Abstract

Ultrasound imaging of the common carotid artery (CCA) is a non-invasive tool used in medicine to assess the severity of atherosclerosis and monitor its progression through time. It is also used in border detection and texture characterization of the atherosclerotic carotid plaque in the CCA, the identification and measurement of the intima-media thickness (IMT) and the lumen diameter that all are very important in the assessment of cardiovascular disease (CVD). Visual perception, however, is hindered by speckle, a multiplicative noise, that degrades the quality of ultrasound B-mode imaging. Noise reduction is therefore essential for improving the visual observation quality or as a pre-processing step for further automated analysis, such as image segmentation of the IMT and the atherosclerotic carotid plaque in ultrasound images. In order to facilitate this preprocessing step, we have developed in MATLAB® a unified toolbox that integrates image despeckle filtering (IDF), texture analysis and image quality evaluation techniques to automate the pre-processing and complement the disease evaluation in ultrasound CCA images. The proposed software, is based on a graphical user interface (GUI) and incorporates image normalization, 10 different despeckle filtering techniques (DsFlsmv, DsFwiener, DsFlsminsc, DsFkuwahara, DsFgf, DsFmedian, DsFhmedian, DsFad, DsFnldif, DsFsrad), image intensity normalization, 65 texture features, 15 quantitative image quality metrics and objective image quality evaluation. The software is publicly available in an executable form, which can be downloaded from http://www.cs.ucy.ac.cy/medinfo/. It was validated on 100 ultrasound images of the CCA, by comparing its results with quantitative visual analysis performed by a medical expert. It was observed that the despeckle filters DsFlsmv, and DsFhmedian improved image quality perception (based on the expert’s assessment and the image texture and quality metrics). It is anticipated that the system could help the physician in the assessment of cardiovascular image analysis.

Download here: