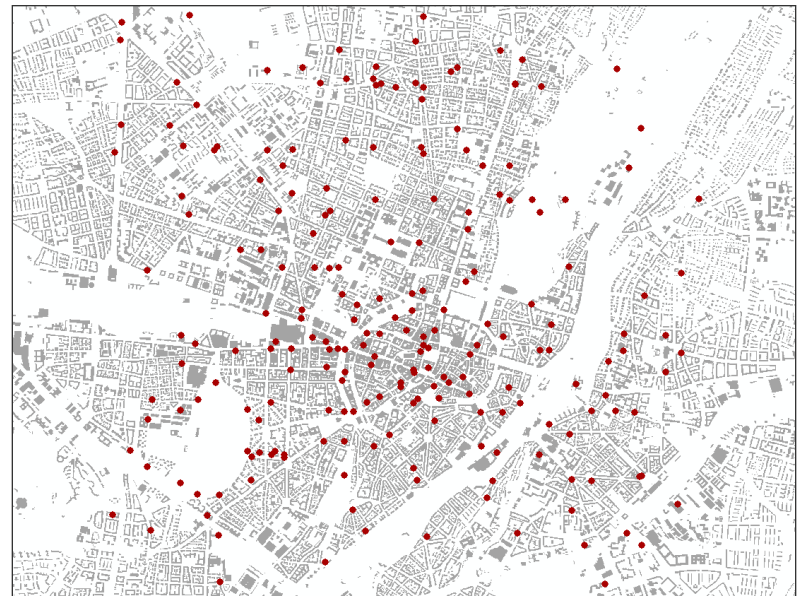


Integrated Spatiotemporal Analysis of Mass Events

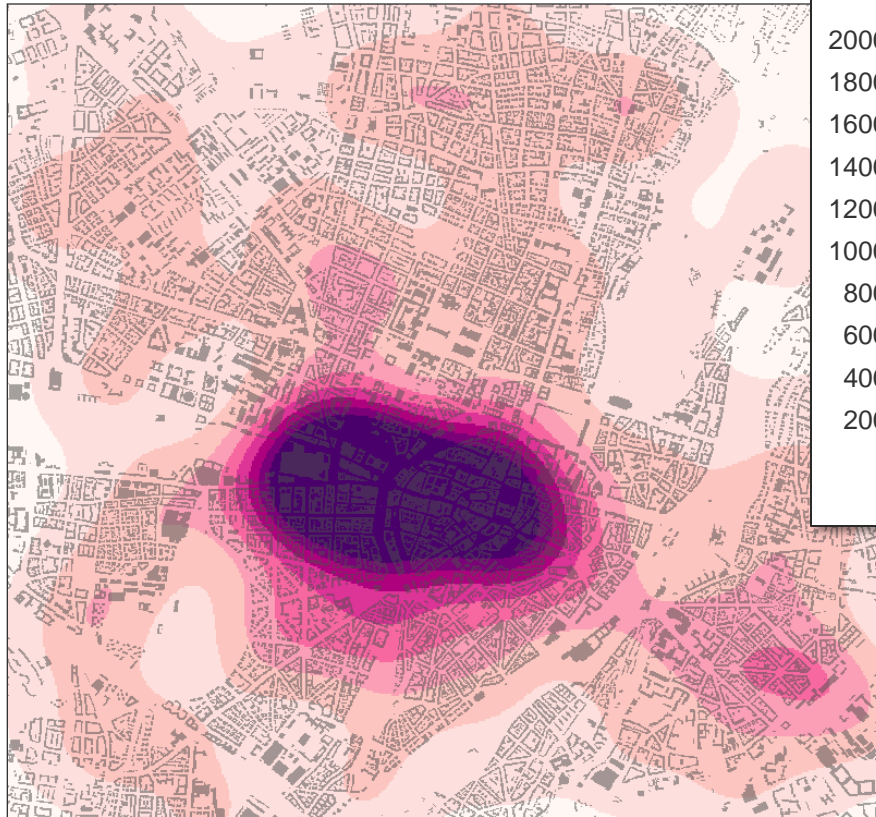
Christian E. Murphy

Data Input

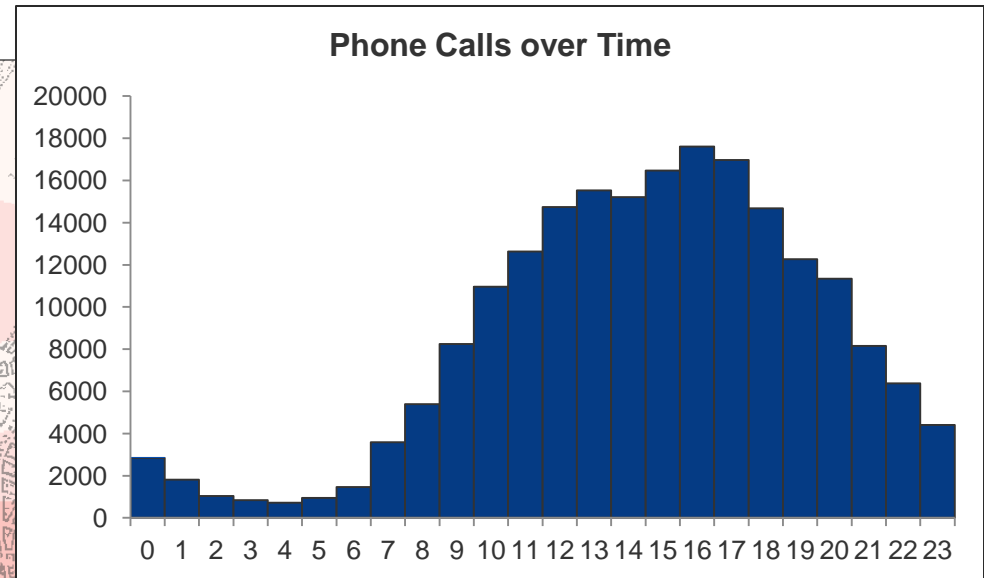
- Mobile phone location dataset
- The events of a mobile phone call were detected and collected
- Logs from every call in Munich of one week
- Calls from base stations in a 7 x 7 km box over Munich centre
- ~1.5 million calls
- All ID's removed



Space and Time Analysis?

