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Image Quality – Requirements For Clinical and Research Applications

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Introduction/ Background

The digitalization of slides and subsequent utilization of whole slide images has a highly visible penetration within digital pathology workflows. Not only research applications moving towards daily use, but also clinical pathology applies digital images increasingly. The use of virtual microscopy, with all of their advantages and benefits, requires additional efforts to assure sufficient image quality [1]. This consist of multiple aspects to be fulfilled, such as sharpness, tissue completeness, color fastness primary and additional secondary properties like existence of artifacts, compression, availability of digitalization metadata and others.

Aims

Scanning devices use multiple different technologies such as brightfield, laser or confocal. Moreover, they partly divide into patch and line scanning concepts. But not only hardware is constantly changing due to upgrades or further developments but also software algorithms, e.g. focus and stitching, are modified. This requires a standardized measurement algorithms and procedures to assure an appropriate quality for relevant aspects, depending on dedicated use cases.

Methods

Each dedicated requirement towards image quality has to be investigated separately, due to the fact that they differ in their origin. Distortions may be introduced through slide preparation, calibration of scanning device or even scanner software parameter. Therefore, we developed multiple algorithms and software tools to calculate a quality measure for each aspect automatically. Recently we are focusing on image sharpness [2], color fastness [3, 4] and completeness of tissue. Sharpness is measured by a no-reference focus algorithm per slide. Color fastness is calculated based on CIEDE2000 [5] for a reference IT8.7/1 color target mounted onto a glass slide per scanner. Completeness is automatically analyzed based on registration and comparison of whole slide overview image and preview camera data. Secondary quality parameters were not part of this investigation.

Results

We established a standard operation procedure to automatically apply slide based tests directly after digitalization. This enables scanning personal to execute quality inspection at a glance and schedule insufficient whole slide images for a rescan. Moreover, we made some of these tools available as a web-based service including a based web-frontend with user management. This enables everyone within the digital pathology community to validate their slides, scanning devices and scanning parameter.
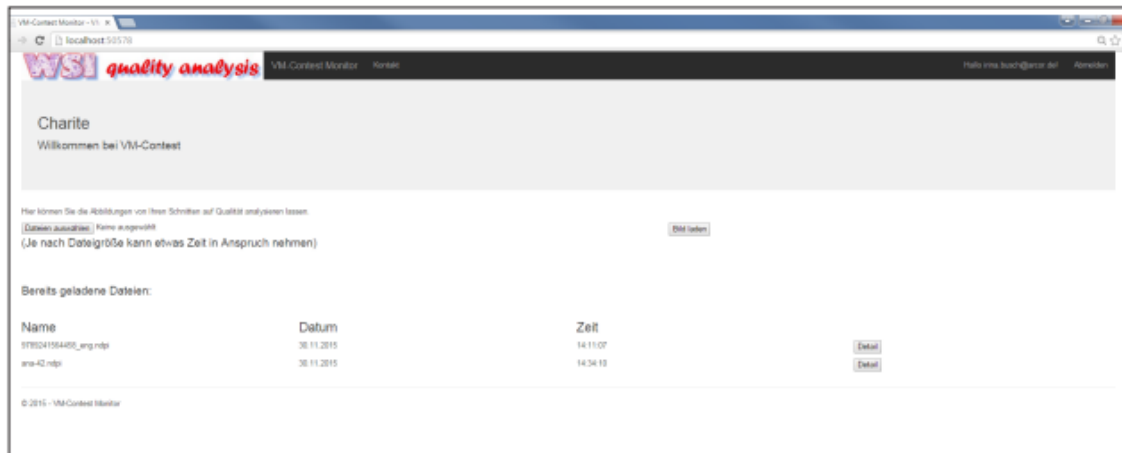
Figure 1: Prototype website to inspect quality aspects for uploaded slides. Each user can upload up to 10 slides.

References:

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