An Evaluation of Spatial resolution in computed Tomography

Mongkolsuk M.¹, Thumwerapong W.², Jangsri N.³

1 Department of Radiological Technology, Faculty of Medical Technology, Mahidol University
2 Division of Radiation and Medical Devices, Department of Medical Science, Ministry of Public Health
3 Radiology Section, Taksin Hospital, Bangkok

Abstract
In order to examine spatial resolution for Computed Tomography (CT) scanners, a small high contract wire must be scanned to obtain the point spread function (PSF). Thereafter, the usual procedure is to determine the Fourier Transforms numerically in order to obtain the Modulation Transfer Function (MTF). This process is difficult, and it requires a computer to work on complex mathematics. Mathematical formulae such as Gamma function, Bessel function, Meclaurin series, Polar coordinate integral, and integral by part can be applied to transform the numerical integration of the Fourier Transforms to the simple equation of an exponential function. It was found that this equation fits the measured PSF data with a Gaussian function. The MTF can be directly determined by a simple equation. That was to eliminate the necessity of performing Fourier Transforms each time. Data form 14 different scanners illustrate that the Gaussian approximation to the PSF is reasonable: the linear correlation coefficient is greater than 0.99 in each scan. Furthermore, the standard Fourier Transforms computed MTF show good agreement with the MTF obtained from the simple equation which is tested by Correlation and Student t-test. It shows the reliability of 99% (Correlation : $r > 0.99$, Student t-test : $P_{value} > 0.01$)

Keywords: Computed Tomography (CT), image quality, spatial resolution, MTF

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