

Image Enhancement Combined with Reduction of X-Ray Dose During PCI-Operations

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Background

Both patients and physicians are exposed to X-ray radiation during PCI-operations (Percutaneous Coronary Interventions). Reducing X-ray dose too much produces images with low quality; Noisy, blurred, faded, under or over exposed images are acquired.

Purpose

To minimize X-ray dose exposure during PCI-operations, in addition to enhancing the acquired X-ray image sequences in real time to achieve high contrast images that can be viewed using ordinary monitors.

Method

An automatic, adaptive image enhancement algorithm was developed and implemented on GPU to achieve real time performance.

Results

The method was, at first, tested on panoramic dental X-ray images acquired with varying dose. The results were promising and indicated the possibility to get diagnose-usable images using reduced dose by 50%. Preliminary results of applying the method to PCI-image sequences (acquired using standard procedure) resulted in enhanced contrast.

Discussion and conclusions

This study shows the possibility to achieve a number of goals that can lead to better patient safety and better healthcare in general, such as:

- Minimized X-ray dose to everybody in the operation room, which can lead to lower risk level of physical damage (e.g. cancer) and psychological damage (e.g. stress) to the health of both the patient and all involved healthcare personnel.
- Better image quality which can lead to better surgery result (due to reduced stress to the healthcare personnel), shorter operation time, and consequently even less X-ray dose.
- Reduced use of harmful, expensive contrast agent, which can cause allergic reactions and damage to the kidneys.
- The enhanced images can be viewed using ordinary monitors (LCD TV or computer monitors) without any need for expensive, exclusive, high-dynamic-range displays.

Future experiments will be more PCI-specific to achieve the best possible performance.