

13:40-14:00

Automatic Breast Ultrasound (ABUS) and Computer Aided Diagnosis (CAD)

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I. Automatic Breast Ultrasound (ABUS)

US screening has been performed using hand-held probes that are used to scan the entirety of both breasts. The technique however, requires practice and is generally performed by a physician. Recently, continuing technological advancement has made available whole-breast US scanning using an automated probe, which images wide field of view of breast tissue in three dimension (3D) reconstructed images.

From 2007.11-2007.12, 134 bilateral whole breast US was obtained using U-systems in 67 consecutive women who were scheduled to undergo US guided needle biopsy due to 72 suspicious breast masses (24 invasive cancers and 48 benign lesions). Detection rate of malignant nodule (91.7% to 95.8 %) was significantly higher than those of benign nodule (56.2% to 66.7 %) when the 3 radiologists read the 3D breast volume data. In another study, we assessed the performance of 3 radiologists for the detection of breast cancers using 3D ABUS (40 diseased and 37 normal). Almost 95 % of cancers were consistently detected with variable false positive rates (10-40%) by the radiologists. Most of false positive findings were associated with posterior shadowing beneath Cooper's ligament.

Our study suggests that the use of ABUS and interpretation with 3D volume data has the potential to reduce the recall rate for benign masses without missing the malignant masses. Even though substantial degree of cancer detection was achieved by using 3D breast volume data, radiologists' experience and training are still

needed to identify small cancers and to reduce false positive rates. CAD systems may assist the radiologist in the early detection of breast cancer by highlighting suspicious areas seen on ABUS.

II. Computer Aided Diagnosis (CAD)

PURPOSE: To evaluate the robustness of a breast ultrasound computer-aided diagnosis (CAD) system in terms of its performance across different patient populations.

MATERIALS AND METHODS: Three different sonographic databases were analyzed for this study: one South Korean and two United States databases, all of which were utilized in an IRB-approved and HIPAA-compliant manner. Round-robin analysis and independent testing were performed to evaluate the performance of a computerized breast cancer classification scheme across the databases. Receiver operating characteristic (ROC) analysis was used to evaluate performance differences.

RESULTS: The round-robin analyses of each database demonstrate similar results (area under the ROC curves ranging from 0.88 [0.82; 0.92] to 0.91 [0.85; 0.95]). The independent testing of each database, however, indicates that although the performances

were similar, the range in areas under the curve was wider than that of the round-robin tests (0.79 [0.73; 0.84] to 0.87 [0.79; 0.92]). However, the only instances in which statistically significant differences in performance were demonstrated occurred when the Korean database was used in a testing capacity in independent

testing.

CONCLUSION: The few observed statistically significant differences in performance indicate that while the sonographic features used by the system are useful across the databases, their relative importance differs. In practice, this means that a CAD system may need to be adjusted when applied to a different population.

References

1. Chen JH, Huang CS, Moon WK, et al. Breast density analysis for whole breast ultrasound images. *Med Phys* 2009;36:4933-43.
2. Gruszauskas NP, Drukker K, Giger ML, Chang RF, Sennett CA, Moon WK. Breast US computer-aided diagnosis system: robustness across urban populations in South Korea and the United States. *Radiology* 2009;253:661-71.