Leveraging Digital Pathology Image Analysis for Research

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Disclosure

I am currently the founder of a start-up company previously known as:

![2DP logo](image-url)
pathology in personalized medicine

Precision Pathology:

Ultimately Drive Precision Predictions
personalized medicine will tailor a treatment for each patient
whole genome information to understand specifics
in practice this is a ‘grind and find’ approach
tumors are heterogeneous; but not hopelessly complex
image quantification can enhance the pathologist’s opportunity
to contribute to personalized medicine
leverage the advantages of digital pathology for clinical research
three clinically relevant research examples

1) segmentation

2) feature extraction

3) feature evaluation
GBM H&E segmentation

Long Term Survival

Short Term Survival

n=154

Lloyd, Egan: AACR 2013
morphologically distinct features of both cancer cells and environment
BrCa IHC segmentation

CAIX

CAXII

Lloyd: PSOC 2013

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BrCa vessel segmentation

Nucleus Mask and Binary Segmentation

Vessel Mask and Binary Segmentation

Lloyd, Robertson-Tessi: submitted Cancer Research

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BrCa collagen segmentation

Tumor region is outlined in yellow.

White arrows are regions of micro-invasion

Red arrows are degraded collagen fibers

Intact collagen is green

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xenograft necrosis segmentation

Lloyd, Das: preliminary data

Viable tumor is masked in **dark blue**
Partial necrosis **light blue**
Necrosis is **green**
Other non-target tissue is **red**

Sample31
Tissue Composition

- Necrosis (%): 5.3%
- Tumor Class 1 (%): 4.1%
- Tumor Class 2 (%): 30.1%
- Other (%): 60.5%
three clinically relevant research examples

1) segmentation

2) feature extraction

3) feature evaluation
feature extraction: osteosarcoma
feature extraction: single cell features

Sensitive

Resistant

Lloyd, Pledger, Reed: in preparation
feature extraction: prediction

Area
Length
Width
Mean Layer 1
Mean Layer 2
Mean Layer 3
Ratio Layer 1
Ratio Layer 2
Ratio Layer 3
Hematoxylin Intensity
Optical Density Density
Roundness
Compactness
Shape Index
Length: Width
Elliptical Fit
Circularity
Ellipticity

n=16

Sensitive
Resistant

n=16

Sensitive
Resistant

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feature extraction: prediction

Lloyd, Pledger, Reed: in preparation

Long Survival
Short Survival
three clinically relevant research examples

1) segmentation

2) feature extraction

3) feature evaluation
feature evaluation: landscapes

Lloyd, Rejniak:
Submitted 2014, AAP

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feature evaluation: landscapes
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