Digistain: a digital staining instrument for histopathology

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Contents

- What is Digistain
- How can clinicians benefit from using Digistain?
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QUANTIFIABLY assesses malignancy grade in unstained biopsy sections in cost effective and REPRODUCIBLE way

- Produces images that complement conventional H & E stained tissue images
How does it work

- Chemical bonds – infrared spectra
- Chemical images provide morphological and biochemical information.
- Constructed using IR absorbance values of chemical species
- Phosphate and Amide I absorbance indicative of nuclear and cytoplasmic material concentrations – useful for contrast
Absorption Spectrum of Typical Unstained Biopsy Section

Specific chemical species relating to bio-content are highlighted

Absorbance (AU) vs. Wavenumbers (cm$^{-1}$)

- 1176 cm$^{-1}$ Phosphodiester
- 1234 cm$^{-1}$ Phosphodiester (PO$^{-2}$)
- 1650 cm$^{-1}$ Amide I
- 1605 cm$^{-1}$ Amide I

Baseline Reference
Digistain in Action...
Contents

- What is Digistain
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How useful for clinicians?

- Key problems with IR spectroscopy tools in pathology - superfluous data, equipment expensive
- More cost effective than other staining techniques
- Very quick to process biopsies – 20 seconds
- Digistain Score is reproducible and robust.
Cancer Research

- Digistain provides visual representation of chemical information – QUANTIFIABLE

- Small footprint instrument – 1 ft x 1 ft

- Records images in seconds with UNSTAINED tissue slides

Let's look at an Example....
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An Example:

Conventional H & E Stained Image

Digistain Image – with unstained tissue

High Grade Dysplastic Oesophagus Epithelium tissue

4.5mm
An Example:

Conventional H & E Stained Image

- Normal Epithelial Tissue
- High Grade Dysplastic Epithelial Tissue

Digistain Image – with *unstained* tissue

Instantly differentiable visually with superior contrast

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An Example:

Quantitative Data: Two regions differ in Phosphate: Amide Absorbance (P:A)
- Low Grade Dysplasia $P:A = 0.64 \pm 0.01$
- High Grade Dysplasia $P:A = 0.75 \pm 0.01$

High Accuracy and NO OVERLAP: Potential for developing test for onset of Dysplasia in oesophageal tissue

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Reproducibility Results!!!

- Classified oesophageal biopsy imaged with Digistain
- **Low grade dysplasia** areas - phosphate/amide ratio: 0.680±0.010
- **High grade dysplasia** areas - phosphate/amide ratio: 0.765±0.021
- Measurements repeated 100 times on each of 20 samples
- **NO OVERLAP OF MEASUREMENTS**
TASTER: Breast Core biopsies

- 85 breast core samples analysed in blind study

- Areas of high nuclear content faithfully represented by Digistain in 85 core biopsies – **indicative of N:C ratio**

- Pathologist grading of each sample replicated with Digistain successfully.
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What Next?

- Positive results with pilot study of 85 breast core biopsy images with Digistain
- Conducting advanced study of 2000 breast cancer patients
- Adopt DIGISTAIN Score into clinics as a useful Recurrence Score
- Commercial interest from industry
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