Bugs fixed in spatstat

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For spatstat version 3.0-3

This vignette lists all *important* bugs detected and fixed in the spatstat package since 2010. It also explains how to search the list of all recorded bugs in the spatstat family of packages.

Contents

1 Bug history

Thousands of bugs have been detected and fixed in `spatstat` since it was first released in 2001. We started recording the bug history in 2010.

Bugs that may have affected the user are listed in the package `NEWS` file, and can be searched using the R command `news` or the `spatstat` command `bugfixes`.

To see the bugs which have just been fixed in the latest version of `spatstat`, type

```
> bugfixes
```

To see all bugs which were fixed after a particular version of `spatstat`, for example, bugs that were fixed in version `1.50-0` or later, type

```
> bugfixes(sinceversion="1.50-0")
```

To see all bugs in `spatstat` that were fixed after a particular date, for example 30 June 2017, type

```
> bugfixes(sincedate="2017-06-30")
```

To see all bugs fixed after the book [1] was written, type

```
> bugfixes("book")
```

To see all bugs in the entire recorded history of `spatstat`, type

```
> bugfixes("all")
```

which currently produces a list of 995 bugs, of which 472 were detected after publication of the book [1].

Recently `spatstat` was divided into a family of sub-packages. The command `bugfixes` now covers the bug history in all of these sub-packages. See the help for `bugfixes` for further details.

The current versions of the `spatstat` family of packages (used to produce this document) are:

```
       date           package version
 2022-10-19   spatstat.utils   3.0-1
 2022-10-20    spatstat.data   3.0-0
 2022-10-19  spatstat.sparse   3.0-0
 2023-01-22    spatstat.geom   3.0-5
 2023-01-25  spatstat.random   3.1-3
 2023-01-26 spatstat.explore   3.0-6
 2023-01-26   spatstat.model   3.1-2
 2023-01-27  spatstat.linnet   3.0-4
 2023-01-28         spatstat   3.0-3
```

2 Serious bugs

Following is a list of the **most serious bugs**, in decreasing order of potential impact.

A bug is classified as "serious" if it produced incorrect results without the user's knowledge.

Bugs which cause an error exit are not listed here, because the presence of a bug is obvious, and the bug would not have misled the user.

2.1 Serious Bugs, Always Wrong, Broad Impact

- `nncross.ppp`: Results were completely incorrect if $k > 1$.
  (Bug introduced in `spatstat 1.31-2`, april 2013; fixed in `spatstat 1.35-0`, december 2013)
- `nncross.pp3`: Results were completely incorrect in some cases.
  (Bug introduced in `spatstat 1.32-0`, august 2013; fixed in `spatstat 1.34-0`, october 2013)
- `cdf.test.ppm`: Calculation of p-values was incorrect for Gibbs models: $1 - p$ was computed instead of p.
  (Bug introduced in `spatstat 1.40-0`, december 2014; fixed in `spatstat 1.45-2`, may 2016)
- `Smooth.ppp`: Results of `Smooth(X, at="points", leaveoneout=FALSE)` were completely incorrect.
  (Bug introduced in `spatstat 1.20-5`, august 2010; fixed in `spatstat 1.46-0`, july 2016)
- `rmh`:
  - Simulation was completely incorrect in the case of a multitype point process with an interaction that does not depend on the marks, such as `ppm(betacells, ~marks, Strauss(60))` due to a coding error in the `C` interface.
    (Bug introduced in `spatstat 1.22-3`, march 2010; fixed in `spatstat 1.22-3`, june 2011)
  - Simulation of the Area-Interaction model was completely incorrect.
    (Bug introduced in `spatstat 1.23-6`, october 2011; fixed in `spatstat 1.31-0`, january 2013)
  - Simulation of the Geyer saturation process was completely incorrect.
    (Bug introduced in `spatstat 1.31-0`, january 2013; fixed in `spatstat 1.31-1`, march 2013)
  - Simulation of the Strauss-Hard Core process was partially incorrect, giving point patterns with a slightly lower intensity.
    (Bug introduced in `spatstat 1.31-0`, january 2013; fixed in `spatstat 1.37-0`, may 2014)
  - Simulation of the *multitype* hard core model was completely incorrect (the interaction was effectively removed, changing the model into a Poisson process).
    (Bug introduced in `spatstat 1.31-0`, january 2013; fixed in `spatstat 1.63-0`, january 2020)
  - The result of simulating a model with a hard core did not necessarily respect the hard core constraint, and simulation of a model with strong inhibition did not necessarily converge. This only happened if the first order trend was large, the starting state (`n.start` or `x.start`) was not given, and the number of iterations `nrep` was not very large. It occurred because of a poor choice for the default starting state. (Bug was present since about 2010. Fixed in `spatstat 1.40-0`, december 2014)
  - Simulation was incorrect in the case of an inhomogeneous multitype model with `fixall=TRUE` (i.e. with a fixed number of points of each type) if the model was segregated (i.e. if different types of points had different first order trend). The effect of the error was that all types of points had the same first order trend. (Bug was present since about 2010. Fixed in `spatstat 1.43-0`, september 2015)

