

Welcome to the Aperio Science Webinar: Histology Pattern Recognition with Genie™

Upcoming Events

Digital Pathology Seminar Series

30th March, 2009: Berlin, Germany

* [registration open now](#)

1st April, 2009: Copenhagen, Denmark

* [registration open now](#)

3rd April, 2009: Amsterdam, Netherlands

* [registration open now](#)

15th April, 2009: Research Triangle Park, NC

17th April, 2009: Philadelphia, PA

* Register for these seminars online: www.aperio.com/seminars

Webinars

February 18, 2009 / Two Sessions: 7 AM PST and 5 PM PST

Image Analysis 101: Tools for Analyzing Histology from A to Z

March 19, 2009 / One Session 7:00 am PST / 10:00 am EST / 3:00 pm GMT session

SPECIAL PRESENTATION IN SPANISH

Telepathology in Multi-discipline Hospitals Worldwide

Questions? Email events@aperio.com



Histology Pattern Recognition with Genie™

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Aperio Technologies**

Histology Pattern Recognition with Genie™

Outline

- **History of Genie**
- **Sample applications of Genie to histology**
- **A conceptual overview of how Genie works**
- **Genie Demo**
- **Questions**

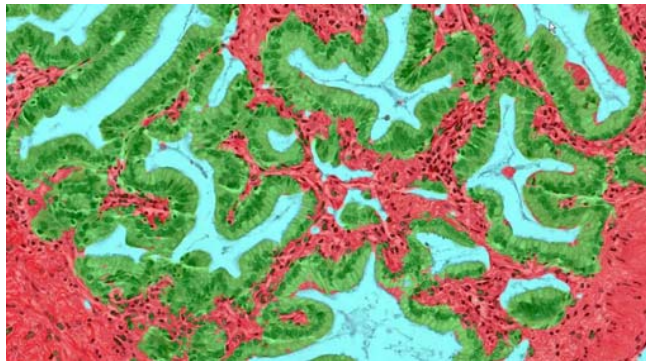
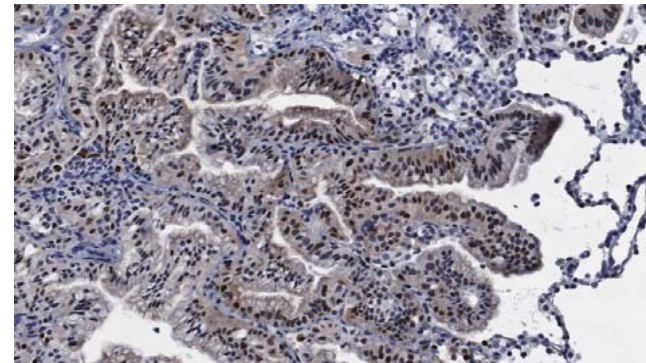
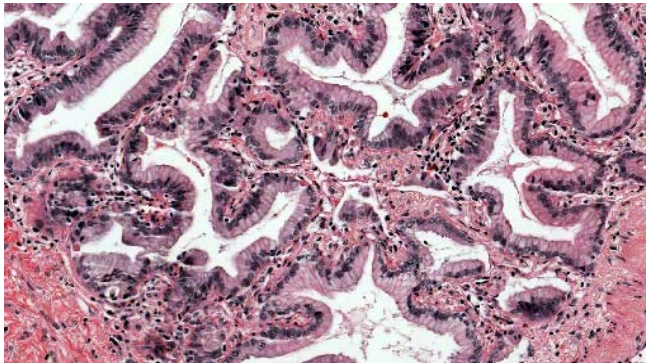
History of Genie

- **1999 – Development began by Los Alamos National Laboratories (LANL)**
 - **Based upon many years of research and hundreds of publications in peer reviewed journals.**
 - **Re-written entirely in C/C++**
 - **Optimized for speed in learning**
 - **Originally for geospatial applications**
- **2005 – Windows based evaluation system finished**
- **2007 – Exclusive license to Aperio for Digital Pathology applications.**
- **2008 – Integrated into Spectrum (Release 10.0)**

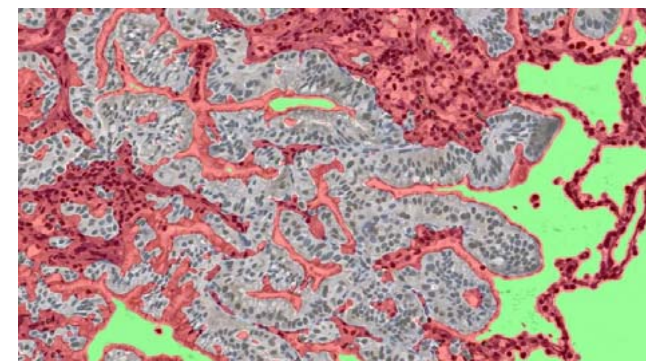
What is Genie?

