A FLEXIBLE WEB-BASED PLATFORM FOR VIRTUAL MICROSCOPY IN EDUCATION AND RESEARCH

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ADVANTAGES OF VIRTUAL MICROSCOPY

Whole slide microscopy scanning systems are of increasing interest. Batches of slides can be scanned completely with high resolution in short times. Such whole slide images play a major role in online education or distributed multi-center research projects. Samples, generated in one center can be scanned and digitally provided to students or research partners at different locations. Digital slides enable all participants to view identical data by fast and cheap distribution without loss of quality or the need to send duplicated glass slides. However, the huge amount of data of these whole slide images and the different proprietary file formats are one drawback for efficient and flexible web-based applications. Our proposed solution offers a flexible web-based platform for education or research purposes utilizing virtual microscopy.

DIGITAL SLIDES

Whole slide images digitized with slide scanners are usually related to file sizes of up to 5Gigabyte per slide. Hence, in typical distributed client/server scenarios, a download of complete slides is impossible. To optimize the data distribution to the remote client, only those regions are transferred in required resolutions, which are currently visualized onto the screen. Conversion of the whole slide image data to a tiled pyramid structure can enable the provision of selected tiles in defined resolutions directly. Depending on the requirements and system specification, this generation of tiles can be done prior the deployment and without additional computation during access or on the fly triggered by the clients.
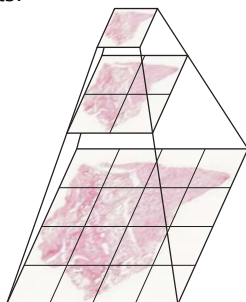

Figure 1: Generation of a tiled pyramid-structure

WEB-BASED PLATFORM

The platform has been developed as a browser-based solution. On the client side nearly all popular operating systems and web-browsers are supported. In most cases no additional software has to be installed. Only a standard browser plug-in is required. The platform consists of two parts. A generic virtual microscopy module serves as basis for all applications. The digital slides are visualized efficiently and smooth in high quality and the user can zoom to any preferred magnification level and pan the slide freely while only the visualized parts and details are transferred to the client. The image data can be enhanced by additional descriptions and iconic annotations, either previously defined or interactively by the participant. This module is embedded in a flexible framework to administer the digital slides and different projects or courses. Depending on the application, this framework can be adopted and configured for the required functionality. Different collections of slides can be defined corresponding to courses or research projects. Specific slides can be added to those collections and participants can be granted access that they can view the specimens. For organizational and search purposes, the slides can be tagged by key words and identifiers. Users can select and sort the slides depending on their needs or tasks.
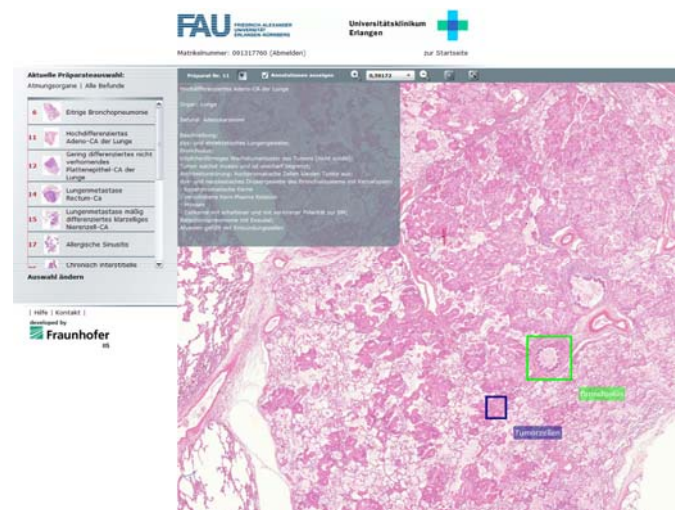

Figure 2: Visualization of a virtual slide with related information in an educational application based on the flexible platform.

ONLINE EDUCATION

In academic education of microscopic histology and pa-thology, an independent training in the recognition of specimens is an important supplement to core lectures. As the availability of necessary resources such as microscopes, rooms, and personnel is limited, innovative internet tech-nologies can help to provide flexible and continuous op-portunities in education. Based on the flexible web-based virtual microscopy platform, an educational application has been developed in cooperation between the Fraun-hofer IIS, the University Hospital Erlangen, and the Univer-sity Erlangen-Nuremberg. To offer training possibilities at any time without the need of constant administration this solution is currently in use in two different universities supporting various lectures with hundreds of students. Approximately 1,000 specimens have so far been digitized and provided to the students. The specimens have been tagged with clinical aspects as anatomical structures, pa-thological findings, or staining. The students can select topics or navigate freely through the lecture depending slides. Additional descriptions and annotations are com-plementing the learning process. An exercise mode and an exam simulation offer self-tests about the learning process The feedback by the students from the past courses is constantly overwhelming and the platform is stable even during peaks of usage prior exams.

DISTRIBUTED RESEARCH

Microscopic research often deals with the analysis and assessment of rare specimens or different occurrences of them. A digital distribution of slides hence enables the in-volvement of different experts world-wide and to share identical data. Typical such tasks are the definition of a consensus classification of a slide or the localization of specific regions and to mark them. Using an application for distributed research, based on the proposed web-ba-sed virtual microscopy platform, such projects can be easi-ly be organized and handled efficiently. Clinical research partners can be granted access to project specific slides and the experts may choose classifications for the spe-cimen and annotate regions interactively. The results of the classification process can be shared between the part-ners and lead to innovative agreements in the classifi-cation of specimen. A prototypic application is currently under evaluation in first projects examining different aspects of histopathological diagnosis.

REFERENCES
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