

## Automatic intravascular ultrasound image segmentation method

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**Keywords:** Image processing, simultaneous segmentation of multiple vessel structures, intravascular ultrasound

### Background

The intravascular ultrasound (IVUS) technology is a catheter based medical imaging technique that produces cross-sectional ultrasonic images of blood vessels in which the lumen, intima, atherosclerotic plaque structure, and media of the wall are visible. Over the past few years, this technology has become a useful tool both in research and in some clinical applications, particularly in atherosclerotic disease studies.

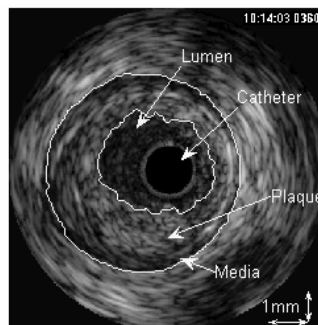
The IVUS modality produces a large amount of data, which makes by-hand analysis long and fastidious. In order to facilitate the examination of intravascular ultrasound series, IVUS users require automatic identification of anatomical structures of the vessel wall. However, contour detection is a difficult task because IVUS image quality is compromised by speckle noise, imaging artifacts, and shadowed parts of the vascular wall caused by plaque components like calcifications. Given these limitations, there is an obvious need for the development of specific IVUS segmentation methods.

### Technology

The IVUS contour detection problem is addressed with a multiple interface fast-marching segmentation model. The vessel wall boundaries are modeled as layered contours that propagate simultaneously under a new speed function. This function is based on a combination of complementary region and contour information, namely the gray level probability density functions (PDFs) of the vessel wall structures and the image gradient. The multiple interfaces are propagated in the 3D IVUS series after their initial automatic positioning. This segmentation model handles topological changes and contour irregularities often shown by the atherosclerotic plaque structure.

### Results

The following figure shows automatically detected contours that are very close to the vessel lumen and media of a typical cross-sectional intravascular ultrasound image.



### Applications

- Boundary detection in 3D images of multi-layered vessels or structures, such as intravascular ultrasound series.
- Computation of plaque volume, intima-media thickness, percentage of stenosis, and vessel remodeling from detected boundaries.
- Precise evaluation of the atherosclerotic disease in progression-regression pharmaceutical protocols or in difficult diagnosis cases.

### Competitive Advantages

With this new IVUS segmentation method, based on a multiple interface propagation model, all vessel wall layers are automatically detected in parallel. The combination of global and local image information in this new segmentation model increases the segmentation robustness of the noisy IVUS images.

### Patent Status

PCT application #CA2004/001970

### Business Opportunity

Univalor is seeking an exclusive licensing agreement or contracts with a commercial partner.

### Contact

**Anne-Marie Larose, MBA, Ph.D.**  
Manager, Business Development, Life Sciences  
**Univalor**  
+1 (514) 340-3243 ext. 4239  
[anne-marie.larose@univalor.ca](mailto:anne-marie.larose@univalor.ca)

**Guy Cloutier, Eng., Ph.D.**  
Director LBUM – Professor  
**CRCHUM / University of Montréal**  
+1 (514) 890-8000 ext. 24703  
[guy.cloutier@umontreal.ca](mailto:guy.cloutier@umontreal.ca)