Software to Aid Mammography Daily QC

Introduction

NHSBSBP Equipment Report 0702, ‘Routine Quality Control Tests for Full Field Digital Mammography Systems’ lists the set of Quality Assurance (QA) checks required by the Breast Screening Programme (BSP). There is a requirement for these checks to be quick, easy to implement and cheap. The report expresses a need for a multitude of tests, of which section 3, ‘system checks’ with Perspex blocks being the most frequent and time consuming. As with all QC records there is also a need to store results. System checks include a daily, weekly and monthly set of checks which can be seen in more detail in the NHSBSBP0702 report.

Software

In this example IQWorks is a medical physics software tool, which allows the user to build analysis trees to help automate the analysis of digital DICOM images.

The Task

There is a need to measure and record Mean Pixel Value (MPV) and Standard Deviation (SD) on this image to perform the tests described in section 3 of NHSBSBP0702. These values need to be taken at a range of Regions of Interest (ROI), and consistency of position from one image to the next is important. The only distinguishable area on this image is a 0.2mmAl square of 2cm by 2cm positioned 6cm up from the image edge, slightly off centre.

Software Solution

An analysis tree has been developed in IQWorks to locate all the ROI required and gather the required information. The Analysis tree firstly locates the Al square using an edge detection technique. The edge detection technique used is Fuzzy C-Mean Canny, which has the benefit of having a low error rate and a well localised edge point. Using this edge detection technique as a reference point, ROI recommended by the NHSBSBP0702 report are positioned on the image. In total the analysis tree contains 7 ROI on the image, 2 of which are required to collect Signal to Noise Ratio (SNR) and Contrast to Noise Ratio (CNR) results and 5 ROI to collect image uniformity. The analysis tree also collects useful data from the DICOM header such as date, beam quality information, breast thickness, and mAs. The raw data collected is stored in a database and used to display the SNR and CNR as well as other required data in a user friendly way. All calculations are performed automatically through excel to reduce radiographer daily system checks to a one click button once exposure has taken place. The database acts as a data store for the results and along with providing values for the test, will display a pass, remedial fail or suspension fail notification depending on the result.

Benefits of Software

This software reduces the time taken for a radiographer to perform daily QC tests. The process of drawing a ROI, noting the MPV and SD and then recording it in an electronic database has been removed from the radiographer to the requirement of just a one click button. Once a week, CNR and uniformity are measured, and this takes the radiographer time, drawing further ROIs and entering more data. This software, with no further effort on the part of the radiographer, is able to perform these CNR and uniformity tests on a daily basis. Further advantages include the removal of human error, which when reviewing this software against radiographer collected results proved that errors in positioning of the ROI manually does occur. The review of the software also showed that typo errors when recording mAs or kV occurs, where collection from the DICOM header will rectify this. There is also an added consistency of position and size of ROI with using computer based software as opposed to human drawn ROI.

Below: shows the ROI automatically selected by the IQWorks

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