



# Master in Artificial Intelligence (UPC-URV-UB)

## Master's Thesis Proposal<sup>1</sup>

### General Information

Title: *Automatic keyframe extraction in Intravascular Ultrasound Image Sequences*

Expiry Date: 11/04/12  
Modality: technological project  
X research work  
Advisor/s: Oriol Pujol  
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Observations:  
Student's Name:  
(if already known)

### M.Sc. Thesis Description

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<sup>1</sup> Each M.Sc. Th. Proposal should be in a separate file, named as follows: "MSc-Th-Proposal-2-or-3-title-first-words-Advisor/s-AcademicYear.pdf".

For Example: "MSc-Th-Proposal-Syntactic-and-Semantic-LluisMarquez&JesusGimenez-1011.pdf"

The proposal could be elaborated with any text processor (Word, Openoffice, etc.), but the file electronically delivered to LSI Dept. Secretary ([merce@lsi.upc.edu](mailto:merce@lsi.upc.edu)) MUST BE a single PDF file

## Main issues / Brief Description [Mandatory]:

This Master Thesis is focused on Intravascular Ultrasound (IVUS) Image analysis and understanding as one of the most prominent imaging technique to inspect vessels and guide their intervention. Similarly to summarizing movies in few shots/scenes, our goal will be to define an automatic method for keyframes detection and summarization of IVUS sequences based on Computer Vision and Machine Learning. Since the presence of strong artifacts affect the IVUS frame interpretation, a context-based classification method based on Conditional Random Fields will be studied and a key-frame extraction method based on the classification results will be proposed.

## Detailed Description including a task planning [Mandatory]:

Intravascular Ultrasound videos is a unique imaging technique that allows to guide interventions of coronary vessels and visualize atherosclerotic plaque. Today physicians should inspect long videos of up to 3000 frames during patient intervention before choosing the proper treatment. In this Master thesis we will study how to summarize the videos in a few specific key frames that will create fast video representation and allow for rapid decision making of physicians. In particular, critical parameters like lumen area or atherosclerotic plaque amount and composition determine the choice of the most adequate intervention: stent type, need of performing a pre-dilation before stenting, and pressure for the balloon-dilation.

The detection of most salient vascular phenomena is a keypoint for the choice of the appropriate treatment. Up to this moment, keyframe extraction is usually performed on general video analysis but not on medical imaging. We aim at proposing a method for the automatic keyframes detection and summarization of IVUS sequences based on the analysis of morphological vessel profile. Since the presence of strong artifacts affects the IVUS frame interpretation, we will develop strong techniques for context-based multi-class classification. The work will be developed in a close collaboration

of one of the most important hospitals of Catalunya and the company that is a main developer of IVUS imaging techniques.

## Task planning:

- Review of the state of the art techniques for video keyframe extraction.
- Intravascular keyframe database construction
- Implementation of a content based keyframe system.
- Validation in in-vivo cases.

## References [Mandatory]:

Chatzigiorgaki, M., Skodras, A.N.: Real-time keyframe extraction towards video content identification. (2009) 934–939

Lafferty, J., Mccallum, A., Pereira, F.: Conditional random fields: Probabilistic models for segmenting and labeling sequence data. In: ICML. (2001) 282–289

Ciampi, F., Pujol, O., Fernndez-Nofreras, E., Mauri, J., Radeva, P.: Ecoc random fields for lumen segmentation in radial artery ivus sequences. MICCAI 5762 (2009) 869–87

## Minimal Requirements & Previous Knowledge [Optional]:

Computer Vision knowledge recommended

## Other comments [Optional]:

Location and Date: Barcelona, November 1st 2010

**To the Academic Commission of the Master in Artificial Intelligence (CAIMIA)**