  - Simulation of the Geyer saturation process was incorrectly initialised, so that the results of a short run (i.e. small value of `nrep`) were incorrect, while long runs were correct.
    (Bug introduced in `spatstat 1.17-0`, october 2009; fixed in `spatstat 1.31-1`, march 2013)

- `nnmark, as.im.ssf`: If `marks(X)` was a matrix rather than a data frame, the results were completely incorrect.
  (Bug introduced in `spatstat 1.32-0`, august 2013; fixed in `spatstat 1.55-1`, april 2018)

- `rVarGamma`: Simulations were incorrect; they were generated using the wrong value of the parameter `nu.ker`.
  (Bug introduced in `spatstat 1.25-0`, december 2011; fixed in `spatstat 1.35-0`, december 2013)

- `rCauchy`: Simulations were incorrect; they were generated using the wrong value of the parameter `omega`.
  (Bug introduced in `spatstat 1.25-0`, december 2011; fixed in `spatstat 1.25-2`, january 2012)

- `lppm`: For multitype patterns, the fitted model was completely incorrect due to an error in constructing the quadrature scheme.
  (Bug introduced in `spatstat 1.23-0`, july 2011; fixed in `spatstat 1.30-0`, december 2012)

- `[.lpp`: The local coordinate `seg` was completely incorrect, when `i` was a window.
  (Bug introduced in `spatstat 1.31-2`, april 2013; fixed in `spatstat 1.45-0`, march 2016)

- `lohboot`: Implementation was completely incorrect.
  (Bug introduced in `spatstat 1.26-1`, april 2012; fixed in `spatstat 1.53-2`, october 2017)

- `leverage.ppm`, `influence.ppm`, `dfbetas.ppm`: Results were incorrect for non-Poisson processes due to a mathematical error.
  (Bug introduced in `spatstat 1.25-0`, december 2011; fixed in `spatstat 1.51-0`, may 2017)

2.2 Serious Bugs, Often Completely Wrong, Moderate Impact

- `pairdist.lpp`: Results could have been completely incorrect, due to an internal bug, if the linear network data was in the non-sparse representation.
  (Bug introduced before `spatstat 1.65-0`, december 2020; fixed in `spatstat.linnet 3.0-3`, january 2023)

- `matrixsqrt`, `matrixinvsqrt`, `matrixpower`: If the result was a complex-valued matrix, the values were completely incorrect.
  (Bug introduced in `spatstat 1.48-0`, december 2016; fixed in `spatstat.sparse 2.1-1`, february 2021)

- `pcf.ppp`: Estimates were incorrectly scaled (they were incorrectly multiplied by the area of the window.) Spotted by Maximilian Hesselbarth.
  (Bug introduced in `spatstat.explore 3.0-0`, may 2022; fixed in `spatstat.explore 3.0-6`, january 2023)

- `rLGCP`, `simulate.kppm`: Simulation results for log-Gaussian Cox processes were incorrect unless the pixel dimensions and pixel spacings were identical on the horizontal and vertical axes. (If pixel dimensions were not specified, then the results were incorrect whenever the Frame of the simulation window was not a square.)
  (Bug introduced in `spatstat 1.22-2`, june 2011; fixed in `spatstat 1.65-0`, december 2020)

- `deviance.lppm`, `pseudoR2.lppm`: Results were completely incorrect, due to a coding error.
  (Bug introduced in `spatstat 1.44-0`, december 2015; fixed in `spatstat 1.64-2`, november 2020)

- `kppm`: Results were sometimes incorrect for method='clik2' and method='palm' because the log composite likelihood was erroneously truncated to positive values. Any fitted model for which `logLik(model) = 2.2e-16` should be suspected of being incorrect.
  (Bug introduced in `spatstat.core 2.0-0`, march 2021; fixed in `spatstat.core 2.3-2`, november 2021)

- `bw.pcf`: Results were totally incorrect due to a typo.
  (Bug introduced in `spatstat 1.51-0`, may 2017; fixed in `spatstat 1.52-0`, august 2017)

- `density.ppp`: edge correction factors were calculated incorrectly when the window was not a rectangle, causing a negative bias in the estimated intensity.
  (Bug introduced in `spatstat 1.57-0`, oct 2018; fixed in `spatstat 1.64-0`, april 2020).

- `density.ppp`: The standard error (calculated when `se=TRUE`) was incorrect when `sigma` was a single numeric value. The output was equal to `sqrt(sigma)` times the correct answer.
  (Bug introduced in `spatstat 1.41-1`, february 2015; fixed in `spatstat 1.57-0`, october 2018)

- `rthin`: If `P` was close to 1, the result was sometimes an empty point pattern when it should have been identical to `X`.
  (Bug introduced in `spatstat 1.43-0`, october 2015; fixed in `spatstat 1.57-0`, october 2018)

- `predict.mppm`: If the model included random effects, and if the library `MASS` was not loaded, the predictions were on the log scale (i.e. they were logarithms of the correct values).
  (Bug introduced in `spatstat 1.43-0`, october 2015; fixed in `spatstat 1.55-1`, april 2018)

- `nnmap`, `nnmark`: Values were incorrect if the resulting pixel image had unequal numbers of rows and columns.
  (Bug introduced in `spatstat 1.35-0`, december 2013; fixed in `spatstat 1.55-0`, january 2018)

