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Level crossings in biological time series

Kedem in his research [1] made use of zero crossings theory in time series analysis. Zero crossings are remarkably simple and effective tool to examine the autocorrelation structure of time series. The application of nonlinear binary transformation of time series allows to retain information contained in the autocorrelation function of the original data. Kedem (1989) found relation between first order autocorrelation and the expected zero crossings rate. In the case of zero mean stationary Gaussian time series there exist explicit formula (*cosine formula*), connecting the first order autocorrelation ρ_1 and the expected number of zero crossings $E[D]$. The relationship looks as follows

$$\rho_1 = \cos\left(\frac{\pi E[D]}{n-1}\right).$$

Cosine formula is therefore very useful for the estimation purposes. Having given the number of zero crossings, we can estimate first order autocorrelation in a very simple and fast way. Using Electroencephalogram (EEG) signal we illustrate how accurate the cosine formula is. We also answer the question how far precisely we can compute the first order autocorrelation using zero crossings.

REFERENCES

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