

AbstractID: 1104 Title: Toward objective evaluation of imaging phantom scores – ACR/MAP

Using statistical decision theory (SDT), one can determine upper bounds on the diagnostic accuracy obtainable from an imaging system for a specified imaging task. Such upper bounds describe the performance of a special observer (ideal), defined as the observer making optimal use of the detected data in performing the specified task. When the task is detecting a signal known exactly (SKE) from a background known exactly (BKE) in the presence of independent noise, the ideal-observer signal-to-noise-ratio (SNR) takes on an elegant form for linear, shift-invariant imaging systems. Most imaging phantoms, such as the ACR/MAP, provide SKE/ BKE imaging tasks. The advent of digital imaging systems provides an opportunity to objectively score imaging phantoms using the SDT formulism and algorithmic representations of the observers. We have generated a set of images of the ACR/MAP using the GE Senographe 2000D full field digital mammography system at settings of 30 kVp, Rh/Rh; 26 kVp, Mo/Rh; 26 kVp, Mo/Mo; and 24 kVp, Mo/Mo. Different algorithmic approaches were used to arrive at observer SNRs (ideal and quasi-ideal) for all of the objects in the ACR/MAP at each setting. For example, at 26 kVp, Mo/Mo, 100 mAs, on the GE 2000D, the SNRs for the first four groups of micro-calcifications were 33, 16, 13 and 7, respectively. These data correlate with human observer (subjective) scoring of the ACR/MAP. Thus, the technique provides objective not subjective data from imaging phantoms for imaging system evaluation, quality assurance and optimization.