- `vcov.mppm`: Format was incorrect (rows/columns were omitted) in some cases.
  (Bug introduced in `spatstat 1.45-1`, may 2016; fixed in `spatstat 1.55-0`, january 2018)

- `model.matrix.ppm`, `model.frame.ppm`: Values were sometimes incorrect when applied to the result of `subfits`. To be precise, if `fit` was an `mppm` object fitted to a hyperframe that included "design covariates" (covariates that take a constant value in each row of the hyperframe), and if `futs <- subfits(fit)`, then `model.matrix(futs[[i]])` gave incorrect values in the columns corresponding to the design covariates.
  (Bug introduced in `spatstat 1.45-1`, may 2016; fixed in `spatstat 1.55-0`, january 2018)

- `predict.rhohat`, `simulate.rhohat`: Results were incorrect for a `rhohat` object computed from linear network data (class `"lpp"` or `"lppm"`).
  (Bug introduced in `spatstat 1.31-0`, march 2013; fixed in `spatstat 1.63-1`, february 2020)

- `predict.rho2hat`: Results were incorrect for a `rho2hat` object computed from a point pattern.
  (Bug introduced in `spatstat 1.42-0`, may 2015; fixed in `spatstat 1.52-0`, august 2017)

- `density.ppp`: Result was incorrect for non-Gaussian kernels when `at="points"` and `leaveoneout=FALSE`.
  (Bug introduced in `spatstat 1.47-0`, october 2016; fixed in `spatstat 1.57-0`, october 2018)

- `envelope.ppm`: If the model was an inhomogeneous Poisson process, the resulting envelope object was incorrect (the simulations were correct, but the envelopes were calculated assuming the model

was CSR).
(Bug introduced in spatstat 1.23-5, september 2011; fixed in spatstat 1.23-6, october 2011)

- linearK, linearpcf, linearKinhom, linearpcfinhom and multitype versions: These functions were sometimes greatly underestimated when the network had segments shorter than 10 coordinate units.
(Bug introduced in spatstat 1.44-0, december 2015; fixed in spatstat 1.46-2, july 2016)

- nncross, distfun, AreaInter: Results of nncross were possibly incorrect when X and Y did not have the same window. This bug affected values of distfun and may also have affected ppm objects with interaction AreaInter.
(Bug introduced in spatstat 1.9-4, june 2006; fixed in spatstat 1.25-2, january 2012)

- update.kppm:
  - Did not function correctly when several additional arguments were given.
(Bug introduced in spatstat 1.42-2, june 2015; fixed in spatstat 1.54-0, november 2017)
  - If the call to update did not include a formula argument or a point pattern argument, then all arguments were ignored. Example: update(fit, improve.type="quasi") was identical to fit.
(Bug introduced in spatstat 1.42-2, june 2015; fixed in spatstat 1.45-0, march 2016)

- markcorrint: Results were completely incorrect.
(Bug introduced in spatstat 1.39-0, october 2014; fixed in spatstat 1.40-0, december 2014)

- leverage.ppm, influence.ppm, dfbetas.ppm: Results were slightly incorrect for models with a hard core, due to a mathematical error.
(Bug introduced in spatstat 1.51-0, may 2017; fixed in spatstat 1.55-1, april 2018)

- Ops.msr: If the input data contained a pixel image of the smoothed density, this image was not updated; it was copied to the output unchanged. Plots of the resulting measure were incorrect.
(Bug introduced in spatstat 1.52-0, august 2017; fixed in spatstat 1.55-1, april 2018)

- [.linnet: in calculating L[W] where W is a window, the code ignored segments of L that crossed W without having a vertex in W.
(Bug introduced in spatstat 1.53-0, september 2017; fixed in spatstat 1.55-1, april 2015)

- as.im.function: if the function domain was not a rectangle and the function values were categorical (factor) values, the result was an empty image.
(Bug introduced in spatstat 1.42-0, may 2015; fixed in spatstat 1.57-0, october 2018)

- density.lpp: If weights were given, the results were completely incorrect if leaveoneout=TRUE (the default) and at="points".
(Bug introduced in spatstat 1.51-0, may 2017; fixed in spatstat.linnet 3.0-0, june 2022)

2.3 Bugs, Substantially Incorrect, Moderate Impact

- closepairs.ppp: If distinct=FALSE and what="all", the resulting vectors yi and yj contained incorrect values, and had the wrong length.
(Bug introduced before spatstat 1.56-0, june 2018; fixed in spatstat.geom 2.4-0, march 2022)

- nncross.ppp: When k > 1, distance values were incorrectly replaced by Inf in some cases.
(Bug introduced before spatstat 1.56-0, june 2018; fixed in spatstat.geom 2.4-0, march 2022)

- `nncross.ppp`: If the argument `by` was given, some of the results were incorrect. [Spotted by Hank Stevens.]
  (Bug introduced in `spatstat 1.32-0`, august 2013; fixed in `spatstat 2.2-0`, june 2021)

- `"[<-.im"`: Incorrect values were assigned in `x[] <- v` when `x` and `v` were both factor-valued but with different sets of levels.
  (Bug introduced before `spatstat 1.56-0`, june 2018; fixed in `spatstat.geom 3.0-5`, january 2023)

