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Method for noise reduction in Computed Tomography images with an approximate bilateral filter

Despite the clear evidence that computed tomography provides very valuable information for diagnosis, there is a potential risk for the use of ionizing radiation. In CT, decreasing the dose of radiation increases the amount of noise in the images; therefore, the noise can hide anatomical details and decrease the detection of injuries. The Bilateral filter, proposed by Tomasi and Manduchi, is able to preserve the edges of the image and to reduce noise in uniform regions. The ability of the BF to reduce noise depends on the function of two sub-factors including spatial distance and intensity weights. In the BF the functions of these weights are exponential. This function has the advantage of reducing the greater amount of noise and better preserving the structural details. The disadvantage is that this noise reduction and detail preservation capability decreases after a certain noise value by reducing filter performance. The advantages of this feature have a very narrow margin and can easily be lost in practical applications where noise variability increases. This affects the performance of the BF causing blurring in the details of the image and a decrease in the ability to reduce noise in the image. In order to be more effective the filtering process in our work, we made a reformulation of the sub-factors of spatial distance and intensity. The function exponential of these sub-factors was approximated to fractional through the MacLaurin serial development. The reformulation, guarantees a better stability in the noise reduction capacity, a better preservation of details in the image when there is an increase in noise variability as well as a reduction in the execution time.

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