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Article Title

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Abstract

Purpose: The abstract serves both as a general introduction to the topic and as a brief, non-technical summary of the main results and their implications. The abstract must not include subheadings (unless expressly permitted in the journal's Instructions to Authors), equations or citations. As a guide the abstract should not exceed 200 words. Most journals do not set a hard limit however authors are advised to check the author instructions for the journal they are submitting to.

Methods: The abstract serves both as a general introduction to the topic and as a brief, non-technical summary of the main results and their implications. The abstract must not include subheadings (unless expressly permitted in the journal's Instructions to Authors), equations or citations. As a guide the abstract should not exceed 200 words. Most journals do not set a hard limit however authors are advised to check the author instructions for the journal they are submitting to.

Results: The abstract serves both as a general introduction to the topic and as a brief, non-technical summary of the main results and their implications. The abstract must not include subheadings (unless expressly permitted in the journal's Instructions to Authors), equations or citations. As a guide the abstract should not exceed 200 words. Most journals do not set a hard limit however authors are advised to check the author instructions for the journal they are submitting to.

Conclusion: The abstract serves both as a general introduction to the topic and as a brief, non-technical summary of the main results and their implications. The abstract must not include subheadings (unless expressly permitted in the journal's Instructions to Authors), equations or citations. As a guide the abstract should not exceed 200 words. Most journals do not set a hard limit however authors are advised to check the author instructions for the journal they are submitting to.}

Keywords: key, dictionary, word
JEL Classification: D8 , H51
MSC Classification: 35A01 , 65L10

1 Methods

1.1 Spatial Autocorrelation and Map Pattern

Spatial autocorrelation is a condition whereby the value of a variable at one location is correlated with the value(s) of the same variable at one or more proximal locations. A tool widely used to measure spatial autocorrelation is Moran’s coefficient of autocorrelation, or MC for short. In matrix form, MC can be formulated as follows:

$$MC = \frac{n}{\sum_i \sum_j w_{ij}} \frac{x'Wx}{x'x} \quad (1)$$

where x is a vector ($n \times 1$) of mean-centered values of a georeferenced variable, and W is a spatial weights matrix of dimensions ($n \times n$) with elements w_{ij} . The elements of the spatial weights matrix take non-zero values if locations i and j are deemed to be spatially proximate in some sense, and 0 otherwise. It can be appreciated that the coefficient is composed to two elements: the variance of the random variable (i.e., $(x'x)/n$) and its spatial autocovariance $\frac{(x'Wx)}{\sum_i \sum_j w_{ij}}$. As an alternative, the numerator of the right-hand term of Equation 1 can be expressed as follows:

$$x' \left(I - \frac{11'}{n} \right) W \left(I - \frac{11'}{n} \right) x \quad (2)$$

with I as the identity matrix of size $n \times n$ and 1 a conformable vector of ones.

One possible interpretation of spatial autocorrelation is as map pattern. More concretely, the eigenvalues of the following matrix represent the range of possible values of MC given a spatial weights matrix W , and the extreme eigenvalues are in fact associated with the minimum and maximum values of MC for the system of relationships represented by W :

$$\left(I - \frac{11'}{n} \right) W \left(I - \frac{11'}{n} \right) \quad (3)$$

A remarkable discovery is that the eigenvectors associated with the eigenvalues of the matrix in Expression 3 represent a catalogue of latent map patterns, each with a level of autocorrelation (as measured by MC) given by its corresponding eigenvalue. Furthermore, the patterns represented by the eigenvectors are orthogonal by design, and so they furnish n maps that are independent from each other. Since these map patterns depend only on the spatial weights matrix – and not the spatial random variable – they constitute an extensive set of latent map patterns that can be used in regression analysis as filters. This is explained next.

