Cascade Pattern Recognition Structure for Improving Quantitative Assessment of Estrogen Receptor Status in Breast Tissue Carcinomas

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OBJECTIVE: To develop and validate a computer-based approach for the quantitative assessment of estrogen receptor (ER) status in breast tissue specimens for breast cancer management.

STUDY DESIGN: Microscopy images of 32 immunohistochemically (IHC) stained specimens of breast cancer biopsies were digitized and were primarily assessed for ER status (percentage of positively stained nuclei) by a histopathologist. A pattern recognition system was designed for automatically assessing the ER status of the IHC-stained specimens. Nuclei were automatically segmented from background by a pixel-based unsupervised clustering algorithm and were characterized as positively stained or unstained by a supervised classification algorithm. This cascade structure boosted the system’s classification accuracy.

RESULTS: System performance in correctly characterizing the nuclei was 95.48%. When specifying each case’s ER status, system performance was statistically not significantly different to the physician’s assessment ($p = 0.13$); when ranking each case to a particular 5-scale ER-scoring system (giving the chance of response to endocrine treatment), the system’s score and the physician’s score were in agreement in 29 of 32 cases.

CONCLUSION: The need for reliable and operator independent ER-status estimation procedures may be served by the design of efficient pattern recognition systems to be employed as support opinion tools in clinical practice. (Anal Quant Cytol Histol 2008;30:218–225)

Keywords: estrogen receptors; histopathology; image analysis; pattern recognition.

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