- `vcov.mppm`: For Gibbs (non-Poisson) models, the variance matrix was calculated incorrectly in some cases.
  (Bug introduced in `spatstat 1.45-1`, may 2016; fixed in `spatstat.core 2.4-1`, may 2022)

- `vcov.mppm`: Results were sometimes incorrect if the two models had different interactions (e.g. Strauss vs Poisson).
  (Bug introduced in `spatstat 1.45-1`, may 2016; fixed in `spatstat.core 2.4-1`, may 2022)

- `distmap.owin`: If the window was a binary mask, the distance values were slightly too large (by a factor `1 + 1/n` where `n` is the pixel grid dimension).
  (Bug introduced before `spatstat 1.19-0`, may 2010; fixed in `spatstat.geom 2.4-0`, march 2022)

- `distfun.owin`: If the window was a binary mask, the distance values were slightly too small (typically reduced by 1/20 of a pixel width).
  (Bug introduced before `spatstat 1.19-0`, may 2010; fixed in `spatstat.geom 2.4-0`, march 2022)

- `nncross.ppp`, `nncross.pp3`: If `iX` and `iY` were given, some of the results were incorrect.
  (Bug introduced in `spatstat 1.32-0`, august 2013; fixed in `spatstat 2.2-0`, june 2021)

- `vcov.ppm`: Result was sometimes incorrect for Gibbs models. The Fisher information was slightly underestimated.
  (Bug introduced in `spatstat 1.31-1`, march 2013; fixed in `spatstat 1.64-1`, may 2020)

- `as.linnet.psp`: Sometimes produced a network with duplicated segments. [Such objects can be repaired using `repairNetwork`.]
  (Bug introduced in `spatstat 1.41-1`, february 2015; fixed in `spatstat 1.62-0`, december 2019)

- `addvar`: If the covariate contained `NA`, `NaN` or `Inf` values, the calculations were sometimes incorrect.
  (Bug introduced in `spatstat 1.45-0`, march 2016; fixed in `spatstat .core 2.4-1`, march 2022)

- `rlpp`: The resulting pattern was unmarked even when it should have been multitype.
  (Bug introduced in `spatstat 1.48-0`, december 2016; fixed in `spatstat 1.63-0`, january 2020)

- `spatialcdf`: Argument `weights` was ignored, unless it was a fitted model. (Bug was present since about 2010. Fixed in `spatstat 1.59-0`, march 2019)

- `ppp`: Points inside the window were erroneously rejected as lying outside the window, if the window was a polygon equivalent to a rectangle with sides longer than 10^6 units. (Bug was present since the beginning. Fixed in `spatstat 1.59-0`, march 2019)

- `inside.owin`: All results were `FALSE` if the window was a polygon equivalent to a rectangle with sides longer than 10^6 units. (Bug was present since the beginning. Fixed in `spatstat 1.59-0`, march 2019)

- `sumouter`: result was incorrect (all entries were zero) if `w` was missing and `y` was given.
  (Bug introduced in `spatstat 1.47-0`, october 2016; fixed in `spatstat 1.59-0`, march 2019)

- `simulate.dppm`, `simulate.detpointprocfamily`: In dimensions higher than 2, the result was shifted so that it was centred at the origin.
  (Bug introduced in `spatstat 1.54-0`, december 2017; fixed in `spatstat 1.55-0`, january 2018)

- `integral.msr`: If the result was a matrix, it was the transpose of the correct answer.
  (Bug introduced in `spatstat 1.35-0`, december 2012; fixed in `spatstat 1.55-1`, april 2018)

- `density.ppp`: Values of `density(X, at="points")` and `Smooth(X, at="points")` were sometimes incorrect, due to omission of the contribution from the data point with the smallest x coordinate.
  (Bug introduced in `spatstat 1.26-0`, april 2012; fixed in `spatstat 1.46-1`, july 2016)

- `multiplicity.default`: The first occurrence of any value in the input was incorrectly assigned a multiplicity of 1.
  (Bug introduced in `spatstat 1.32-0`, december 2013; fixed in `spatstat 1.57-1`, november 2018)

- `update.ppm`: If the argument `Q` was given, the results were usually incorrect, or an error was generated.
  (Bug introduced in `spatstat 1.38-0`, august 2014; fixed in `spatstat 1.38-1`, august 2014)

- `subfits`: The interaction coefficients of the submodels were incorrect for Gibbs models with a multitype interaction (`MultiStrauss`, etc).
  (Bug introduced in `spatstat 1.35-0`, december 2013; fixed in `spatstat 1.45-2`, may 2016)

- `F3est`: Estimates of $F(r)$ for the largest value of r were wildly incorrect. (Bug was present since about 2010. Fixed in `spatstat 1.48-0`, december 2016)

- `kppm`, `matclust.estpcf`, `pcfmodel`: The pair correlation function of the Mátern Cluster Process was evaluated incorrectly at distances close to 0. This could have affected the fitted parameters in `matclust.estpcf()` or `kppm(clusters="MatClust")`.
  (Bug introduced in `spatstat 1.20-2`, august 2010; fixed in `spatstat 1.33-0`, september 2013)

