

# CHAPTER 5 EXPERIMENTAL RESULTS AND ANALYSIS

## 5.1 Introduction

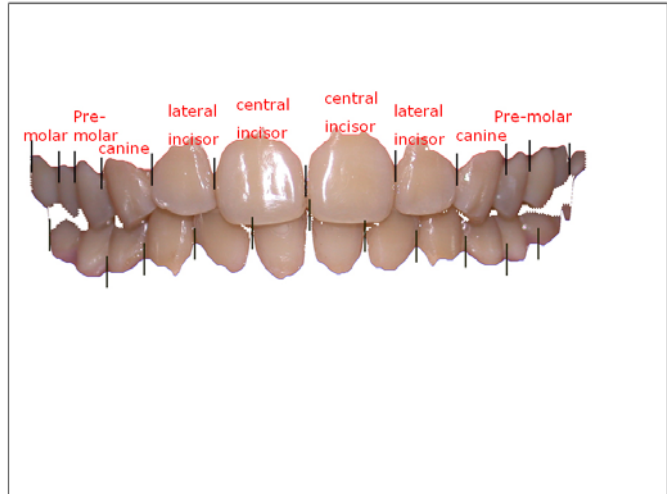
In this chapter, we present and discuss some experimental result.

The proposed system is developed on the Pentium 4 2.0GHz personal computer with 512M RAM. The software development environment includes: (1) Microsoft Windows XP, (2) Microsoft Visual C++ 6.0 with MFC (Microsoft foundation Class). Our test samples are acquired by digital camera. We use some tool such as lip retractor to expand mouth so that we can see the whole tooth regions. The output image resolution of the digital camera is 2048x1536, which is the input resolution of our system. The training data has 50 images. The test data has 130 images.



## 5.2 Experiments of tooth segmentation

We show results of tooth segmentation from Fig. 5.2.1 to Fig. 5.2.5.



(a)



(b)

Fig. 5.2.1 Tooth segmentation in the front view



(a)

