Simple Overview of Statistical Concepts of week 9

Spatial Poisson process. Spatial Poisson processes are types of point processes used to model the distribution of events or occurrences in a spatial domain.

A homogeneous spatial Poisson process assumes that the rate of occurrence of events is same over the entire spatial domain. In other words, the density of events is the same everywhere in the domain.

In contrast, an inhomogeneous spatial Poisson process allows for the density of events to vary across the spatial domain. The intensity function of the process specifies the expected number of events per unit area, which can vary over locations. The process is non-stationary.

Kolmogorov-Smirnov test. The Kolmogorov-Smirnov (KS) test is a statistical tool used to test whether a given dataset follows a certain distribution. In the context of spatial analysis, the KS test can be used to test whether a set of spatial points are distributed randomly or not.

When applied to the problem of Complete Spatial Randomness (CSR), the KS test can be used to test whether a set of spatial points is distributed randomly in space, without any underlying pattern or trend. If the observed distribution deviates significantly from the expected distribution (p-value is small, usually ¡ 0.05), then it suggests that the points are not randomly distributed and some underlying process or pattern is at work. On the other hand, if the observed distribution is consistent with the expected distribution (p-value ¿ 0.05), then it suggests that the points are indeed randomly distributed and there is no underlying pattern to explain their spatial arrangement.

Fitting a Poisson process. Fitting a Poisson process to spatial data involves modeling the spatial distribution of events occurring in a specific region of interest. To fit a Poisson process to spatial data, one use the concept of intensity, which represents the average rate at which events occur per unit area. The intensity function can be estimated using various methods, such as kernel smoothing or maximum likelihood estimation. When employing a parametric approach, it is necessary to specify a functional form for the intensity function, which includes unknown parameters that need to be estimated.

Once the intensity function is estimated, the residuals can be calculated by comparing the observed and expected number of events at each location in the region of interest. The residuals represent the deviation of the observed data from the fitted model, and their large values can be used to identify spatial patterns or trends that are not explained by the Poisson process model.

Cross-type pair correlation function.

The cross-type pair correlation function is used to measure the spatial dependence between two different types of points in a point pattern. The cross-type pair correlation function measures the likelihood of finding two points of different types at a particular distance from each other, compared to the expected value under a random distribution. The cross-type pair correlation function can be used to identify clustering or repulsion between the two types of points, as well as to measure the strength and scale of their interaction.

When the cross-type pair correlation function for a multitype spatial point pattern is below 1, it suggests that the two types of points are less likely to be found near each other than what would be expected under a random distribution. This indicates a repulsion or avoidance between the two types of points.

On the other hand, when the cross-type pair correlation function is above 1, it suggests that the two types of points are more likely to be found near each other than what would be expected under a random distribution. This indicates a clustering or attraction between the

two types of points.

The magnitude of the cross-type pair correlation function provides information about the strength and scale of the interaction between the two types of points. Larger values indicate stronger interaction, while the distance at which the function peaks provides information about the scale of the interaction.