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Title	二次元warpingを用いた頸部X線画像からの骨年齢推定 に関する研究
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Citation	
Issue Date	2002-03
Туре	Thesis or Dissertation
Text version	author
URL	http://hdl.handle.net/10119/1552
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Description	Supervisor:下平 博, 情報科学研究科, 修士



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Estimation of bone age from cervical vertebrae X-ray image using Two-dimensional warping

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February 15, 2002

Keywords: bone age,two-dimensional warping,cervical vertebrae,skeletal maturation function.

1 Introduction

The degree of maturity of the bone accompanied by growth is called bone age. This is one of freatures necessary for deciding the policy of the growth diagnosis and the correction treatment in this field of the orthodontics department. A part of evaluatin of bone age which depends on a subjective evaluation from doctor. So ,The evaluation error is caused in this by the doctor. Therefore, there hos been a great deal of demand to develop a computerized automatic analysis for the assessment of bone age.

In this research, not hand bone X-ray image but cervical vertebrae X-ray image is used. In the past, bone age was evaluated by using hand bone X-ray image for the correction treatment. Therefore, both hand bone and cervical vertebrae images ware necessary.

Based on such persent condition, it aims at developing the technique of predictiong automatically bone age from cervival vertebrae X-ray image using a computer by this research.

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2 Bone age evaluation

2.1 ROI image

Cervival vertebrae is composed by some bones. The third cervical vertebrae, the fourth cervical vertebrae, and the fifth cervical vertebrae are used for ROI in this reseach.

2.2 Pre-processing

The pre-processing of out method is followed:

• Reduction of image

The image is redeced for the reduction of the amount of the calculation.

• Median Filter

To remove the small noize in ROI image, we equalize data by using median filter.

• Cutting out

This oparation done manually.

• Giving of characteristic

The shape of the cervical certebrae is complex. The thing to obtain an accurate characteristic by the automatic operation is difficult. Therefore, the characteristic was given to the ROI image which became a reference pattern beforehand.

• The skeletal maturation function Using the given characteristic, The skeletal maturation function is requested by using multiple linear regression analisis. The bone age is presumed by using this function.

2.3 Evaluation method

Two-dimentional warping transform one side of two images to approach the other one. Bone age estimation was attempted by two methods. First method is estimate bone age only using two-dimensional warping distance. Secondarily, the age of the estimation bone age is output by the thing to input the characteristics of image to the skeletal maturation function ,which origin of the idea of input image are approaching the reference images .

3 Conclusion

The estimation error is 0.87 years old and the correlation coefficient is 0.94 by the thing to use two-dimensional warping which is elastic matching minimization of the distance between images. Using two-dimensional warping has been understood that the bone age with high accuracy can presume.

The error of a low age from 4 to 6 years old is growing compared with other age. This problem can be evaded by the thing to increase the pattern of the image from 4 to 6 years old.