Automatic Window and Level Calculation for Magnetic Resonance DICOM to JPEG Conversion

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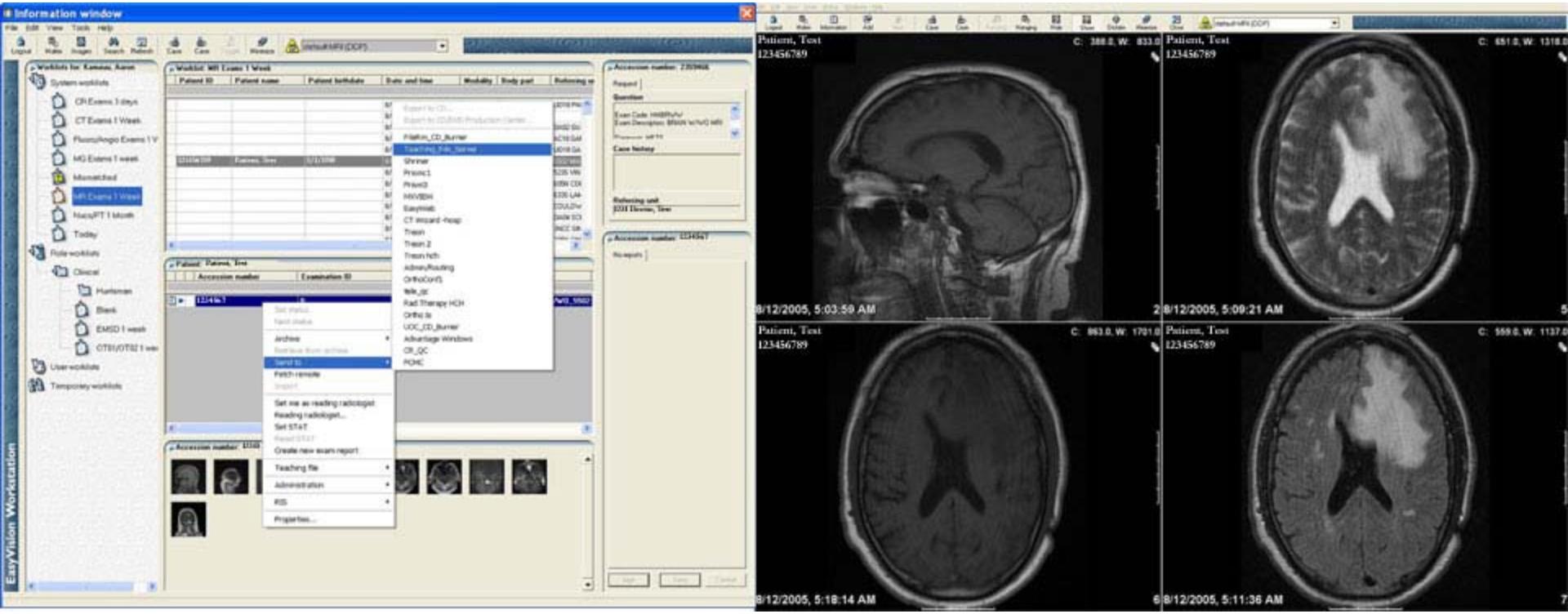
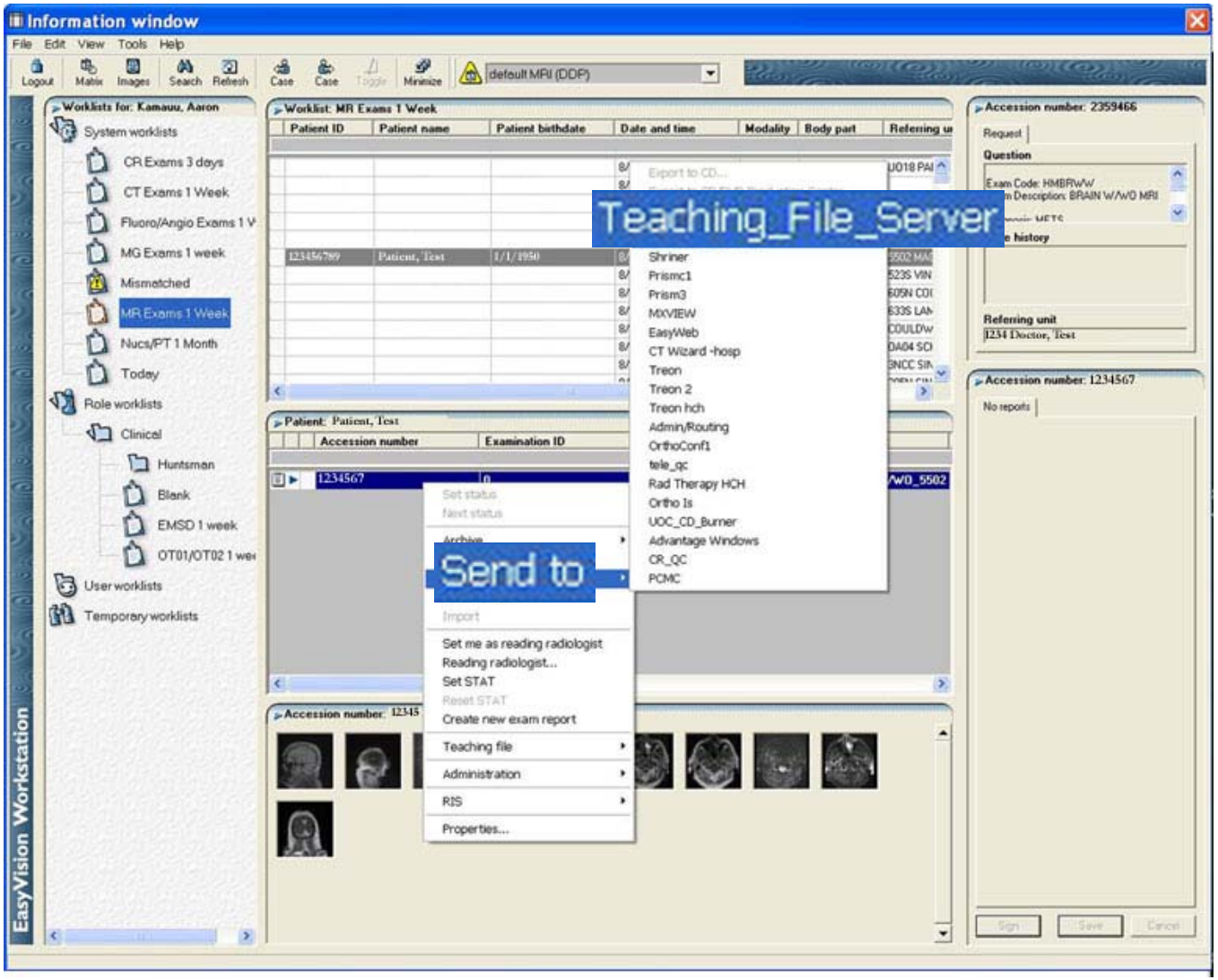
PACS Workstation



