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# Digital Pathology: An Electronic Environment for Performing Pathologic Analyses from image

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**Abstract- Digital pathology is slowly gaining acceptance in both the clinical and research markets, and this is due in part to the wide spectrum of whole-slide scanning systems in the market today. However, whole slide scanning on its own is not sufficient. In order for digital pathology to be fully embraced by both clinical and research pathologists, image acquisition must be bundled with comprehensive image analysis applications and image management systems to provide a total digital pathology solution.**

**Digital pathology is the product of a series of technologic innovations driven by a number of companies, as well as by investigators who have harnessed this technology to enhance their research and clinical practice. One of the most familiar technologic changes is the introduction of digital cameras to capture still images, replacing film as the preferred medium for photo microscopy. Hardly noticed now, this change introduced many pathologists to the benefit of capturing fields of interest in a digital format. This relatively modest change has afforded us the ability to use imaging information in new and innovative ways in clinical, educational and research endeavours.**

**The use of digital pathology tools is essential to adapt and lead in the rapidly changing environment of 21st century neuropathology. Our study on the current state of the digital pathology suggests that the nature and pace of technologic change occurring within pathology are such that implementation of digital pathology technology and applications and will take a leading role in diagnostics and research.**

**Keywords: Tissue microarrays (TMAs), Brain Pathology, Computer Aided Diagnosis**

## 1. INTRODUCTION

Advances in computing and telecommunications have resulted in the availability of a range of online tools for use in pathology training and quality assurance. The majority focus on either enabling pathologists to examine and diagnose cases, or providing image archives that serve as reference material.

Limited emphasis has been placed on analysing the diagnostic process used by pathologists to reach a diagnosis and using this as a resource for improving diagnostic performance. Digital pathology has the potential to eliminate the pathological barriers of geography, subjectivity and cross-discipline communication in tissue-based research. Digital pathology is an emerging technology that provides an image-based environment for managing and interpreting the information generated from a digitized glass slide, offering substantial improvements in pharmaceutical drug development across discovery, preclinical GLP pathology and oncology clinical trials. Digital pathology is transforming global pharmaceutical research by enabling data sharing to integrate dispersed pathology labs around the world.

Most pathologists already use computers in some way, if only to make notes in patient files. For now, the hundreds of millions of pathology slides prepared annually get handled as they have for more than 100 years. A tissue sample gets cut into paper-thin, or thinner, sections, and a stain brings out specific features. Then, a pathologist puts the glass slide under a microscope. In a breast cancer biopsy, for example, a pathologist looks for a range of features in the tissue, including the number of abnormal cells in the section and the tumor grade, the latter depending on features such as cell structure.

In fact, pathologists do not look at every spot on every slide, but digitized versions could be inspected more thoroughly. A computer could analyse each pixel on every digital slide. And it could find and measure attributes indicative of health and disease such as internal structure, colour, texture and intensity of every pixel in every cell. A pathologist hunched over a microscope would assess those same attributes in only a small number of the cells. With continued technologic improvements and the introduction of fluorescent side scanning and multispectral detection, future developments in digital pathology offer the promise of adding powerful analytic tools to the pathology work environment.

Turning to computers, though, will not take pathologists out of the picture. Instead digitizing slides can actually bring more pathologists into the process of making a diagnosis and thereby avoid medical error.

The greatest potential of digital pathology may be realized when pathologists choose to reconfigure their work environments to utilize this technology for routine clinical work in order to take advantage of computer-aided diagnosis and analytic tools to supplement traditional histopathology assessment.

The difference between virtual microscopy and digital pathology is the addition of tools to allow the pathologist not only to read and annotate an individual slide, but also to interface WSI data with existing LIS, perform image analysis and correlate pathology data in WSI with other imaging and test result data available for a given patient. Only recently have vendors begun to develop software to support this functionality for WSI. This development of an information management system that supports both the imaging application as well as a comprehensive support of workflow within the digital pathology workspace is analogous to the development of picture archiving and communication systems (PACS) in radiology. .

One key obstacle to this vision is simply producing a high-resolution, digital image of a specimen on a slide, a task that is harder than it might seem. In the early 1990s some pathologists started to experiment with digital approaches by simply aiming a digital camera down the eyepiece of a microscope and snapping images.

