空间广义线性模型

代码实现

黄湘云

2018 年 3 月

摘要

hello

1 引言

1.1 模型

$$f(x) = \frac{1}{\sqrt{2\pi}\sigma} \mathrm{e}^{-\frac{(x-\mu)^2}{2\sigma^2}}$$

列出 tex 版本及其他信息

```
system('pdflatex --version')
## pdfTeX 3.14159265-2.6-1.40.18 (TeX Live 2017)
## kpathsea version 6.2.3
## Copyright 2017 Han The Thanh (pdfTeX) et al.
## There is NO warranty.  Redistribution of this software is
## covered by the terms of both the pdfTeX copyright and
## the Lesser GNU General Public License.
## For more information about these matters, see the file
## named COPYING and the pdfTeX source.
## Primary author of pdfTeX: Han The Thanh (pdfTeX) et al.
## Compiled with libpng 1.6.29; using libpng 1.6.29
## Compiled with zlib 1.2.11; using zlib 1.2.11
## Compiled with xpdf version 3.04
```

```
pkg <- base::system("tlmgr list --only-installed", intern = TRUE)
do.call(rbind, strsplit(pkg, split = ":"))[, 1]
```

```
##   [1] "i a4wide"                  "i adjustbox"
##   [3] "i ae"                      "i algorithm2e"
##   [5] "i algorithms"              "i amscls"
##   [7] "i amsfonts"                "i amsmath"
##   [9] "i animate"                 "i apacite"
##  [11] "i appendix"                "i arphic"
##  [13] "i asymptote"               "i asymptote.x86_64-linux"
##  [15] "i babel"                   "i bbm-macros"
##  [17] "i beamer"                  "i beebe"
##  [19] "i biblatex"                "i bibtex"
##  [21] "i bibtex.x86_64-linux"     "i blkarray"
##  [23] "i booktabs"                "i boondox"
##  [25] "i breakcites"              "i breakurl"
##  [27] "i caption"                 "i ccaption"
##  [29] "i changepage"              "i chemgreek"
##  [31] "i cite"                    "i cjk"
##  [33] "i cleveref"                "i cm"
##  [35] "i cns"                     "i collectbox"
##  [37] "i colortbl"                "i comment"
##  [39] "i courier"                 "i csquotes"
##  [41] "i ctable"                  "i ctex"
##  [43] "i datetime"                "i diagbox"
##  [45] "i doi"                     "i doublestroke"
##  [47] "i draftwatermark"          "i dvipdfmx"
##  [49] "i dvipdfmx.x86_64-linux"   "i dvipng"
##  [51] "i dvipng.x86_64-linux"     "i dvisvgm"
##  [53] "i dvisvgm.x86_64-linux"    "i ec"
##  [55] "i enumitem"                "i environ"
##  [57] "i eso-pic"                 "i etex"
##  [59] "i etoolbox"                "i euenc"
##  [61] "i eurosym"                 "i everypage"
##  [63] "i fancybox"                "i fancyhdr"
##  [65] "i fancyvrb"                "i fandol"
```

```
##  [67] "i filehook"                  "i float"
##  [69] "i floatrow"                  "i fmtcount"
##  [71] "i fonts-tlwg"                "i fontspec"
##  [73] "i footmisc"                  "i fp"
##  [75] "i fpl"                       "i framed"
##  [77] "i garuda-c90"                "i geometry"
##  [79] "i glyphlist"                 "i graphics"
##  [81] "i graphics-cfg"              "i graphics-def"
##  [83] "i gsftopk"                   "i gsftopk.x86_64-linux"
##  [85] "i hardwrap"                  "i harvard"
##  [87] "i helvetic"                  "i hyperref"
##  [89] "i hyphen-base"               "i ifluatex"
##  [91] "i ifmtarg"                   "i iftex"
##  [93] "i ifxetex"                   "i inconsolata"
##  [95] "i jknapltx"                  "i kastrup"
##  [97] "i kerkis"                    "i knuth-lib"
##  [99] "i koma-script"               "i kpathsea"
## [101] "i kpathsea.x86_64-linux"     "i l3experimental"
## [103] "i l3kernel"                  "i l3packages"
## [105] "i lastpage"                  "i latex"
## [107] "i latex-bin"                 "i latex-bin.x86_64-linux"
## [109] "i latex-fonts"               "i latexconfig"
## [111] "i lineno"                    "i lipsum"
## [113] "i listings"                  "i lm"
## [115] "i lm-math"                   "i logreq"
## [117] "i lualibs"                   "i luaotfload"
## [119] "i luaotfload.x86_64-linux"   "i luatex"
## [121] "i luatex.x86_64-linux"       "i makecell"
## [123] "i makecmds"                  "i makeindex"
## [125] "i makeindex.x86_64-linux"    "i manfnt"
## [127] "i marvosym"                  "i mathabx"
## [129] "i mathpazo"                  "i mathspec"
## [131] "i mathtools"                 "i mdframed"
## [133] "i mdwtools"                  "i memoir"
## [135] "i metafont"                  "i metafont.x86_64-linux"
## [137] "i metalogo"                  "i mfware"
```

```
## [139] "i mfware.x86_64-linux"       "i mhchem"
## [141] "i microtype"                 "i morefloats"
## [143] "i ms"                        "i multirow"
## [145] "i mwcls"                     "i natbib"
## [147] "i needspace"                 "i newtx"
## [149] "i nextpage"                  "i norasi-c90"
## [151] "i ntgclass"                  "i ntheorem"
## [153] "i oberdiek"                  "i palatino"
## [155] "i paralist"                  "i parskip"
## [157] "i pbox"                      "i pdfcrop"
## [159] "i pdfcrop.x86_64-linux"      "i pdfpages"
## [161] "i pdftex"                    "i pdftex.x86_64-linux"
## [163] "i pgf"                       "i picinpar"
## [165] "i pict2e"                    "i placeins"
## [167] "i plain"                     "i polyglossia"
## [169] "i preprint"                  "i preview"
## [171] "i psnfss"                    "i realscripts"
## [173] "i relsize"                   "i rsfs"
## [175] "i sauerj"                    "i scheme-infraonly"
## [177] "i sectsty"                   "i setspace"
## [179] "i shadethm"                  "i shapepar"
## [181] "i siunitx"                   "i soul"
## [183] "i sourcecodepro"             "i sourcesanspro"
## [185] "i sourceserifpro"            "i stmaryrd"
## [187] "i subfig"                    "i subfigure"
## [189] "i symbol"                    "i tabu"
## [191] "i tabulary"                  "i tcolorbox"
## [193] "i tetex"                     "i tetex.x86_64-linux"
## [195] "i tex"                       "i tex-ini-files"
## [197] "i tex.x86_64-linux"          "i tex4ht.x86_64-linux"
## [199] "i texlive.infra"             "i texlive.infra.x86_64-linux"
## [201] "i textcase"                  "i threeparttable"
## [203] "i threeparttablex"           "i thumbpdf"
## [205] "i thumbpdf.x86_64-linux"     "i times"
## [207] "i tipa"                      "i titlesec"
## [209] "i titling"                   "i tocbibind"
```

```
## [211] "i tocloft"                    "i todonotes"
## [213] "i tools"                      "i trimspaces"
## [215] "i ttfutils"                   "i ttfutils.x86_64-linux"
## [217] "i tufte-latex"                "i txfonts"
## [219] "i type1cm"                    "i ucs"
## [221] "i uhc"                        "i ulem"
## [223] "i underscore"                 "i unicode-data"
## [225] "i unicode-math"               "i units"
## [227] "i upquote"                    "i url"
## [229] "i varwidth"                   "i vmargin"
## [231] "i wadalab"                    "i wallpaper"
## [233] "i wrapfig"                    "i xargs"
## [235] "i xcolor"                     "i xcomment"
## [237] "i xecjk"                      "i xetex"
## [239] "i xetex.x86_64-linux"         "i xetexconfig"
## [241] "i xifthen"                    "i xkeyval"
## [243] "i xltxtra"                    "i xstring"
## [245] "i xtab"                       "i xunicode"
## [247] "i ycbook"                     "i zapfchan"
## [249] "i zapfding"                   "i zhnumber"
```

