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# Modelling Spatial Dynamics of Terrorism

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**Abstract :** To this day, terrorism persists as a worldwide threat, exemplified by the recent deadly attacks in January 2015 in Paris and the ongoing massacres perpetrated by ISIS in Iraq and Syria. In response to this threat, states deploy various counterterrorism measures, the cost of which could be reduced through effective preventive measures. In order to increase the efficiency of preventive measures, policy-makers may benefit from accurate predictive models that are able to capture the complex spatial dynamics of terrorism occurring at a local scale. Despite empirical research carried out at country-level that has confirmed theories explaining the diffusion processes of terrorism across space and time, scholars have failed to assess diffusion's theories on a local scale. Moreover, since scholars have not made the most of recent statistical modelling approaches, they have been unable to build up predictive models accurate in both space and time. In an effort to address these shortcomings, this research suggests a novel approach to systematically assess the theories of terrorism's diffusion on a local scale and provide a predictive model of the local spatial dynamics of terrorism worldwide. With a focus on the lethal terrorist events that occurred after 9/11, this paper addresses the following question: why and how does lethal terrorism diffuse in space and time? Based on geolocalised data on worldwide terrorist attacks and covariates gathered from 2002 to 2013, a binomial spatio-temporal point process is used to model the probability of terrorist attacks on a sphere (the world), the surface of which is discretised in the form of Delaunay triangles and refined in areas of specific interest. Within a Bayesian framework, the model is fitted through an integrated nested Laplace approximation - a recent fitting approach that computes fast and accurate estimates of posterior marginals. Hence, for each location in the world, the model provides a probability of encountering a lethal terrorist attack and measures of volatility, which inform on the model's predictability. Diffusion processes are visualised through interactive maps that highlight space-time variations in the probability and volatility of encountering a lethal attack from 2002 to 2013. Based on the previous twelve years of observation, the location and lethality of terrorist events in 2014 are statistically accurately predicted. Throughout the global scope of this research, local diffusion processes such as escalation and relocation are systematically examined: the former process describes an expansion from high concentration areas of lethal terrorist events (hotspots) to neighbouring areas, while the latter is characterised by changes in the location of hotspots. By controlling for the effect of geographical, economical and demographic variables, the results of the model suggest that the diffusion processes of lethal terrorism are jointly driven by contagious and non-contagious factors that operate on a local scale – as predicted by theories of diffusion. Moreover, by providing a quantitative measure of predictability, the model prevents policy-makers from making decisions based on highly uncertain predictions. Ultimately, this research may provide important complementary tools to enhance the efficiency of policies that aim to prevent and combat terrorism.

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