Assessment of image quality in x-ray fluoroscopy using model observers for quality control and image optimisation

Low-contrast detectability is recognised as an important image quality measure in x-ray fluoroscopy. Measuring low-contrast detectability with high precision is difficult with subjective, human observers. High precision is needed in order to assess if the imaging system performance is maintained, for example after repair or maintenance of the x-ray unit. One of the aims of this work is to evaluate measurements of the square of the signal-to-noise ratio rate, $\text{SNR}^2_{\text{rate}}$ on modern fluoroscopy units to assess its potential for quality control and dose optimisation. A model observer can be used to measure $\text{SNR}^2_{\text{rate}}$ objectively in phantom and possibly patient images.

The image acquisition technique can be altered and may affect both $\text{SNR}^2_{\text{rate}}$ and patient exposure rate. The search for the technique that maximises image quality per absorbed dose to the patient (or dose efficiency) is called optimisation. A computer software ‘FluoroQuality’ is available and can be used to measure $\text{SNR}^2_{\text{rate}}$ and its potential will be explored in search for optimal image acquisition techniques. The figure compares the dose efficiency as function of tube potential for two different added Al/Cu-filtrations and shows the good agreement between Monte Carlo simulated and measured dose efficiency estimations.

The tasks:

1. Implement the FluoroQuality software in quality control in our regional hospitals.
2. Use the FluoroQuality software to search for dose efficient clinical settings.
3. Compare image quality of different clinical protocols using human observers.

Task 3 may be replaced or reformulated depending on the progress on tasks 1-2.

Requirements:

The student should be familiar with image analysis, general principles of x-ray imaging, particularly fluoroscopy, x-ray image detectors and Matlab-programming. The project is suitable for a medical physics or biomedical engineering student.

The work will consist of image acquisition, software development, image analysis and human observer studies. Active approach to problem solving will be encouraged; results will be discussed in a research group.

Student's location:

Medical Physics, Division of Radiological Sciences, IMH, Linköping University.

References:


For more information contact
- Michael Sandborg, Professor, sjukhusfysiker (Michael.Sandborg@liu.se)

Updated: 2015-03-04 www.imh.liu.se/radiologiska-vetenskaper