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OPTIMAL IMAGE DATA COMPRESSION FOR WHOLE SLIDE IMAGES

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Introduction/ Background

Whole slide scanning is rapidly entering routine pathology laboratories. Modern scanners enable digitization of tens or even hundreds of thousands slides each year. If all WSI images are stored permanently, hundreds of terabytes image files need to be stored. It is essential to use image storage methods that preserve the scan image quality, but also keep storage costs in a reasonable level.

Aims

Today all WSIs are stored with lossy compression methods using a variety of different file formats. At the practical level it is important to find an image file format, which results in small-sized image files but retaining image quality as "visually lossless".

Methods

In this study we compared file formats of Hamamatsu, Aperio, and 3D-Histech scanners to standard JPEG2000 and to JPEG2000 specially optimized for brightfield histology WSIs. As for image quality readout we used standardized resolution charts, and evaluation by three pathologists who ranked the images by their visual quality, when displayed on a 4K computer monitor.

Results

Differences in WSI file sizes of scanned images deemed "visually lossless" were significant. If we set Hamamatsu Nanozoomer .NDPI file size (using its default "jpeg80 quality") as 100%, the size of a "visually lossless" JPEG2000 file was only 15-20% of that. Comparisons to Aperio and 3D-Histech files (.svs and .mrxs at their default settings) yielded similar results. A further optimization of JPEG2000 was done by treating empty slide area as uniform white-grey surface, which could be maximally compressed. Using this algorithm, JPEG2000 file sizes were only half, or even smaller, of original JPEG2000. Variation was due to the proportion of empty slide area on the scan. We anticipate that wavelet-based image compression methods, such as JPEG2000, have a significant advantage in saving storage costs of scanned whole slide image. In routine pathology laboratories applying WSI technology widely to their histology material, absolute cost savings can be substantial.