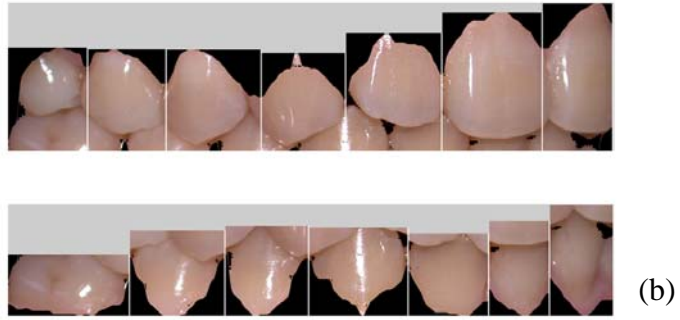


Fig. 5.2.2 Tooth segmentation in the right view

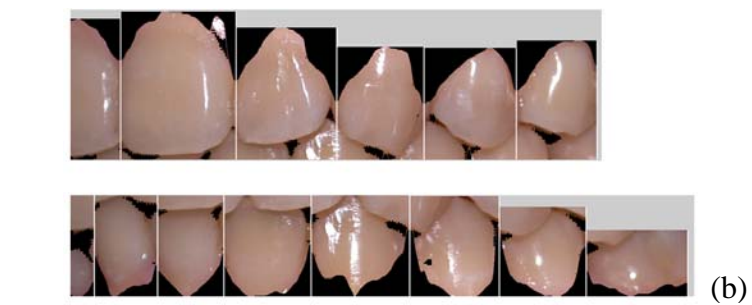


Fig. 5.2.3 Tooth segmentation in the left view

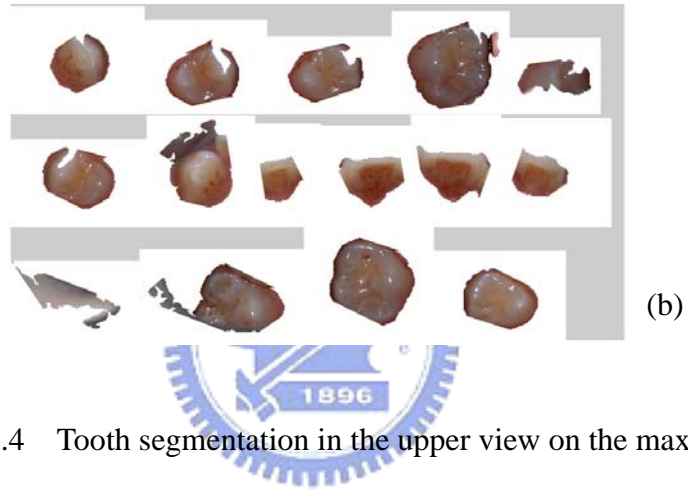
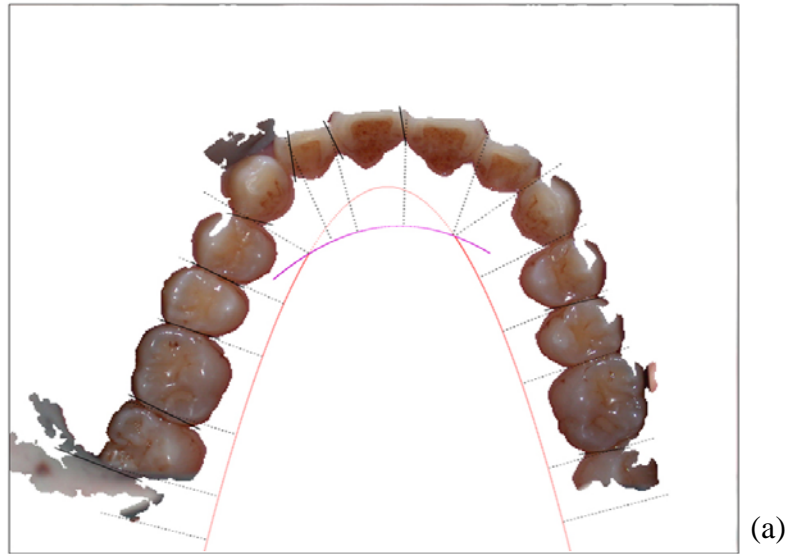
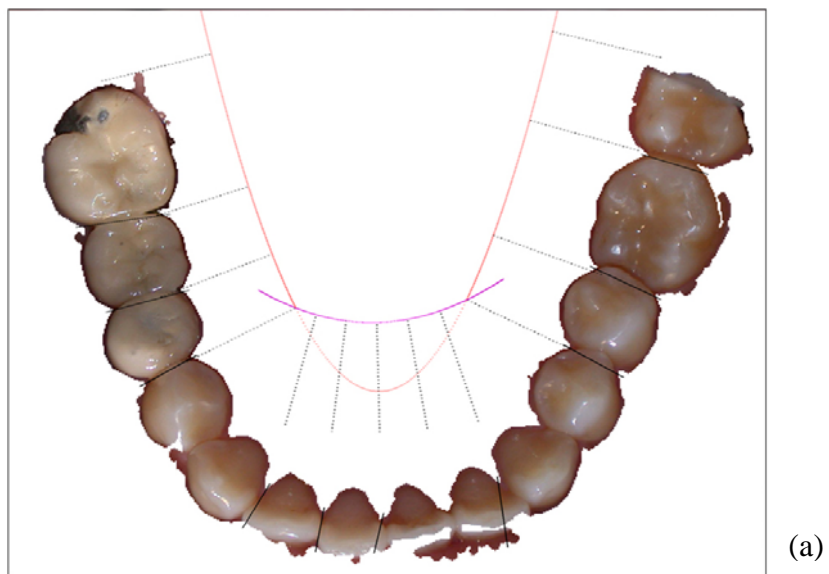


Fig. 5.2.4 Tooth segmentation in the upper view on the maxilla



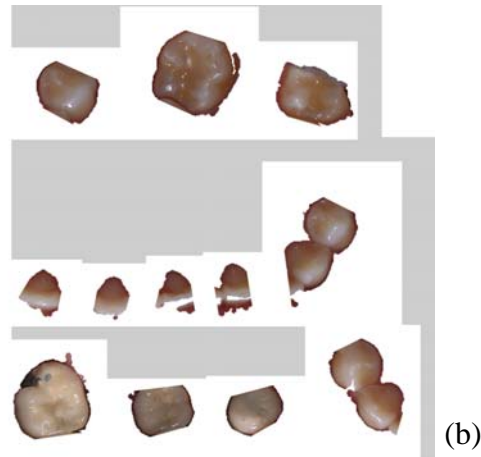


Fig. 5.2.5 Tooth segmentation in the upper view on the mandible

We show the result of tooth segmentation. The experiment is divided into five categories: tooth segmentation in the front view, the left view, the right view, the upper view on the maxilla, and the lower view on the mandible.






	#success	#total	Correct rate
the front view 	550	612	89.8%
the left view 	367	398	92.2%
the right view 	353	388	90.9%
the upper view on the maxilla 	337	361	93.3%
the lower view on the mandible 	356	379	93.9%

Table 5.1.1 Correct rate of tooth segmentation

### 5.2.1 Correctness of tooth segmentation

Correctness definition is defined as follow.

