

AbstractID: 1651 Title: A Performance Metric for Consumer vs. Medical grade monitors for Medical Image Viewing

We have studied the display of grayscale images on monitors that have been calibrated to the grayscale display function (GSDF) of the DICOM standard. The perceptual linearization of grayscale as a function of input-output digitization and the role of ambient light in limiting the number of perceived grayscale levels (just noticeable differences, JNDs) is analyzed. We examined two medical grade monochrome LCDs, and four consumer grade color LCDs under clinical viewing conditions and within a maximum luminance range of 500 cd/m^2 . The display monitors were calibrated using a commercially available calibration tool kit and graphical user interface, and the study was carried out in two different digitization modes: 8 bit x 8 bit and 10 bit x 10 bit. Calibration in the 10 x 10 digitization mode gave the most accurate conformance to GSDF, i.e. 0.59 JNDs per digital input interval with a standard deviation of 0.02, while calibration in the 8 bit x 8 bit digitization mode gave the least accurate conformance – an average of 2.10 JNDs per digital input interval with a standard deviation of 0.24. It was observed that the amount of ambient light present and the luminance ratio were the two critical factors that determined perception of the maximum number of displayable grayscale levels by the human visual system. The effect of ambient light in a clinical review environment was observed to reduce the luminance ratio of flat panel displays by as much as 45% with the resulting loss of JNDs in the displayed image.