Dynamic Radionuclide Images Compression Based on Principal Component Analysis

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Abstract

This study is undertaken to develop a two-stage compression method for dynamic radionuclide images.

Dynamic radionuclide images are generally obtained by administering a substance labelled with radio-isotope to patients and recording the γ -ray distribution of organs within the patients. As radioactive disintegrations occur, the emitted gamma photons are collected by a scintillation camera from which the internal distribution of the radioactivities can be estimated. The physiological function of the organ can thus be revealed by the time-activity curve (TAC) of the corresponding dynamic study. From the mathematical point of view, TAC is a function of time and can be described by a number of basis functions. To get only an approximation of the original function, principal component analysis (PCA) of the images is performed to extract a limited number of principal component images. They are still images and can be further compressed by the JPEG (Joint Photographic Experts Group) method.

The result of PCA+JPEG technique for 12 gated blood pool studies shows a compression ratio from 122:1 to 69:1 without significant degradation of the images and the quantitative parameters. The decompressed images are compared to the original images by computing the root meam square errors, the signal to noise ratio, and the routinely used parameters.

In summary, we report a highly efficient radionuclide image compression technique with clinical usefulness.

Keywords : PCA, JPEG, Dynamic Radionuclide Images, Compression Ratio.