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Pathology Summit 2018: Efficient support for digital pathology in standard medical imaging repositories - Tiago Marques Godinho - University of Aveiro, Portugal.

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Today, the field of digital pathology is in the spotlight thanks to advances in imaging technologies on complete slides. In this area, the operation of digital laboratories has significant advantages, namely faster and more precise diagnosis, better support for tele-pathology as well as new clinical and research applications. Despite these advantages, there has been very slow adoption of whole slide imaging. In fact, it raises several technical challenges that can compromise the benefits of its operation, including performance issues associated with the storage and distribution of huge volumes of data and the deficiency of interoperability with further hospital evidence systems. , such as Depiction Archive and Communications Systems (PACS) grounded on the DICOM standard. We have developed the architecture of a web pathology PACS which is able to overcome these challenges and unlock the full potential of digital pathology and full slide imaging for clinical practice. Our solution fully complies with the DICOM standard for both communications and data formats. It embraces a PACS record capable of storing whole slide images with other medical imaging modalities as well as a zero-fingerprint viewer that runs in any common web browser. In summary, it allows the integration of digital pathology and whole slide imaging with other medical imaging methods while being very competitive in terms of efficiency and user-friendliness.

Digital pathology is a sub-field of pathology that focuses on data management based on information generated from digitized sample slides. Thanks to the use of computer technology, digital pathology uses virtual microscopy. Glass slides are converted to digital slides that can be viewed, managed, shared and analyzed on a computer screen. With the practice of whole slide imaging (WSI), which is another name for virtual microscopy, the field of digital pathology is developing and has applications in diagnostic medicine, with the aim of making diagnoses, prognoses and effective and cheaper disease forecasts. .

History

The roots of digital pathology go back to the 1960s, when the first experiments in tele-pathology took place. Later in the 1990s, the principle of virtual microscopy appeared in several areas of life science research. At the turn of the century, the scientific community agreed more and more on the term “digital pathology” to designate the efforts of digitization in pathology. However, in 2000, the technical requirements (scanner, storage and network) were still a limited factor for a wide dissemination of the concepts of digital pathology. In the past 5 years, that has changed with the appearance of new powerful and affordable scanner technologies as well as mass / cloud storage technologies. The arena of radiology endured digital transformation virtually 15 years ago, not because radiology is more advanced, but there are fundamental differences between digital images in radiology and digital pathology: the image source in radiology is the patient (alive), and today in most cases, the image is even mainly captured in digital format. In pathology, digitization is carried out from preserved and processed samples, for retrospective studies even from slides stored in a biobank. In addition to this difference in pre-analysis and metadata content, the storage required in digital pathology is two to three orders of magnitude higher than in radiology. However, the expected benefits of digital pathology are similar to those of radiology:

• Ability to quickly transmit digital slides over distances, allowing tele-pathology scenarios.

• Ability to access previous samples from the same patients and / or similar cases for comparison and review, with much less effort than retrieving slides from archive shelves.

• Ability to simultaneously compare different areas of multiple slides (slide by slide mode) using a virtual microscope.

This work is partly presented at 15th Global Experts Meeting on Pathology and Laboratory Medicine, July 02-03, 2018 held at Bangkok, Thailand.

• Ability to annotate areas directly on the slide and share them for teaching and research.

Digital pathology is currently broadly used for educational commitments in tele-pathology and teleconsultation as well as in research projects. Digital pathology makes it much easier to share and annotate slides, and uploading annotated course sets creates new opportunities for online learning and knowledge sharing in pathology. Digital pathology in diagnosis is an emerging and future field.

Challenges:

A Leica Biosystems full slide image scanner with an attached control screen to display the scanned slides. Digital pathology has stood permitted by the FDA for primary diagnosis. The approval was based on a multicenter study of 1992 cases in which whole slide imaging (WSI) was not inferior to microscopy on a wide range of samples of surgical pathology, types of samples and spots. Though there are benefits for WSI when generating digital data from glass slides, with respect to real-time tele pathology applications, WSI is not a solid choice for discussion and collaboration between several distant pathologists. In addition, unlike digital radiology where the elimination of film makes the return on investment (ROI) clear, the ROI of digital pathology equipment is less obvious. The strongest ROI rationale includes better quality health care, increased efficiency for pathologists and reduced costs for handling glass slides.

Potential:

Trained pathologists traditionally observe tissue slides under the microscope. These tissue slides can be stained to highlight cellular structures. When the slides are digitized, they can be shared by tele-pathology and analyzed digitally using computer algorithms. The algorithms can be used to automate manual counting of structures or to classify tissue conditions as used in the classification of tumors. They can also be used for the detection of features of mitotic figures, epithelial cells or tissue-specific structures such as lung cancer nodules, glomeruli or vessels. This has the potential to reduce human error and improve the accuracy of diagnostics. Digital slides can be easily shared, increasing the potential for using data in education as well as in consultations between expert pathologists.

Biography:

Tiago Marques Godinho obtained his master's degree in computer engineering and telematics from the University of Aveiro in 2013. He is currently pursuing a doctoral program in computer science. He received a national grant to conduct his research on performance optimization in medical imaging information systems. He has published 5 articles in international peer-reviewed journals and has participated in major field conferences. He focused his research on computer systems for digital pathology.

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