

論文 / 著書情報
Article / Book Information

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学位種別(和文)	博士論文
Category(English)	Doctoral Thesis
種別(和文)	論文要旨
Type(English)	Summary

(博士課程)
Doctoral Program

論文要旨

THESIS SUMMARY

専攻 : Department of	知能システム科学	専攻	申請学位 (専攻分野) : Academic Degree Requested	博士 (學術) Doctor of
学籍番号 : Student ID Number			指導教員 (主) : Academic Advisor(main)	廣田 薫 教授
学生氏名 : Student's Name	TANGEL Martin Leonard		指導教員 (副) : Academic Advisor(sub)	

要旨 (英文 800 語程度)

Thesis Summary (approx.800 English Words)

This thesis, entitled “Fuzzy Guided Segmentation and Labeling for Dental Based Personal Identification System,” consists of six chapters.

Chapter 1 「Introduction」 mentions various difficulties and challenges of identifying victims of massive disasters and how the proposed dental based personal identification system can provide effective solutions. In addition, several dental radiograph types with their advantages and disadvantages are mentioned.

Chapter 2 「Fuzzy Logic based Multi Agent System Approach for Radiograph Segmentation」 explains about the proposal “Fuzzy Logic based Multi Agent System Approach for Radiograph Segmentation.” The proposal has capabilities to obtain natural segmentation result that achieves balance separation between teeth and background of radiograph. The proposal works by spreading agents into the 33% area of the radiograph randomly and running the predefined algorithm. Each agent can die, move around, and produce offspring. After several iterations, once the convergence criteria are achieved, the pixel that is occupied by the active agent is considered as the object pixel (tooth). Based on the experiments on 122 radiographs from the faculty of dentistry, University of Indonesia, the proposal suggests 71.91% segmentation accuracy, 16.36% accuracy improvement compared with the classical approach that does not use fuzzy logic. This result gives insight for an improved method in Chapter 3.

Chapter 3 「Multiscale Image Aggregation for Dental Radiograph Segmentation」 presents an improved segmentation method that does not require iteration like the one using multi agent system. The proposal has capabilities to make adaptive adjustment of the fuzzy rules and perform segmentation without iteration. The proposal works by creating three scaled-down radiographs with sizes 50%, 25%, and 12.5% of the original input radiographs. Each of the scaled-down radiographs is a subject to fuzzy inference system based segmentation algorithm. The segmentation results from each different scale are averaged aftermath to form an average of four segmentation radiographs. This process produces a radiograph that is easier to be segmented. From experiments on 122 radiographs, the proposal reaches up to 77.7% accuracy and the improvements is confirmed by T-test. These results suggest the applicability of the proposal to be used as a submodule for dental classification that is explained in chapter 4.

Chapter 4 「Multiple Fuzzy Attribute for Dental Classification on Periapical Radiograph」 explains about a classification method for special type of radiograph, called periapical radiograph. This chapter shows one of the pioneer studies for the segmentation in periapical radiograph that is more representative to the victims' dental conditions. In addition, the proposed method provides a classification method that avoids speculative classification; therefore it performs its assistive functions for forensics and minimizes errors at the same time. The complexity is quadratic, linear to the number of the pixels. The proposal works by calculating the integral projection of the segmentation result from the algorithm used in Chapter 3. As the result, from the local minima detected in the integral projection result, each tooth can be isolated. From each isolated tooth,

several measurements such as width, length, area, and perimeter of tooth can be extracted and used for the classification purpose. The classification process uses fuzzy inference and the output is an output radiograph where each tooth are labeled as molar, premolar, canine, or incisor tooth. From experiments on 78 periapical radiographs, average classification accuracy 82.51% is achieved. These experiments also give insight of the nature of lower and upper jaw different challenges that provides information for the next research. This proposal is a submodule for the dental based personal identification system that is mentioned in chapter 5 as well as for the one that is being developed in the University of Indonesia.

Chapter 5 「Implementation for Dental Based Personal Identification System and Its Potentials」 shows proposals implementation for dental based personal identification system that yields fast retrieval performance with 8 correct retrieval from 10 queries. This implementation proves that the concept and system architecture suggested can be realized. This realization is vital as this implementation shows the feasibility of the algorithm to be implemented in the real world system. The application on general application such as deep level emotion understanding that requires classification is also briefly mentioned.

Chapter 6 「Conclusions and Future Perspective」 concludes the whole proposals and their implementations. Several perspectives such as its implementations to multimodal identity archiving system and problem-domain based algorithmic enhancements are mentioned. This chapter also shows that the main goal stated in the beginning of research is successfully achieved while several tailored methods and techniques are introduced to deal with the domain-specific problems and challenges.

To sum up, two methods of dental segmentation and a method of dental classification are proposed and its implementation to dental based personal identification system is realized. Their merits and broader potentials for other applications are discussed. As the result, these works build the whole contents of this Ph.D. dissertation.

備考：論文要旨は、和文 2000 字と英文 300 語を 1 部ずつ提出するか、もしくは英文 800 語を 2 部提出してください。

Note : Thesis Summary should be submitted in either a copy of 2000 Japanese Characters and 300 Words (English) or 2 copies of 800 Words (English).