- **Genie:**
 - **A tool for finding patterns in images**
 - **Learns from examples**
 - **Builds a classification algorithm**
 - **Requires no programming experience by the user**
 - **Lets pathologists do what they do best – identify structures in images.**
- **Has two uses:**
 - **Find and measure patterns (area analysis)**
 - **Pre-filter for other image analysis algorithms**

Sample Applications: Oncology

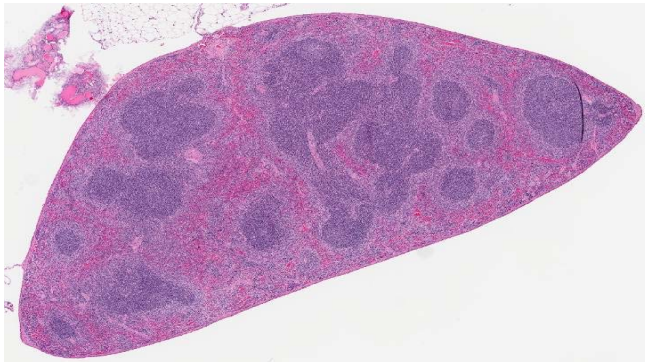


Neoplastic components (green) and background stroma (red) in a human bronchoalveolar carcinoma.

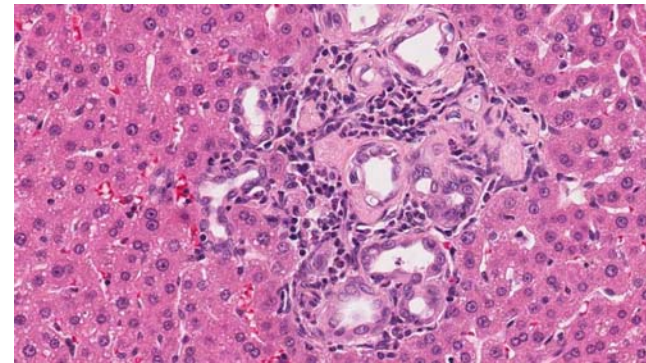


Pulmonary parenchyma (red) and alveolar lumina (green) in human pulmonary bronchoalveolar carcinoma (white).

Sample Applications: Toxicology

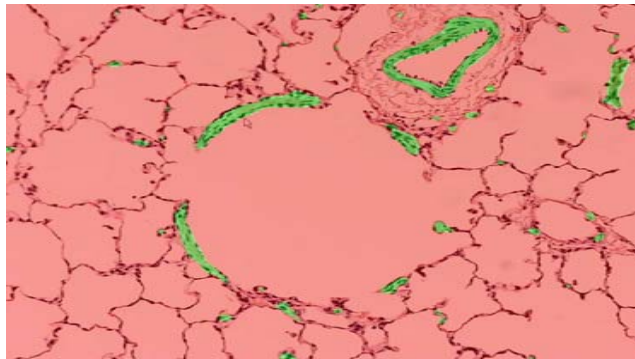
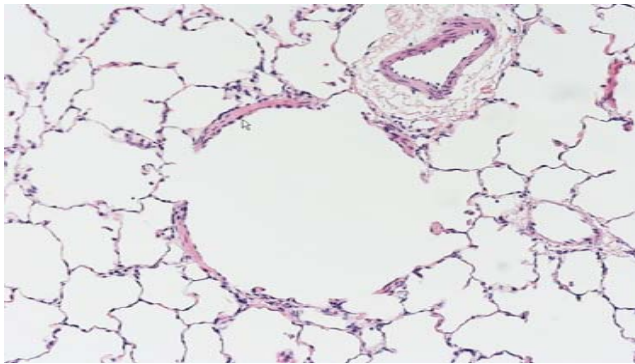


Periarteriolymphoid tissue (green) and red pulp (red) in a mouse spleen.