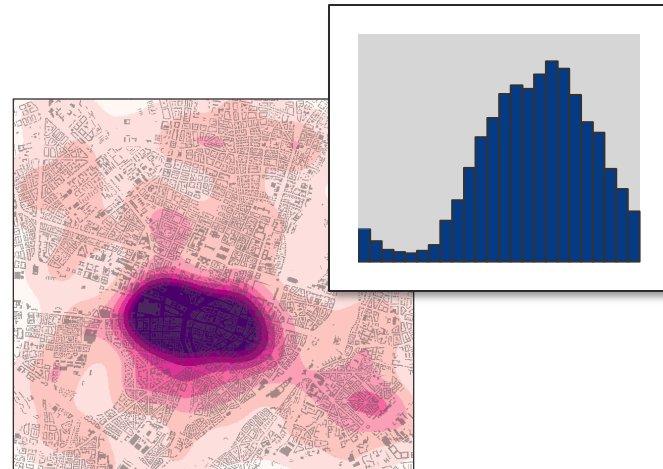


Phone Calls in Space



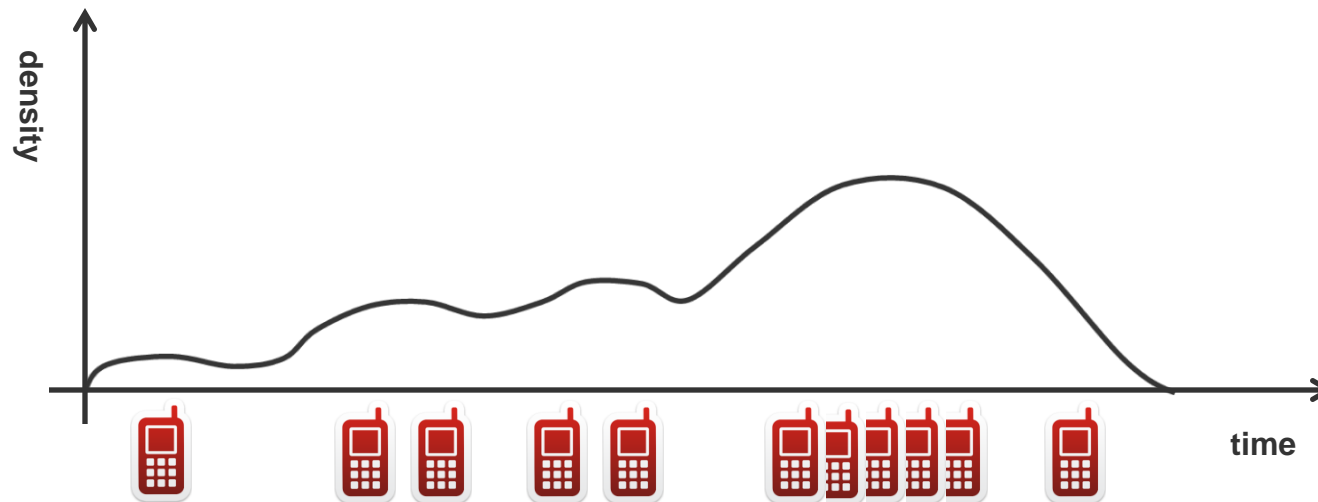
Main Drawbacks

- *Analysis of Space or Time*
- *Visualisation of Space or Time*



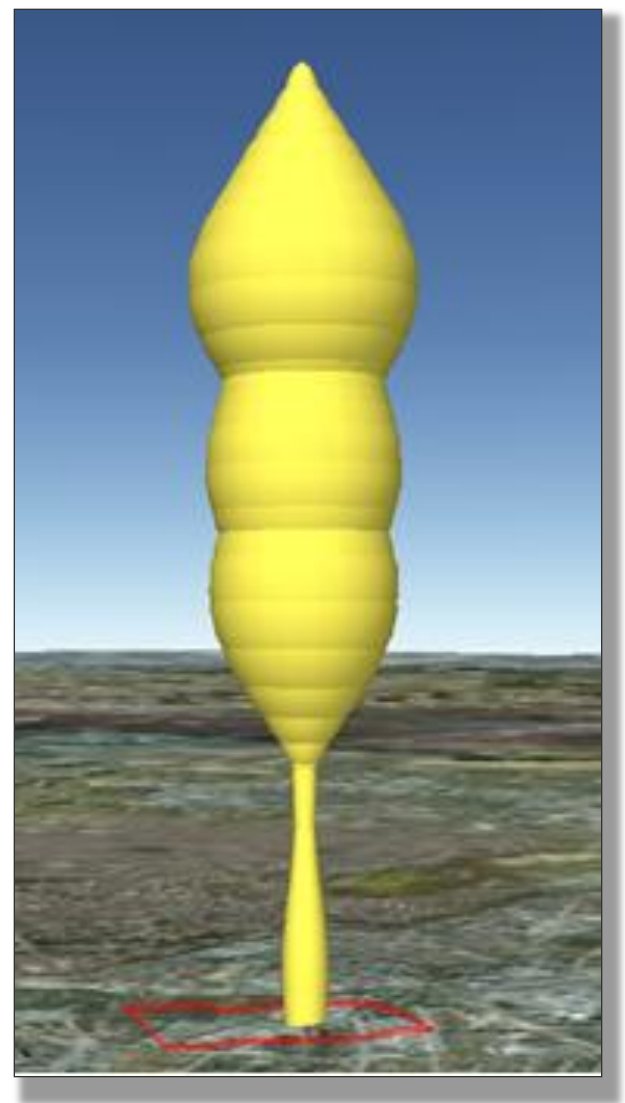
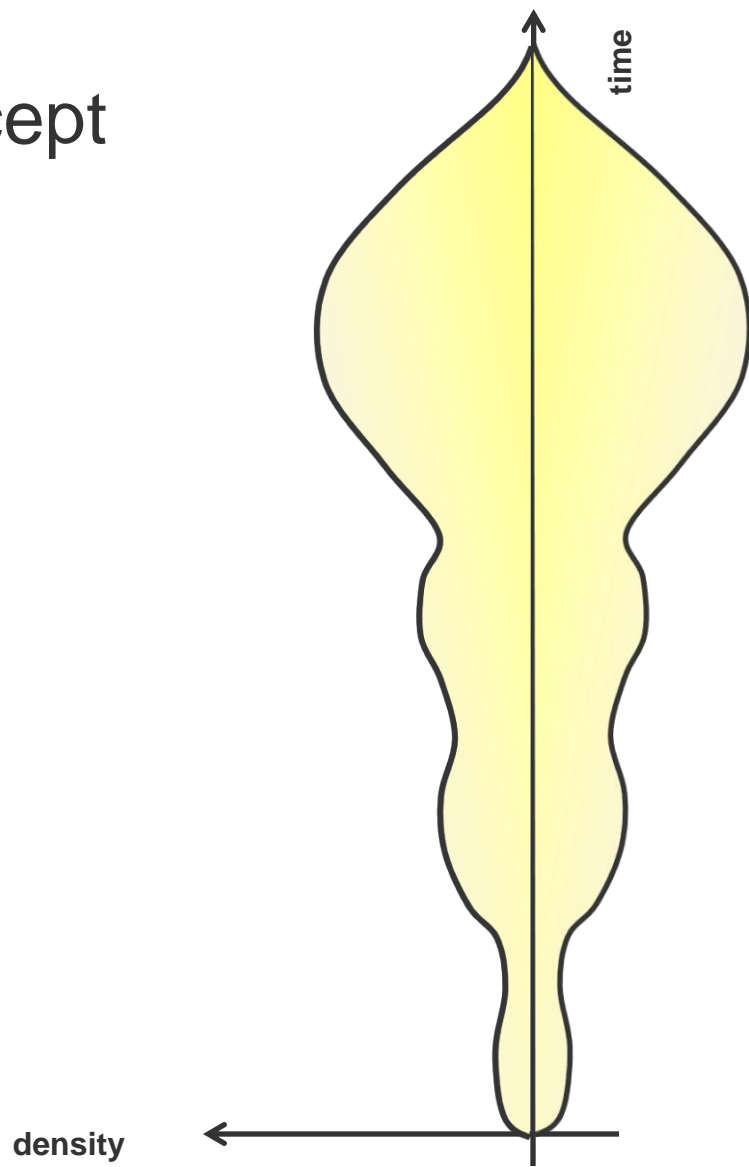
- Areas can't be explored over time in detail
- Spatiotemporal Hotspots are not identifiable
- Time is not applied as continuous

Concept



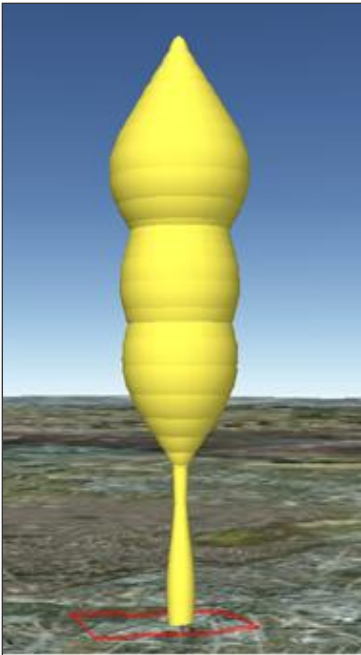
$$\hat{f}_h(x) = \frac{1}{h} \sum_{i=1}^N K\left(\frac{x - x_i}{h}\right)$$

