

Future Crime: Detection and Prevention

The Royal Institution

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Imperial College
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The
Alan Turing
Institute

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Urban Structure

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- For criminal activity, what, where, when scenarios

Research



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Stochastic modelling of urban structure

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The building of mathematical and computer models of cities has a long history. The core elements are models of flows (spatial interaction) and the dynamics

Looking Forward in Time - Plausible Scenarios

We need the forward evolution of configurations of activity in a spatial domain e.g. London activity over a ten year period

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Describe evolution by formal mathematical model using a Stochastic Differential Equation

$$\frac{dX}{dt} = -\nabla V(X) + \sqrt{2\gamma^{-1}} \circ \frac{dB}{dt}, \quad X(0) = x,$$

where V is a potential function. The SDE is interpreted in the Stratonovich sense.

$$V(X) = \underbrace{-\epsilon\alpha^{-1} \sum_{i=1}^N O_i \ln \sum_{j=1}^M \exp(\alpha X_j - \beta c_{ij})}_{\text{Utility}} + \underbrace{\epsilon\kappa \sum_{j=1}^M \exp(X_j)}_{\text{Capacity}},$$

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Can encapsulate socio-economic and criminological theories in a formal manner and use these to study evolution of patterns of crime.

The London Retail System

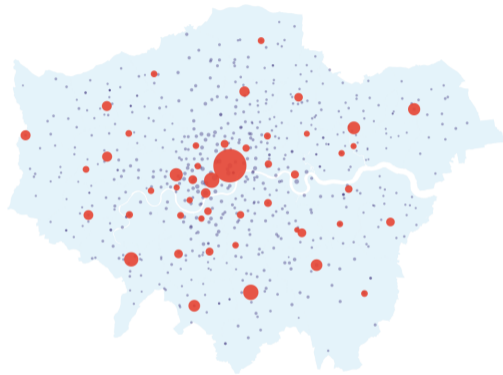


Figure: London retail structure for 2008 for international and metropolitan town centres. The locations of retail zones and residential zones are red and blue, respectively. Sizes are in proportion to floorspace and spending power, respectively. $N = 625$ and $M = 49$.

Plausible Retail Configurations Forward in Time

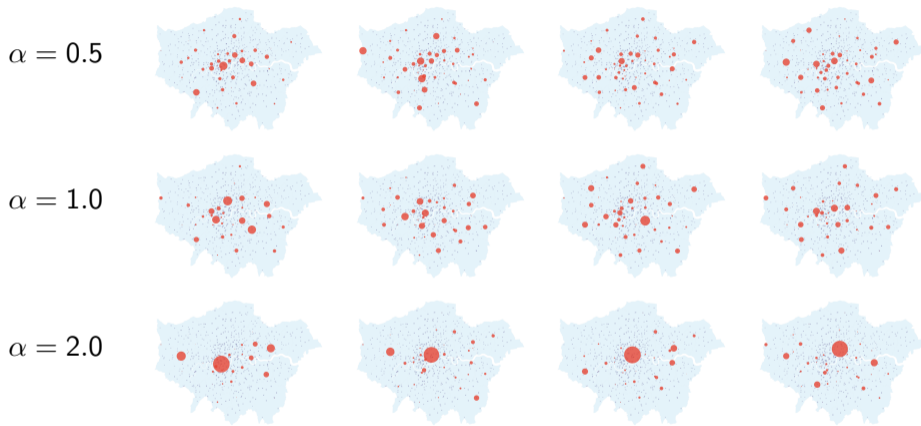


Figure: Uncertainty Associated with predicted plausible scenarios available to police intelligence

Burglary

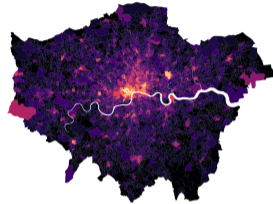
Theft from the person

Bayesian Modelling of Crime in London

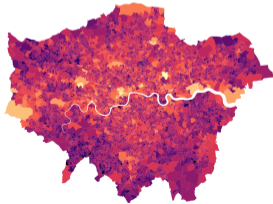
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Vehicle Crime



Shoplifting



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- Not a bad place to start