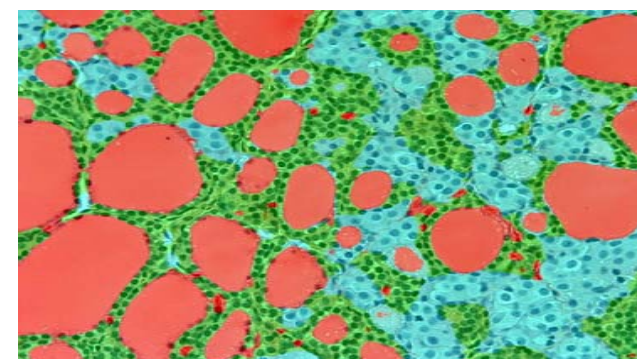
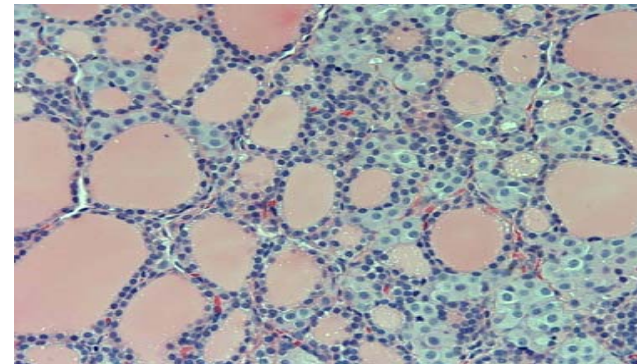


Hyperplastic bile duct (green), hepatic parenchyma (red), periportal inflammatory cells (blue), periductal collagen (brown), bile duct & sinusoidal lumina (yellow) in rat liver.