- `ppm`: Results were incorrect for the Geyer saturation model with a non-integer value of the saturation parameter `sat`.
  (Bug introduced in `spatstat 1.20-0`, july 2010; fixed in `spatstat 1.31-2`, april 2013)

- `clip.infline`: Results were incorrect unless the midpoint of the window was the coordinate origin.
  (Bug introduced in `spatstat 1.15-1`, april 2009; fixed in `spatstat 1.48-0`, december 2016)

- `intensity.ppm`: Result was incorrect for Gibbs models if the model was exactly equivalent to a Poisson process (i.e. if all interaction coefficients were exactly zero).
  (Bug introduced in `spatstat 1.28-1`, june 2012; fixed in `spatstat 1.47-0`, october 2016)

- `idw`: Results were incorrect if `se=TRUE` and `at="pixels"` and `power` was not equal to 2. The pixel values of `$estimate` were all equal to zero.
  (Bug introduced in `spatstat 1.58-0`, january 2019; fixed in `spatstat 1.63-0`, january 2020)

- `funxy`: Did not correctly handle one-line functions. The resulting objects evaluated the wrong function in some cases.
  (Bug introduced in `spatstat 1.45-0`, march 2016; fixed in `spatstat 1.46-0`, july 2016)

- `kernel.moment`: Result was incorrect for `kernel="cosine"` and `kernel="optcosine"`.
  (Bug introduced in `spatstat 1.45-2`, may 2016; fixed in `spatstat 1.56-0`, june 2018)
- `[.msr`: Format was mangled if the subset contained exactly one quadrature point.
  (Bug introduced in `spatstat 1.21-3`, january 2011; fixed in `spatstat 1.56-0`, june 2018)
- `hyperframe`: Did not correctly handle date-time values (columns of class `"Date"`, etc).
  (Bug introduced in `spatstat 1.19-1`, may 2010; fixed in `spatstat 1.63-0`, january 2020)
- `tess`: If a list of tiles was given, and the tiles were pixel images or masks, their pixel resolutions were ignored, and reset to the default 128×128. (Bug fixed in `spatstat 1.56-0`, june 2018)
- `nnorient`: crashed if the point pattern was empty.
  (Bug introduced in `spatstat 1.40-0`, december 2015; fixed in `spatstat 1.57-0`, october 2018)
- `as.im.data.frame`: Results were incorrect for factor-valued data.
  (Bug introduced in `spatstat 1.45-2`, may 2016; fixed in `spatstat 1.63-0`, january 2020)
- `predict.ppm`: Argument `new.coef` was ignored in calculating the standard error when `se=TRUE`.
  (Bug introduced in `spatstat 1.29-0`, october 2012; fixed in `spatstat.model 3.0-0`, june 2022)
- `predict.ppm`: Argument `new.coef` was ignored in calculating the standard error (and therefore the width of the interval) when `type="count"` and (`interval="confidence"` or `interval="prediction"`).
  (Bug introduced in `spatstat 1.29-0`, october 2012; fixed in `spatstat.model 3.0-0`, june 2022)

2.4 Partially Incorrect

- `rjitter.ppp`: If `retry=FALSE`, marks were ignored.
  (Bug introduced before `spatstat 1.65-0`, december 2020; fixed in `spatstat.geom 3.0-5`, january 2023)
- `rhohat.lpp`: The argument `subset` was not handled correctly in the internal data. The estimated function `rho` was correct, but if `predict.rhohat` was applied, predictions were computed only in the `subset`, and were possibly incorrect values.
  (Bug introduced before `spatstat 1.65-0`, december 2020; fixed in `spatstat.linnet 3.0-0`, june 2022)
- `rhohat.ppp`: The argument `subset` was not handled correctly in the internal data. The estimated function `rho` was correct, but if `predict.rhohat` was applied, predictions were computed only in the `subset`, and were possibly incorrect values.
  (Bug introduced before `spatstat 1.65-0`, december 2020; fixed in `spatstat.explore 3.0-0`, june 2022)
- `density.lpp`: The result had the wrong length if `x` contained duplicated points when `weights` were given and `at="points"`. [Spotted by Andrea Gilardi]
  (Bug introduced in `spatstat 1.55-1`, april 2018; fixed in `spatstat 2.2-0`, june 2021)
- `crossdist.pp3`: Results with `periodic=TRUE` were partially incorrect.
  (Bug introduced in `spatstat 1.34-1`, dec 2013; fixed in `spatstat 1.65-0`, dec 2020)
- `mppm`: Internal data were malformed if the interaction was `Hardcore` or `MultiHard` or a hybrid involving these interactions. This caused various errors when the fitted model was used.
  (Bug introduced in `spatstat 1.61-0`, september 2019; fixed in `spatstat 1.64-0`, april 2020).
- `mppm`: Ignored the arguments `nd` and `eps` controlling the quadrature scheme.
  (Bug introduced in `spatstat 1.35-0`, december 2013; fixed in `spatstat 1.64-0`, april 2020).

