PHILIPS

Computational pathology

TissueMark

4.0

Accurate and reliable tumor estimation powered by Deep Learning

Analyze solid tumor tissue samples fast and enhance the quality and accuracy of macro-dissection, nucleic acid extraction, and molecular profiling using Philips TissueMark[1]. TissueMark is a key offering in our computational pathology portfolio that assists the user to examine the region of interest for macro dissection by:

- Visualizing the region of interest (ROI) and
- Indicating the estimated cellular profile in the region of interest

TissueMark enables region of interest detection and cellular profile estimation in digital whole slide images of Lung Histology, Lung Cytology, Breast and Colon[2] formalin-fixed paraffin embedded, H&E stained tissue samples.

The application provides three levels of visualization – a macro dissection boundary, a visual heat map of tumor density and, at higher magnification, cellular visualizations. Color-coded, this enables differentiation of the region of interest from stroma, inflammation, lymphocytes and necrosis thereby providing an accurate macro dissection boundary for further molecular testing.

Key advantages

- Improve the quality of molecular tests with **accurate ROI and cellularity guidance**

- **High throughput, intuitive workflow** to save valuable time of lab personnel

- **Interoperable with Philips IntelliSite Pathology Solution** thereby providing a unified digital workflow between anatomic and molecular pathology labs

[1] TissueMark is not intended for diagnostic, monitoring or therapeutic purposes or in any other manner for regular medical practice. PathXL is the legal manufacturer and is a Philips company
[2] Supports non-small cell lung adenocarcinoma biopsy and resection histology samples, non-small cell lung adenocarcinoma cytology samples extracted via pleural effusion or fine needle aspiration, breast adenocarcinoma (including invasive ductal and invasive lobular only) biopsy and resection samples and colon adenocarcinoma biopsy and resection samples only. Philips does not guarantee performance across other tissue samples

Improve the quality of molecular tests with **accurate ROI and cellularity guidance**

Validated macro dissection boundaries
TissueMark deep learning algorithms work at multiple magnification levels systematically identifying tissue and related morphological structures e.g. mucosa, fat etc. The application further uses cellular classification inputs to identify and differentiate the region of interest from stroma, necrosis and lymphocytes. Given the inter–pathologist variation that is widely acknowledged[3] in the industry, TissueMark macro dissection boundary suggestions show a high acceptance[4] by pathologists.
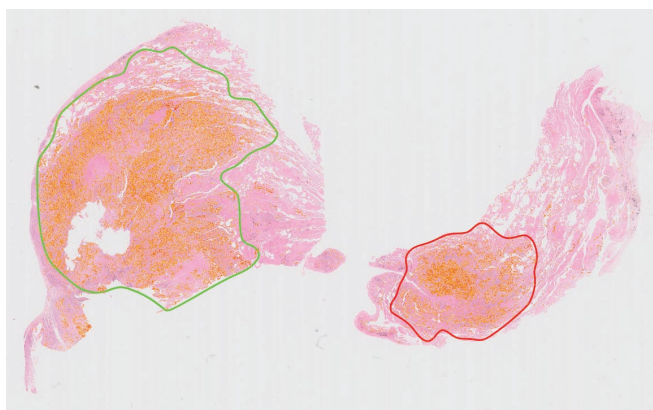
Identify insufficient samples for molecular tests with accurate cellularity guidance
TissueMark deep learning algorithms are trained to identify cellular structures from other morphology and classify identified cells into tumor vs non–tumor cells. This provides a reliable, accurate cellularity estimate that can help pathologists determine if the sample is sufficient for further molecular testing. Research studies have shown very high correlation (Pearson Correlation Coefficient > 0.95 across all supported tissue types) between TissueMark nuclei detection and the gold standard, hand counted estimations of pathologists.
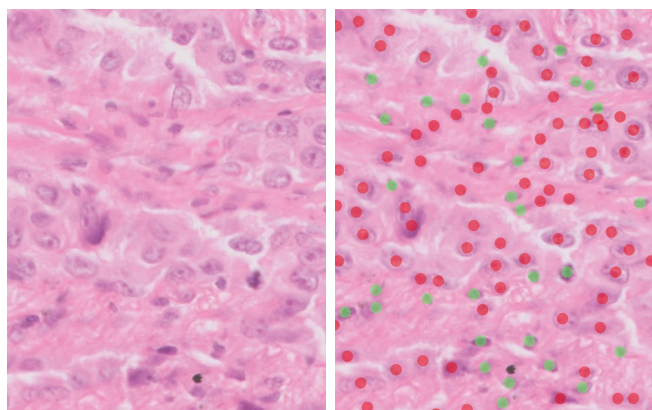
Original WSI **Algorithm results**

