

# Digital pathology: an overview

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## Abstract

Recent years have seen digital pathology playing a very important role in the discipline of pathology and have increasingly become a necessary tool in the modern laboratory environment. Digital pathology not only enables sharing of information and data, helping in circulating novel ideas and knowledge but is also a critical method for validation and reproducibility of results, important for quality assurance.

## Concept of digital pathology

A digital image consists of thousands of pixels which are displayed by the computer monitors with good resolution and colour quality [1]. Digital pathology has now become synonymous with whole slide imaging (WSI). WSI, as the name suggests, consists in the scanning of the entire slide at high resolution. WSI enables the pathologist to see the entire tissue or cytological smear and also provides the option to look for minute details or particular areas of interest.

Beside the image acquisition, the practice of digital pathology involves several steps in the workflow: saving and storing of the images, annotation and analysis of the images, and then sharing of the images or data accrued from the images. Data management systems integrating analysis software's enable high-throughput analysis with constant and standardized parameters and recording of the analysis results, thus offering better traceability [2]. Digital images can be a part of the laboratory information system, which can be accessed by the pathologists, and shared over the internet for second opinion or for educational purposes.

## Applications and advantages of digital pathology

Virtual microscope systems can be used for not only for the primary diagnosis, but also for sending the images across for a second opinion or consultation in doubtful cases. This technique is called telepathology/ teleconsultation, and consists of static (image capture and sent for diagnosis), dynamic (possibility of remote handling of slides), and a combination of both technologies [3]. Automated image analysis has recently proven to be a very important tool is the identification of biomarkers by immunohistochemistry, especially in relation to molecular pathology, oncology and clinical research. A good example of this is the HER2 image analysis, approved by the American Society of Clinical Oncology and College of American Pathologists, for evaluation of breast cancer, when used under specific conditions [4]. Biobanking, tissue microarray analysis and molecular profiling of tissue has also benefited from these developments. Digital pathology is also tremendously useful for archiving slides, thereby helping in education and research. Reproducibility and easy retrieval of the images helps in quality control and research. The method also reduces considerable inter-observer and intra-observer variability, and scanning of the

slides standardizes illumination and light balance, two important parameters which affect image analysis/ reading. Digital pathology also avoids problems related to glass slide storage: breakage, loss, staining attenuation, but also cumulated weight requiring storage facilities. It smoothenes the process of archives consultation by significantly reducing time dedicated to recover slides from archives.

## Challenges

Despite obvious advantages and continuous advances in digital pathology and whole slide imaging, the implementation in routine clinical practice remains slow. The first pathology laboratory to switch to 100% digital diagnosis for all clinical histology cases (the Laboratory for Pathology East Netherlands Foundation, the largest pathology laboratory in the Netherlands) only achieved it in 2015 [5]. Feedback of such pioneer laboratories will undoubtedly contribute to alleviate fears in the coming years. Despite the recent advances in digital pathology and whole slide imaging, better quality control guidelines are needed right from sample preparation to whole slide imaging and image analysis. Also, independent quality assessment guidelines for different software's are needed for automated quantification, helping to make a uniform assessment for image analysis [2,6]. Universally accepted file formats and data storage capacities continue to be additional challenges. The cost to implement a digital pathology workflow is certainly another source of apprehension but has to be balanced by the improved pathologist efficiency.

## Future perspectives

These are exciting times for digital pathology and the emerging research will lead to better image acquisition and analysis. Despite the challenges, innovations in digital technology will not only improve the pathology services, but will also revolutionize research and healthcare.

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## References

1. Parwani AV, Feldman M, Balis U, Pantanowitz L (2012) Digital imaging. In: Pantanowitz L, Balis UJ, Tuthill JM (editors). *Pathology Informatics: Theory & Practice*. ASCP Press 15: 231-256.
2. Bouzin C, Lamba Saini M, Khaing KK, Ambroise J, Marbaix E, et al. (2015) Digital pathology: elementary, rapid and reliable automated image analysis. *Histopathology* 68: 888-896.
3. Pantanowitz L (2010) Digital images and the future of digital pathology. *Journal of Pathology Informatics* 1: 1-15.
4. Wolff AC, Hammond ME, Hicks DG, Dowsett M, McShane LM, Allison KH, et al. (2014) Recommendations for human epidermal growth factor receptor 2 testing in breast cancer: American Society of Clinical Oncology/College of American Pathologists clinical practice guideline update. *Arch Pathol Lab Med* 138: 241-56.
5. Cheng CL, Tan PH (2016) Digital pathology in the diagnostic setting: beyond technology into best practice and service management. *J Clin Pathol* 70: 1-13.
6. Higgins C (2015) Applications and challenges of digital pathology and whole slide imaging. *Biotechnic & Histochemistry* 90: 5.