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论文

DNA测序信号小波去噪分析的新方法

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摘要：

在DNA荧光测序中，噪声影响分析的准确度和检出限。相比其它滤波方法，小波分析具有良好的时频域分辨特性。在小波去噪处理中，正确选择合适的小波基函数、去噪阈值和分解层数直接关系到信号去噪处理的质量。由于电泳荧光信号峰存在展宽现象，并不是严格的高斯型，为了真实构建信号模型并准确评价去噪算法的有效性，实验中通过实际系统中采集到的DNA荧光信号经前期研究中优选的小波去噪后，叠加随机噪声构建DNA测序仿真信号。去噪分析的结果表明：选择db8小波基函数、分解层数（lev＝5）与使用固定格式软阈值，有效去除了DNA测序信号的噪声。将其用于处理实际的DNA电泳荧光信号，相比基于高斯荧光信号峰模型筛选的算法，去噪后的信号更加真实可靠。

关键词： DNA测序 荧光信号 小波分析 去噪 DNA Sequencing Fluorescence signal Wavelet analysis Denoising

A Novel Wavelet Analyzing Method for the Signals Denoising of DNA Sequencing

Abstract:

Fluorescence signals in DNA sequencing are often contaminated by noise, which has negative influence on the accuracy and detection limit of analysis. Wavelet analysis has excellent time and frequency domain resolution for signal denoising comparing with other conventional filtering methods. Before the signal denoising process, a key problem is how to choose a suitable wavelet base, decomposition level and denoising threshold, which have great influence on the quality of signal denoising. In order to construct the same peak model as that in experiment and evaluate the denoising algorithm precisely, a novel method was presented: random noise was added to a real denoised DNA signal to simulate a noisy sequencing signal, thus the denoising efficiency could be evaluated accurately. The denoising results indicate that using db8 wavelet base, decomposition level at 5 and using fixed form soft threshold can effectively reduce the noise. When the same algorithm was applied to the experimental DNA sequencing data, the results were more credible than that obtained through other algorithms based on the Gaussian peak model.

Keywords:

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