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[3] A Prospective, Multi-Institutional Diagnostic Trial to Determine Pathologist Accuracy in Estimation of Percentage of Malignant Cells, Viray et al
[4] Independent pathologists' evaluation on 446 WSIs from multiple labs. Average boundary acceptance (including minor edits) of TissueMark generated macro-dissection boundaries, across Lung, Breast and Colon, at 80%

High throughput, intuitive **workflow** to save valuable time of lab personnel

High throughput support

TissueMark is inter-operable with Philips IntelliSite Pathology Solution (PIPS) and via PIPS with your Laboratory Information System (LIS), thereby enabling automatic execution of algorithms on whole slide images (WSI) that are chosen for molecular testing. TissueMark algorithms are designed for fast execution with a runtime of 60 seconds[5] on every whole slide image across the tissue types supported. Fast algorithm execution combined with the workflow design ensures that the pathologist always has the results when they begin to review the slide, thereby saving valuable pathologist minutes in the lab.

Easy case management

TissueMark helps lab managers and technicians organize the caseload and monitor lab progress. TissueMark helps organize and dispatch whole slide images rather than slide trays with glass slides which require manual sorting, preparation and logistical transport.

Efficient case organization and viewing

TissueMark provides automatic organization of the worklist of a pathologist . In comparison to the current glass based workflow, the pathologist[6]
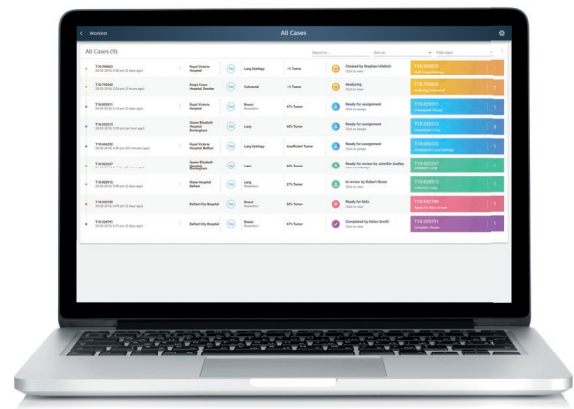
can view the entire worklist assigned to get an overview of the pending, completed, and urgent work. TissueMark also provides intuitive ways to sort the worklist in the manner preferred e.g., tumor percentage, case state, tissue types etc.

Opening cases in TissueMark means immediate access to a full slide overview that helps the pathologist collect key insights on the sample quickly by focusing on the regions of interest highlighted. By enabling efficient case organization with quick access to relevant regions of interest on the WSI, the pathologist can save time so they can

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[5] As measured on whole slide images with tissue area of 15mmx15mm and run on server configured with 128GB RAM, processor: Intel ® Xeonr CPU E5-2640 v4@2.4 GHz, GPU Nvidia Tesla P4; measured without any inter-operability with the IMS

[6] Relies on the level of PIPS-LIS interoperability with TissueMark

start reading and signing out on cases sooner. Lastly, TissueMark enables streamlined macro dissection workflow by providing similar case organization and viewing environment to the Histotech post pathologist review. The histotech is provided with a printout that can be conveniently used for subsequent macrodissection from blank sections.

Designed to help you stay in control
TissueMark is an easy-to-use, intuitive tool that is aligned to the needs of the modern day molecular lab. TissueMark allows the pathologist to edit or add regions of interest while providing updated tumor percentage and cellularity statistics on the updated annotations. This gives full control to the pathologist to verify and approve the outcomes of the application. Further for tissue types that are not supported, TissueMark allows for manual annotation and scoring for tumor cellularity estimation.

To learn more, please visit:

www.philips.com/tissuemark