Concept

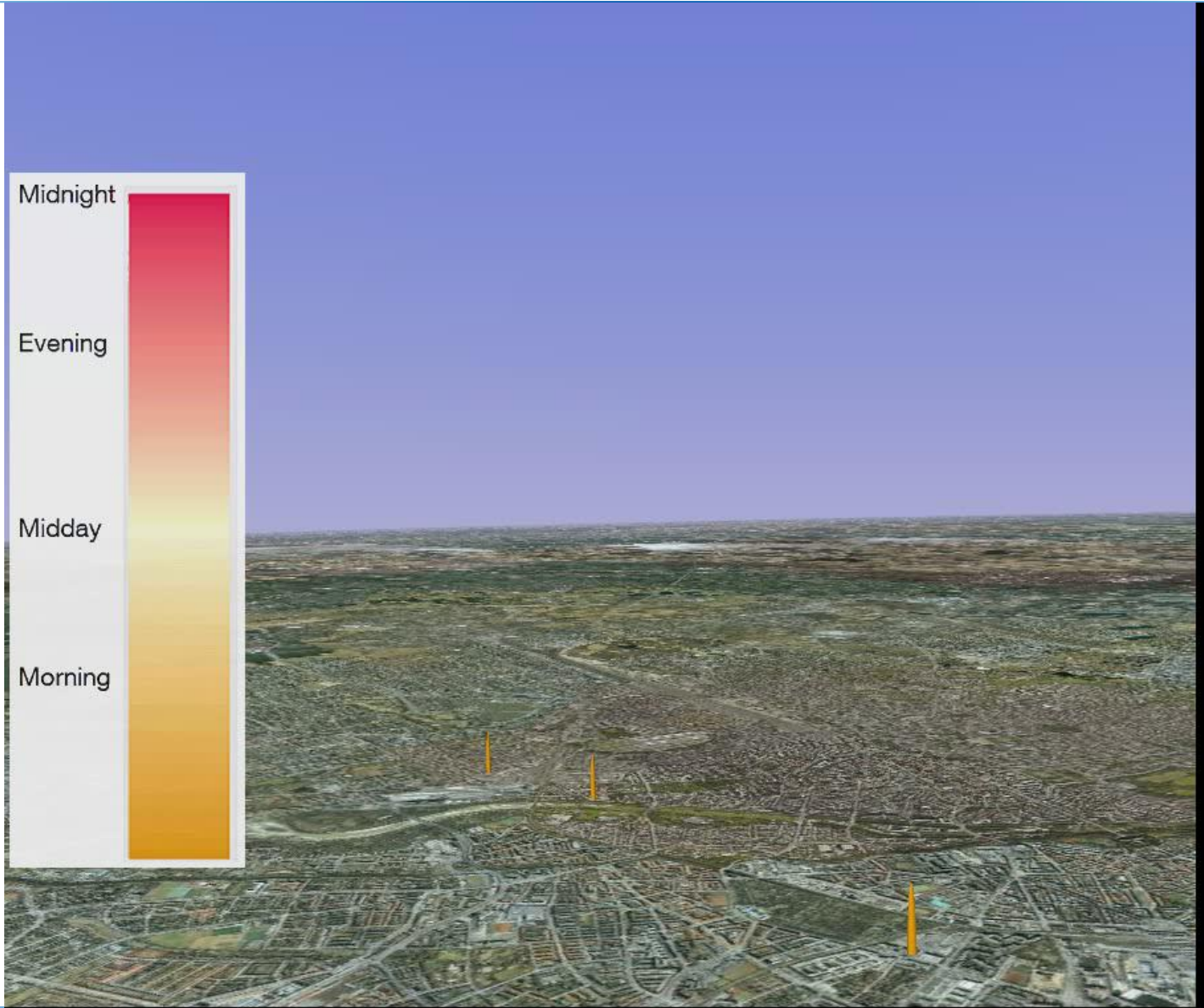
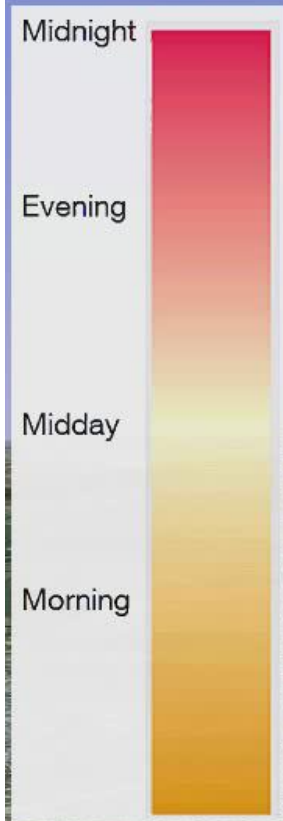