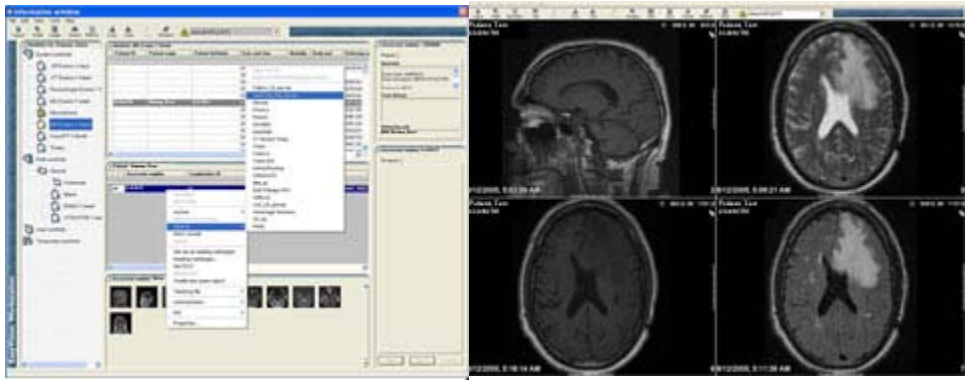
From the PACS workstation, the radiologist identifies an interesting case.