If a cut point falls into the correct position of segmentation which is the valley separating two neighboring teeth, we view it as a correct case.

### 5.2.2 Error analysis for tooth segmentation

Error analysis (A):

In upper teeth, the slope usually was flat in the right side and left side so that we could not exactly found the valley such we cannot segment teeth correctly in the left side of Fig. 5.2.6.

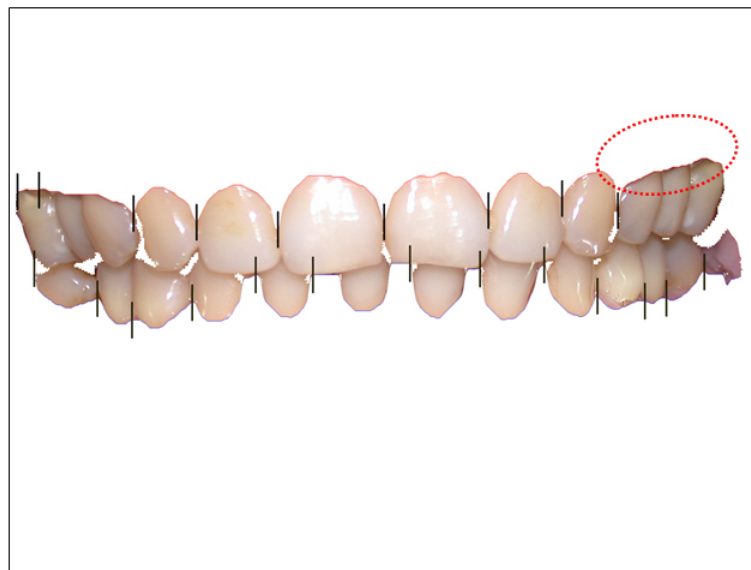


Fig. 5.2.6 Error analysis of tooth segmentation

### Error analysis (B):

Some noise and some teeth which are not well-aligned tooth segmentation. Since some non-tooth region is not excluded exactly, we cannot obtain a precise wave of the teeth to segment teeth properly. Due to some not well-aligned, we also cannot gain a correct wave of teeth to segment teeth. Therefore, we cannot cut properly in such example.

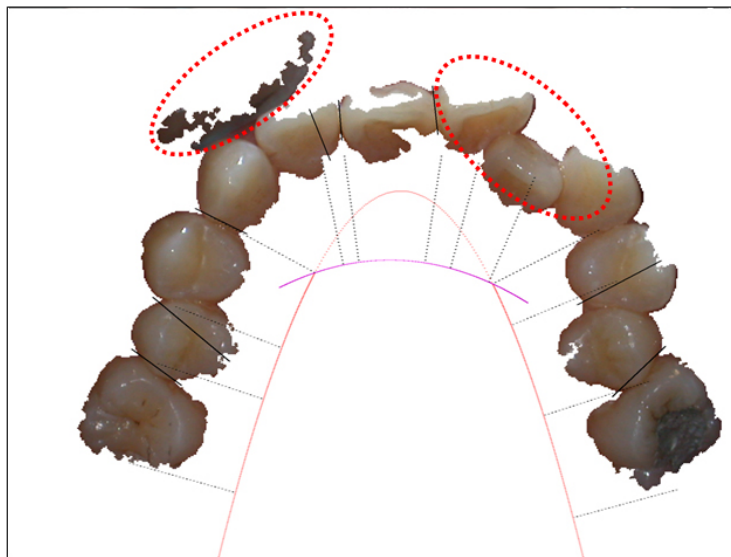


Fig. 5.2.7 Error analysis of tooth segmentation

## 5.3 Experiments of amalgam detection

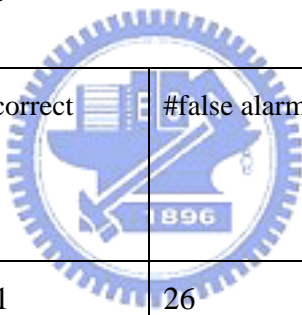
### 5.3.1 Amalgam detection

#### **Correct detection:**

Detecting a tooth is amalgam and its status is really amalgam.

#### **False alarm detection:**

Detecting a tooth is amalgam but its status is not amalgam.



#total teeth	#total amalgam	#correct	#false alarm	False alarm rate	correct rate
396	85	81	26	6.5%	95.2%

Table 5.3.1 Correct rate of amalgam detection



### 5.3.2 Error analysis for amalgam detection

Error analysis (A):

Regions of amalgam affected by a flashlight were too bright so that it can not be detected effectively such as Fig. 5.3.1. We cannot obtain the amalgam regions.