2 Introduction	093
The Introduction section, of referenced text Campbell and Gear (1995) expands on the background of the work (some overlap with the Abstract is acceptable). The introduction should not include subheadings.	094
Springer Nature does not impose a strict layout as standard however authors are advised to check the individual requirements for the journal they are planning to submit to as there may be journal-level preferences. When preparing your text please also be aware that some stylistic choices are not supported in full text XML (publication version), including coloured font. These will not be replicated in the typeset article if it is accepted.	095
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5 Equations	120
Equations in L ^A T _E X can either be inline or on-a-line by itself (“display equations”). For inline equations use the <code>\$...\$</code> commands. E.g.: The equation $H\psi = E\psi$ is written via the command <code>\$H \psi = E \psi\$</code> .	121
For display equations (with auto generated equation numbers) one can use the <code>equation</code> or <code>align</code> environments:	122
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Notice the use of <code>\nonumber</code> in the <code>align</code> environment at the end of each line, except the last, so as not to produce equation numbers on lines where no equation	137
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Table 1 Caption text

temperature	pressure
0	0.0002
20	0.0012
40	0.0060
60	0.0300
80	0.0900
100	0.2700

numbers are required. The `\label{}` command should only be used at the last line of an align environment where `\nonumber` is not used.

$$Y_{\infty} = \left(\frac{m}{\text{GeV}}\right)^{-3} \left[1 + \frac{3 \ln(m/\text{GeV})}{15} + \frac{\ln(c_2/5)}{15}\right] \tag{6}$$

The class file also supports the use of `\mathbb{}`, `\mathscr{}` and `\mathcal{}` commands. As such `\mathbb{R}`, `\mathscr{R}` and `\mathcal{R}` produces \mathbb{R} , \mathscr{R} and \mathcal{R} respectively (refer Subsubsection 4.1.1).

6 Tables

Tables can be inserted via the normal `knitr::kable()` function or other table-generating packages.

Tables can also be inserted via the normal table and tabular environment. To put footnotes inside tables you should use `\footnotetext[]{\dots}` tag. The footnote appears just below the table itself (refer Tables 2 and 3). For the corresponding footnotemark use `\footnotemark[...]`

Table 2 Caption text

Column 1	Column 2	Column 3	Column 4
row 1	data 1	data 2	data 3
row 2	data 4	data 5 ¹	data 6
row 3	data 7	data 8	data 9 ²

Source: This is an example of table footnote. This is an example of table footnote.

¹Example for a first table footnote. This is an example of table footnote.

²Example for a second table footnote. This is an example of table footnote.

The input format for the above table is as follows:

```
\begin{table}[<placement-specifier>]
\caption{<table-caption>}\label{<table-label>}%
\begin{tabular}{@{}llll@{}}
\toprule
```

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Column 1 & Column 2 & Column 3 & Column 4\\
\midrule
row 1 & data 1 & data 2 & data 3 \\
row 2 & data 4 & data 5\footnotemark[1] & data 6 \\
row 3 & data 7 & data 8 & data 9\footnotemark[2]\\
\botrule
\end{tabular}
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This is an example of table footnote.}
\footnotetext[2]{Example for a second table footnote.
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\end{table}

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Table 3 Example of a lengthy table which is set to full textwidth

Project	Element 1 ¹			Element 2 ²		
	Energy	σ_{calc}	σ_{expt}	Energy	σ_{calc}	σ_{expt}
Element 3	990 A	1168	1547 ± 12	780 A	1166	1239 ± 100
Element 4	500 A	961	922 ± 10	900 A	1268	1092 ± 40

Note: This is an example of table footnote. This is an example of table footnote this is an example of table footnote this is an example of table footnote this is an example of table footnote.

¹Example for a first table footnote.

²Example for a second table footnote.

