



P1.110: Bridging Radiologic and Macroscopic Scales for Precise Intraoperative Assessment of Clinical Stage IA LUAD (SuRImage-CT)

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INTRODUCTION

- Accurate intraoperative assessment of pathological invasiveness and IASLC grading is crucial for surgical decision-making in stage IA LUAD.
- While the macroscopic-image-based SuRImage model captures textural details, it lacks 3D spatial context and suffers from information loss.
- We developed SuRImage-CT, a multimodal framework integrating preoperative HRCT and intraoperative macroscopic images, to provide a comprehensive and precise intraoperative diagnostic tool.

METHODS

- The SuRImage-CT model employs a dual-stream architecture: a 3D Swin-Transformer to extract density and peritumoral features from CT scans, and SE-ResNet50 to capture macro-textures from macroscopic images.
- Evaluation focused on three core tasks: Task 1 binary invasive identification, Task 2 ternary pathological diagnosis, and Task 3 multi-class IASLC histological grading.
- Diagnostic performance was quantified using the Area Under the Curve (AUC) with 95% confidence intervals (CI). This study was registered with the Chinese Clinical Trial Registry (ChiCTR2300075999).

DISCUSSION AND CONCLUS

- By bridging the gap between preoperative imaging and intraoperative morphology, the SuRImage-CT framework successfully integrates macro-radiological scales with micro-anatomical textures.
- SuRImage-CT offers a high precision risk assessment and a robust digital evidence base for personalized surgical decision-making in early-stage LUAD.

RESULTS

- The study utilized a multicenter dataset of 1,707 paired cases from three institutions.
- The model development cohort (GDPH) consists of 1529 patients with paired chest CT and surgical resection images.

Table 1. The area under the receiver operating characteristic curve (AUC) of SuRImage-CT model.

Cohort	Task 1	Task 2	Task 3
GDPH DEVELOPMENT	0.925	0.909	0.876
GDMUAH	0.919	0.873	0.791
MZPH	0.856	0.828	0.768

RESULTS

- Quantitative interpretability analysis indicated that the model's predictions were mainly driven by the macroscopic image modality, with an average contribution rate of 60.28%.
- Subgroup analysis showed that the weight of the CT modality was closely related to lesion size. As the lesion diameter increased, the diagnostic contribution of the CT modality correspondingly rose from 38.55% in lesions ≤ 1 cm to 47.46% in lesions 2-3 cm.

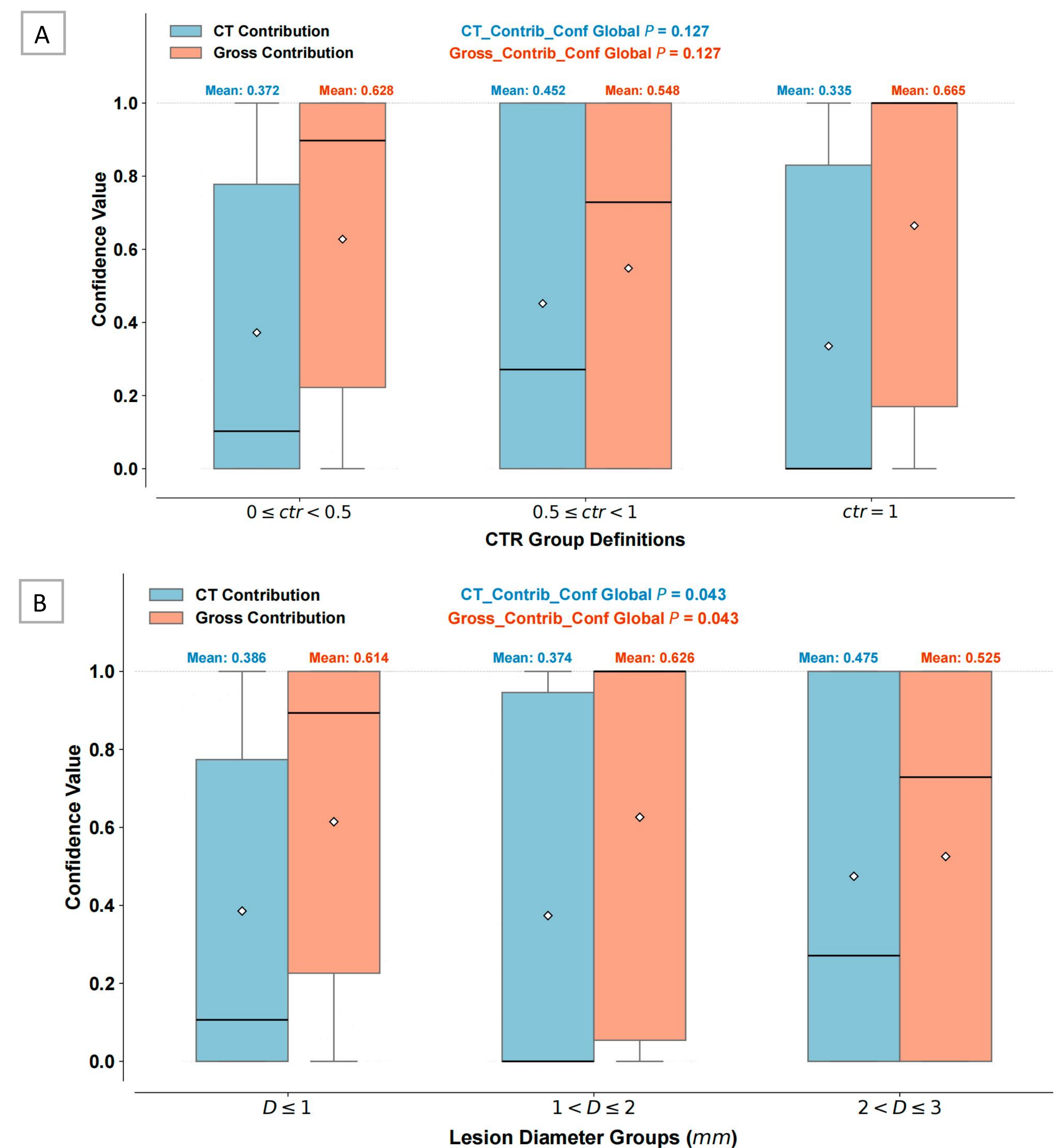


Figure 1. The contribution of SuRImage and CT modalities in multimodal SuRImage-CT model in different consolidation to tumor ratio (CTR) subgroup.