In current digital pathology, a slide is prepared as usual, but then it is loaded into a scanner. A microscope objective inside the scanner—basically a magnifying lens—moves back and forth over the slide, and imaging technology, such as a CCD

(charge-coupled device) camera, captures the image. Speed is of the essence in digital pathology.

There are also current examples of computer-based diagnosis for neuropathology applications similar to that used in the systems described above. For instance, a computer-assisted diagnosis system for grading astrocytoma has been developed and tested using digital images from haematoxylins and eosin (H&E) stained slides that were analysed with imaging and learning algorithms.

If patients have a breast lump and want it checked out, a surgical biopsy is a good way to get a clear diagnosis. This type of breast biopsy removes the largest size of tissue sample, as compared to any type of needle biopsy. In some cases, the entire mass and a margin of healthy tissue may be removed. The tissue will be examined in a pathological lab right away to ensure that it is an accurate sample and get a diagnosis. Surgical breast biopsy takes the largest tissue sample and has the highest accuracy rate of all biopsy methods.

A pathology lab can use two methods to study your tissue sample. The quickest method is called "frozen section" . The tissue is rapidly frozen and sliced with a special blade into a section thin enough to see through. A permanent section method is a more thorough process, using special chemicals to get more information from the tissue slide.

In the era computer and telecommunications, pathologist's still mount tissue slices on glass slides, treat them with appropriate stains and examine them through a microscope. Despite advances in staining techniques, it's a process that has changed little over the last twenty years. Interpreting what they see is a time-consuming process and requires a great deal of skill and experience. Imaging techniques can play an important role in helping perform breast biopsies, especially of abnormal areas. In our research work, to understand the type of human breast cancer and attempt to analyze the histopathological slides with our proposed method to identify cancer parts just using simple technique of isolation of insignificant portion of slide by color polarization. The simplicity of algorithm is leads to less computational time. Thus, this approach is suitable for automated real-time breast cancer diagnosis tool.

The four main aspects of applied medical information technology, which change the traditional systems of the entire health care service is signal and data processing, digital modelling and interface optimisation. The information technology serving individual clinical specialties including clinical histopathology is changing at each of the four levels resulting in transformation of the communication paradigms. The object of investigation in histopathology is the digital slide, which is accessible throughout the world with no time or geographical limits. It permits the digital modelling of routine histological and/or cytological slide and it also allows measurements by using image analysis or stereology software packages. The electronic slide can be viewed, examined and diagnosed on a computer connected to a microscope, a new interface in diagnostic histopathology. This paper describes the main theoretical and practical aspects, including challenges, of digital pathology and it also discusses the detection of breast cancer based on pathological slides.

## 2. REVIEW WORKS

The first focus of digital pathology was to automate the microscope. In its earlier days, image-analysis applications were produced but limited to existing testing paradigms which had less impact than die leap to slide digitization. Fast-forward five years. Today, image quality is virtually identical to viewing a glass slide under the microscope. In fact, pathologists are willing to make diagnoses based on an image versus actual glass [1-5].

The next goal of imaging proponents is to have digital pathology fully accepted as a tool in all types of pathology labs, from research to translational to clinical. Rapid exchanges and increased collaboration will allow science and diagnostic decisions to progress faster and improve information flow. As with automation development in other fields, the further integration of all aspects of the entire process will improve workflow [6-7].

From a technology standpoint, scanners will continue to advance and become incrementally better. New algorithms are clearly a candidate for innovation. Access to case data and digital images will become more ubiquitous and multimodal. Standards for image formats and data interchanges will be adopted [8-12].

Fluorescence-based methods will come to the forefront for protein, RNA analysis, and DNA analysis due to improved precision, dynamic range, and novel, independent labeling methodologies (e.g., miRNA, mRNA, FISH in FFPE), optical-imaging technologies, and more advanced image-analysis algorithms [13-20].

One change that is not expected is biopsies being replaced by surrogate markers in blood or through imaging because the information that can be retrieved from a biopsy is, by its nature, specific to the disease and is comprehensive.

