Table 1: Main functions contained within remotePARTS, separated into the two steps for analyzing spatiotemporal data.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Analysis** | **remotePARTS function** | **Description** |
| Step 1 | Time-series analyses | fitCLS(), fitAR() | Fit time-series regression to a location and return estimate of time trend coefficient |
| Multiple time-series analyses | fitCLS\_map(), fitAR\_map() |  |
| Estimate spatial parameters  (from residuals) | fitSpatialcor() | Find ML estimates of spatial parameters by comparing residual correlations with distances among points |
| Step 2 | Spatial analyses (small datasets) | fitGLS() | Fit GLS to data, given covariance parameters |
| Spatial analyses using partitions (large datasets) | fitGLS\_partition() | Fit GLS to partitioned data, given covariance parameters |
| Generate random partitions | sample\_partitions() | Produce a random partition matrix containing indices to locations in an *n*-length dataset |
|  | Spatial covariance matrix | fitV() | Produces a covariance matrix from a distance matrix under exponential or power-exponential functions |
|  | Combined covariance estimation and GLS | fitGLS\_opt() | Estimate spatial parameters from data rather than residuals, fit covariance matrix, and fit GLS. Primarily used as alternate method for spatial parameter estimation in certain contexts |

Table 2. Simulation studies for five cases to illustrate the performance of remotePARTS. Both simulation and fitting model are given, with part of the fitting model denoted by " when it is the same as the simulation model. Parameter values which differed among simulations are given. Bias is given by the average difference between parameter estimates and the true value, and P() give the rejection rates of the null hypotheses = q0 and = q1 under the significance level of alpha = 0.05. Parameters common among simulations are:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| case | simulation model | fitted model | parameters | N sims | - q0 | - q1 | P(q0) | P(q1) |
| i | *yi* = q0 + q1*x* + d*i* | " | *n* = 1042 | 200 |  |  | - | - |
|  | d*i* ~ N(0, 2****(D,*r*)) | " | 1442 | 200 |  |  | - | - |
|  |  |  | 2002 | 200 |  |  | - | - |
|  |  |  | 2802 | 200 |  |  | - | - |
|  |  |  | *r* = 0 | 500 |  |  | ? |  |
|  |  |  | 0.05 | 500 |  |  |  |  |
|  |  |  | 0.25 | 500 |  |  |  |  |
| ii | *yi* = q0 + q1*xi* + d*i* | " | *r* = 0 | 1000 |  |  | ? |  |
|  | d*i* ~ N(0, 2*****ts*(D,*r*)) | d*i* ~ N(0, 2****(D,*r*)) | 0.05 | 500 |  |  |  |  |
|  |  |  | 0.25 | 500 |  |  |  |  |
| iii | *yi* = q0 + q1*xi* + *zi* + d*i* | *yi* = q0 + q1*xi* + d*i* | *N* = 1 | 200 |  |  | - | - |
|  | d*i* ~ N(0, 2****(D,*r*)) | " | 4 | 200 |  |  | - | - |
|  |  |  | 9 | 200 |  |  | - | - |
| iv | *yi*(*t*) = *b*0 + *b*1*xi* + (q0 + q1*xi*)*t* + *i*(*t*) | " | *r* = 0 | 200 |  |  | ? |  |
|  | *i*(*t*) = r*i*(*t*–1) + *i*(*t*) | " | 0.05 | 200 |  |  |  |  |
|  | *i*(*t*) ~ N(0, 2****(D,*r*)) | " | 0.25 | 200 |  |  |  |  |
| v | *yi*(*t*) = *b*0 + *b*1*xi* + (q0 + q1*xi*)*t* + u*i*(t) + *i*(*t*) | *yi*(*t*) = *b*0 + *b*1*xi* + (q0 + q1*xi*)*t* + *i*(*t*) | ru = 0, ru = 0 | 200 |  |  | - | - |
|  | *i*(*t*) = r*i*(*t*–1) + *i*(*t*) | " | 0, 0.4 | 200 |  |  | - | - |
|  | *i*(*t*) ~ N(0, 2****(D,*r*)) | " | 0.4, 0 | 200 |  |  | - | - |
|  | *ui*(*t*) = r*uui*(*t*–1) + a*i*(*t*) |  | 0.4, 0.4 | 200 |  |  | - | - |
|  | a*i*(*t*) ~ N(0, 2****(D,*ru*)) |  |  |  |  |  |  |  |

Table 3: Comparison between remotePARTS and a GLMM model. Columns give the average estimates from 1000 simulations and P(q1), the proportion of simulations in which the null hypothesis q1 = 0 was rejected at the significance level of alpha = 0.05.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| simulated q1 | remotePARTS estimate | GLMM estimate | remotePARTS P(q1) | GLMM P(q1) |
| 0 | -0.001 | -0.002 | 0.042 | 0.033 |
| 0.25 | 0.239 | 0.242 | 0.172 | 0.157 |
| 0.5 | 0.492 | 0.494 | 0.612 | 0.612 |
| 0.75 | 0.736 | 0.736 | 0.916 | 0.919 |