Spatial Configuration of Geodetic Points

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Introduction

• The geodetic control network provides a reference system for determining the position of all geospatial data, defined by coordinates in the national reference frame.

• It plays a key role in developing all core data and users’ thematic data, because it provides the spatial reference source to register all other spatial data.
The study aims at:

• Analysing the relationship between the number of geodetic control points (GCP) and the type of land use using linear regression (OLS) and geographically weighted regression (GWR).

• Analysing the density of geodetic control points.
Study area

Fig. 1. Radomski county location

Fig. 2. Detailed, horizontal geodetic network, an example
Density of geodetic control points (GCP)

- The average density of GCPs is one point per 21.3 ha.
- Local density of GCPs varies from 0.54 to 15.4 points over 1 km² and shows places of higher and lower point density.
- A significant increase in the density of geodetic points is observed in urbanized regions.
Number of GCPs in the vicinity of roads, railways, electricity lines and water bodies.

<table>
<thead>
<tr>
<th>Buffer zones</th>
<th>Geodetic Control Points Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 m around paved road</td>
<td>6056</td>
</tr>
<tr>
<td>15 km around railways</td>
<td>89</td>
</tr>
<tr>
<td>100 m around electricity lines</td>
<td>4426</td>
</tr>
<tr>
<td>100 m around water</td>
<td>787</td>
</tr>
</tbody>
</table>
## Density of GCPs over land use types

<table>
<thead>
<tr>
<th>Land use</th>
<th>Number of GCPs</th>
<th>Area [ha]</th>
<th>Number of GCPs per 1 ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural</td>
<td>3816</td>
<td>92838.3</td>
<td>24.3</td>
</tr>
<tr>
<td>Built-up</td>
<td>2421</td>
<td>39465.7</td>
<td>16.3</td>
</tr>
<tr>
<td>Forested</td>
<td>693</td>
<td>17707.4</td>
<td>25.6</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>93</td>
<td>2935.3</td>
<td>31.6</td>
</tr>
</tbody>
</table>
Moran’s I and Getis-Ord hot spot

- Global Moran’s I statistics, based on GCPs density, returned negative I and z-score values of 10.459 with a 99% level of significance.
- This empowers rejection (with a probability greater than 1%) of the null hypothesis assuming that, density of geodetic control points is randomly distributed in the study area.
- Therefore, the spatial distributions of geodetic control point density is clustered.
## OLS regression

<table>
<thead>
<tr>
<th>Exploratory variables</th>
<th>coefficient</th>
<th>Std.</th>
<th>T statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area</td>
<td>-0.01</td>
<td>0.02</td>
<td>-0.52</td>
</tr>
<tr>
<td>Road density</td>
<td>0.28</td>
<td>0.09</td>
<td>3.22</td>
</tr>
<tr>
<td>Built-up areas (%)</td>
<td>0.26</td>
<td>0.05</td>
<td>5.68</td>
</tr>
<tr>
<td>Forests (%)</td>
<td>-0.04</td>
<td>0.03</td>
<td>-1.34</td>
</tr>
<tr>
<td>Rural areas (%)</td>
<td>-0.02</td>
<td>0.03</td>
<td>-0.88</td>
</tr>
</tbody>
</table>

R² = 0.40  
corrected R² = 0.39  
Akaike AIC = 1349.73
CONCLUSIONS

• The conducted study proved that geodetic control points are scattered with significantly visible groupings along roads, railways, and built-up area.

• It also shows that information on the land use has a vital influence on the number of geodetic control points and indicates where geodetic control needs densification.
Thank you

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