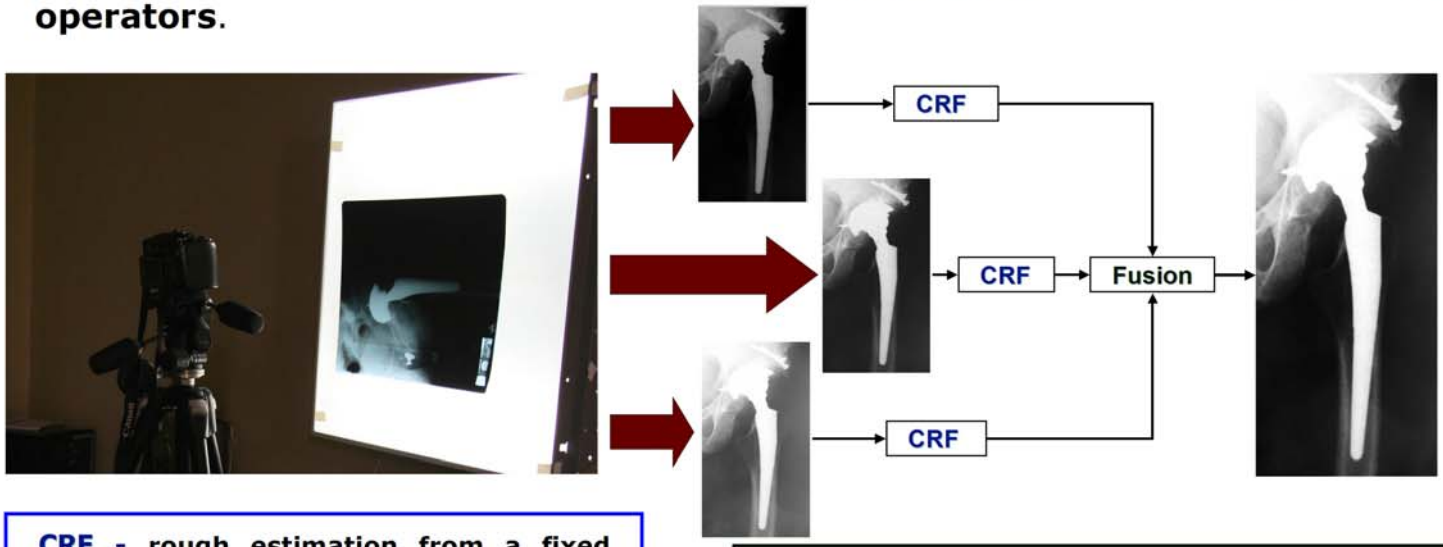
LOGARITHMIC MODEL-BASED DYNAMIC RANGE ENHANCEMENT OF HIP XRAY IMAGES

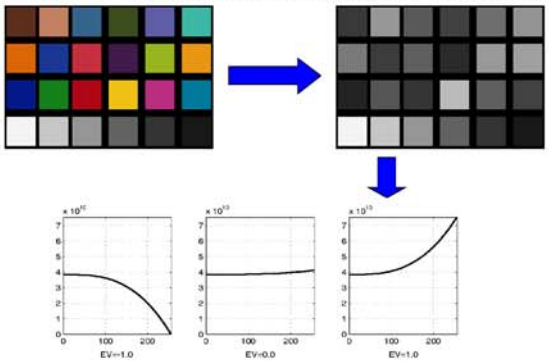
Corneliu Florea, Constantin Vertan, Laura Florea

Politehnica University of Bucharest
Image Processing and Analysis Laboratory

Abstract. Capture with consumer digital still camera of the radiographic film significantly decreases the details visibility. We propose a method that boosts the dynamic range of the processed image based on the fusion of a set of digital images acquired under different exposure values. The fusion is controlled by a fuzzy-like confidence information and the luminance range is over-sampled by using logarithmic image processing operators.



CRF - rough estimation from a fixed chart to determine confidence weights.



Fusion - log-bracketing using convex combination of the weighted frames:

$$f_{HDR}(l,m) = \frac{\sum_{i=1}^{N} \left(\mu(EV(i), f_i(l,m)) \cdot 2^{EV(i)}\right) \otimes f_i(l,m)}{\left(\sum_{i=1}^{N} \mu(EV(i), f_i(l,m))\right)}$$

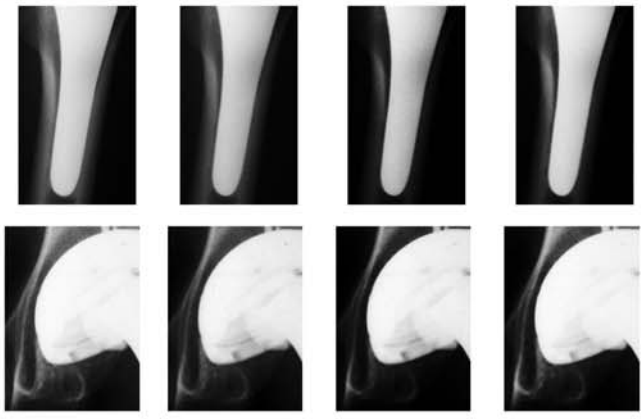
$$v_1 \oplus v_2 = v_1 + v_2 - \frac{v_1 v_2}{D} \qquad \lambda \otimes v = D - D\left(1 - \frac{v}{D}\right)^{\lambda}$$

Classical LIP

$$z_1 \oplus z_2 = \frac{z_1 + z_2}{1 + z_1 z_2} \qquad \lambda \otimes z = \frac{(1+z)^{\lambda} - (1-z)^{\lambda}}{(1+z)^{\lambda} + (1+z)^{\lambda}}$$

Homomorphic LIP

Results



Conclusions

Logarithmic implementation of a convex combination of images acquired under various exposure settings conduct to a high dynamic range image. The solution was successfully applied to digitized radiographies of the hip prostheses. The most robust choice has been provided by the use of the classical LIP model.

Acknowledgments

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