

## CV 2010/2011

**Note:** This is a full MSc Thesis Proposal. This document should be used only as introduction and motivation for the topic. The specific work for the MAP-I CV course project will be discussed between the supervisor and the students.

**Team size:** 2 students.

Orientadores:

Jaime S. Cardoso ([jaime.cardoso@fe.up.pt](mailto:jaime.cardoso@fe.up.pt)), Gilson Giraldi ([gilson@lncc.br](mailto:gilson@lncc.br))

Responsável pelo acompanhamento do trabalho na instituição:

Jaime S. Cardoso ([jaime.cardoso@fe.up.pt](mailto:jaime.cardoso@fe.up.pt))

Título:

Semi-automatic computer aided lesion detection in dental X-rays

Áreas envolvidas:

Aplicações Médicas; Processamento de Imagem e Visão por Computador

Resumo:

The diagnosis of many dental anomalies would be impossible without radiographs, because of their location in the mineralized tissues (bone and teeth) or because they are hidden under the surface of the cortical plate that cannot be seen during a visual examination in dental practices. The use of radiographs is indispensable during the treatment phase, e.g., during root canal treatment to monitor the progress of the root preparation, or to know the orientation of wisdom molars to be extracted. The effect of dental treatment of bony structures, e.g., the treatment of periodontal defects or the success of an apicoectomy can be established by radiographic examination only.

However, although digital dental X-rays are becoming widely used, it is a challenging task to do automatic, or even semiautomatic, computer aided dental X-rays analysis.

Dental X-rays analysis is a challenging problem for classic image processing methods due to the following characteristics: (1) poor image modalities: noise, low contrast, and sampling artifacts; (2) complicated topology; (3) arbitrary teeth orientation; and (4) lack of clear lines of demarcation between regions of interest, which is especially true for dental X-rays since problem teeth tend to have very complicated structures and are normally coupled with healthy teeth. Therefore dental X-rays are normally inspected by a dentist. Although efficient, human inspection requires specialized training and a dentist's time, which are increasingly expensive. Moreover, human inspection gives a subjective judgment, which may vary from dentist to dentist, and, as such, does not give a quantitative measurement. Inspection results could be affected by many factors, such as fatigue and distraction by other features, especially the main features they are looking for, in the image, for example. Also, some early lesions may not be even visible to the human eye. All of these issues indicate a need for effective automatic or semi-automatic dental X-rays analysis.

Objetivos e resultados esperados:

Review and compare the state of the art techniques for the processing and analysis of dental x-ray images. Explore new models for the segmentation of dental x-ray images based on wavelets and hierarchical level sets. Semi-automatic extraction of important points in the dental x-ray image. Development of a workstation implementing the aforementioned algorithms.

Plano de trabalhos (incluindo plano de trabalho):

- 1) Acquisition the necessary knowledge to develop the research work, including wavelets and hierarchical level sets;
- 2) Review of the state of the art in dental x-ray image processing and analysis;
- 3) Critical comparison of the state of the art techniques for dental x-ray image processing and analysis;
- 4) Proposal and implementation of new segmentation algorithms for dental x-ray images;
- 5) Implementation of algorithms for the semi-automatic extraction of fiducial points in the dental x-ray image;
- 6) Development of a workstation for the semi-automatic analysis of for dental x-ray images;
- 7) Writing of the dissertation and of a scientific article;
- 8) Preparation of the thesis defence.

Aspectos inovadores:

Development of novel algorithms for the segmentation of dental x-ray images.

Conferências científicas na área da dissertação:

CVPR – IEEE Computer Society Conference on Computer Vision and Pattern Recognition  
ICCV – IEEE International Conference on Computer Vision  
VISIGRAPP – International Joint Conference on Computer Vision, Imaging and Computer Graphics Theory and Applications  
SIBGRAPI – Simpósio Brasileiro de Computação Gráfica e Processamento de Imagens  
WVC: Workshop de Visão Computacional

Referências bibliográficas:

Shuo Li, Thomas Fevens, Adam Krzyzak, Chao Jin, Song Li, Semi-automatic computer aided lesion detection in dental X-rays using variational level set, Pattern Recognition, 2007.