

20 March 2020

Environmental Risk Assessment, Assignment 2, Part 1

Task instructions

Part 1: Spatial epidemiology (1500 words maximum) – 40% of this portfolio #2 [led and assessed by Dr Elias Symeonakis]

This assessment component focuses on the use of GIS in Spatial Epidemiology covered during the third teaching block (i.e. during the first half of term two) of the Environmental Risk Management unit.

For the purpose of this part of the unit assessment, **you have 3 options:**

Option 1:

complete the PC-based GIS practical exercises on (i) **Point Pattern Analysis** and (ii) **Polygon Pattern Analysis** (that were provided and demonstrated in class during weeks commencing 20th and 27th January) and submit them as a portfolio. The report that you submit should consider and include the following:

- Introduction, including clear statement of aims and objectives.
- Summary of methods.
- Data synthesis, analysis, interpretation and discussion, including evidence of integration with published reports and scientific journal articles.
- Use of supporting figures and tables.
- Conclusions.

Option 2:

Write two literature review essays on:

“The application of the spatial statistical techniques of (i) Point Pattern Analysis and (ii) Polygon Pattern Analysis in Spatial Epidemiology”.

Each essay should be 750 words long, and should

- (i) introduce the techniques
- (ii) critically discuss how the techniques has been used in the specific scientific field of spatial epidemiology, drawing on case-study evidence from a minimum of 4 academic papers (see indicative lists below)
- (iii) synthesise evidence from the case studies to present a summary and conclusion addressing how the techniques have been used in the specific scientific field of Spatial Epidemiology.

Indicative papers on Point Pattern Analysis and Spatial Epidemiology you could choose to review:

Karch, R., Neumann, F., Ullrich, R., Neumüller, J., Podesser, B.K., Neumann, M., Schreiner, W. The spatial pattern of coronary capillaries in patients with dilated, ischemic, or inflammatory cardiomyopathy (2005) *Cardiovascular Pathology*, 14 (3), pp. 135-144.

Mollalo, A., Alimohammadi, A., Shirzadi, M.R., Malek, M.R. Geographic information system-based analysis of the spatial and spatio-temporal distribution of zoonotic cutaneous leishmaniasis in golestan province, North-East of Iran (2015) *Zoonoses and Public Health*, 62 (1), pp. 18-28.

Reader, S. Using survival analysis to study spatial point patterns in geographical epidemiology (2000) *Social Science and Medicine*, 50 (7-8), pp. 985-1000.

Mollalo, A., Alimohammadi, A., Shirzadi, M.R., Malek, M.R. Geographic information system-based analysis of the spatial and spatio-temporal distribution of zoonotic cutaneous leishmaniasis in golestan province, North-East of Iran (2015) *Zoonoses and Public Health*, 62 (1), pp. 18-28.

Liu, D., Kelly, M., Gong, P., Guo, Q. Characterizing spatial-temporal tree mortality patterns associated with a new forest disease (2007) *Forest Ecology and Management*, 253 (1-3), pp. 220-231.

Myllymäki, M., Särkkä, A., Vehtari, A. Hierarchical second-order analysis of replicated spatial point patterns with non-spatial covariates (2014) *Spatial Statistics*, 8 (C), pp. 104-121.

Loh, J.M. K-scan for anomaly detection in disease surveillance (2011) *Environmetrics*, 22 (2), pp. 179-191.

Rafati, A.H., Safavimanesh, F., Dorph-Petersen, K.-A., Rasmussen, J.G., Møller, J., Nyengaard, J.R. Detection and spatial characterization of minicolumnarity in the human cerebral cortex (2016) *Journal of Microscopy*, 261 (1), pp. 115-126.

Delmelle, E.M., Zhu, H., Tang, W., Casas, I. A web-based geospatial toolkit for the monitoring of dengue fever (2014) *Applied Geography*, 52, pp. 144-152.

Kingham, S.P., Gatrell, A.C., Rowlingson, B. Testing for clustering of health events within a geographical information system framework (1995) *Environment & Planning A*, 27 (5), pp. 809-821.

Wilschut, L.I., Laudisoit, A., Hughes, N.K., Addink, E.A., de Jong, S.M., Heesterbeek, H.A.P., Reijnders, J., Eagle, S., Dubyanskiy, V.M., Begon, M. Spatial distribution patterns of plague hosts: Point pattern analysis of the burrows of great gerbils in Kazakhstan (2015) *Journal of Biogeography*, 42 (7), pp. 1281-1292.