- `edge.Ripley`: Results were incorrect for data points lying exactly at the corners of a rectangle.
  (Bug introduced before `spatstat 1.21-0`, november 2010; fixed in `spatstat.core 2.3-2`, november 2021)

- `kppm`, `AIC`: For kppm models fitted with `method='clik2'`, the resulting value of `logLik()` was equal to 1/2 of the correct value. This would have affected model comparison using AIC, and model selection using `step`.
  (Bug introduced in `spatstat 1.42-0`, may 2015; fixed in `spatstat 1.63-0`, january 2020).

- `edge.Ripley`, `Kest`, `Kinhom`: Isotropic correction weights for polygonal windows were sometimes incorrect for small radius `r` if the polygon contained many small segments or if the polygon was very long and thin.
  (Bug introduced in `spatstat 1.60-0`, june 2019; fixed in `spatstat 1.62-0`, december 2019).

- `edge.Ripley`, `Kest`, `Kinhom`: Isotropic edge correction weight was computed incorrectly for a data point lying exactly on a corner of a rectangular window.
  (Bug introduced in `spatstat 1.60-0`, june 2019; fixed in `spatstat.explore 3.0-4`, november 2022)

- `beachcolours`, `beachcolourmap`: The number of colours was not always equal to `ncolours`.
  (Bug introduced in `spatstat 1.32-0`, august 2013; fixed in `spatstat 1.59-0`, march 2019)

- `extractbranch.lpp`: Point pattern coordinates were sometimes erroneously set to `NA`.
  (Bug introduced in `spatstat 1.42-0`, may 2015; fixed in `spatstat 1.59-0`, march 2019)

- `rotmean`: When `result="im"` the resulting image did not have the same dimensions as the input.
  (Bug introduced in `spatstat 1.42-2`, june 2015; fixed in `spatstat 1.58-0`, january 2019)

- `quadratcount.ppp`: Sometimes issued an incorrect warning that data points were outside the tessellation, when `tess` was a tessellation represented by a pixel image. (Bug fixed in `spatstat 1.59-0`, march 2019)

- `quadrat.test`: the p-value was `NA` if one of the observed counts was zero, for the Cressie-Read tests with `CR` not equal to 1 or -1.
  (Bug introduced in `spatstat 1.38-0`, august 2014; fixed in `spatstat 1.59-0`, march 2019)

- `quadrat.test`: argument `CR` was ignored if `method="MonteCarlo"`.
  (Bug introduced in `spatstat 1.38-0`, august 2014; fixed in `spatstat 1.61-0`, september 2019)

- `rotmean`: If argument `origin` was given, and if `result="im"` was specified, the resulting image was wrongly displaced.
  (Bug introduced in `spatstat 1.42-2`, june 2015; fixed in `spatstat 1.58-0`, january 2019)

- `runifpointx`: Result was mangled when `n=0` or `n=1`.
  (Bug introduced in `spatstat 1.50-0`, march 2017; fixed in `spatstat 1.58-0`, january 2019)

- `model.matrix.ppm`: The attribute `assign` was omitted in some cases.
  (Bug introduced in `spatstat 1.45-1`, may 2016; fixed in `spatstat 1.55-0`, january 2018)

- `model.matrix.mppm`: Sometimes returned a matrix with the wrong number of rows.
  (Bug introduced in `spatstat 1.55-0`, january 2018; fixed in `spatstat 1.63-0`, january 2020)

- `density.ppp`: If the smoothing bandwidth `sigma` was very small (e.g. less than the width of a pixel), results were inaccurate if the default resolution was used, and completely incorrect if a user-specified resolution was given.
  (Bug introduced in `spatstat 1.26-0`, april 2012; fixed in `spatstat 1.52-0`, august 2017)

- `selfcrossing.psp`: y coordinate values were incorrect.
  (Bug introduced in `spatstat 1.23-2`, august 2011; fixed in `spatstat 1.25-3`, february 2012)

- `Geyer`: For point process models with the `Geyer` interaction, `vcov.ppm` and `suffstat` sometimes gave incorrect answers.
  (Bug introduced in `spatstat 1.27-0`, may 2012; fixed in `spatstat 1.30-0`, december 2012)

- `leverage.ppm`, `influence.ppm`, `dfbetas.ppm`: Calculations were incorrect for a Geyer model fitted using an edge correction other than `"border"` or `"none"`.
  (Bug introduced in `spatstat 1.25-0`, december 2011; fixed in `spatstat 1.51-0`, may 2017)

- `leverage.ppm`, `influence.ppm`, `dfbetas.ppm`: Results were slightly incorrect for models fitted using the border correction.
  (Bug introduced in `spatstat 1.25-0`, december 2011; fixed in `spatstat 1.54-0`, november 2017)

- `leverage.ppm`: The mean leverage value (shown as a contour level in `plot.leverage.ppm`) was slightly incorrect for Gibbs models.
  (Bug introduced in `spatstat 1.25-0`, december 2011; fixed in `spatstat 1.54-0`, november 2017)

- `vcov.ppm`, `suffstat`: These functions sometimes gave incorrect values for marked point process models.
  (Bug introduced in `spatstat 1.27-0`, may 2012; fixed in `spatstat 1.29-0`, october 2012)

