

# Using Quasi Renewal Processes to Investigate Feature Distributions in Markov Switching Models

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Abstract:

Markov switching models are widely used in the analysis of nonlinear time series. However, evaluation of distributions such as the number of regime switches, the maximal length of regimes or other feature distributions related to the data can be problematic as they are functions of the entire state sequence. Direct computation is not possible given the exponential number of possible state sequences. Estimates can be made of these quantities by using surrogates such as the most probable sequence, but these yield no distributional information about the features, nor is it easy to evaluate the properties of the estimates themselves. Here it will be shown that by defining appropriate auxiliary processes, which will be shown to be quasi renewal processes, computation of exact distributions for many features, including those above, is possible. This computation is then not only possible, but very efficient given the ‘almost’ linear algorithm that can be defined based on the renewal properties. These processes can be found for many commonly used Markov switching models, and will be demonstrated using Hamilton's classic Markov switching AR(4) model used to find recessions in GNP data. It will be shown that distributional information can be found for some of the features qualitatively mentioned in the original paper.