

Continuous Distributions as Conjugates of Discrete Distributions in likelihood testing

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I have Dirichlet distribution which I know is a conjugate distribution for a multinomial. Is it true that the actual value of the Dirichlet probability at any integer value is lower than the Multinomial because the Multinomial takes positive integers only – hence the density stacks up on the integers? Both integrate to 1 and are always positive or zero so the Dirichlet likelihood at any integer value has to be less than the Multinomial? The probability of the modes of these distributions are not equal numerically for example. I am performing a likelihood analysis with a Dirichlet and a Multinomial model and finding that the Test Statistic is lower for the Dirichlet than the equivalent Multinomial presumably because of the continuity issue. The log ratio of the modes relative to some other ratio along the two functions is not equal so even a likelihood ratio test seems conservative with the continuous conjugate (Dirichlet) vs the discrete. Integrating the Dirichlet by dividing up the real number line is hard so I thought maybe look at the two likelihood ratio tests instead...

Can someone point me in the direction of some literature or papers looking into the continuity issues of discrete and continuous conjugates with regard to likelihood ratio testing? I am having a hard time finding anyone who works or publishes on that.

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