AbstractID: 5589 Title: Intensity modulation patterns for regional exposure control with multiple angle slot scan imaging: simulated annealing optimization technique approach

Purpose: To study the feasibility of using simulated annealing algorithm to determine the intensity modulation patterns for regional exposure control with multiple angle slot scan imaging.

Method and Materials: We acquired a digital image from the chest radiography and then processed with a 2-D Gaussian filter as an exposure equalization mask. Slot scanning exposures at evenly spaced angle between 0 and 180 degrees were used to achieve the ideal exposure distribution. An optimization technique, simulated annealing, was used to search the best intensity modulation patterns. This method is based on the theory of statistical physics and uses Boltzmann probability distribution to locate the minimum energy state. An objective function was mathematically constructed and Metropolis scheme was incorporated into the numerical computation. Various tuning parameters such as the control temperature setting for the annealing schedule were explored and the best combination was empirically chosen. We also calculated the percent root mean square error to quantify the results.

Results: A wide range of scanning angles was tested in the study. For 8 projection angles, it took 10 minutes to complete the intensity modulation patterns search in a single processor computer and the percent root mean square error was 12.0%. The percent root mean square error can be further reduced by adding the number of scanning angles.

Conclusion: Our study indicated that simulated annealing technique has the potential to determine the optimized intensity modulation patterns. Current work is focused on the reduction of both the computing time and percent root mean square error. Other optimization techniques such as the conjugate gradient method and the applications of parallel computing methods to accelerate the search algorithms are to be investigated.

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