

Digistain: A novel biomarker imaging platform for grading Breast DCIS tumours using routinely processed paraffin sections

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Introduction



- Pathology Diagnostic tool
- Quantitative and objective way to grade cancer biopsies¹
- **Quantifiable** and **reproducible** scoring of tissue sections
- Complements conventional H&E stained tissue images

How it works

Digistain Prototype in Operation

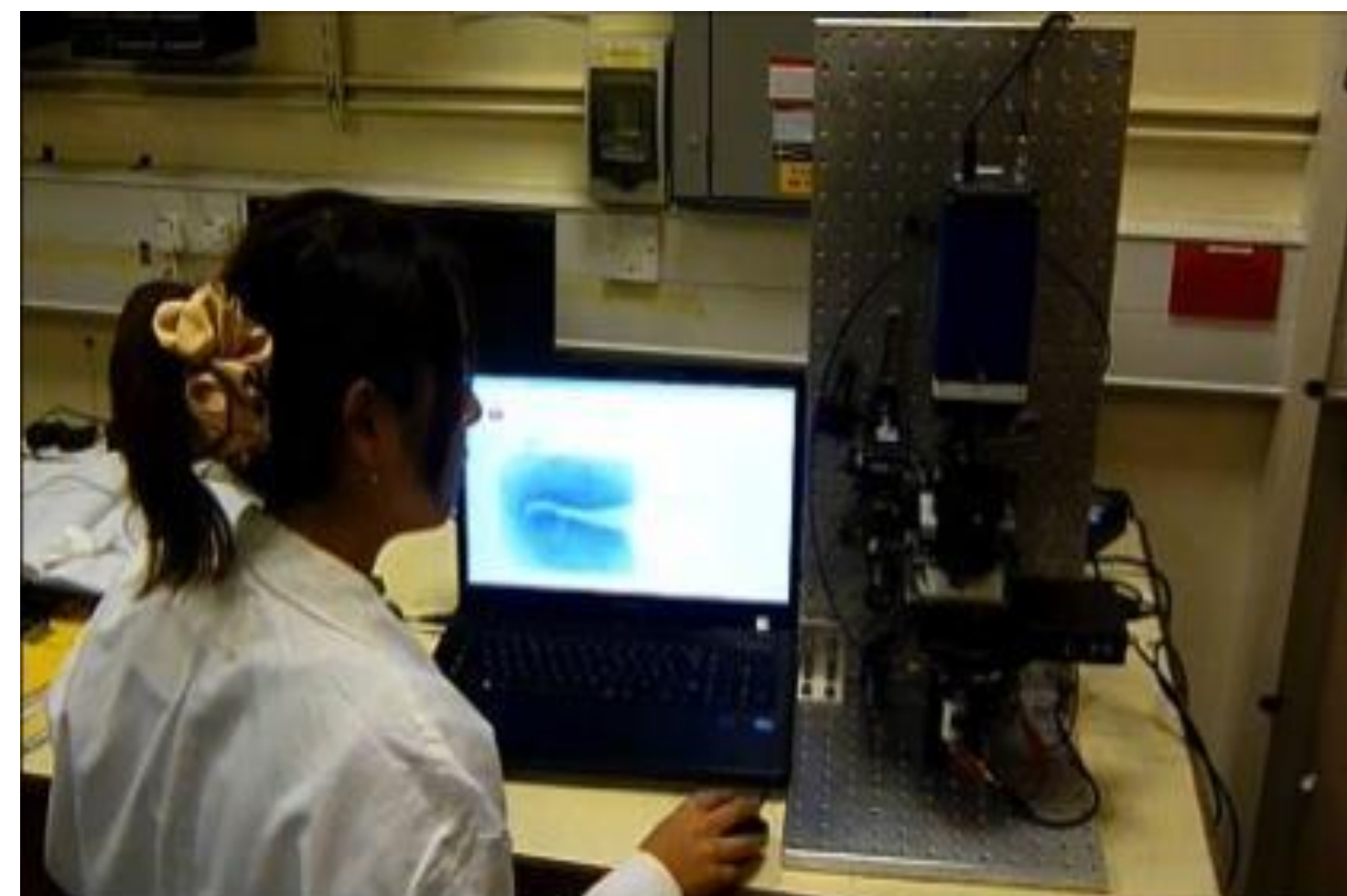


Fig 1: Original prototype used by lab technician to examine oesophageal biopsy

- Uses infrared imaging to assess Nuclear: Cytoplasmic ratio (N:C ratio) across tissue section²
- Correlation between N:C ratio and mitotic activity & pleomorphism^{1,2}
- Chemical images automatically processed to produce a **Digistain Index (DI)**
- Operates using routinely processed paraffin sections
- Results obtained within minutes of loading a slide