The continuing improvement in many aspects of pathology lab automation will certainly continue with an eye to increased throughput and improved results. In the future, along with faster and higher throughput imaging, lab scientists can expect to see improved immunohistochemistry automation and, although not as visible on a bench, improved collaboration and image-analysis software[21-23].

Digital pathology's value is more than just in creating an image. Pathology assays, when imaged digitally, can be inputs, or resources, to analysis methods which provide optimized results. These tests may not exist today because the methods have not existed previously or the resolution of the existing methods has not been sufficient to make the assays useful to me field. 'Those working in this field need to look at the entire process as a whole, from the treatment of the sample through imaging to analysis," Christiansen advises.

Digital pathology, coupled with the combination of improved assays that provide optimized results, allows clinicians as well as researchers to carry science and diagnostics to the next level.

## 3. PROPOSED METHOD

In our work, used free Tissue Blocks downloaded from OriGene Technologies, Inc, 2009. In the experiments, different breast cancer tissues from different patients and different non-cancerous falsely detected breast tissues from different normal females are considered. Each of the 24-bit bitmap image size is 640X480 Pixels.

The different types breast cancers pathological slide are as follows (Figure 1-4):

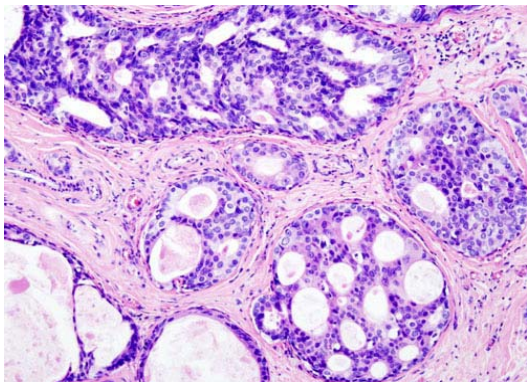

Figure 1. Ductal Carcinoma in Situ

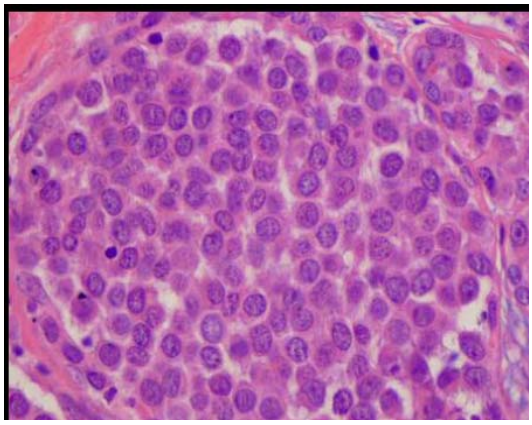

Figure 2. Lobular Carcinoma in Situ

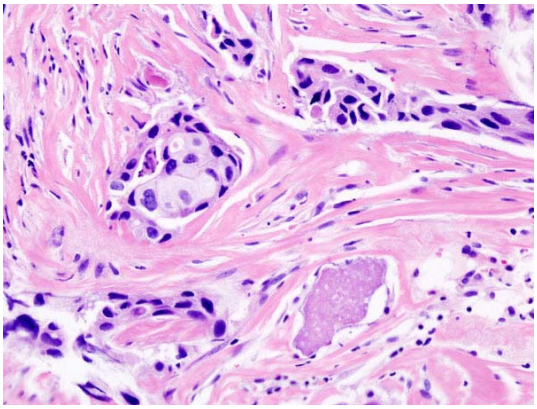

Figure 3. Invasive Ductal Breast Cancer

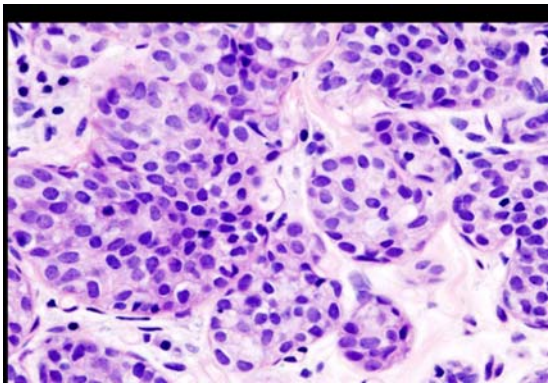

Figure 4. Invasive Lobular Breast Cancer

**Process1.** Convert the 24-bit color bitmap image to 256-shaded grey scale image after increasing contrast of the source image.

