

Scan statistics and multiple testing in networks with applications to veterinary epidemiology

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Scan statistics can be used for early detection of outbreaks in animal populations by testing large regions for faint but detectable diagnostic measurements. Traditional scan statistic implementations, such as the SaTScan software [1], fuse neighboring measurements to obtain more powerful global null tests. We present computationally efficient methods and software that can utilize both spatial proximity and network information, and precisely localize the outbreak. We outline modern tools for performing scan statistics on networks, such as hierarchical multiple testing [2] and combinatorial scan statistics [3]. First, we introduce a novel false discovery rate controlling hierarchical testing procedure that is combined with hierarchical decompositions of networks such as spectral and spanning tree based decompositions. Second, we introduce a computationally efficient network scanning procedure that fuses graph neighborhood data. Finally, we demonstrate applications of these methods to syndromic surveillance using transportation networks between swine farms.

Acknowledgements

This work was also supported by NSF DMS 1712996 and NSF BIGDATA-IA 1838207.

References

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Keywords: Scan Statistics, False discovery rate (FDR), Syndromic surveillance, graph signal processing, Hierarchical test

Conference: GeoVet 2019. Novel spatio-temporal approaches in the era of Big Data, Davis, United States, 8 Oct – 10 Oct, 2019.

Presentation Type: Senior oral presentation **Topic:** Spatio-temporal surveillance and modeling approaches

Citation: Sharpnack J, Shemetov D, Proksch K and Martínez-López B (2019). Scan statistics and multiple testing in networks with applications to veterinary epidemiology. *Front. Vet. Sci. Conference Abstract: GeoVet 2019. Novel spatio-temporal approaches in the era of Big Data*. doi: 10.3389/conf.fvets.2019.05.00059

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