Methods of noise reduction in medical images and their applications

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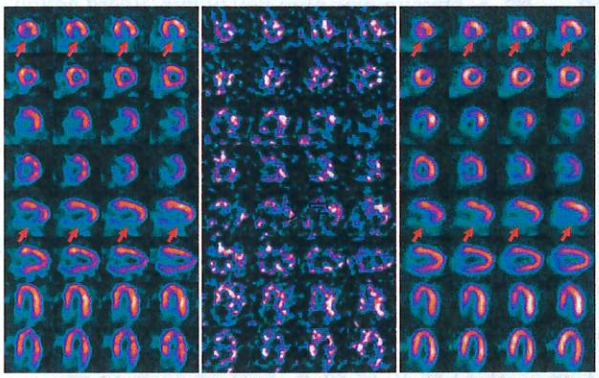
Experience:

https://www.ntuh.gov.tw/nm/Vcard.action?q_type=-1&q_itemCode=1384

Market Needs:



Left: Normal dose　　Middle: 5% dose　　Right: Reconstruction

Myocardial perfusion image (MPI) is the most commonly used functional study for cardiovascular evaluation. In the United States, there are more than 18 million MPI examinations each year. In Taiwan, there are more than 150,000 MPI examinations each year. Because radioisotopes are used in nuclear medicine imaging, patients are exposed to internal radiation after the examinations. The duration of radiopharmaceuticals stay in the body varies with different examinations. There is always a trade-off between radiation dose, acquisition time, and image quality. Image quality is related to the accuracy of clinical diagnosis and cannot be compromised. In order to make image clear, the product of radiation dose and acquisition time should be sufficient. And thus, the radiation exposure caused by MPI exceeds ten times of annual background radiation dosimetry. During the scanning process, sufficient radiotracer needs to be injected to ensure clear images. Even some radiotracers need to be injected twice in the same examination. Moreover, patients with chronic disease require multiple examinations, causing patients to receive more radiation exposure. Besides, radiotracers are becoming more expensive because most of they rely on foreign imports. If there are insufficient drugs, the examination and the following treatment may be delayed. This technology can correct ultra-low radiation dose images to reduce the dose of radiotracer or shorten the examination time, which means to reduce the patient's radiation exposure, but still maintain high image quality.

Our Technology:

We have developed a deep-learning based technique for low-dose image noise reduction. Our network model deconstructs the low-dose image, hierarchically analyzes the features to reduce noise, and finally reconstructs them back into a high-quality image, mimicking the full-dose image. We have verified this technique on simulated low-dose cardiac studies from more than one thousand real patients. This technology maintained the same diagnostic accuracy while reducing 90% of radiation dosage. In the future, we will apply this technique to different organs and whole-body imaging.

Strength:

- This technology can be directly used on existing instruments to perform customized image reconstruction of different doses.
- It can be easily calibrated to be applied on other scanners.
- It has a precise product positioning. With this product, we can maintain excellent image quality while reducing radiation exposure, shortening acquisition time, and increasing daily throughput.

Competing Products:

IQ SPECT、D-SPECT、DNM530c

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