APPLYING A CHARACTERISATION OF THE UNIFIED GENERALIZED POISSON DISTRIBUTION WITH RESPECT TO THE STATISTICAL CURVATURE

BY

Obilade[1], Titi; Francis, S.D. and Adelodun, O.A.

Email[1]: tobilade@yahoo.com

Department of Mathematics, Obafemi Awolowo University, Ile-Ife, Nigeria.

ABSTRACT

In this paper we present a unified treatment of the generalized Poisson distribution defined by

$$P_r\{N_q = n\} = g(\lambda,\theta,n) = \begin{cases} f(\lambda,\theta,n)/F_q(\lambda,\theta), & \text{n} = 0,1,\ldots \\ 0 & \text{otherwise} \end{cases}$$

where $F_q(\lambda,\theta) = P_r\{N_\infty \le q\} = \sum_{n=0}^{q} f(\lambda,\theta,n), \qquad q = 0{,}1{,}2\ldots.$

and $P_r\{N_\infty = n\} = f(\lambda,\theta,n) = \frac{\lambda}{n!}(\lambda+n\theta)^{n-1} e^{-(\lambda+n\theta)}, \qquad \text{n} = 0,1,\ldots$

We derive a simple characterization of the generalized Poisson distribution as follows:

$$(\lambda,\theta)\ I_\theta(N_q)\ (\lambda,\theta)' = (1-\theta)^2\ Var(N_q)$$

where $I_\theta(N_q)$ is the negative definite Fishers information matrix.

Also provided are some closed form recurrence relations for moments and moment generating functions of generalized Poisson distributions related by some affine transformations of their parameters. A numerical demonstration of how the resulting functional relations can be utilized for some hypothesis testing is given using some copious data from the biological literature.

KEYWORDS: generalized Poisson distribution, Fishers information matrix, moment generating function, empirical moment generating function.

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[1] Correspondence author.