

**FIG WORKING WEEK**  
**• HONG KONG 5'2007 •**

# SPATIAL STATISTICS FOR REAL ESTATE DATA

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## Two phenomena occurring on real estate markets

- Spatial autocorrelation**  
*„everything is related to everything else, but near things are more related than distant things”*  
 Waldo Tobler, First Law of Geography (1979)
- Spatial Heterogeneity**  
*relationship varying over space, spatial non – stationarity*

**How to manage the problems?**  
**How to apply Spatial Statistics methods?**

## GEOSTATISTICAL APPROACH (SPATIAL AUTOCORRELATION)

*searching for local markets homogenous in respect of price, restoring the image of market with missing data – the example –*

## KRIGING INTERPOLATION

$$\hat{\gamma}(h) = \frac{1}{2 \cdot N(h)} \sum_{i=1}^{N(h)} [\bar{z}(s_i + h) - \bar{z}(s_i)]^2$$

↓

**empirical semivariogram**

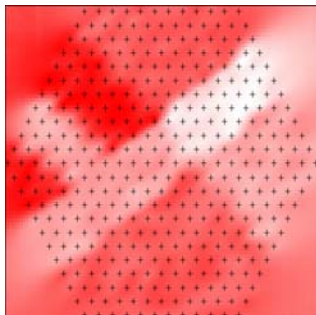
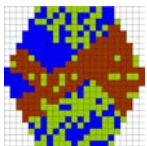
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**theoretical semivariogram**

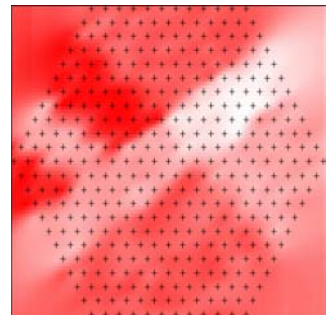
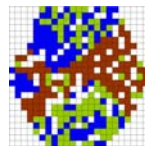
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**the base for the KRIGING procedure**

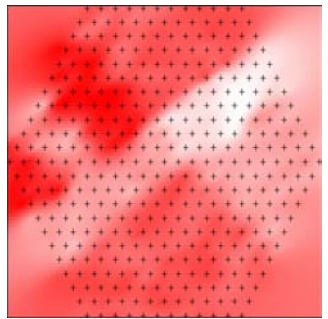
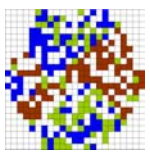
*the example*



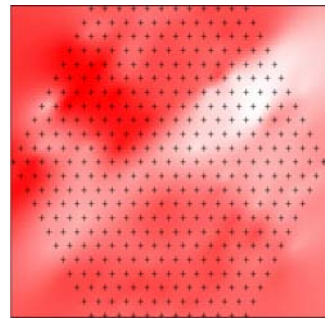
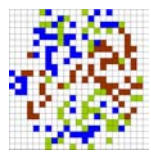
*the example*



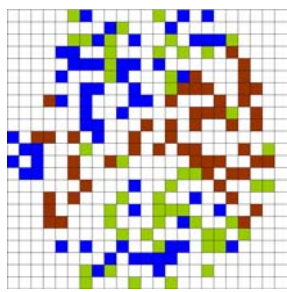
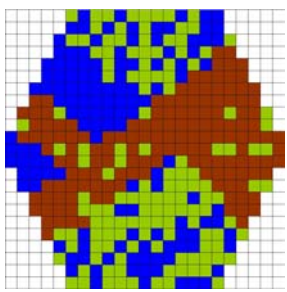
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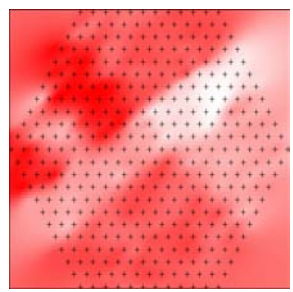
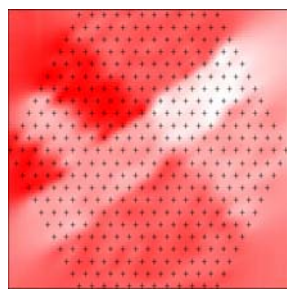
the example



the example



the example



**Geographically Weighted Regression (GWR)  
- spatial heterogeneity -**

*searching for local markets homogenous  
in respect of hedonic prices*

**classical regression model**

**GWR model**

*one model fits all*

*modeling relationship varying over space*

$$y = X \cdot \beta + \varepsilon$$

$$\hat{\beta} = (X^T X)^{-1} X^T y$$

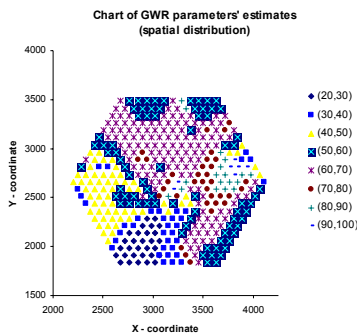
$$y = X \cdot \beta(u, v) + \varepsilon$$

$$\hat{\beta}(u, v) = (X^T W(u, v) X)^{-1} X^T W(u, v) y$$

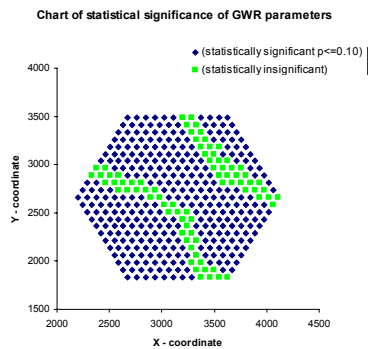
*one set of parameters'  
estimates for the entire study area*  
**global model**

*each location obtains its own  
set of parameters' estimates*  
**local models**

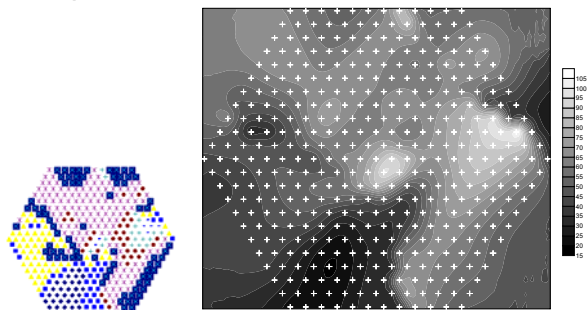
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conclusions

The tools of spatial statistics including geostatistics bring new explorative opportunities on real estate markets. Using these methods, we obtain a brighter image of processes and changes appearing on real estate markets. Depending on needs and character of researches, the methods mentioned in the content of this presentation may be successfully applied and discover these properties of market which were invisible using classical methods.

From the statistical point of view, a usage of spatial statistics method gives us more accurate estimators enabling more precise inference what means in practice that we have more explicit insight in mechanisms and processes occurring on real estates market then previously.

thank you for your attention

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