**Code documentation for the Estimation of the Spatial Panel Count Model**

This addendum serves to document the estimation code for the spatial panel count model that accounts for spatial and temporal dependence among the counts in a spatial unit/territory. An explanation of the parameters in the model and the different settings available within the code are documented below. Please refer to Castro, Paleti, and Bhat (2012) for the notations and the model structure.

Castro, M., R. Paleti, and C.R. Bhat (2012), "A Latent Variable Representation of Count Data Models to Accommodate Spatial and Temporal Dependence: Application to Predicting Crash Frequency at Intersections," Transportation Research Part B, Vol. 46, No. 1, pp. 253-272

**1. Input Dataset Specifications**

The dataset should be in the form of a gauss data file created using the ATOG utility. The dataset should include the following columns..

1. A column of 1s with a variable label *uno*
2. A column of 0s with a variable label *sero*
3. Case ID: A column of observation numbers from 1 to number of spatial units in the data. The label for this column in the sample data is *ID*.
4. Year: This variable refers to the year corresponding to the observation in the panel data.
5. Dependent variables: As many columns as the number of dependent variables, with each column taking the observed count value of the corresponding dependent variable. The label for this column in the sample data is: *AccNew*
6. Explanatory variables: One column for each explanatory variable

**2. Sample Data**

The data consists of 170 spatial records each with 7 years of data (i.e., the number of rows in the dataset = 170\*7). The following table presents the contents and the structure of the sample data:

|  |  |  |
| --- | --- | --- |
| **Column No** | **Name** | **Explanation** |
| 1 | ID | Intersection ID |
| 2 | Year | Year |
| 3 | AccNew | Dependent Variable: Number of accidents at the intersection |
| 4 | Light | Regular Signal Light |
| 8 | Yield | Yield sign |
| 5 | uno | 1 for all records |
| 6 | sero | 0 for all records |
| 7 | NoStret | At least one approach road is non-street road |

**3. Code settings**

"weights" is the distance matrix used to create the weight matrix to capture the spatial interdependence pattern among spatial units.

The path to the distance matrix must be provided in the code.

"dBand" is the distance band used in selecting pairs based on a specified distance threshold. Currently, a distance band of 3 miles is used.

The model specification has five parts:

1. Lambda specification
2. Threshold alpha specification
3. Latent propensity specification
4. Temporal correlation parameter
5. Spatial correlation parameter

The first alpha parameter must always be fixed to zero in the "Threshold alpha specification". Similarly, the coefficient of constant in the "Latent propensity specification" must also be fixed to zero. This can be done using the global "\_max\_active".

In addition, the user must also specify the elements of the latent propensity that have random parameter heterogeneity. It is also important to note that the spatial and temporal parameters are parameterized as 1/[1+exp(rho)] and 1/[1+exp(delta)], respectively and the likelihood function is optimized with respect to the "rho" and "delta" parameters.

**4. Estimation Results**

The user should ignore the standard errors that are printed by default by Gauss.

The correct standard errors and t-stats must be computed using the second code name "Standard Errors". This code requires a global variable "grid\_int" as input which contains all the spatial units at the corners of the square grid that must be used to compute the standard errors.

For the purposes of demonstration, we assumed that 81 out of the 170 intersections are used in the standard error computation. The IDs of these 81 intersections are listed in the file named "grid.txt".