The Pilot Study

- Double-blinded study
- 23 breast biopsies were reviewed and graded by an experienced breast pathologist
- New section cut from each block, left unstained and loaded into Digistain Instrument
- A region of interest defined by the pathologist was analysed to generate a DI score for each case
- The cohort consisted of 23 female breast cancer patients with no primary invasive tumour at time of diagnosis

Grading Characteristics of Cohort

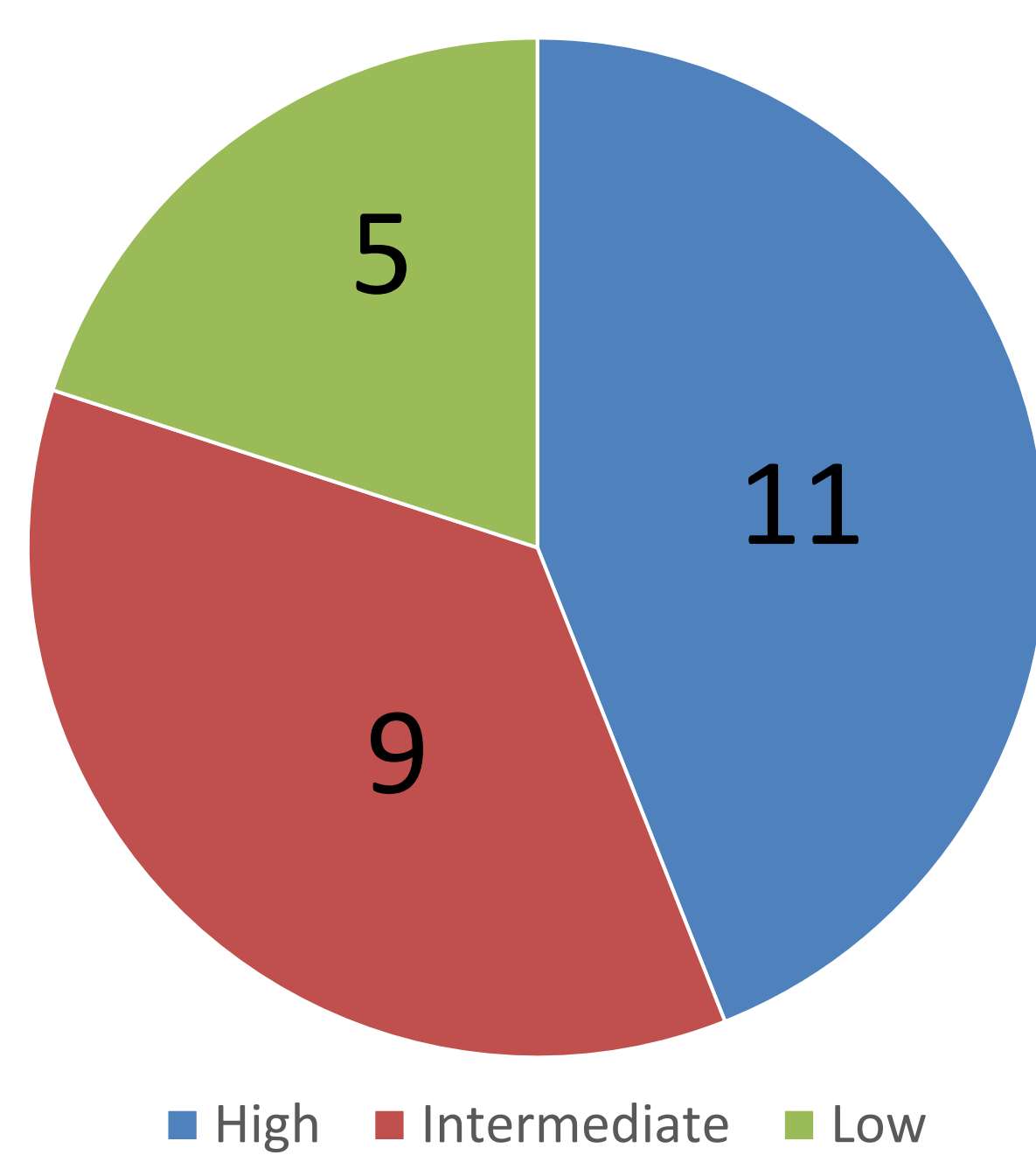


Fig 2: 23 DCIS Cases consisting of 11 High grade, 9 intermediate and 5 low grade

Results and discussion

- The ROI selected by the breast pathologist is represented as false colour image which maps the DI score across tumour (Figure 3)

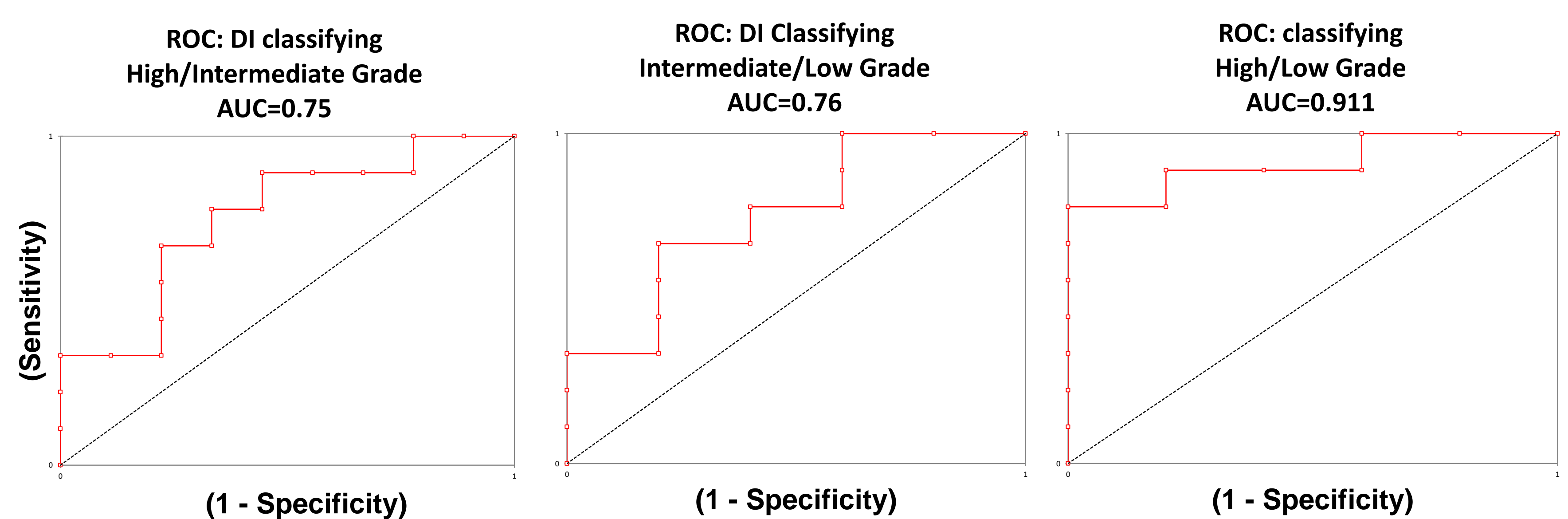


Fig 4: ROC plots for grading classification using DI score alone with calculated AUC for each plot. The benchmark in cancer diagnosis is typically 0.6