Solid of Revolution for Spatiotemporal task

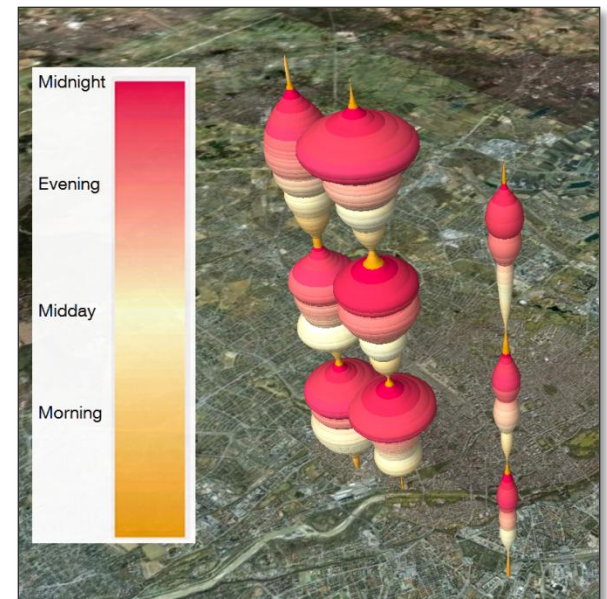


- Set up by a rotating plane density curve
- Visualises event density function
- One hour wide Gaussian Kernel
- Quantative Kernel function allows comparison
- Z-axes origins on a base station
- Amount of events indicated by radius
- Time treated as continous
- Time value indicated by distance from surface
- Back face problem is solved



Integrated Spatiotemporal Analysis

- The Analyst can “see the whole”
- Any specific place in time and space can be examined
- Free navigation enabled
- Size acts as quantitative value
- Colour acts as ordering value
- Visual occlusion is minimized by the power to easily change the view
- Enhanced 3D perception by:
 - Shading texture
 - Motion by navigation

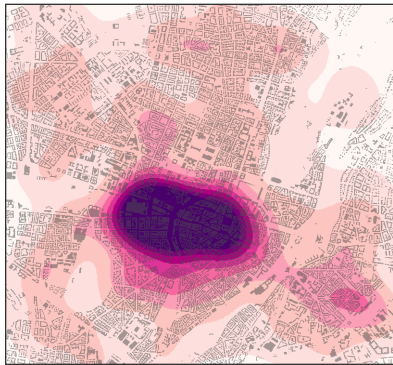




Conclusion

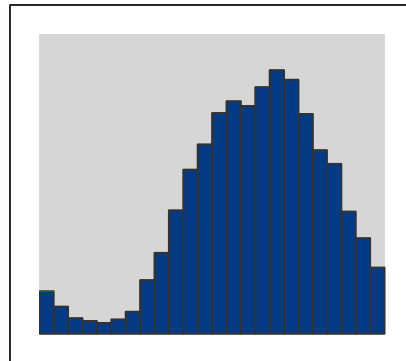
- This 3d symbolization is appropriate for visualising mass event data in space and time
- The symbols are directly derived from the temporal density analysis
- Effective for data exploration
- Any spatially aggregated event data can be explored in detail with this space-time proportional symbol map
- The visualization model can easily exchanged from person to person