- `diagnose.ppm`: When applied to a model obtained from `subfits()`, in the default case (`oldstyle=FALSE`) the variance calculations were incorrect. Consequently the dotted lines representing significance bands were incorrect. An error or warning about negative variances occurred sometimes. However, calculations with `oldstyle=TRUE` were correct. The default has now been changed to `oldstyle=TRUE` for such models.
  (Bug introduced in `spatstat 1.35-0`, december 2013; fixed in `spatstat 1.45-0`, march 2016)

- `Smooth.ppp`: Results for `at="points"` were garbled, for some values of `sigma`, if `X` had more than one column of marks.
  (Bug introduced in `spatstat 1.38-0`, october 2014; fixed in `spatstat 1.46-0`, july 2016)

- `linearK`, `linearKinhom`: If any data points were located exactly at a vertex of the linear network, the weights for Ang's correction were incorrect, due to numerical error. This sometimes produced infinite or NA values of the linear K function.
  (Bug introduced in `spatstat 1.23-0`, july 2011; fixed in `spatstat 1.27-0`, may 2012)

- `Kinhom`, `Linhom`: the results were not renormalised (even if `renormalise=TRUE`) in some cases.
  (Bug introduced in `spatstat 1.21-0`, december 2010; fixed in `spatstat 1.37-0`, may 2014)

- `Kinhom`, `Linhom`: Ignored argument `reciplambda2` in some cases.
  (Bug introduced in `spatstat 1.39-0`, october 2014; fixed in `spatstat 1.40-0`, december 2014)

- `Kinhom`, `Linhom`: Calculations were incorrect if `lambda` was a fitted point process model.
  (Bug introduced in `spatstat 1.38-0`, august 2014; fixed in `spatstat 1.38-1`, august 2014)

- `integral.linim`, `integral.linfun`:

  – results were inaccurate because of a bias in the distribution of sample points.
    (Bug introduced in `spatstat 1.41-0`, february 2015; fixed in `spatstat 1.47-0`, october 2016)

  - results were inaccurate if many of the segment lengths were shorter than the width of a pixel.
    (Bug introduced in `spatstat 1.41-0`, february 2015; fixed in `spatstat 1.48-0`, december 2016)
  - results were wildly inaccurate in some extreme cases where many segments were very short.
    (Bug introduced in `spatstat 1.41-0`, february 2015; fixed in `spatstat 1.54-0`, november 2017)

- `predict.ppm`: Calculation of the conditional intensity omitted the edge correction if `correction='translate` or `correction='periodic'`.
  (Bug introduced in `spatstat 1.17-0`, october 2009; fixed in `spatstat 1.31-3`, may 2013)

- `varblock`: Calculations were incorrect if more than one column of edge corrections was computed.
  (Bug introduced in `spatstat 1.21-1`, november 2010; fixed in `spatstat 1.39-0`, october 2014)

- `scan.test` Results were sometimes incorrect due to numerical instability (a 'Gibbs phenomenon').
  (Bug introduced in `spatstat 1.24-1`, october 2011; fixed in `spatstat 1.26-1`, april 2012)

- `relrisk`: When `at="pixels"`, a small fraction of pixel values were sometimes wildly inaccurate, due to numerical errors. This affected the range of values in the result, and therefore the appearance of plots. (Bug fixed in `spatstat 1.40-0`, december 2014)

- `predict.slrm`: Results of `predict(object, newdata)` were incorrect if the spatial domain of `newdata` was larger than the original domain.
  (Bug introduced in `spatstat 1.21-0`, november 2010; fixed in `spatstat 1.25-3`, february 2012)

- `Lest`: The variance approximations (Lotwick-Silverman and Ripley) obtained with `var.approx=TRUE` were incorrect for `Lest` (although they were correct for `Kest`) due to a coding error.
  (Bug introduced in `spatstat 1.24-1`, october 2011; fixed in `spatstat 1.24-2`, november 2011)

- `bw.diggle`: Bandwidth was too large by a factor of 2.
  (Bug introduced in `spatstat 1.23-4`, september 2011; fixed in `spatstat 1.23-5`, september 2011)

- pair correlation functions (`pcf.ppp`, `pcfdot`, `pcfcross` etc:) The result had a negative bias at the maximum r value, because contributions to the pcf estimate from interpoint distances greater than `max(r)` were mistakenly omitted. (Bugs fixed in `spatstat 1.35-0`, december 2013)

- `Kest`, `Lest`: Gave incorrect values in very large datasets, due to numerical overflow. 'Very large' typically means about 1 million points in a random pattern, or 100,000 points in a tightly clustered pattern. [Overflow cannot occur unless there are at least 46,341 points.]

