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最小二乘支持向量回归滤波系统性能分析

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Performance analysis of least squares support vector regression filtering system

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摘要 支持向量机(Support Vector Machine: SVM)一直作为机器学习方法在统计学习理论基础上被研究和发展,本文从
的角度出发,证明了平移不变核最小二乘支持向量机(Least Squares SVM: LS-SVM)是一个线性时不变系统.以Ricker子
探讨了不同参数对最小二乘支持向量回归(Least Squares Support Vector Regression: LS-SVR)滤波器频率响应特性
些参数的不同选择相应地控制着滤波器通带上升沿的陡峭性、通带的中心频率、通带带宽以及信号能量的衰减,即滤波器长
的上升沿越陡,核参数值越大通带的中心频率越高,且通带带宽越宽,正则化参数值越小,通带带宽越窄(但通带中心频率基本
有效信号幅度衰减越严重.合成地震记录的仿真实验结果表明,Ricker子波核LS-SVR滤波器在处理地震勘探信号的应用中,
于径向基函数(Radial Basic Function: RBF)核LS-SVR滤波器以及小波变换滤波和Wiener滤波方法.

关键词: 支持向量机 Ricker子波核 最小二乘支持向量回归滤波系统 频率响应 随机噪声

Abstract: Support vector machine (SVM) is always researched and developed as a machine learning m
the base of statistical learning theory. As viewed from signal and system, the least squares support vect
machine (LS-SVM) with the translation invariant kernel is a linear time invariant system. Taking the Ricke
kernel as an example, we investigate the effects of different parameters on frequency responses of the
squares support vector regression (LS-SVR) filter. Those parameters affect the rising edge, the band wic
central frequency of passband, and also the attenuation of signal energy. In other words, the longer the
LS-SVR filter, the sharper the rising edge generated; the larger the kernel parameter, the higher the cen
frequency and the wider the bandwidth of the passband; the smaller the regularization parameter, the na
the bandwidth of passband and the greater the attenuation of the desired signal. The experimental resul
synthetic seismic data show that the LS-SVR filter with the Ricker wavelet kernel works better than the
filter with the RBF kernel, the wavelet transform-based method and adaptive Wiener filtering method.

Keywords: Support vector machine Ricker wavelet kernel Least squares support vector regression f
system Frequency response Random noise

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