RadICS

Using the teleradiology functions built in to all PACS, the interesting case can be sent to the Radiology Interesting Case Server (RadICS) with just a few mouse clicks.



PACS Workstation → RadICS



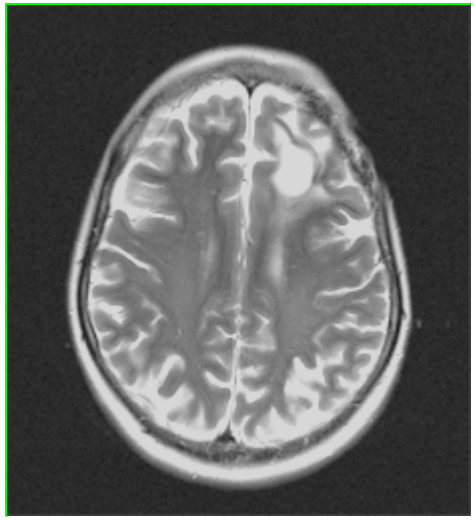
PACS Workstation

RadICS

Because RadICS uses the standard DICOM RECEIVE, no vendor specific adjustments need to be made. As soon as RadICS is plugged in behind the Radiology department firewall, it is ready to receive interesting cases.

Automatic Window and Level Calculator

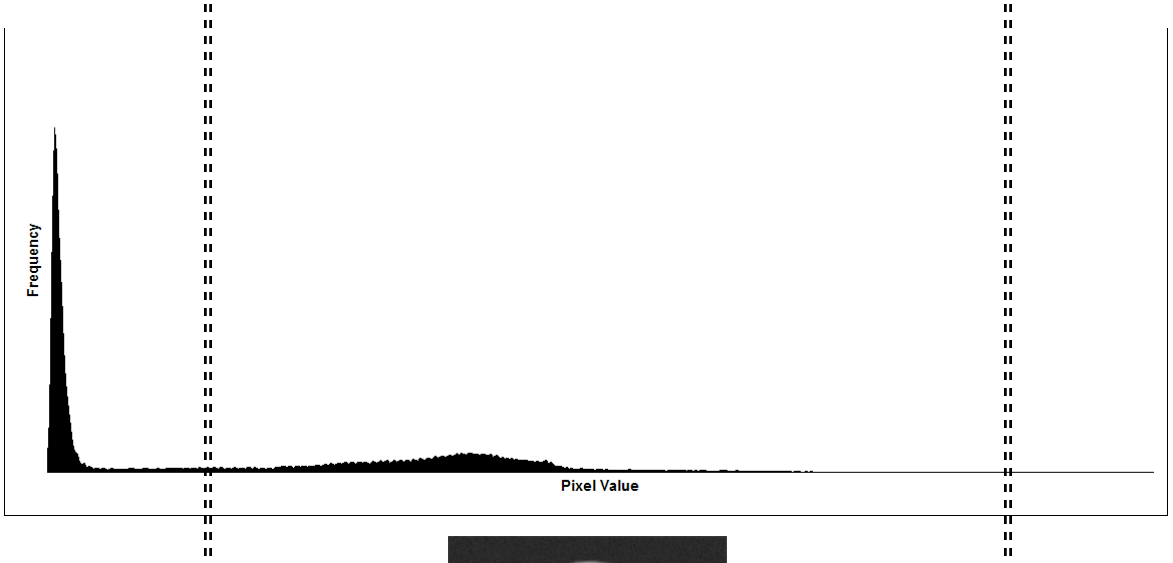
Vendor Neutral Teaching File

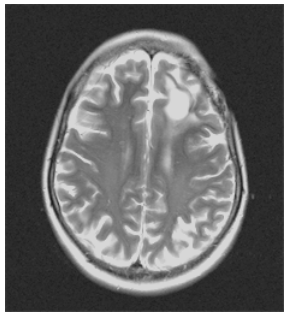


When cases arrive at RadICS, each image is analyzed and a near optimum window and level setting is calculated. These window and level adjustments allow the DICOM images to be converted into JPEG images for display and key image selection.