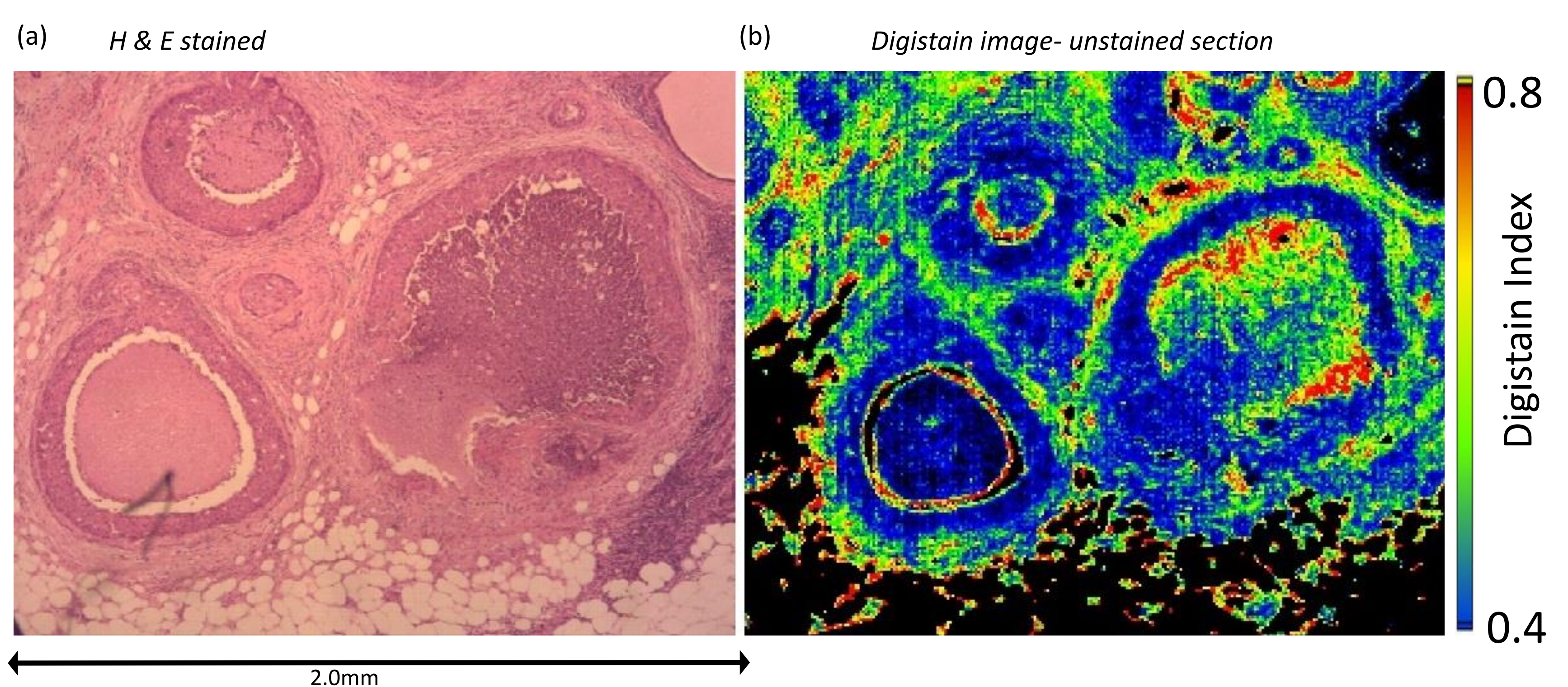


Fig 3(a) Breast DCIS in H&E stained section with (b) Digistain Image counterpart from adjacent section left unstained (mostly intermediate grade)

- User independent DI score used to sort each case into its respective grade group (Fig 4)
- Kruskal Wallis test gives two-tailed **P = 0.04** for association of DI with Grade

Conclusions

- User independent and objective grading demonstrated for DCIS cases with AUC > 0.75. The benchmark for AUC in cancer diagnostics is 0.6.
- Association of Digistain Index and histological grade with P = 0.04 in a low statistical power study!
- Higher power study required to investigate links of DI with probability of primary invasive tumour recurrence

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References

- ¹ H. Amrania et al. 2012. Digistain: a digital staining instrument for histopathology. *Optics Express* 20:7290-7299
- ² H. Amrania et al. 2015. New IR imaging modalities for cancer detection. *Faraday Discuss.* 2016, 187, 539