

## AI-Powered Predictions of Breast Ductal in Situ Carcinoma Morphology and Surgical Outcomes

David Andraş<sup>1,2</sup>, Radu Alexandru Ilieş<sup>3</sup>, Victor Eşanu<sup>1,2</sup> and George Călin Dindelegan<sup>1,2</sup>

<sup>1</sup>1st Surgical Clinic, Department of General Surgery, Iuliu Hațieganu University of Medicine and Pharmacy, Cluj-Napoca, Romania

<sup>2</sup>Emergency County Hospital Cluj, First Surgical Unit, Cluj-Napoca, Romania

<sup>3</sup>Faculty of Medicine, Iuliu Hațieganu University of Medicine and Pharmacy, Cluj-Napoca, Romania

### Abstract

**Background/Objectives:** Artificial intelligence (AI) is increasingly integrated into oncological imaging, but its ability to predict detailed histopathological features from standard mammography remains understudied in ductal carcinoma in situ (DCIS). This study aimed to evaluate the performance of a large language model (ChatGPT-4, Open AI, May 2025) in predicting nuclear grade, architectural subtype, comedo necrosis, and stromal invasion from specimen mammography.

**Materials and Methods:** We conducted a retrospective and methodological study of 29 patients with histologically confirmed DCIS or invasive carcinoma with DCIS components. Our clinical protocol is based on NCCN/ESMO guidelines of treatment ductal carcinoma in situ. Preoperatively, all patients with confirmed disease benefited from wire guide localization of the breast lesion. Patients were then submitted to surgical excision (lumpectomy) and surgical specimen mammography to confirm the complete macroscopic excision. For each of these cases, mammographic specimens were analyzed using an AI model designed to extract and process radiomic features. AI-model reports were compared with histopathological reports which served as the gold standard. Diagnostic performance was evaluated for four parameters: DCIS nuclear grade, architectural subtype, comedo necrosis, and stromal invasion. Accuracy, sensitivity, specificity, precision, and F1 scores were computed.

**Results:** The size of mammographic lesions ranged from 1.2 to 10.0 mm (mean  $\pm$  SD: 4.46  $\pm$  2.25 mm). Histopathological diagnoses included pure DCIS (n = 17), invasive NST carcinoma with DCIS (n = 10), and mixed histologies (n = 2). The AI model achieved 65.5% accuracy for detecting comedo necrosis (sensitivity 75.0%, specificity 53.8%) and 72.4% accuracy for detecting stromal invasion (specificity 94.1%, sensitivity 41.7%). Nuclear grade classification matched histopathology in 20.7% of cases, while architectural subtype classification achieved 17.2% agreement. Multiclass predictions showed low F1 scores for most categories.

**Conclusion:** Although the AI model demonstrated acceptable utility for detection of comedo necrosis and excluding stromal invasion, it faced several difficulties regarding nuclear grading and architectural subtype classification. Although limited by the small sample size and 2D imaging, this methodological study provides an insight for future AI and radiomics approaches in breast tumor characterization.

**Keywords:** radiomics, artificial intelligence, ductal carcinoma in situ, mammography, histopathology