Bursty Markovian Arrival Processes

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ABSTRACT

We consider stationary Markovian Arrival Processes (MAPs) where both the squared coefficient of variation of inter-event times and the asymptotic index of dispersion of counts are greater than unity:

$$c^2 = \frac{\mathrm{Var}(T_n)}{\mathbb{E}^2\left[T_n\right]} \geq 1, \qquad d^2 := \lim_{t\to\infty} \frac{\mathrm{Var}(N(t))}{\mathbb{E}[N(t)]} \geq 1.$$

We refer to such MAPs as *bursty*. The simplest bursty MAP is a Hyperexponential Renewal Process (H-renewal process). Applying Matrix analytic methods (MAM), we establish further classes of MAPs as Bursty MAPs: the Markov Modulated Poisson Process (MMPP), the Markov Transition Counting Process (MTCP) and the Markov Switched Poisson Process (MSPP). Of these, MMPP has been used most often in applications, but as we illustrate, MTCP and MSPP may serve as alternative models of bursty traffic. Hence understating MTCPs, MSPPs, and MMPPs and their relationships is important from a data modelling perspective. We establish a duality in terms of first and second moments of counts between MTCPs and a rich class of MMPPs which we refer to as slow-MMPPs (modulation is slower than the events).

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