Abstract

Ismail M El-Badawy

Improved time-domain approaches for locating exons in DNA using zero-phase filtering

Accurate prediction of exons locations in deoxyribonucleic acid (DNA) sequences is an important issue for geneticists. Time-domain periodogram (TDP) and average magnitude difference function (AMDF) are two time-domain approaches previously proposed for this purpose. These two approaches employ a second-order infinite impulse response (IIR) resonant filter as a preprocessing stage so as to emphasize the period-3 behavior exhibited by the exonic segments of DNA strands. The major drawback of IIR filters is their non-linear phase response, which results in a delay distortion experienced by the spectral components of the genomic signal at the filter output. This type of distortion affects the exons prediction accuracy of the TDP/AMDF classifier. This paper proposes the use of zero-phase filtering technique in the preprocessing stage so as to eliminate the phase distortion introduced by the traditional filtering. MATLAB simulation conducted on the ASP67 genomic dataset shows that the proposed modified time-domain approaches using zero-phase filtering reveal better performance, compared with the traditional approaches, in terms of the receiver operating characteristic (ROC) curve, precision-recall curve and F-measure.