

## Research Notes:

# Introduction to Dynamic Spatio-Temporal Models

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### Abstract:

In the geometric distribution,  $\theta$  represents the probability of succes in each trial. Furthermore, it should follow that  $y$  is countable and greater than one. In general, in the negative binomial distribution,  $y$  is the number of trials until get the  $k$  first success. For this reason, the negative binomial distribution has certain assumptions considering that each event come from a Bernoulli distribution.(i) Each  $x_i$  is independent of any.

### Keywords:

Spatiotemporal, Climate variability, Malaria prevalence.

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## 1. Section 1

In the geometric distribution,  $\theta$  represents the probability of succes in each trial. Furthermore, it should follow that  $y$  is countable and greater than one. In general, in the negative binomial distribution,  $y$  is the number of trials until get the  $k$  first success.

### Statement:

$p(y > r|\theta) = (1 - \theta)^r$ , where  $r = 1, 2, \dots$

### Proof:

$$p(y > r|\theta) = 1 - p(y \leq r|\theta)$$

$$p(y > r|\theta) = 1 - \sum_{k=1}^r (1 - \theta)^{k-1} \theta$$

$$p(y > r|\theta) = 1 - \theta \sum_{k=1}^r (1 - \theta)^{k-1}$$

$$p(y > r|\theta) = 1 - \theta \left[ \frac{1 - (1 - \theta)^r}{1 - (1 - \theta)} \right]$$

$$p(y > r|\theta) = 1 - \theta \left[ \frac{1 - (1 - \theta)^r}{\theta} \right]$$

$$p(y > r|\theta) = 1 - [1 - (1 - \theta)^r] = (1 - \theta)^r \quad \blacksquare$$

For this reason, the negative binomial distribution has certain assumptions considering that each event come from a Bernoulli distribution.(i) Each  $x_i$  is independent of any other  $x_j$ , (ii). They are identically distributed  $x_i \sim \theta^{x_i} (1 - \theta)^{1-x_i}$ , where  $i = 1, 2, \dots$  (iii) The variance is greater than the mean. For this reason is used in overdispersed countable data. (iv) This distribution is unimodal.

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