Reviewer’s report

Title: Automated classification of dense calcium tissues in gray-scale intravascular ultrasound images using a deep belief network

Version: 1 Date: 09 Oct 2019

Reviewer: Jouke Dijkstra

Reviewer's report:

Automated classification of dense calcium tissues in gray-scale IVUS images.

First of all, the ground truth of the classification is based upon VH-IVUS. There has been a lot of discussions about the validity of VH-IVUS. The authors of this paper present a method which can nicely reproduce the VH dense calcium classification in regions of interest in gray-scale image with using the RF signal like used by VH.

It would be good that the authors would mention this limitation of the method. Furthermore, the amount of calcium is difficult to estimate in IVUS due to the high reflectance of calcium and what is happening in the shadow zone in unknown. This limitation is also true for the VH classification.

More in detail:

Page 2, line 22: VH does not recognize the media, it is an artificial layer created just inside the media-adventitia border.

Page 2, line 25: I think the authors overrate the importance of calcified tissue. The presence of "soft tissue" is also very important for the prognosis for the patient, especially with respect to the vulnerable plaque.

Page 2, Line 35: The RF signal is analysed using the ECG gated acquisition to reduce the amount of data to be processed. Especially in older system the amount of data which could be handled real-time was limited and therefore it was decided to analyse a subset of the IVUS frames. Technically all frames can be analysed with RF analysis.

Page 3: Line 25: What is meant by the unnecessary dead zone? The centre of the image is the position of the IVUS catheter and by leaving in the black zone, the spatial measurements can be performed correctly.

Page 3, line 36: The analysis has been performed suing this threshold method. How many DC regions are missed due to this threshold method?
Section feature extraction: A lot of these features are standard features which are described elsewhere. This part could be much shorter.

Page 7, line 20: Disagree with this statement. Too strong.

Page 7, line 27. Still it is not clear what the benefit of this method is above the traditional indication of calcified regions. The amount of calcium is still difficult to indicate.

Page 7, line 46: I did not see any genetic algorithm in this paper.

Page 7; line 54: Not clear what is meant by sporadically distributed plaques in the inner vessel.

Page 8, line 26: Necrotic cores typically are dark on IVUS image and calcium is bright. I do not see much overlap in their intensity.

Page 8, line 26: How well can VH classify Necrotic Core tissue?

Page 8, line 32: So it take 0.7 sec per frame. This means it cannot process the data with 30 frame per second and ends up with similar longitudinal resolution as VH.

Page 8, line 57: Adding OCT is much more complicated than stated here.

Overall: There are no images showing the classification results and the corresponding VH map.

Are the methods appropriate and well described?
If not, please specify what is required in your comments to the authors.

No

Does the work include the necessary controls?
If not, please specify which controls are required in your comments to the authors.

Yes

Are the conclusions drawn adequately supported by the data shown?
If not, please explain in your comments to the authors.

Yes

Are you able to assess any statistics in the manuscript or would you recommend an additional statistical review?
If an additional statistical review is recommended, please specify what aspects require further assessment in your comments to the editors.

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