An efficient architecture to support digital pathology in standard medical imaging repositories

Tiago M. Godinho[1], Rui Lebre[1], Luís B. Silva[2], Carlos Costa[1]

Clinical pathology is facing a growing crisis caused by the combination of two factors; the reduced number of pathologists per capita, and the increasing demand for their services. Digital medical imaging workflows and telemedicine are considered an important tool to face this crisis since they have been successfully applied to other medical specialities. In recent years, digital pathology and whole-slide imaging (WSI) have been gaining momentum due to the appearance of digital scanners. However, the technology is not sufficiently mature to support remote clinical practice in pathology. Several technical challenges have been contributing to the slow implementation of telepathology platforms. Most notably, the performance issues associated with the storage and distribution of huge volumes of data, the tremendous WSI resolution (gigapixel scale), and the interoperability with other systems associated with the medical practice, such as Picture Archive and Communications Systems (PACS) based on the DICOM standard.

This article proposes a novel architecture of a Web Pathology PACS that is fully compliant with DICOM standard communications and data formats. The solution includes a Cloud-ready repository that stores WSI studies in DICOM and offers a communication interface based on the most recent DICOM Web services. The second main component is a zero-footprint viewer that runs in any web browser. It features a tiling engine especially suited to manage the extreme requirements of WSI image pyramids. These components were designed with a special focus on efficiency and usability. The performance of the proposed system was assessed through a comparative analysis of the state-of-the-art solutions. The results demonstrate that it is possible to have a very competitive solution based on standard workflows. For instance, our solution managed to complete a visualization workflow on average 18x faster than its best counterpart.

1 — Department of Electronics, Telecommunications and Informatics & IEETA, University of Aveiro
2 — BMD Software, Portugal

FIGURE 1
Pathology PACS Architecture

FIGURE 2
Zero-footprint Web Viewer

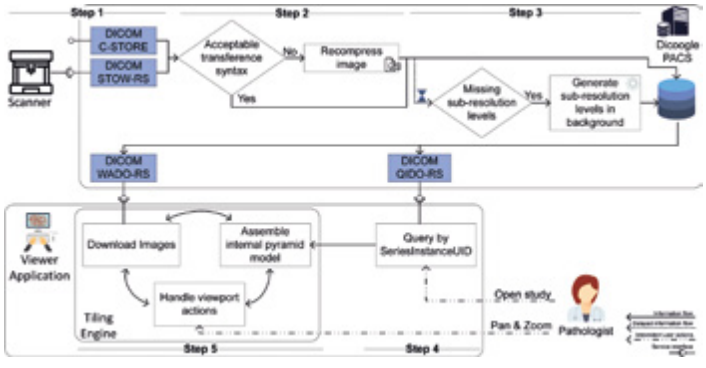

Figure 1

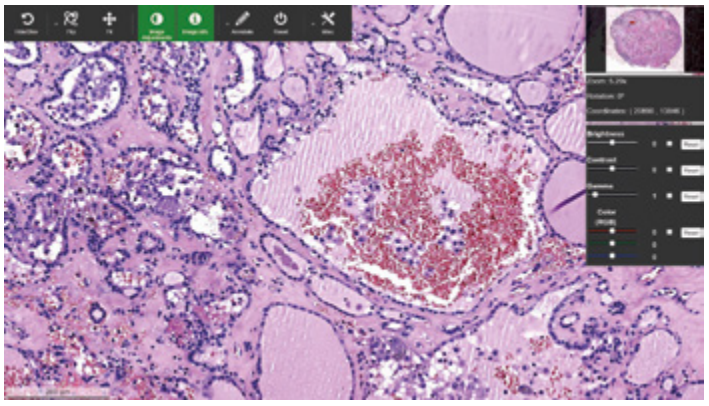

Figure 2