# The S Transform in Medical Imaging

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## Abstract

The S transform (ST) was developed in 1994 for analyzing geophysics data. It is a generalization of the short time Fourier transform (STFT) and an extension of the wavelet transform (WT). The one-dimensional continuous ST of $f(t)$ is defined as

$$S(\tau,k)=\frac{|k|}{\sqrt{2\pi}}\int_{-\infty}^{+\infty} f(t)e^{\frac{(t-\tau)^2k^2}{2}}e^{-i2\pi kt}dt, \qquad (1)$$

with "window" being the Gaussian function, where $-\infty < t,k < \infty$. The window width of the ST is automatically adjusted according local frequency content, which is an advantage over the STFT with constant window width. Moreover, the frequencies defined by the ST are closely connected to the classical Fourier frequencies, while the frequency of the WT is less associated with Fourier frequencies. These properties make the ST unique in the medical imaging field. In this talk, we focus on its two applications especially in Magnetic Resonance imaging (MRI): texture analysis in Multiple Sclerosis and the S transform filtering.