

making sense of spatial patterns

aim

*spatial pattern analysis:
understanding underlying mechanisms by analysing the (abstract)
spatial pattern*

spatial data

spatial statistics...

- analyses data collected “in space”

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- **not** this kind of space:

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- **not** this kind of space:



- but data for which the **sampling location is known and “relevant”**

spatial data II

well, what do we mean by **relevant**?

two scenarios:

- 1 spatial structure in the data is of scientific interest;
aim is to **describe and analyse** the spatial structure
- 2 spatial structure in the data is a “nuisance”;
aim is to account for the spatial structure or **spatial autocorrelation**

spatial data II

well, what do we mean by **relevant**?

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This is not always as clean-cut as it sounds – many studies have a little bit of both...

making sense of spatial patterns of terrorism

- information contained in spatial (and spatio-temporal) patterns
- analyse spatial patterns to gain better understanding of underlying mechanisms

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spatial statistics understanding spatial structures in patterns of conflict/terrorism by

- *identifying areas with high (and low!) numbers of incidences (“clusters”, “hotspots”) and*
- *relating those to local conditions*

clustering revisited

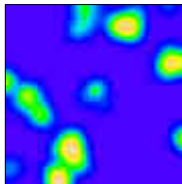
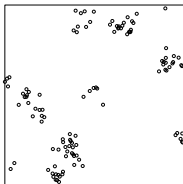
Finding clusters – why do we need statistics – can't we just see them?

clustering revisited

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Let's see...

clustered pattern (artificial data)

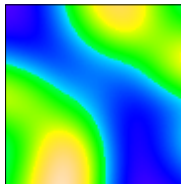
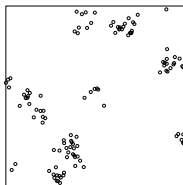


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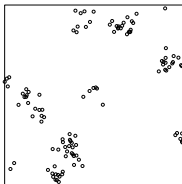


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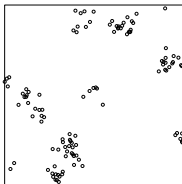


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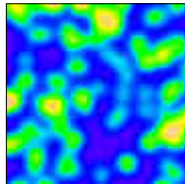
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- not good...

clustering revisited

Finding clusters – are they really there?

Similarly...

another pattern... (artificial data)

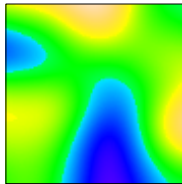
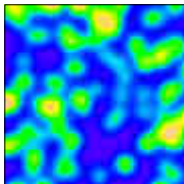


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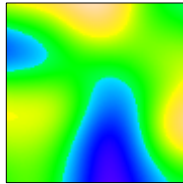
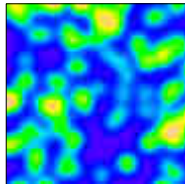
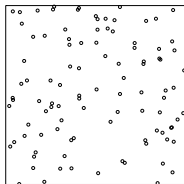


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⇒ this is where statistical models come in...

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- relate observed data to potential local explanatory factors
- decide how relevant (“significant”) each of these factors is

spatial statistical models

- decide if observed clusters are real clusters
- relate observed spatial patterns to potential explanatory factors – in space
- provide mechanisms to tell us how relevant these are

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this implies...

- increased understanding of mechanisms that facilitate terrorism
- prediction... aiding strategic decisions

spatial statistical models

types of models:

- point process models
- geostatistical models
- generalised additive models....

common property: accounting for spatial structure

complexity...

spatial statistical models are complex – why?

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 - this makes things
 - rather complicated (dependence structures)
 - computationally expensive
- ⇒ ongoing statistical research

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- ⇒ ongoing statistical research
- ⇒ spatio-temporal models – even more complex...

recent developments in spatial modelling

issues:

- computational cost
- simplistic modelling with unrealistic assumptions on data structures
 - observation window small, rectangular
 - stationarity spatial behaviour
 - every event observed

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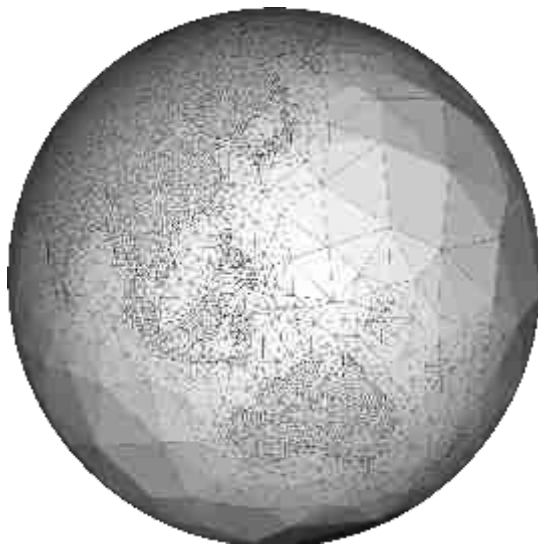
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⇒ we can develop “useful” models

useful models...



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⇒ interdisciplinary work that provides us with nice challenges

truly multi-disciplinary...

mutual understanding

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interdisciplinary statistician's role:

- aiding communication by:
 - participating in scientific dialogue **on both sides**
 - engaging with contents and relevant scientific questions

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- fostering symbiosis:
 - contributing to both scientific fields
 - stimulating research in both areas

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- fostering symbiosis:
 - contributing to both scientific fields
 - stimulating research in both areas
- developing methods that are
 - statistically interesting and
 - practically relevant

this workshop...

initiate **communication**:

- to help us learn from each other
- what can our models do?
- what are interesting relevant questions?

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⇒ develop a common language and **common interests**