Automatic Window and Level Calculator

Vendor Neutral Teaching File

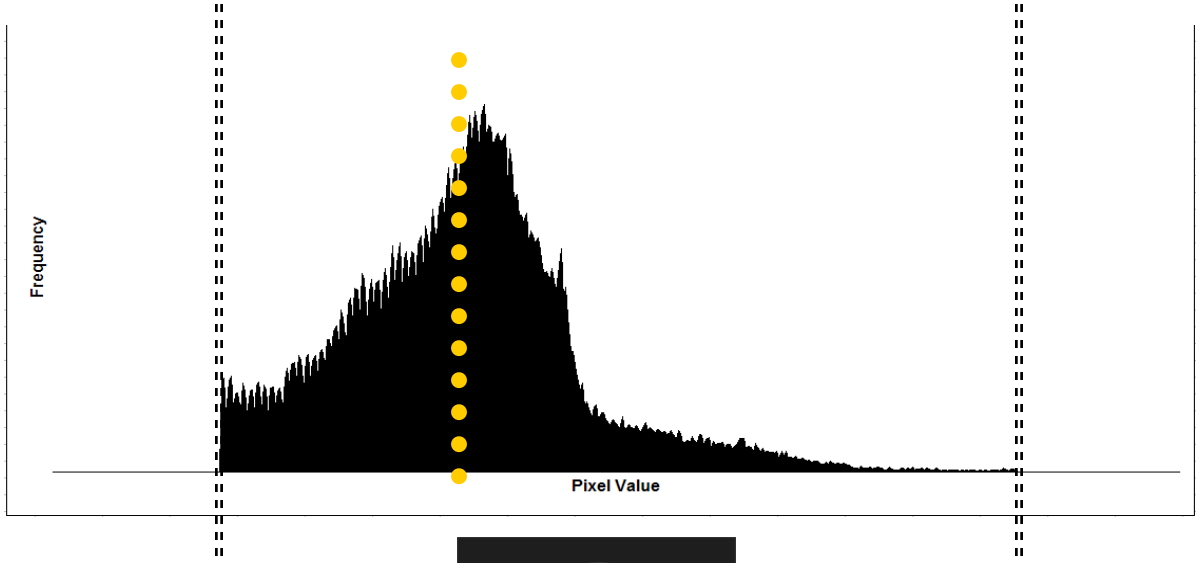


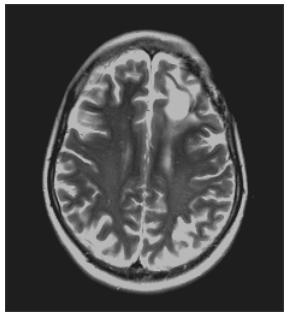


A histogram of the image is created and the top and bottom 15% of pixel values are truncated. The large spike of low values represent the black pixels surrounding the image.