Please note that, at the end, the parameter estimates and standard errors of only those parameters that are estimated in the optimization process are presented.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Mean | log-likelihood | -814.764 |  |  |  |  |  |  |  |
| Number | of | cases | 1190 |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
| Covariance | matrix | of | the | parameters | computed | by | the | following | method: |
| Inverse | of | computed | Hessian |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
| Parameters | Estimates | Std. | err. | Est./s.e. | Prob. | Gradient |  |  |  |
| ------------------------------------------------------------------ | | | | | |  |  |  |  |
| UNO | 1.3479 | 0.0075 | 179.003 | 0 | -0.3006 |  |  |  |  |
| NOSTRET | 0.9032 | 0.0057 | 157.47 | 0 | 0.0893 |  |  |  |  |
| LIGHT | 0.252 | 0.0041 | 62.161 | 0 | -0.2224 |  |  |  |  |
| THRESH02 | 0 | . | . | . | -0.2061 |  |  |  |  |
| THRESH03 | 0.6595 | 0.0053 | 124.804 | 0 | 0.0729 |  |  |  |  |
| THRESH04 | 0.9175 | 0.0074 | 124.731 | 0 | -0.0422 |  |  |  |  |
| THRESH05 | 0.9645 | 0.0089 | 108.39 | 0 | -0.014 |  |  |  |  |
| UNO | 0 | . | . | . | 0.7025 |  |  |  |  |
| YIELD | -1.4331 | 0.0126 | -114.006 | 0 | 0.0159 |  |  |  |  |
| UNO | 1.8416 | 0.0064 | 287.471 | 0 | 0.0222 |  |  |  |  |
| YIELD | 1.4466 | 0.0205 | 70.526 | 0 | 0.0894 |  |  |  |  |
| Rho | 100 | . | . | . | 0 |  |  |  |  |
| Delta | -0.9968 | 0.0152 | -65.539 | 0 | -0.0769 |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
| Hessian |  |  |  |  |  |  |  |  |  |
| 304747 | 37650.94 | 193323.4 | -24350.3 | -16707.9 | -75578.1 | 69152.19 | 57192.74 | 5404.031 | 70646.11 |
| 37646.21 | 40186.76 | 19656.71 | -604.044 | -875.77 | -8825.52 | 5858.976 | 3284.291 | -86.7718 | 5732.371 |
| 193541.7 | 19658.35 | 201658.7 | -13997.5 | -9885.78 | -49024 | 31913.27 | 31195.56 | -72.597 | 41570.05 |
| -24349.3 | -605.099 | -13997.1 | 146026.3 | -84952.4 | -647.909 | -6999.9 | 5846.956 | -631.964 | -9368.33 |
| -16707.2 | -875.754 | -9885.82 | -84952.5 | 212602 | -118175 | -4428.64 | -3739.05 | -926.323 | -4340.38 |
| -75645.9 | -8825.41 | -49028.6 | -647.663 | -118175 | 146649.5 | -11552.9 | -53863 | -3009.78 | -4142.73 |
| 69166.77 | 5859.465 | 31914.4 | -6999.95 | -4428.66 | -11552.9 | 26615.86 | 7451.599 | 3518.309 | 20106.83 |
| 57592.92 | 3284.004 | 31219.54 | 5846.913 | -3739.08 | -53863.1 | 7451.614 | 99354.94 | 4229.501 | -13098.9 |
| 5406.278 | -86.5271 | -72.5209 | -631.995 | -926.336 | -3009.84 | 3518.313 | 4229.692 | 3355.294 | 655.9957 |
| 70385.54 | 5743.426 | 41450.5 | -9387.98 | -4335.41 | -3990.62 | 20092.52 | -13383.5 | 653.9304 | 29591.56 |
|  |  |  |  |  |  |  |  |  |  |
| Estimate | St | Error | T-stat |  |  |  |  |  |  |
| 1.3479 | 0.0261 | 51.5634 |  |  |  |  |  |  |  |
| 0.9032 | 0.0181 | 49.8097 |  |  |  |  |  |  |  |
| 0.252 | 0.0129 | 19.5039 |  |  |  |  |  |  |  |
| 0.6595 | 0.0152 | 43.3156 |  |  |  |  |  |  |  |
| 0.9175 | 0.0213 | 43.059 |  |  |  |  |  |  |  |
| 0.9645 | 0.0254 | 37.9275 |  |  |  |  |  |  |  |
| -1.4331 | 0.033 | -43.4118 |  |  |  |  |  |  |  |
| 1.8416 | 0.015 | 123.0811 |  |  |  |  |  |  |  |
| 1.4466 | 0.028 | 51.7388 |  |  |  |  |  |  |  |
| -0.9968 | 0.0212 | -46.9887 |  |  |  |  |  |  |  |