AbstractID: 9851 Title: Assessment Methodologies for CAD

Fryback and Thornbury have pointed out that the efficacy (or effectiveness) of a radiologic procedure can be assessed at any of six levels that range from technical reproducibility to societal impact. Efficacy at the higher levels usually is of greatest interest, but lower-level efficacy is almost always easier to measure. The "diagnostic accuracy" of a medical-imaging procedure is defined as the extent to which radiologists' (or physicians') image-based diagnoses agree with patients' actual states of health or disease. Receiver operating characteristic (ROC) analysis is now recognized as the best approach for evaluating diagnostic accuracy, primarily because it separates differences in discrimination capacity from differences that are only due to "decision-threshold" effects.

Computer-aided diagnosis (CAD) has received much attention in the medical-imaging community during recent years, creating a need for objective evaluation of the gains in diagnostic accuracy that newly-developed CAD techniques may provide. The purposes of this lecture are to review the fundamental principles of ROC analysis, to point out some of the issues that arise in designing ROC studies for the evaluation of CAD, and to describe recent important developments in ROC methodology. Especially noteworthy progress has been made in reducing the likelihood of ROC curve-fitting problems; in developing methods that describe the precision of each ROC curve and evaluate the statistical significance of differences between ROC curves; and in generalizing conventional ROC methodology to accommodate situations where more than one abnormality may be present in each image.

Educational Objectives:
1. To become acquainted with the fundamental concepts of ROC analysis, with emphasis on the evaluation of CAD.
2. To understand the basic issues that must be considered in designing observer studies for the evaluation of CAD, in fitting ROC curves, and in testing the statistical significance of differences between ROC estimates.
3. To become aware of several software packages for analysis of ROC data that are available without cost.