Popular Article

Trends in Agriculutre Science

Vol.2, Issue 3, March, 2023, Page: 148-151

Digital Pathology: An Overview

[1]P. D. Baraiya, [2]J. M. Patel, [3]P. D. Vihol, [4]J.K. Raval, [5]H.C. Parmar, [6]S. A. Patel, [7]P. R. Panzade

[1, 6, 7]M.V.Sc. Scholar; [2]Associate Professor; [3]Associate Professor & Head, [4]Assistant Research Scientist, [5]Assistant Professor

[1,2,3,6,7]Department of Veterinary Pathology,

[5]Department of Veterinary Clinical Complex,

College of Veterinary Science & Animal Husbandry,

Kamdhenu University, Navsari.

[4]Livestock Research Station,

Navsari Agricultural University, Navsari

https://doi.org/10.5281/zenodo.7723175

Introduction

Digital pathology is a specialized area within the field of pathology that deals with managing data obtained from digitized specimen slides. This is achieved through the use of computer-based technology and virtual microscopy, which enables glass slides to be converted into digital slides that can be viewed, analyzed, and shared on a computer screen.

The adoption of Whole-Slide Imaging (WSI) has led to significant growth in the field of digital pathology, particularly in diagnostic medicine. DP technology modifies the images observed through a microscope, converting them into digital image files that can be stored in computer servers or cloud systems and transmitted over the internet. This enables medical professionals to view the images from anywhere and facilitates collaboration between experts in different locations.

WSI, also known as virtual microscopy, provides a digital representation of an entire glass slide at microscopic resolution. This has revolutionized the field of pathology by enabling pathologists to view the entire specimen on a single screen, eliminating the need for physical slides and reducing the risk of loss or damage. Additionally, the use of Artificial Intelligence and Machine Learning has made it possible to analyze large amounts of digital pathology data more efficiently, leading to faster diagnoses, better treatment decisions, and improved patient outcomes.

Discovery of digital pathology

Over a century ago, scientists were already developing a methodology resembling digital pathology by transferring microscope images onto photographic plates for storage. In the late 1960s, telepathology emerged as a means of practicing pathology remotely, allowing scientists to easily access slide images produced at labs in other locations. During this time, the National Aeronautics and Space Administration (NASA) also successfully monitored the health of their astronauts from a distance using telemonitoring systems.

On October 4, 1993, Dr. Bhattacharya and Dr. Ronald S. Weinstein—known as the "father of telepathology"—discussed the first telepathology report made in China. The first software system to handle whole slide images was created by Renato Ferreira and Joel Saltz in the late 1990s. They used a robotic microscope and computer software to combine individual static images of a slide taken in a tile-based mosaic pattern. However, each focal plane produced 7 GB of data, and a single disc could produce up to 210 GB.

New Whole Slide Image (WSI) scanners have been created as a result of improvements in digital cameras, objective optics, robotics, and computers. These scanners create high-resolution digital slides with manageable file sizes. Commercial WSI scanners of all sizes, from those with a tiny footprint to those that could handle more than 100 slides, were being produced by the year 2000. Overall, these technical developments have revolutionised the field of digital pathology and opened the door for quicker and more precise disease diagnoses and prognoses.

Components of digital pathology

The three major parts of the digital pathology ecosystem are as follows:

1. A digital pathology system
2. information networks (DPS)
3. Computer equipment

Various healthcare systems, including the hospital information system (HIS), electronic medical record (EMR), laboratory information system (LIS), and radiology image archiving and communication system, are included in the information systems. (PACS).

A device, like a whole slide scanner, is used to acquire and handle digital images, and a workstation, like a display cockpit, is used to examine and/or share the images. These two interconnected subsystems make up the DPS. Together, the DPS subsystems guarantee seamless administration of digital images.

trendsinagriculturescience.com
trendsinagriculturescience@gmail.com
Published: 11 March 2023

The digital pathology environment includes the DPS and information systems in addition to system tools like image analysis algorithms. These tools make it possible to analyse and modify digital pictures for a variety of uses, including computer-assisted diagnosis. Digital pathology has revolutionised the field of pathology by making diagnoses, prognoses, and illness predictions more accurate, more affordable, and more efficient.

Whole Slide Scanner (WSS)

Robotic microscopes called whole slide scanners (WSS) can digitise glass slides by taking pictures of each field of view (FOV) and stitching them together to create a complete photograph of the slide. High-throughput scanners are frequently used in clinical or research settings because they can constantly load and remove slides while others are still being scanned. Both low-volume and high-volume scanners are available for use in labs. Depending on the level of magnification needed for particular applications like surgical pathology and identifying microorganisms, various objective lenses with magnifications ranging from 1.25 to 100X are used.

Image analysis algorithms/ Software

Image analysis algorithms are used to extract useful information from whole slide images. There are several commercially available specialized software platforms that can perform image analysis, such as Visiopharm, Definiens, Indica Labs, Virtuoso from Roche, and Genie from Leica. These algorithms are designed to identify specific events in the body, such as detecting nuclei, tumor cells, microorganisms, and mitoses. They can also be used to measure the extent of tissue fibrosis and identify micro metastases in lymph nodes.

Application of digital pathology

- Digital pathology has become an important part of both undergraduate and postgraduate pathology education, as well as research.
- In the field of diagnostics, digital pathology allows for consultations between pathologists in different locations, either within the same practice or remotely for expert opinions.
- Digital pathology is also widely used in research, particularly for scoring tissue microarrays and exchanging digital images between institutions, as well as for quantifying cells and analyzing cell viability.
- Whole slide images (WSIs) are permanently saved with consistent quality, making them easily retrievable for teaching, research, and clinical purposes. Additionally, multiple observers can access the same case simultaneously, and WSIs can be integrated into pathology reports and hospital information systems.

trendsinagriculturescience.com
trendsinagriculturescience@gmail.com
Published: 11 March 2023

Conclusions

Digital pathology has emerged as a valuable and practical resource in both clinical and research pathology. It has the ability to convert glass slides into digital images through the use of whole slide scanners. Image analysis software is then used to quantify the digital images, producing results in a timely manner. The digital images are easily stored in the cloud and can be archived when needed. The use of digital pathology has significantly reduced the time and manpower required to analyze slides compared to traditional pathological methods.

trendsinagriculturescience.com
trendsinagriculturescience@gmail.com
Published: 11 March 2023