Conclusion (2)



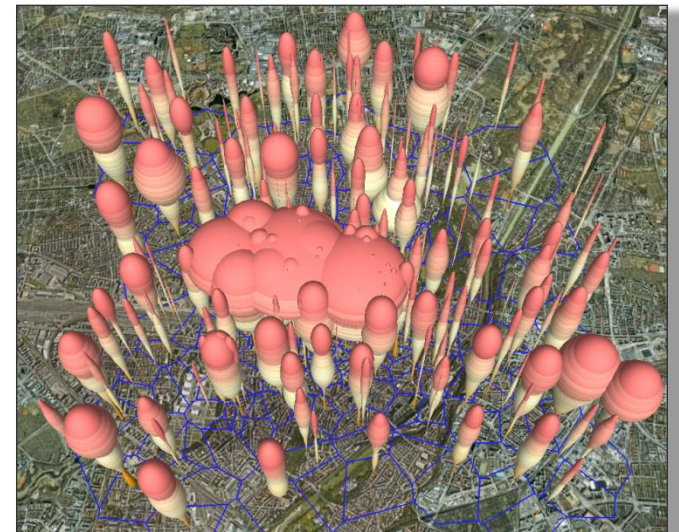
Spatial Analysis

+



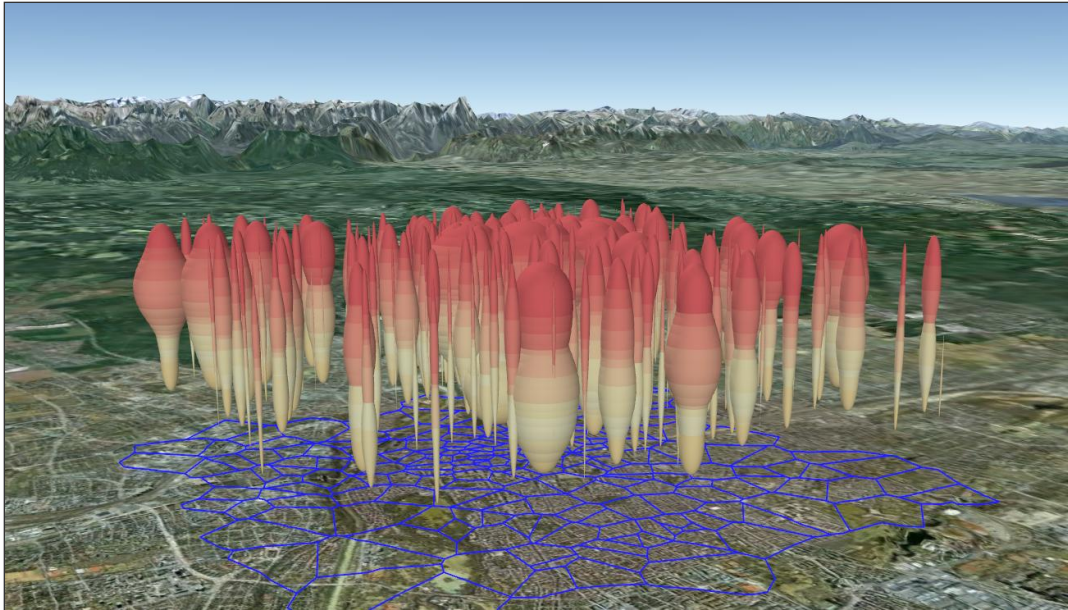
Temporal Analysis

=



Integrated Spatiotemporal Analysis

Thank you!



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