Sample Applications: Toxicology

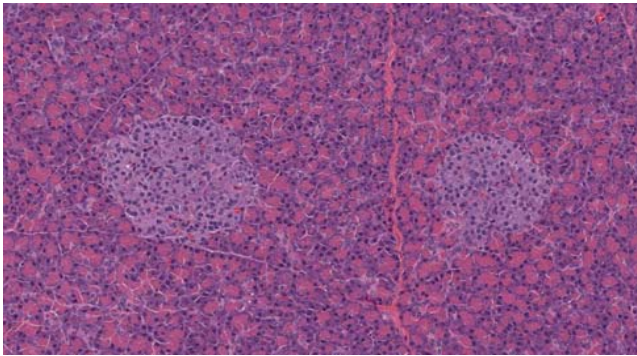


**Pulmonary smooth muscle (green)
in monkey lung.**

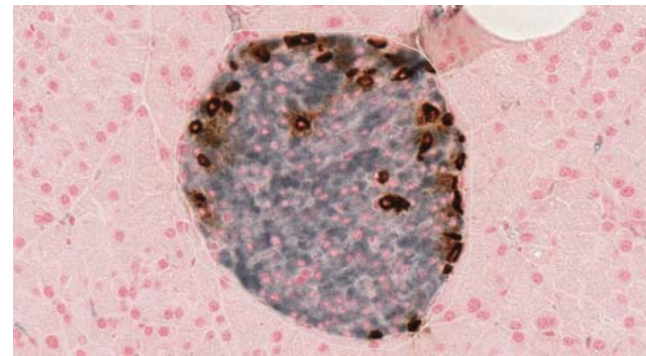


**Follicular epithelium (green), colloid (red)
and c-cells (blue) in dog thyroid.**

Sample Applications: Diabetes

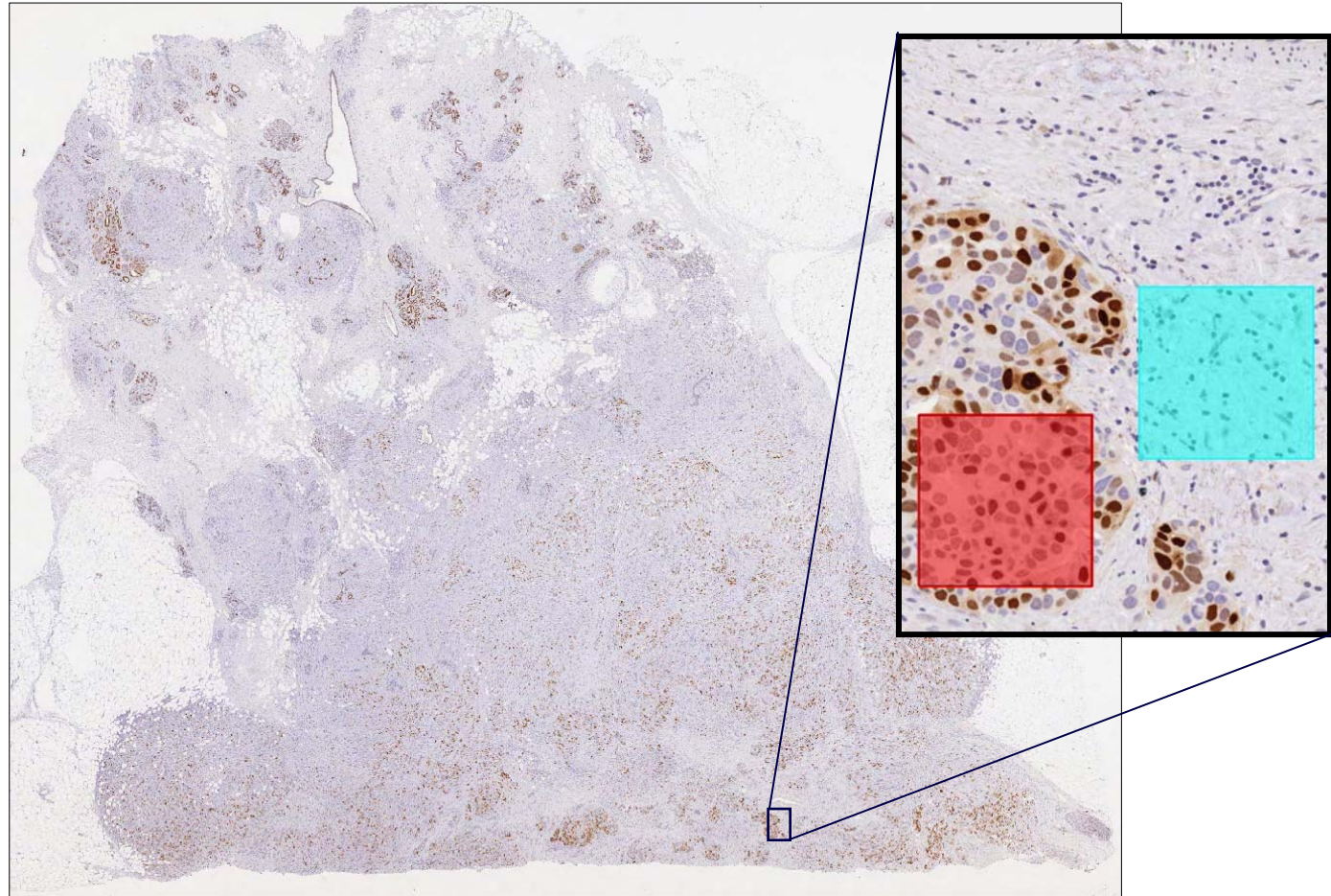


Exocrine glandular tissue (red) and pancreatic islets (green) in mouse pancreas.

