

Abstract

Transcranial Doppler ultrasound can be used to detect emboli in the cerebral circulation. We have implemented and evaluated the first on-line wavelet based automatic embolic signal detection system, based on a fast discrete wavelet transform algorithm using the Daubechies 8th order wavelet. It was evaluated using a group of middle cerebral artery recordings from 10 carotid stenosis patients, and a one hour compilation tape from patients with particularly small embolic signals, and compared with the most sensitive commercially available software package (FS-1), which is based on a frequency filtering approach using the Fourier transform. An optimal combination of a sensitivity of 78.4% with a specificity of 77.5% was obtained. Its overall performance was slightly below that of FS-1, (sensitivity 86.4% with specificity 85.2%), although it was superior to FS-1 for embolic signals of short duration or low energy (sensitivity 75.2% with specificity 50.5%, compared with a sensitivity of 55.6% and specificity of 55.0% for FS-1). The study has demonstrated that the fast wavelet transform can be computed on-line using a standard PC, and used in a practical system to detect embolic signals. It may be particularly good for detecting short duration, low energy signals, although a frequency filtering based approach currently offers a higher sensitivity on an unselected dataset .