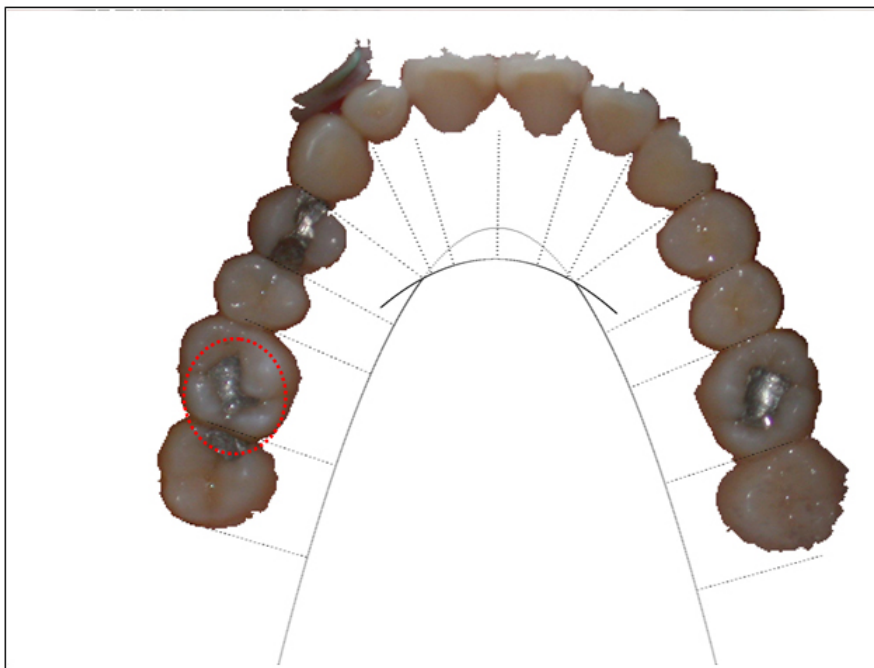


Fig. 5.3.1 Error analysis of amalgam detection

### Error analysis (B):

Colors of metal crown such as Fig. 5.3.2 are similar to that of amalgam so that the metal crown is mistaken as the amalgam.

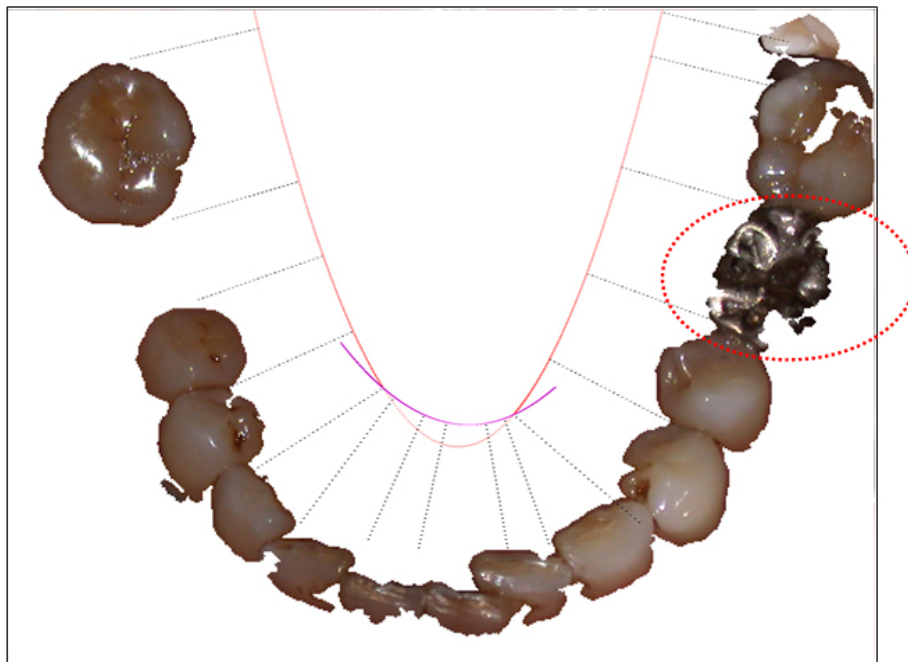


Fig. 5.3.2 Error analysis of amalgam detection with mistaken others as amalgam

### Error analysis (C):

Some parts of lip retractor colors such as Fig. 5.3.3 are similar to that of amalgam so that some parts of lip retractor are mistaken as the amalgam.

