Despeckle Filtering Toolbox for Medical Ultrasound Video

Abstract

Ultrasound medical video has the potential in differentiating between normal and abnormal tissue and structure. Ultrasound imaging is used in border identification and texture characterisation of the atherosclerotic carotid plaque in the common carotid artery (CCA), the identification and measurement of the intima-media thickness (IMT) and the lumen diameter that are very important in the assessment of cardiovascular disease. However, visual perception is reduced by speckle noise affecting the quality of ultrasound B-mode imaging. Noise reduction is therefore essential for increasing the visual quality or as a pre-processing step for further automated analysis, such as the video segmentation of the IMT and the atherosclerotic carotid plaque in ultrasound video sequences. In order to facilitate this analysis, the authors have developed a video analysis software toolbox based on MATLAB® that uses video despeckling, texture analysis and image quality evaluation techniques to automate the pre-processing and complement the disease evaluation in ultrasound CCA videos. The proposed software, which is based on a graphical user interface (GUI), incorporates video normalisation, 4 different despeckle filtering techniques (DsFlsmv, DsFhmedian, DsFkuwahara and DsFsrad), 65 texture features, 11 quantitative video quality metrics and objective video quality evaluation. The software was validated on 10 ultrasound videos of the CCA, by comparing its results with quantitative visual analysis performed by two medical experts. It was shown that the filters DsFlsmv, and DsFhmedian improved video quality perception (based on the expert’s assessment and the video quality metrics). It is anticipated that the system could help the physician in the assessment of cardiovascular video analysis. However, exhaustive evaluation of the despeckle filtering toolbox has to be carried out by more experts on more videos.

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