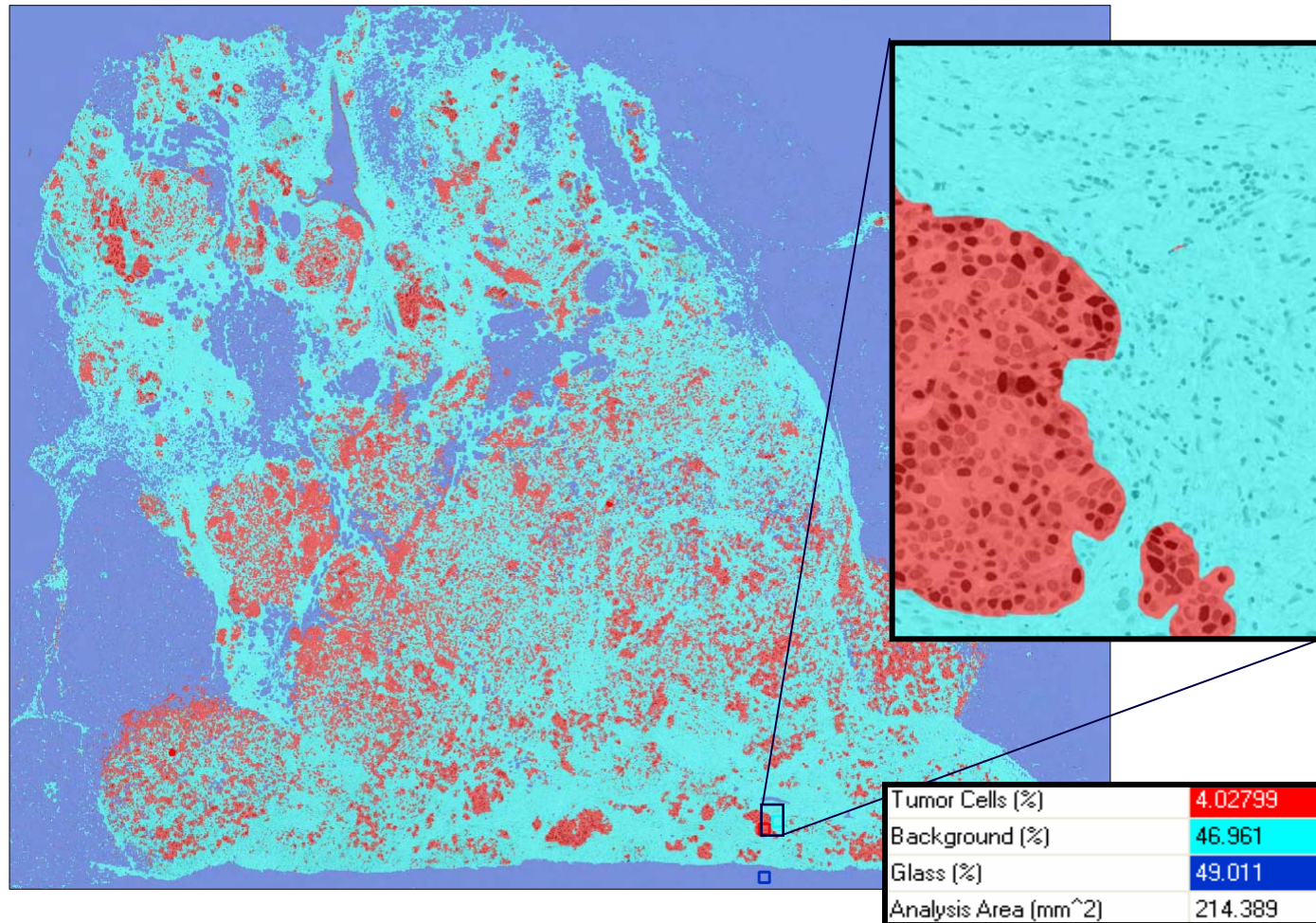


Pancreatic islet beta cells (blue) and islet alpha cells (brown) in double-stained mouse pancreatic islets.