- `bw.relrisk`: Implementation of `method="weightedleastsquares"` was incorrect and was equivalent to `method="leastsquares"`.
  (Bug introduced in `spatstat 1.21-0`, november 2010; fixed in `spatstat 1.23-4`, september 2011)

- `triangulate.owin`: Results were incorrect in some special cases.
  (Bug introduced in `spatstat 1.42-2`, june 2015; fixed in `spatstat 1.44-0`, december 2015)

- `crosspairs`: If `X` and `Y` were identical point patterns, the result was not necessarily symmetric (on some machines) due to numerical artifacts.
  (Bug introduced in `spatstat 1.35-0`, december 2013; fixed in `spatstat 1.44-0`, december 2015)

- `bdist.tiles`: Values were incorrect in some cases due to numerical error. (Bug fixed in `spatstat 1.29-0`, october 2012)

- `Kest.fft`: Result was incorrectly normalised.
  (Bug introduced in `spatstat 1.21-2`, january 2011; fixed in `spatstat 1.44-0`, december 2015)
- `crossdist.ppp`: Ignored argument `squared` if `periodic=FALSE`. (Bug fixed in `spatstat 1.38-0`, july 2014)
- polygon geometry: The point-in-polygon test gave the wrong answer in some boundary cases. (Bug fixed in `spatstat 1.23-2`, august 2011)
- `MultiStraussHard`: If a fitted model with `MultiStraussHard` interaction was invalid, `project.ppm` sometimes yielded a model that was still invalid. (Bug fixed in `spatstat 1.42-0`, may 2015)
- `pool.envelope`: Did not always respect the value of `use.theory`.
  (Bug introduced in `spatstat 1.23-5`, september 2011; fixed in `spatstat 1.43-0`, september 2015)
- `nncross.lpp`, `nnwhich.lpp`, `distfun.lpp`: Sometimes caused a segmentation fault.
  (Bug introduced in `spatstat 1.44-0`, december 2015; fixed in `spatstat 1.44-1`, december 2015)
- `anova.ppm`: If a single `object` was given, and it was a Gibbs model, then `adjust` was effectively set to `FALSE`.
  (Bug introduced in `spatstat 1.39-0`, october 2014; fixed in `spatstat 1.44-1`, december 2015)
- `[.linim`: the result sometimes had the wrong class.
  (Bug introduced in `spatstat 1.53-0`, september 2017; fixed in `spatstat 1.55-1`, april 2015)
- `[.linim`: factor values were erroneously converted to integers, in some cases.
  (Bug introduced in `spatstat 1.53-0`, september 2017; fixed in `spatstat 1.61-0`, september 2019)
- `is.subset.owin`: sometimes gave the wrong result for polygonal windows due to numerical rounding error. (Bug was always present. Fixed in `spatstat 1.59-0`, march 2019)
- `plot.tess`: the legend showed the tile names in lexicographical order, rather than their original order.
  (Bug introduced in `spatstat 1.55-1`, april 2018; fixed in `spatstat 1.59-0`, march 2019)
- `rThomas`, `rMatClust`, `rCauchy`, `rVarGamma`: If the simulation window was not a rectangle, the attribute `Lambda` was a numeric vector, rather than a pixel image as intended.
  (Bug introduced in `spatstat 1.43-0`, october 2015; fixed in `spatstat 1.59-0`, march 2019)
- `effectfun`: In a multitype point process model, `effectfun` ignored any user-specified value of `marks`.
  (Bug introduced in `spatstat 1.52-0`, august 2017; fixed in `spatstat 1.61-0`, september 2019)
- `"[<-.hyperframe"`: Some classes of objects were not handled correctly.
  (Bug introduced in `spatstat 1.37-0`, may 2014; fixed in `spatstat 1.61-0`, september 2019)
- `relrisk.ppp`: Crashed if there were more than 2 types of points and `method = "leastsquares"` or `method = "weightedleastsquares"`.
  (Bug introduced in `spatstat 1.23-4`, september 2011; fixed in `spatstat 1.63-0`, january 2020)
- `nncross.ppp`: Format of output was incorrect if `X` was an empty pattern.
  (Bug introduced in `spatstat 1.56-0`, june 2018; fixed in `spatstat 1.63-0`, january 2020)

- `rmh`, `rmh.default`: For a marked point process, the debugger did not display the marks. (The `rmh` debugger is invoked by calling `rmh` with `snoop=TRUE`).
  (Bug introduced in `spatstat 1.31-1`, march 2013; fixed in `spatstat 1.63-0`, january 2020)

- `model.matrix.mppm`: If the model was fitted using `gam`, the resulting matrix did not have an `"assign"` attribute.
  (Bug introduced in `spatstat 1.55-0`, march 2018; fixed in `spatstat 2.2-0`, june 2021)

- `update.slrm`: Failed to find covariates that were provided in `env`.
  (Bug introduced in `spatstat 1.33-0`, september 2013; fixed in `spatstat 2.2-0`, june 2021)

- `distmap.owin`: Values were incorrect if X was an empty window (`is.empty(X) = TRUE`).
  (Bug introduced before `spatstat 1.19-0`, may 2010; fixed in `spatstat.geom 2.4-0`, march 2022)

- `distmap.ppp`, `distmap.psp`: Values were incorrect if X was an empty pattern (`npoints(X) = 0`).
  (Bug introduced before `spatstat 1.19-0`, may 2010; fixed in `spatstat.geom 2.4-0`, march 2022)

- `distmap.psp`: Values were incorrect if X was an empty pattern (`nsegments(X) = 0`).
  (Bug introduced before `spatstat 1.19-0`, may 2010; fixed in `spatstat.geom 2.4-0`, march 2022)

References

[1] A. Baddeley, E. Rubak, and R. Turner. *Spatial Point Patterns: Methodology and Applications with R*. Chapman & Hall/CRC Press, 2015.