Development of Methods and Strategies for Optimisation of X-ray Examinations

Akademisk avhandling

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Abstract
The overall aim of the work presented in this thesis was to develop methods and strategies for the optimisation process prescribed by legal authorities for medical X-ray imaging. This overall aim was divided into four detailed aims: 1) to analyse and describe the conditions for the optimisation of a given projectional X-ray examination in a digital environment, 2) to develop an overall strategy for the optimisation work in a radiology department, 3) to develop and implement a suitable method for statistical analysis of visual grading characteristics (VGC) data, and, 4) to evaluate the characteristics of the new statistical method by comparison with receiver operating characteristics (ROC) statistical methodology and by simulations.

The four aims are coupled to the five papers presented in this thesis. In Paper I, the conditions for the optimisation of a given projectional X-ray examination in a digital environment are analysed and a proposed optimisation strategy, based on the analysis, is described. In Paper II an overall strategy for the prioritisation of the optimisation work in a radiology department is presented. Paper III describes the development of a suitable method for statistical analysis of VGC data, which is implemented in the software VGC Analyzer. In Papers IV and V, the characteristics of the new statistical method are thoroughly evaluated by comparison with ROC statistical methodology and by simulations.

The strategies developed helped clarify the prerequisites in the process of optimising medical X-ray imaging and were shown to be useful in clinical applications. However, the objective of optimising the radiation protection in medical use of radiation is not fully clarified in legal requirements, and needs further discussion. The development of resampling methods for statistical analysis of VGC data, implemented in VGC Analyzer, provides a method that is easy to apply in clinical optimisation projects where visual grading is judged to be the appropriate evaluation method.

Keywords: optimisation, visual grading, VGC Analyzer