Editor's note to the June 2021 issue

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EDITORIAL

Editor's note to the June 2021 issue

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Dear reader,

In this June 2021 issue you will find again many very interesting papers in the various cardiovascular imaging modalities. For this particular issue, I have selected and would like to recommend the paper entitled "A deep learning methodology for the automated detection of end-diastolic frames in intravascular ultrasound images" [1] by the team from University College London, UK under the supervision of Dr Christoph Bourantas. There are two specific reason for this choice in addition to the high quality of the work of course, being: (1) we do not see many submissions in the field of intravascular imaging in our journal, so that extra attention is warranted; and (2) in general practice, and also in other imaging modalities, such as X-ray angiography, the manual selection of end-diastolic frames in imaging series is hampered by very large variabilities, which apparently can be supported by Deep Learning (DL) techniques.

The analyses are based on only 20 coronary arteries from 6 consecutive patients; the total number of acquired IVUS frames was 92,526, of which 3271 frames were classified as end-diastolic frames by ECG-signal. The DL approach was based on the computation of pixel intensity differences between the IVUS frames. The true ED-frame was based on ECG-analyses. The efficacy of the DL-methodology in identifying end-diastolic frames was compared with two expert analysts and a conventional image-based (CIB)-methodology that relies on detecting vessel movement to estimate phases of the cardiac cycle. A window of $\pm$ 100 ms from the ECG estimations was used to define accurate end-diastolic frames detection. The ECG-signal identified 3167 end-diastolic frames. The mean difference between DL and ECG estimations was 3 ± 112 ms, while the mean differences between the 1st-analyst and ECG, 2nd-analyst and ECG, and the CIB-methodology and ECG were 86 ± 192 ms, 78 ± 183 ms and 59 ± 207 ms, respectively. The DL-methodology was able to accurately detect 80.4%, while the two analysts and the CIB-methodology detected 39.0%, 43.4% and 42.8% of end-diastolic frames, respectively ($P < 0.05$).

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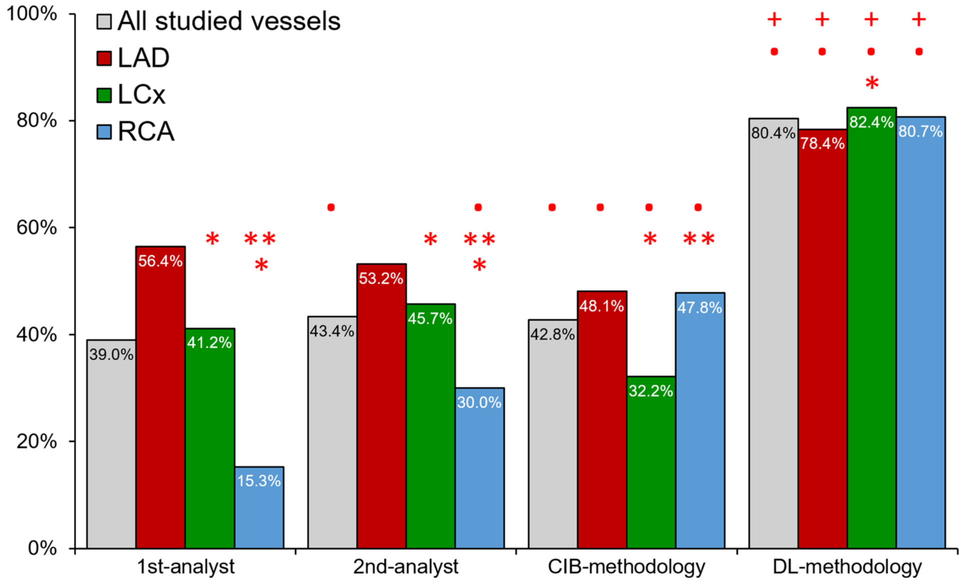

This figure 5 from the article illustrates the accuracy of expert analysts, the CIB- and DL-methodology in the NIRS-IVUS sequences acquired at 30 fps for the various coronary vessels.

It is clear that that there a number of limitations in this study, as the authors also describe, first of all the small number of patients included in the study. But as a small proof-of-concept study, it clearly shows the potential of DL for the selection of end-diastolic frames, which has great potential for daily clinical practice.

The authors conclude as follows: the DL-methodology can identify NIRS-IVUS end-diastolic frames accurately and should be preferred over expert analysts and CIB-methodologies, which have limited efficacy. And also for their particular project: these features render it a useful tool for the analysis of IVUS datasets in longitudinal studies and in studies that fuse IVUS and X-ray angiographic data to assess the implication of the haemodynamic forces on plaque evolution.

I would like to congratulate the authors on this nice work, and of course I refer the readers to the paper in this issue of the International Journal of Cardiovascular Images for more details.

Johan HC Reiber, PhD
Editor-in-chief

Reference

1. Bajaj R, Huang X, Kilic Y et al (2021) A deep learning methodology for the automated detection of end-diastolic frames in intravascular ultrasound images. Int J Cardiovasc Imaging. https://doi.org/10.1007/s10554-021-02162-x