



Proceedings

SY09.03 | Quality Assessment and Quality Management

COMPARISON DISPLAY RESOLUTION ON USER IMPACT FOR DIGITAL PATHOLOGY

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Introduction/ Background

Digital pathology images are very large, up to 100000x100000 pixels which are 30 to 50 times larger than a radiological image for which 12 Mega Pixels (MP) medical displays can be used. Higher resolution displays may have an important influence on digital pathology ergonomics. Three displays with varying resolutions were studied to determine their impact on user interaction.

Aims

Our hypothesis was that “with higher resolution displays, pathologists need less interaction such as panning and zooming actions and can focus more on image content”. A psycho-physical study has been carried out for validating this hypothesis at the University of Pittsburgh Medical Center.

Methods

Three experienced pathologists were selected. Seventy pathology including a wide variety of histological and cytological diagnoses were digitized (Aperio Scanscope XT scanner) and used in a previous study [1]. Customized and optimized viewing software was used to display images and record pathologist's interactions such mouse clicks, zooming and panning. Three medical displays with different resolutions were used: 2MP (BARCO MDSC-2124), 4MP (BARCO MDPC-4130) and 12MP (BARCO MDCC-12133), all with the same maximum luminance. Scripts were used for statistical analyze and 1D, 2D, 3D plotting results. User interactions with each image were used to recreate videos documenting of their exact navigation with each digital slide.

Results

The results of number of zooming and panning interactions are given in the Table 1, as well as averages. When display resolution was increased, the number of panning and zooming interactions significantly decreases for all three observers. For panning, there was on average 1172 panning actions for the 2MP and 951 actions for the 12MP display. For zooming actions, there was on average 12315 zoom actions for the 2MP and 2847 actions for the 12MP display. Between the 2MP and 12MP displays, the ratio of the number of zooms was 4:1 in favor of the 12MP monitor. On <Figure 1>, the 3D plots of one case for the three monitors show the navigation through the slide and show lesser points for higher resolution display. With higher resolution the pathologist goes more directly to the Region Of Interest (ROI) for making the decision. <Figure 2> shows more analysis of the zoom values across the cases for the three monitors. The pathologists have the tendency to remain close to a value of 1 with the 12 MP display where a value of 1 means that no zoom is applied. This is illustrated by the <Figure 2> showing for observer 2 the boxplots of the zoom values for the three displays. It clearly shows that with higher resolution display the trend goes to get closer to one for the zoom value meaning no need to zoom in in the image. We used three different displays instead of one unique display with three different resolutions. Though using just one display would have reduced variability of differing LCD panels, pixel size and structure, it would not have been commercially or clinically realistic.

Despite the limited number of pathologists, this study shows that display resolution used for digital pathology



is important. Higher resolution monitors significantly help reducing the number of user interactions and thereby can minimize pathologist fatigue when reading digital slides.

display	number of panning interactions				number of zooming interactions			
	obs1	obs2	obs3	average	obs1	obs2	obs3	average
2MP	1346	1589	581	1172	8421	18526	9999	12315
4MP	940	2139	819	1299	7090	23879	8235	13068
12MP	1015	1331	506	951	2409	3726	2405	2847

Table 1.

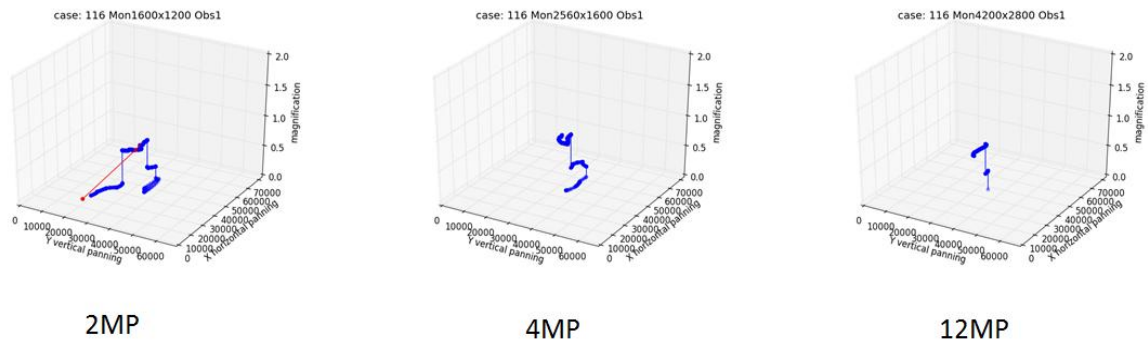


Figure 1.

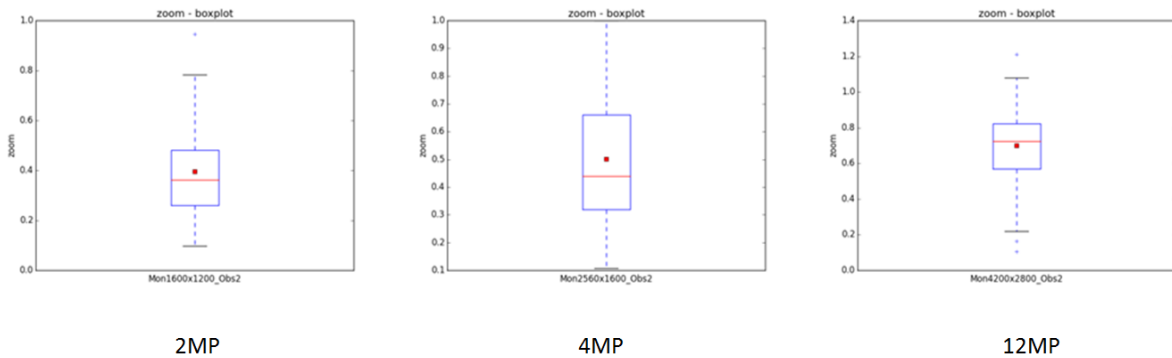


Figure 2.

References:

[1] [Avanaki A.R.N., Espig K.S., Sawhney S., Pantanowitz L., Parwani A.V., Xthona A., Kimpe T.R.L., Aging display's effect on interpretation of digital pathology slide, Proc. SPIE 9420, Medical Imaging 2015: Digital Pathology, 942006.](#)