Reviewer's report

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

Version: 0 Date: 26 Feb 2019

Reviewer: Marta Zerunian

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

General Comments:

This paper aimed to automatically assess the dense calcium (DC) tissue in the gray scale intravascular ultrasound (IVUS) images using the image textural features.

A total of 316 gray-scale IVUS and corresponding virtual histology images were acquired from the right coronary arteries of 26 patients during cardiac catheterization. The DC tissue and corresponding acoustic shadow regions were automatically determined, and manually corrected by a clinician, using the dual-threshold-based segmentation method. Then, a selected feature groups were extracted from the DC candidates. To reduce the dimensionalities, principal component analysis was performed followed by a varimax rotation. Then, the 90% of the whole data obtained with their selected features were used as an input as training set for a deep belief network. Classification performance of the proposed method was validated with the remaining 10 % of data in terms of specificity, sensitivity, positive predictive value, negative predictive value, accuracy, and the area under the ROC curve.

Results showed that the feature dimensionality was reduced by over 50% and the classification performance was slightly improved simultaneously. Moreover, the proposed method had a relatively high sensitivity level of 91%.

The manuscript lacks of important details in the material and method section, and the technical description makes it difficult to read and understand the medical relevance of the importance of the study. The discussion should be rewritten after fixing the issues addressed below. Please see specific comments.

Specific comments:

Title: Ok.

Keywords: ok.

Abstract:
- Please add the word ultrasound after intravascular in Background section.
- Rewrite Methods section and describe shortly if the study is prospective/retrospective and add some information about the number of readers, how the analysis was performed, the kind of sonographer used and what is virtual histology.
- Please report all the results cited in the Methods section including values and corresponding pvalues.

Abbreviations: a list of abbreviation is missing, please add.

Introduction:
- Add a short description regarding texture analysis approach.
- P3L49-50 and P3L57-58 please add some references.
- Please avoid expression as Finally in the Introduction section.
- Please reformulate the purpose of the study in order to make it concise and synthetic avoiding consideration regarding the study structure itself as wrote in P4L6-19.

Materials and methods:
- Patients selection: please add a specific section regarding patients enrolment, inclusion/exclusion criteria, study design (prospective/retrospective), patients preparation for cardiac catheterization.
- Image Data acquisition:
  - Please add some information regarding the clinician who performed the segmentation (e.g. years of experience in the specific sub-specialty).
  - P4L28-29 "Prior to image acquisition…border were automatically determined", please explain in a more detailed way how to get to the image acquisition describing information such as probe used, patients' position and all the information needed in order to make the scientific study reproducible.
  - Please specify the total of plaques recorded.
- Segmentation of DC candidate and acoustic shadow regions:
  - Please specify the term THhigh prior to use it.
- Feature extraction: please specify the software used to extract features. Moreover, all the following sub-section are too technical for a medical imaging purpose even if they are necessary to make the study reproducible. Consider to move the detailed description in an appendix section and just briefly describe them in the whole body of the manuscript.
  - Please describe in a more clear way the two subset of data used separately for training and validation analysis and move the description given in the result section in the methods section.

Results:
- Please expand the patient section with more information.
- Please describe the range of significance.
- Please move the "Comparison with our preliminary study" in the Discussion section.
- In order to use this approach in clinical management, please add some information regarding the total amount of time necessary to perform the whole process of assessment of the plaque from the segmentation to the validation process.
Discussion:
- Should be rewritten basing of the comment of the above sections.

Conclusion:
- Should avoid redundancies and should be written in order to emphasize the innovation of the method and the clinical impact of it.

References: see introduction section.

Tables: ok.

Figures: Please expand all the capture present in the manuscript in order to described more in detail the figures. Capture and figure 1 lack of information useful to a complete comprehension of the process.

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.

No

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

No

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.

I am able to assess the statistics

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Please indicate the quality of language in the manuscript:

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