Automatic Window and Level Calculator

Vendor Neutral Teaching File

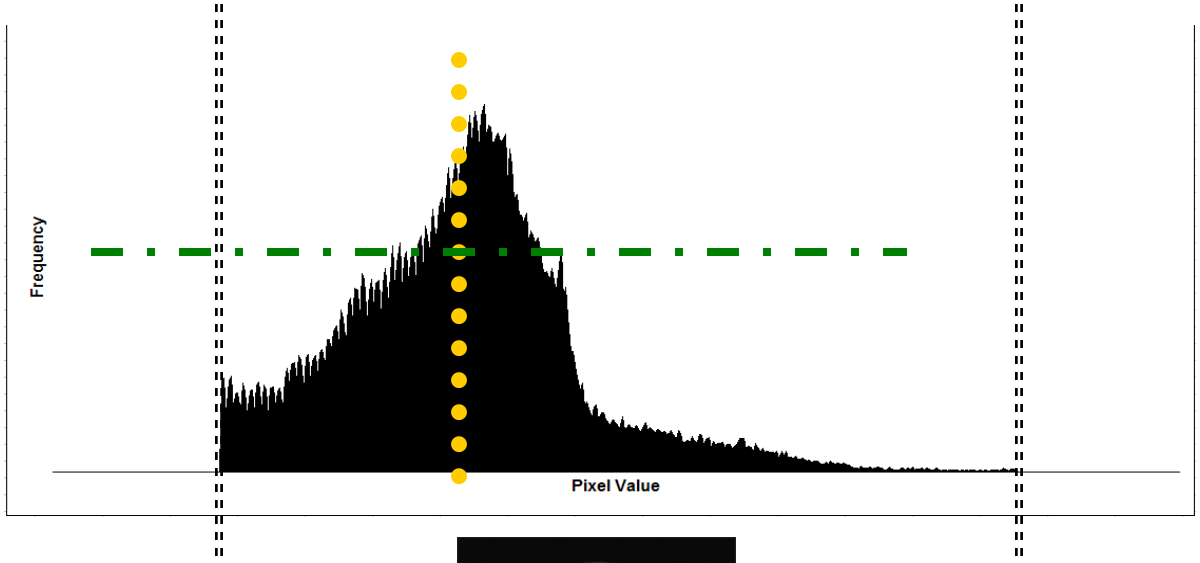


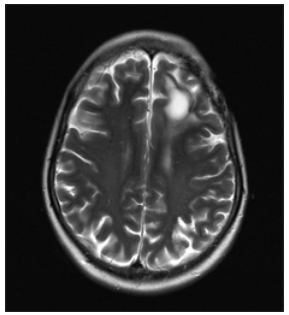


Zooming in after the top and bottom 15% of the histogram are truncated reveals the portion of the image containing the detail. The median is calculated and used as the level setting.

Automatic Window and Level Calculator

Vendor Neutral Teaching File

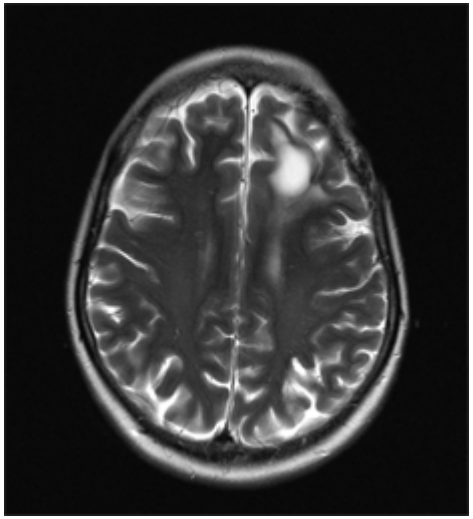




The standard deviation of the pixel values is also calculated and a multiple of the standard deviation is used as the window setting.

Automatic Window and Level Calculator

Vendor Neutral Teaching File



The calculated window and level settings are then applied to each image. The DICOM images are converted into JPEG images for display and key image selection. This entire process happens automatically each time an interesting case is sent from a PACS workstation.

Results

The algorithm was tested on 75 MR images: 25 each of abdomen, brain, and head and neck images. Two CAQ board certified radiologists evaluated the algorithm for its ability to generate JPEG images with appropriate window and level settings for key image selection. The evaluators were asked to score the following comment against each image: The automatically calculated image is appropriate for Key Image Identification.

			5 Strongly Agree	4 Somewhat Agree	3 Undecided	2 Somewhat Disagree	1 Strongly Disagree
Appropriateness for KIS	AVG	N					
MR Abdomen	5.00	25	25	0	0	0	0
MR Brain	4.72	25	20	4	0	1	0
MR Head and Neck	4.36	25	19	1	1	3	1
Total	**4.69**	**75**	**64**	**5**	**1**	**4**	**1**

References

1. Dreyer KJ, Mehta A, Thrall JH. PACS: A Guide to The Digital Revolution. New York: Springer; 2002.

2. Corl FM, Garland MR, Lawler LP, Fishman EK. A five-step approach to digital image manipulation for the radiologist. Radiographics 2002;22(4):981-92.

3. Kamauu AWC, DuVall SL, Robison RJ, Liimatta AP, Wiggins RH, Avrin DE. Informatics in radiology (infoRAD): Vendor-neutral case input into a server-based digital teaching file system. Radiographics 2006;26(6):1877-85.

4. Clason D, Dormody T. Analyzing data measured by indibidual Likert-type items. Journal of Agricultural Education 2000;35(4):31-35.

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