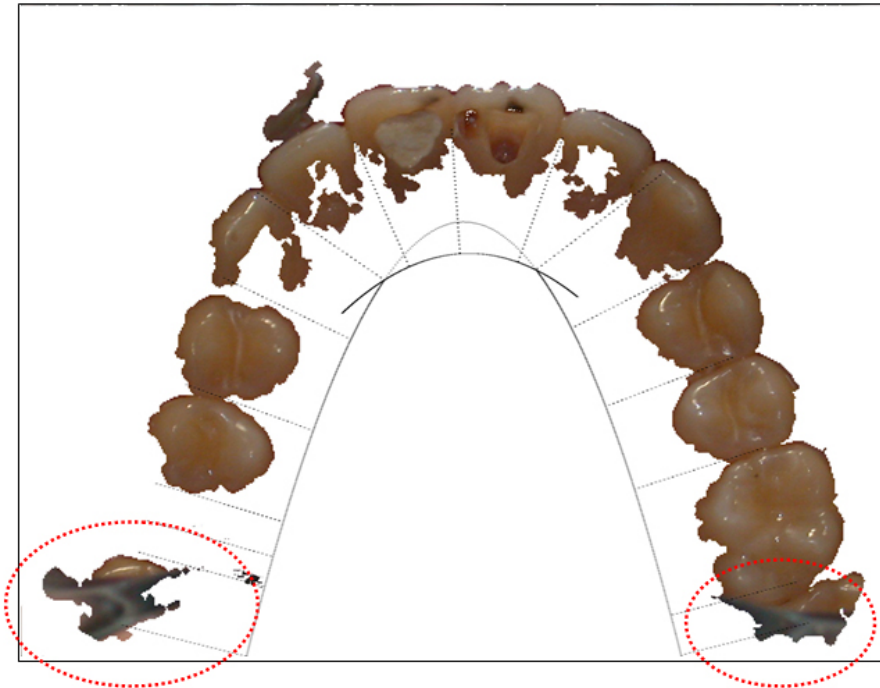


Fig. 5.3.3 Error analysis of amalgam detection with mistaken others as amalgam

## 5.4 Experiments of missing teeth detection

#correct	#total	Correct rate
14	16	87.5%

Table 5.4.1 Correct rate of missing teeth detection

### 5.4.1 Correctness of missing teeth detection

Detect existence of a missing tooth and it is really a missing tooth.

### 5.4.2 Error analysis of missing teeth detection

Error analysis (A):

In line-aligned images, we mistake the missing tooth as a normal tooth due to angle of capturing image.



Fig. 5.4.1 Error analysis of missing teeth detection



Error analysis (B):

Some non-tooth region is mistaken as a normal tooth but is a missing tooth in fact. For example, we cannot find a hole in the wave of teeth so that we mistake a missing tooth as a normal tooth in Fig. 5.4.2.

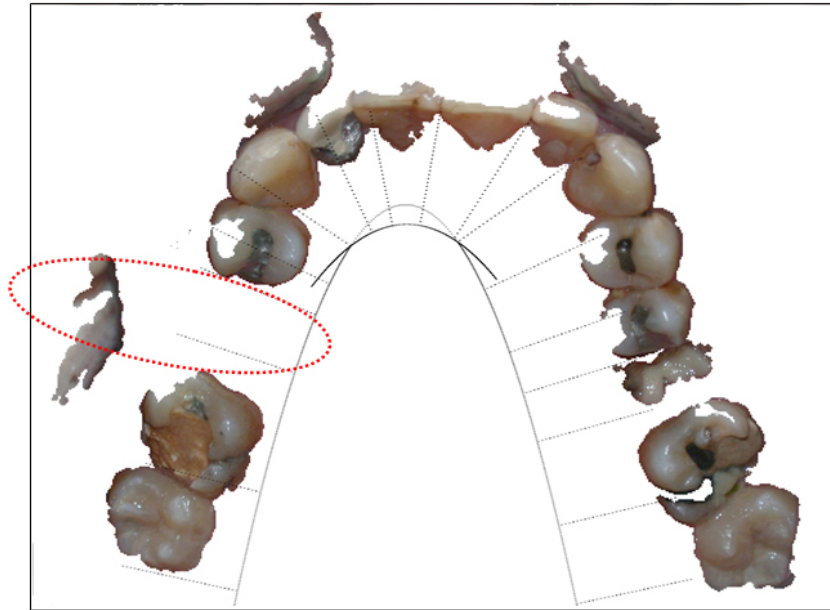


Fig. 5.4.2 Error analysis of missing teeth detection