231 In case of double column layout, tables which do not fit in single column width
 232 should be set to full text width. For this, you need to use `\begin{table*}` ...
 233 `\end{table*}` instead of `\begin{table}` ... `\end{table}` environment. Lengthy
 234 tables which do not fit in textwidth should be set as rotated table. For this, you need to
 235 use `\begin{sidewaystable}` ... `\end{sidewaystable}` instead of `\begin{table*}`
 236 ... `\end{table*}` environment. This environment puts tables rotated to single col-
 237 umn width. For tables rotated to double column width, use `\begin{sidewaystable*}`
 238 ... `\end{sidewaystable*}`.

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240 7 Figures

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242 As per the L^AT_EX standards you need to use eps images for L^AT_EX compilation and
 243 pdf/jpg/png images for PDFL^AT_EX compilation. Use the dev knitr option to use the
 244 appropriate format. This is one of the major difference between L^AT_EX and PDFL^AT_EX.
 245 Each image should be from a single input .eps/vector image file. Avoid using subfig-
 246 ures. The command for inserting images for L^AT_EX and PDFL^AT_EX can be generalized.
 247 The package used to insert images in L^AT_EX/PDFL^AT_EX is the graphicx package. Figures
 248 can be inserted via the normal figure environment as shown in the below example:

249

250 8 Algorithms, Program codes and Listings

251

252 Packages `algorithm`, `algorithmicx` and `algpseudocode` are used for setting algo-
 253 rithms in L^AT_EX using the format:

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254 \begin{algorithm}
255 \caption{<alg-caption>}\label{<alg-label>}
256 \begin{algorithmic}[1]
257 . . .
258 \end{algorithmic}
259 \end{algorithm}
```

260 You may refer above listed package documentations for more details before set-
 261 ting `algorithm` environment. For program codes, the “program” package is required
 262 and the command to be used is `\begin{program}` ... `\end{program}`. A fast
 263 exponentiation procedure:

264 Similarly, for `listings`, use the `listings` package. `\begin{lstlisting}` ...
 265 `\end{lstlisting}` is used to set environments similar to `verbatim` environment. Refer
 266 to the `lstlisting` package documentation for more details.

267 A fast exponentiation procedure:

```
268 begin
269   for  $i := 1$  to 10 step 1 do
270     expt(2,  $i$ );
271     newline() od
272 where
273 proc expt( $x, n$ )  $\equiv$ 
274    $z := 1$ ;
275   do if  $n = 0$  then exit fi;
276   do if odd( $n$ ) then exit fi;
```

Comments will be set flush to the right margin

Table 4 Tables which are too long to fit, should be written using the "sidewaystable" environment as shown here

Projectile	Element 1 ¹			Element ²		
	Energy	σ_{calc}	σ_{expt}	Energy	σ_{calc}	σ_{expt}
Element 3	990 A	1168	1547 \pm 12	780 A	1166	1239 \pm 100
Element 4	500 A	961	922 \pm 10	900 A	1268	1092 \pm 40
Element 5	990 A	1168	1547 \pm 12	780 A	1166	1239 \pm 100
Element 6	500 A	961	922 \pm 10	900 A	1268	1092 \pm 40

Note: This is an example of table footnote this is an example of table footnote this is an example of table footnote
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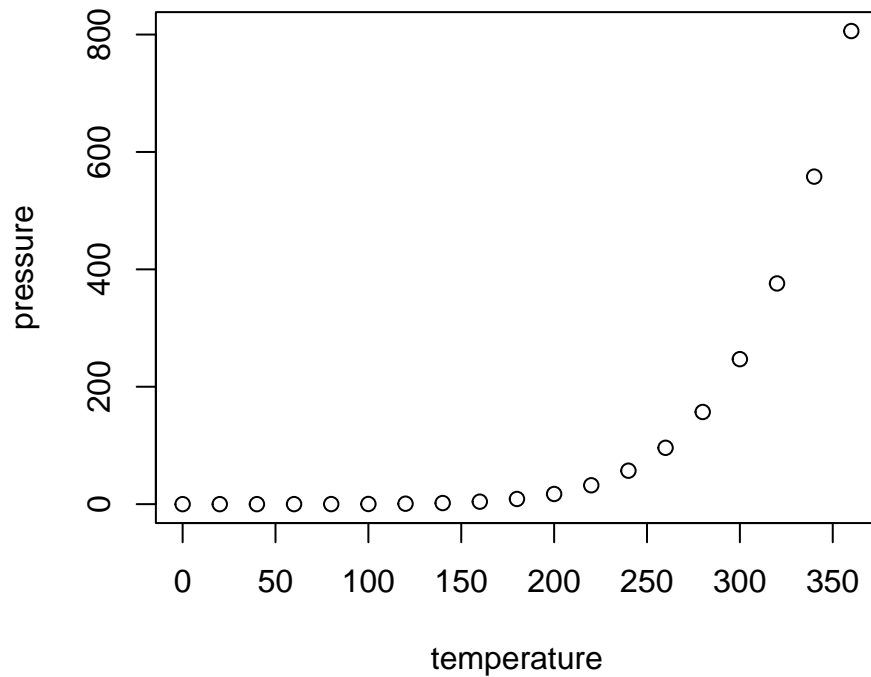


Fig. 1 This is an example of a caption