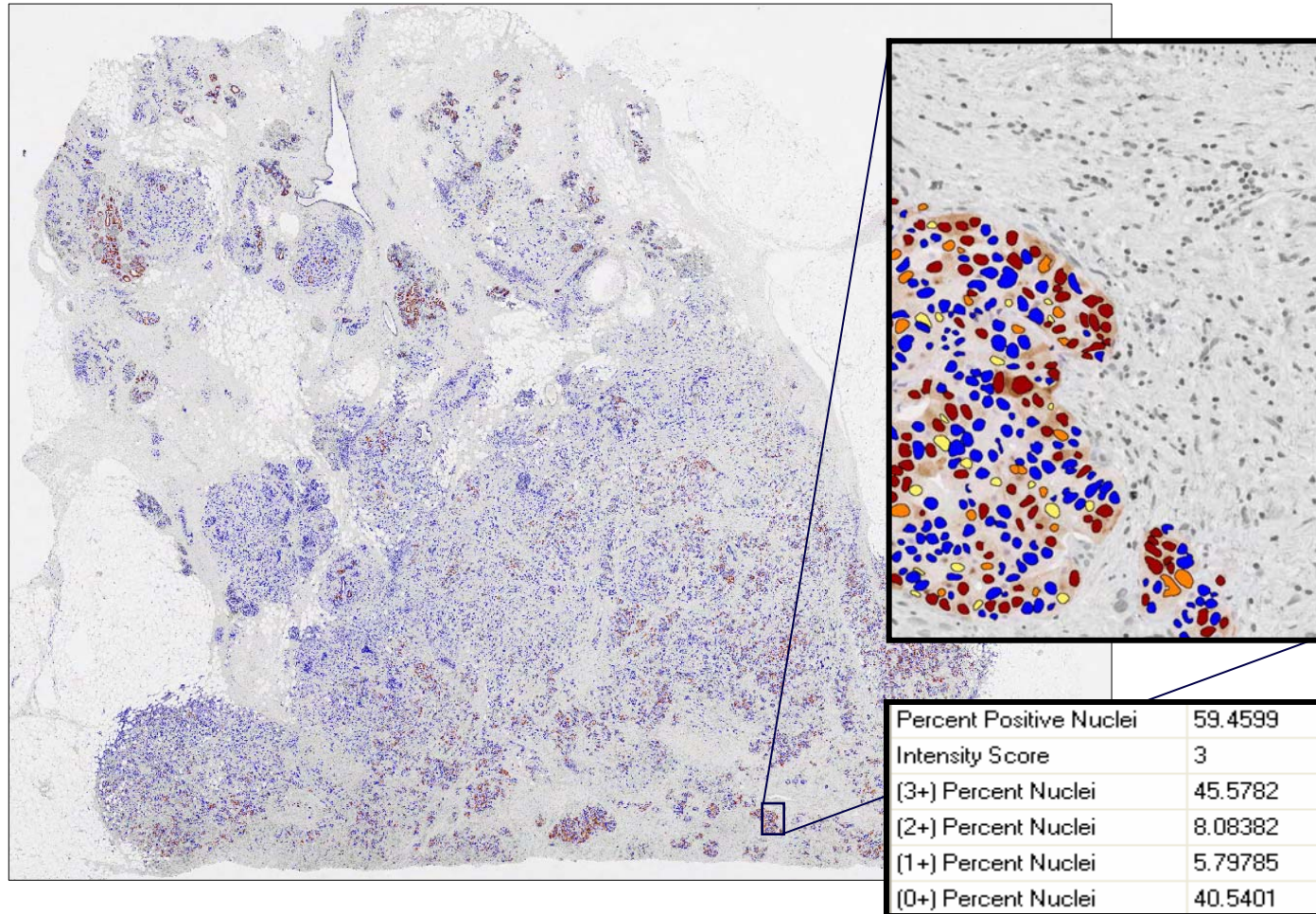
Genie learns from examples tumor/stroma



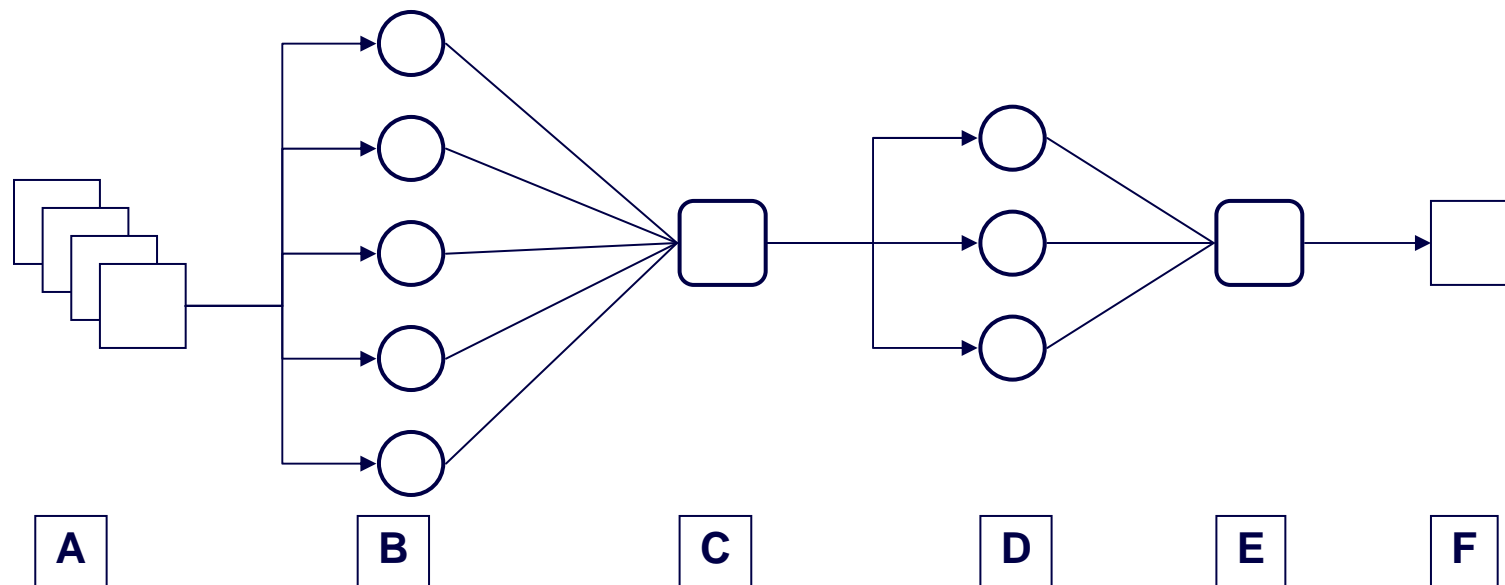
Genie finds/measures learned patterns



Genie as a pre-filter for other algorithms



How Genie Works - Structure of the Classifier



A: Input – Multi-band Image (RGB planes)

