Guest Editorial—Special Issue on Medical Display

THE accelerated development of computational power and advanced imaging and sensing technologies, together with the emergence of compact electronics and input and output devices, is giving rise to novel human user interfaces suitable across a wide range of applications. This Special Issue is focused on emerging medical display technologies that include advances in 2D, 3D, and 4D grayscale and color technologies.

Within the realm of 2D displays, this Special Issue includes fine examples of how new concepts in display device technology can be implemented to maximize the display image quality and field of view. These concepts push the limits of existing display offerings in the medical market for key performance metrics including contrast, resolution, and luminance range that translate into improved display image quality. While (at least, to date) developers ultimately strive to evaluate image quality from a user performance criteria, the optimization of the physical parameters of the display continues to play a key role. The research community is just now transitioning to directly optimize for the medical effectiveness of a display technology as a function of its improved physical parameters.

Beyond 2D displays, this Special Issue brings into the spotlight advanced interfaces for augmented reality 3D displays and volumetric displays, where physics-based and physiology-based modeling are helping bring static models alive through 4D visualizations. The articles discuss how doctors can benefit from such advanced simulations in, for example, guided surgery and radiation oncology with efforts towards real-time 4D patient-specific visualization.

One of the most complex challenges that our community faces is the evaluation of display technologies with respect to their interaction with human viewers, which often lacks the precise metrics and reproducibility of physical measurements. The connections between the physical and psycho-physical experiments always entail a large degree of variability that complicates the studies and may hinder definitive conclusions. The papers included in this Special Issue present a wide variety of assessment methodologies with careful consideration to the aspects of the design study that could cause the conclusions to be limited and only applicable to the specific case considered.

The papers in this issue indicate and form an interesting parallel with current trends for medical imaging displays. A review of the articles clearly indicates the novel directions into which the field is moving; those being luminance, color, and high-resolution rendition, device mobility, visualization through advanced hardware, and volumetric displays. All of these topics are of great interest to the medical imaging community and will prove to be beneficial for the end goal, which is to provide maximum image quality for maximizing the accuracy of visual tasks involved in the interpretation of large volumetric image datasets. The ability to visualize not only the 3D anatomy but also physiological and functional information for individualized patients via dynamic models of breathing lungs with complex realistic air pathways, beating hearts, and overall deformable anatomical structures are becoming an integral part of the medicine of tomorrow.

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