Gonzalez-Rubio, J., Arribas, E., Ramirez-Vazquez, R., Najera, A. Radiofrequency electromagnetic fields and some cancers of unknown etiology: An ecological study (2017) *Science of the Total Environment*, 599-600, pp. 834-843.

Lee, M., Griffith, D.A., Chun, Y. The impact of locational uncertainty on local geographic cluster detection: An application to cancer data from Florida, 2006-2010 (2018) *Proceedings of Spatial Accuracy 2018*, pp. 18-24.

Indicative papers on Polygon Pattern Analysis and Spatial Epidemiology you could choose to review:

Castillo, K.C., Körbl, B., Stewart, A., Gonzalez, J.F., Poncec, F. Application of spatial analysis to the examination of dengue fever in Guayaquil, Ecuador (2011) *Procedia Environmental Sciences*, 7, pp. 188-193.

Mahara, G., Wang, C., Yang, K., Chen, S., Guo, J., Gao, Q., Wang, W., Wang, Q., Guo, X. The association between environmental factors and scarlet fever incidence in Beijing Region: Using gis and spatial regression models (2016) *International Journal of Environmental Research and Public Health*, 13 (11), art. no. 1083, .

Gonzalez-Rubio, J., Najera, A., Arribas, E. Comprehensive personal RF-EMF exposure map and its potential use in epidemiological studies (2016) *Environmental Research*, 149, pp. 105-112.

Dogru, A.O., David, R.M., Ulugtekin, N., Goksel, C., Seker, D.Z., Sözen, S. GIS based spatial pattern analysis: Children with Hepatitis A in Turkey (2017) *Environmental Research*, 156, pp. 349-357.

Cao, Z., Liu, T., Li, X., Wang, J., Lin, H., Chen, L., Wu, Z., Ma, W. Individual and interactive effects of socio-ecological factors on dengue fever at fine spatial scale: A geographical detector-based analysis (2017) *International Journal of Environmental Research and Public Health*, 14 (7), art. no. 795, .

Ahmad, S.S., Aziz, N., Butt, A., Shabbir, R., Erum, S. Spatio-temporal surveillance of water based infectious disease (malaria) in Rawalpindi, Pakistan using geostatistical modeling techniques (2015) *Environmental Monitoring and Assessment*, 187 (9), art. no. 555

Shahid, S.U., Iqbal, J., Hasnain, G. Groundwater quality assessment and its correlation with gastroenteritis using GIS: a case study of Rawal Town, Rawalpindi, Pakistan (2014) *Environmental Monitoring and Assessment*, 186 (11), pp. 7525-7537.

Souris, M., Bichaud, L. Statistical methods for bivariate spatial analysis in marked points. Examples in spatial epidemiology (2011) *Spatial and Spatio-temporal Epidemiology*, 2 (4), pp. 227-234.

Gruebner, O., Lowe, S.R., Sykora, M., Shankardass, K., Subramanian, S.V., Galea, S. Spatio-temporal distribution of negative emotions in New York city after a natural disaster as seen in social media (2018) *International Journal of Environmental Research and Public Health*, 15 (10), art. no. 2275, .

Gao, J., Zhang, Z., Hu, Y., Bian, J., Jiang, W., Wang, X., Sun, L., Jiang, Q. Geographical distribution patterns of iodine in drinking-water and its associations with geological factors in Shandong Province, China (2014) *International Journal of Environmental Research and Public Health*, 11 (5), pp. 5431-5444.

Mollalo, A., Mao, L., Rashidi, P., Glass, G.E. A gis-based artificial neural network model for spatial distribution of tuberculosis across the continental united states (2019) *International Journal of Environmental Research and Public Health*, 16 (1), art. no. 157, .

Zheng, C., Fu, J., Li, Z., Lin, G., Jiang, D., Zhou, X.-N. Spatiotemporal variation and hot spot detection of visceral leishmaniasis disease in Kashi prefecture, China (2018) *International Journal of Environmental Research and Public Health*, 15 (12), art. no. 2784, .

Option 3:

Option 3 is a combination of options 1 and 2. You can carry out one of the two practicals using the GIS software **AND** write a short essay of 750 words for the other topic. **For example**, you can carry out the practical on Point Pattern Analysis (provided and demonstrated in class during week commencing 20th January) using the GIS software **AND** write a short essay of 750 words on the topic of:

““The application of Polygon Pattern Analytical techniques in Spatial Epidemiology”.