B: **Spectral/Textural Features** – Evolved Operator graphs (algorithm generated Features)

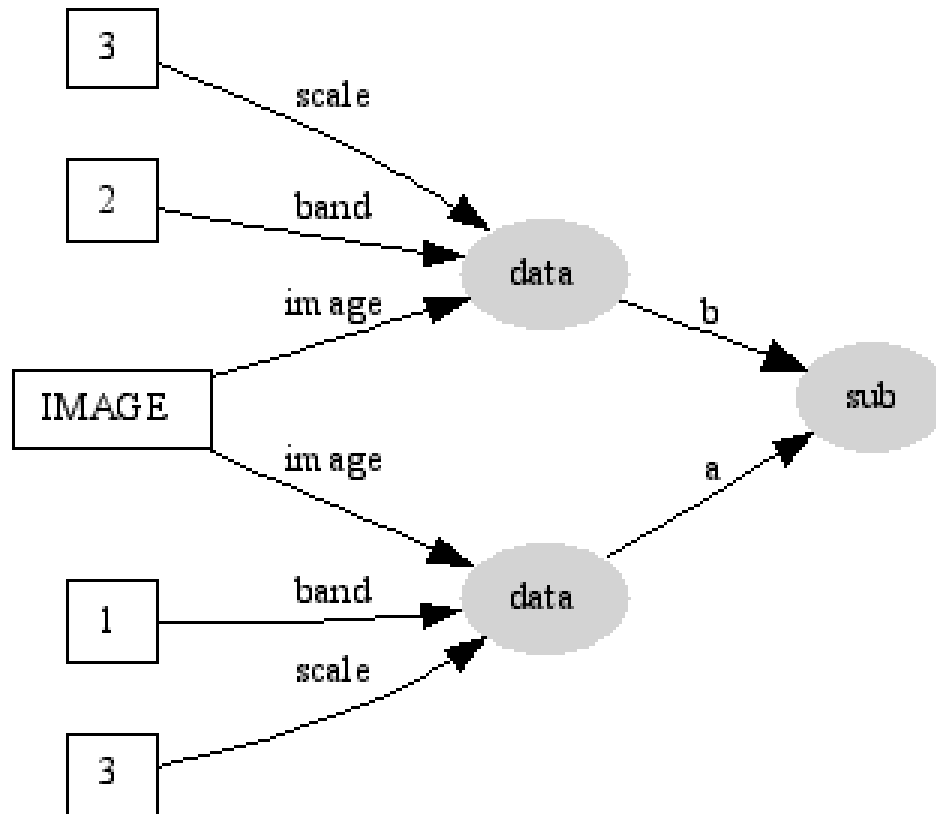
C: Mahalanobis Classifier – Features combined into a Preliminary Classification image.

D: **Morphological Features** – Evolved Operator graphs (algorithm generated Features)

