, Phạm Việt Bình, Nguyễn Tiến Thành, (2009). Sử dụng kỹ thuật phân lớp dữ liệu để tính toán các bins màu động trong tra cứu ảnh dựa trên màu sắc. Tạp chí Khoa học và Công nghệ, Đại học Thái Nguyên, nhận đăng
[9] D.Comaniciu and P.Meer. Mean shift analysis and applications. In Proceedings 7th International Conference on Computer Vision, Kerkyra, Greece.84
[10] Dengsheng Zhang, Aylwin Wong, Maria Indrawan, Guojun Lu. Content-based Image Retrieval Using Gabor Texture Features. Gippsland School of Computing and Information Technology Monash University Churchill, Australia
[11] Avril Styrman, Samppa Saarela. Ontology-Based Image Retrieval .University of Helsinki, Department of Computer Science; Helsinki Institute for Information Technology
[12] Carson, C., et al . Blobworld: a system for region-based image indexing and retrieval. Third Int. Conf. On Visual Information Systems, 1999
[13] Yossi Ruber, Carlo Tomasi and Leonidas J.Guibas. The earth mover's distance as a metric for image retrieval. Computer Science Department, Stanford University
[14] K.S. Ravichandran and B. Ananthi. Color Skin Segmentation Using K-Means Cluster. SASTRA University, Thanjavur, Tamil Nadu, India