```

comment: This is a comment statement;
n := n/2; x := x*x od;
{ n > 0 };
n := n - 1; z := z*x od;
print(z).
end

```

```

for i:=maxint to 0 do begin \{ do nothing \} end; Write('Case
insensitive');-Write('Pascal-keywords. ');

```

9 Cross referencing

Figures and tables are labeled with a prefix (fig or tab, respectively) plus the chunk label. Other environments such as equation and align can be labelled via

Algorithm 1 Calculate $y = x^n$	369
Require: $n \geq 0 \vee x \neq 0$	370
Ensure: $y = x^n$	371
1: $y \leftarrow 1$	372
2: if $n < 0$ then	373
3: $X \leftarrow 1/x$	374
4: $N \leftarrow -n$	375
5: else	376
6: $X \leftarrow x$	377
7: $N \leftarrow n$	378
8: end if	379
9: while $N \neq 0$ do	380
10: if N is even then	381
11: $X \leftarrow X \times X$	382
12: $N \leftarrow N/2$	383
13: else [N is odd]	384
14: $y \leftarrow y \times X$	385
15: $N \leftarrow N - 1$	386
16: end if	387
17: end while	388

the `\label{#label}` command inside or just below the `\caption{}` command. You can then use the label for cross-reference. As an example, consider the chunk label declared for Figure 1 which is fig1. To cross-reference it, use the command `\ref{fig:fig1}`, for which it comes up as “Figure 1”.

To reference line numbers in an algorithm, consider the label declared for the line number 2 of Algorithm 1 is `\label{algl n2}`. To cross-reference it, use the command `\ref{algl n2}` for which it comes up as line 2 of Algorithm 1.

9.1 Details on reference citations

For citations of references, use [Campbell and Gear \(1995\)](#) or [\(Slifka and Whitton, 2000\)](#).

10 Examples for theorem like environments

The documentclass for springer `sn-jnl.cls` contains 3 styling that you can use to set new default for theorems and proofs type

thmstyleone Numbered, theorem head in bold font and theorem text in italic style
thmstyletwo Numbered, theorem head in roman font and theorem text in italic style
thmstylethree Numbered, theorem head in bold font and theorem text in roman style

For mathematics journals, theorem styles can be included as shown in the following examples.

415 **Theorem 1.** *Example theorem text. Example theorem text. Example theorem text.*
416 *Example theorem text. Example theorem text. Example theorem text. Example theorem*
417 *text. Example theorem text. Example theorem text. Example theorem text. Example*
418 *theorem text.*

419 To add labels and subheadings, use LaTeX notation

420 **Theorem 2** (Theorem subhead). *Example theorem text. Example theorem text. Exam-*
421 *ple theorem text. Example theorem text. Example theorem text. Example theorem text.*
422 *Example theorem text. Example theorem text. Example theorem text. Example theorem*
423 *text. Example theorem text.*

424 Other environments are proposition, example, remark, definition, proof and quote
425 Sample body text. Sample body text. Sample body text. Sample body text. Sample
426 body text. Sample body text. Sample body text. Sample body text.

427 **Proposition 3.** *Example proposition text. Example proposition text. Example propo-*
428 *sition text. Example proposition text. Example proposition text. Example proposition*
429 *text. Example proposition text. Example proposition text. Example proposition text.*
430 *Example proposition text.*

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432 body text. Sample body text. Sample body text. Sample body text.

433 *Example 1.* Phasellus adipiscing semper elit. Proin fermentum massa ac quam. Sed
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435 ligula, eleifend at, accumsan nec, suscipit a, ipsum. Morbi blandit ligula feugiat magna.
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445 **Definition 1** (Definition sub head). Example definition text. Example definition text.
446 Example definition text. Example definition text. Example definition text. Example
447 definition text. Example definition text. Example definition text.

448 Additionally a predefined “proof” environment is available. This prints a “Proof”
449 head in italic font style and the “body text” in roman font style with an open square
