

While current developments and evaluations of computer analyses of medical images have yielded extremely promising results, computer-aided diagnosis is still in its infancy. Ultimately, CAD may become an integrated tool in all areas of medical imaging. Using breast imaging as an example, this presentation will describe various mathematical techniques used in the development of computerized methods for the detection and diagnosis of breast cancer as well as in cancer risk assessment. Examples will be shown for mammography, sonography, and MRI of the breast, and various feature-extraction techniques for the characterization of breast lesions will be presented. Also, classification methods (such as linear discriminant analysis and artificial neural networks) for tasks such as distinguishing between actual lesions and false-positive detections or distinguishing between malignant and benign breast lesions will be discussed. In addition, issues crucial to CAD development and evaluation will be raised. For example, the size and characteristics of a database are important in feature selection, classifier training, and evaluation. Also, knowledge of the details of an evaluation is useful in assessing the robustness and applicability of the result. Evaluation of computerized methods ultimately includes the assessment of the benefit of the aid when it is used by radiologists in their interpretation of medical images.

Conflict of Interest Statement: M. Giger is a shareholder in R2 Technology, Inc, Los Altos, CA.

Educational objectives:

1. Learn various mathematical techniques (feature extraction, classification) that are useful in characterizing breast lesions.
2. Compare and contrast feature analyses for mammography, sonography, and MRI of the breast.
3. Appreciate the issues involved in developing, training, and evaluating a computerized image analysis method.
4. Learn methods for evaluating computerized analysis schemes as aids for radiologists.