**Algorithm1:**
Input: 24-bit color bitmap image
RGB_Image = 24-bit color bitmap image
Grey_Image = 256-shaded grey image
Isize = 24-bit color bitmap image size
R = Red Value
G = Green Value
B = Blue Value
Grey = Grey Value
MaxV = Maximum grey value
MinV = Minimum grey value
Output: 256-shaded grey scale image
Begin
Step1. Open RGB_Image to read
Step2. Open Grey_Image to write
Step3. Isize = RGB_Image size
Step4. Loop I=0 to Isize/3
Read R, G, B from RGB_Image
If (R>128)
R=R*1.2
If (R>255) R=255
Else
R=R/1.2
If (R<0) R=0
If (G>128)
G=G*1.2
If (G>255) G=255
Else
G=G/1.2
If (G<0) G=0
If (B>128)
B=B*1.2
If (B>255) B=255
Else
B=B/1.2
If (B<0) B=0
Grey = 0.3 * R+ 0.11 * B +0.59 * G
If (MaxV<Grey)
MaxV=Grey
If (MinV>Grey)
MinV=Grey
Write Grey to Grey_Image
[End of loop]
Step5. Close RGB_Image, Grey_Image
End

**Process2.** Convert the resultant 256-shaded grey scale image to Inverse Bi-Color Monochrome image after increasing contrast of the source image.

**Algorithm1:**
Input: 256-shaded grey image
Grey_Image = 256-shaded grey image
Mono_Image = Bi-Color Monochrome image
Isize = 256-shaded grey image size
Grey = Grey Value
MaxV = Maximum grey value
MinV = Minimum grey value

MidV = Threshold Value
Output: Bi-Color monochrome image
Begin
Step1. Open Grey_Image to read
Step2. Open Mono_Image to write
Step3. MidV = (MaxV – MinV) / 2
Step4. Isize = Grey_Image size
Step5. Loop I=0 to Isize/3
Read Grey from Grey_Image
If (Grey>128)
Grey =R*1.2
If (Grey >255) Grey =255
Else
Grey = Grey /1.2
If (Grey <0) Grey = 0
If (Grey>MidV)
Grey=MaxV
Else
Grey=MinV
Grey=(255-Grey)
Write Grey to Mono_Image
[End of Loop]
Step6. Close Grey_Image, Mono_Image
End

Major objective of the algorithms, to remove the huge amount of fat, connective tissue, and gland tissue from the Cancerous cells within the histopathological biopsy samples.

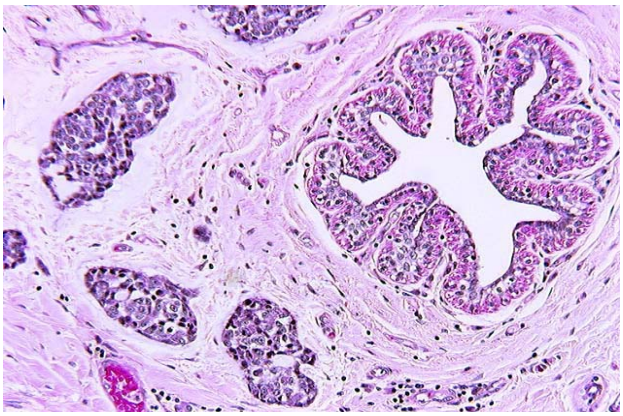

Figure 5. 24-bit Color Image of Histopathological Slide showing Cancer

## 4. CONCLUSIONS

The history and development of digital pathology provide a useful guide to the likely future of these technologies and their impact on the practice of neuropathology in the 21st century. Most critically, however, oncologist need to begin to exercise a leadership role in the introduction of these technologies so that we are able to shape the development of the emerging digital pathology workspace around our skills and needs. It is only by doing this that we will be able to ensure our ability to continue to exercise the historic leadership role of oncologist in diagnostics and research in the 21st century. This paper shows the possibility of detection of cancer.

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