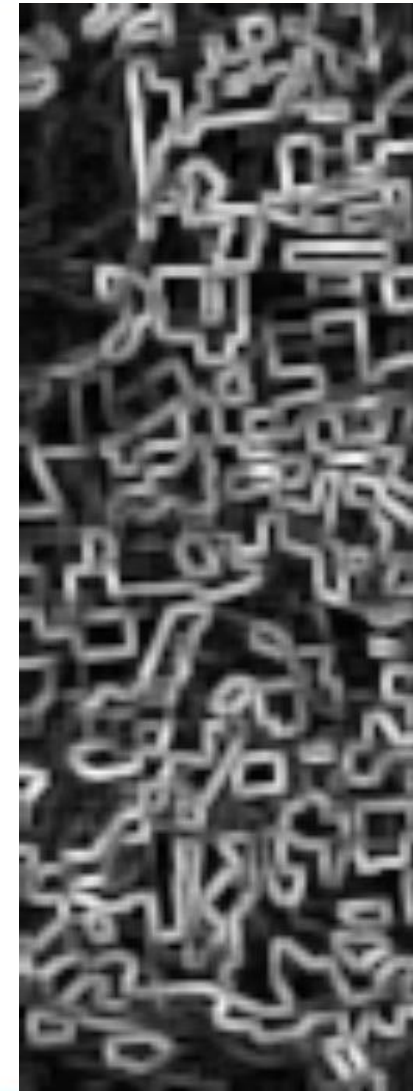
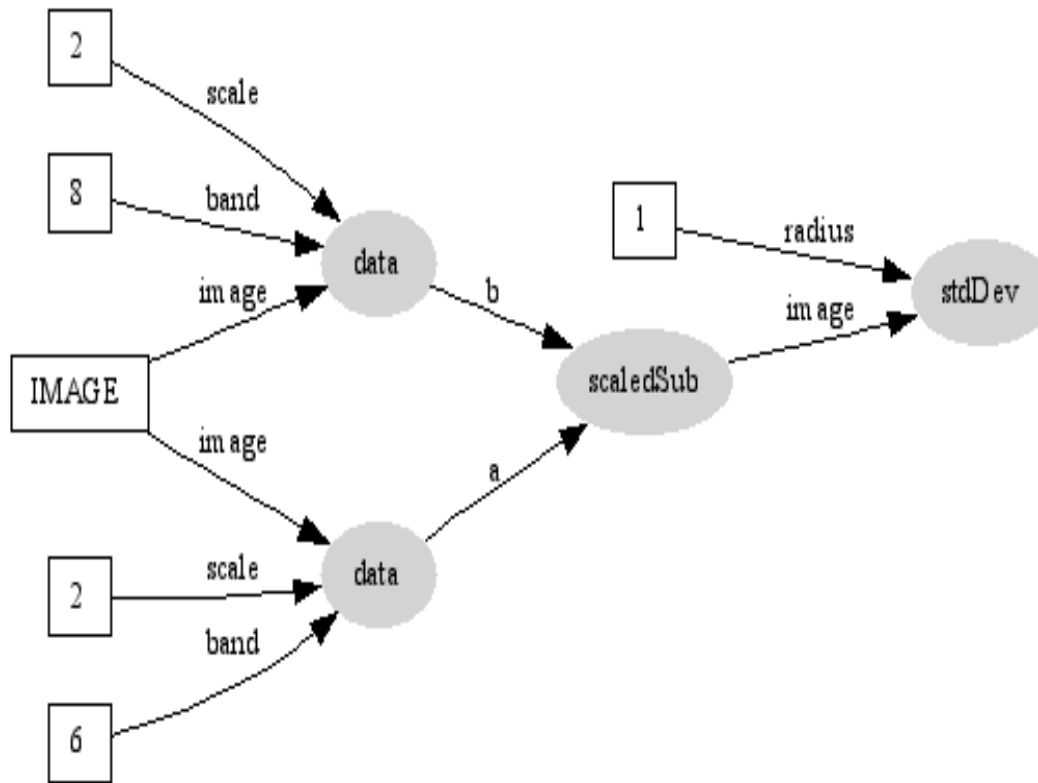
E: Mahalanobis Classifier combines Morphological Attributes into a Final Classification image

F: Output – Final Classification image (Each pixel has Class Value)

How Genie Works – algorithm generated Feature



How Genie Works – algorithm generated Feature



How Genie Works

- **Training phase:**
 - **Use Genie to build the classifier**
 - Genie “learns” algorithms/graphs and classification matrices. Iterate until desired performance is achieved.
 - **User supplies**
 - Training images and class samples.
 - Default parameters good for most applications.
 - **Process is incremental**
 - Performance can be improved by adding new data later.
- **Application phase:**
 - **Images analyzed using trained classifier**
 - Find patterns and report percentage of known classes.
 - Use as pre-processor for other algorithms

Histology Pattern Recognition with Genie™

Questions?

Contact Allen Olson at aolson@aperio.com