450 at the end of each proof environment.

451 *Proof.* Example for proof text. Example for proof text. Example for proof text. Exam-
452 ple for proof text. Example for proof text. Example for proof text. Example for proof
453 text. Example for proof text. Example for proof text. Example for proof text.
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□

456 Sample body text. Sample body text. Sample body text. Sample body text. Sample
457 body text. Sample body text. Sample body text. Sample body text.

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11 Methods

Topical subheadings are allowed. Authors must ensure that their Methods section includes adequate experimental and characterization data necessary for others in the field to reproduce their work. Authors are encouraged to include RIIIDs where appropriate.

Ethical approval declarations (only required where applicable) Any article reporting experiment/s carried out on (i)~live vertebrate (or higher invertebrates), (ii)~humans or (iii)~human samples must include an unambiguous statement within the methods section that meets the following requirements:

1. Approval: a statement which confirms that all experimental protocols were approved by a named institutional and/or licensing committee. Please identify the approving body in the methods section
2. Accordance: a statement explicitly saying that the methods were carried out in accordance with the relevant guidelines and regulations
3. Informed consent (for experiments involving humans or human tissue samples): include a statement confirming that informed consent was obtained from all participants and/or their legal guardian/s

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Discussions should be brief and focused. In some disciplines use of Discussion or ‘Conclusion’ is interchangeable. It is not mandatory to use both. Some journals prefer a section ‘Results and Discussion’ followed by a section ‘Conclusion’. Please refer to Journal-level guidance for any specific requirements.

13 Conclusion

Conclusions may be used to restate your hypothesis or research question, restate your major findings, explain the relevance and the added value of your work, highlight any limitations of your study, describe future directions for research and recommendations.

In some disciplines use of Discussion or ‘Conclusion’ is interchangeable. It is not mandatory to use both. Please refer to Journal-level guidance for any specific requirements.

Supplementary information. If your article has accompanying supplementary file/s please state so here.

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508 unprocessed scans for key as part of their Supplementary information. This may be
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511 **Acknowledgments.** Acknowledgments are not compulsory. Where included they
512 should be brief. Grant or contribution numbers may be acknowledged.

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Declarations

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Some journals require declarations to be submitted in a standardised format. Please
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- Conflict of interest/Competing interests (check journal-specific guidelines for which
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- Code availability
- Authors’ contributions

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Appendix A Section title of first appendix

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An appendix contains supplementary information that is not an essential part of the
text itself but which may be helpful in providing a more comprehensive understanding
of the research problem or it is information that is too cumbersome to be included in
the body of the paper.

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For submissions to Nature Portfolio Journals please use the heading “Extended
Data”.

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References

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