

# 1 Time searies resampling

For the time series of sample rate that is changing, unstable, non-rational to the common rate as well as for the time series with missing values the following procedure should be applied.

Let the time  $t$  be in continous set  $\mathbb{R}_+^1$  and the time series  $s$  be piece-wise constant. There are three possibilities to create such time series from a discrete-values one: 1) the constant goes after the sample  $s(t)$ , 2) before the sample, 3) in the neighborhood of the sample. See red, green and blue lines in the Figure 1.

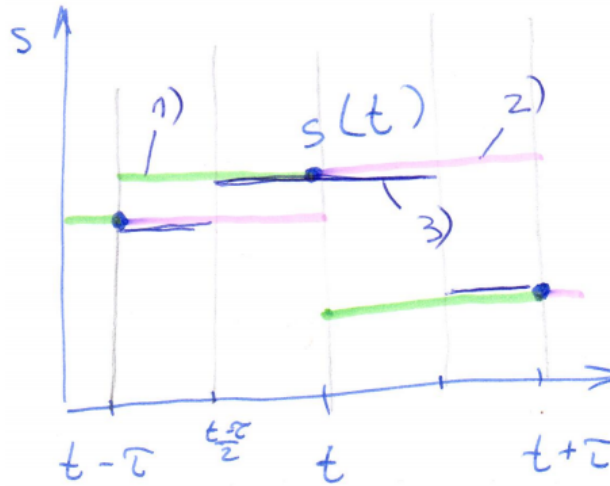


Figure 1: Piece-wise representation of a time series

This assumptions helps introducing a new sampling rate and eliminates the problem of missing values, since the previous (next, current in the terms of Fig. 1) value holds continuously until the following comes. The constant model could be developed into more comples one: a piece-wise, quadratic or cubic spline with its nodes in the time-ticks or over the time-ticks according to the following criterions: 1) NyquistShannon theorem, 2) Fisher-Neyman theorem. The following optimization problem returns the new sampling rate:

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This fixed rate is used to obtain a resampled time series with regular time-ticks.

## 2 NyquistShannon resampling criterion

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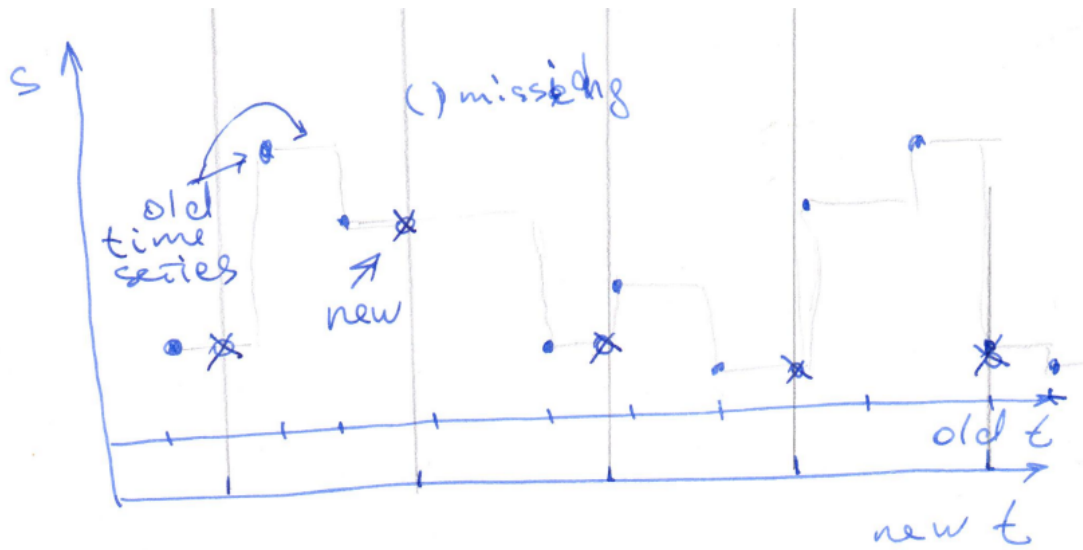


Figure 2: Resample time series of varying sample rate into the fixed one with the optimal period

### 3 Fisher-Neyman resampling criterion

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