

A spatial scan statistic with a modified likelihood ratio

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Kulldorff (Communications in Statistics: Theory and Methods, 1997) developed a circular spatial scan statistic for identifying the most likely cluster of disease and his software SaTScan has been widely used for geographical disease cluster detection and disease surveillance. However, it does not seem to be well recognized that his circular spatial scan statistic tends to detect the most likely cluster much larger than the true cluster by swallowing neighbouring regions with non-elevated risk, due to the model selection criterion based on the maximum likelihood ratio. Other non-circular spatial scan statistics proposed recently also have the same property since all of them are based upon the same type of maximum likelihood ratio. This paper proposes a new spatial scan statistic free from such an undesirable property by modifying the likelihood ratio test statistic so that it scans only the regions with elevated risk. Monte Carlo Simulation study shows that the proposed circular spatial scan statistic is shown to have good ability to identify the true cluster more correctly than Kulldorff's original one in all the cluster models considered. The proposed circular spatial scan statistic is illustrated with mortality data from cerebrovascular disease in Tokyo Metropolitan area, Japan.