系统安装的字体

```
fonts <- base::system("fc-list :lang=en | sort", intern = TRUE)
unique(do.call(rbind, strsplit(fonts, split = ":"))[, 2])
```

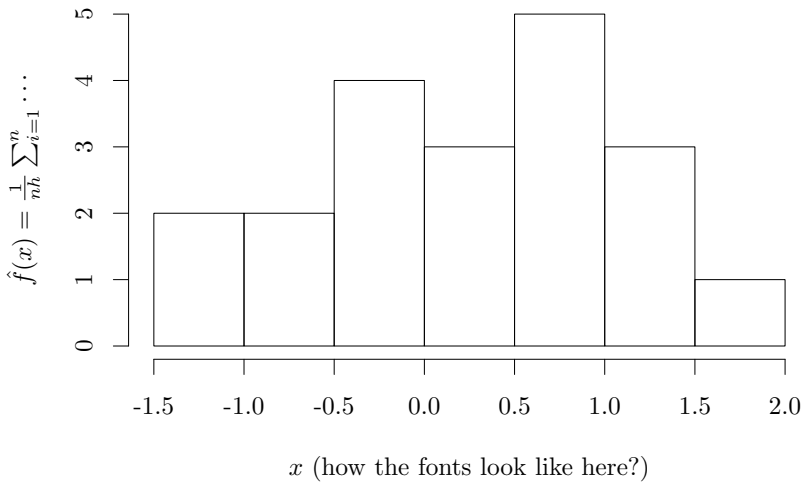
```
##  [1] " Inconsolata"            " DejaVu Sans"
##  [3] " DejaVu Sans Mono"       " DejaVu Serif"
##  [5] " Liberation Mono"        " Liberation Sans"
##  [7] " Liberation Sans Narrow" " Liberation Serif"
##  [9] " Roboto"                 " Roboto Condensed"
## [11] " URW Gothic L"           " URW Bookman L"
## [13] " Century Schoolbook L"   " Nimbus Sans L"
## [15] " Nimbus Roman No9 L"     " Nimbus Mono L"
## [17] " URW Palladio L"         " URW Chancery L"
## [19] " TeX Gyre Bonum Math"    " TeX Gyre DejaVu Math"
## [21] " TeX Gyre Pagella Math"  " TeX Gyre Schola Math"
```

```
## [23] ” TeX Gyre Termes Math”    ” TeX Gyre Adventor”
## [25] ” TeX Gyre Bonum”          ” TeX Gyre Chorus”
## [27] ” TeX Gyre Cursor”         ” TeX Gyre Heros”
## [29] ” TeX Gyre Heros Cn”       ” TeX Gyre Pagella”
## [31] ” TeX Gyre Schola”         ” TeX Gyre Termes”
```

```
(x=rnorm(20))
```

```
##  [1]  0.2284088  0.9830875 -0.8816531  0.1081202  0.1411199  1.2955804
##  [7]  0.8661917  0.6452292 -0.3310529 -0.2701249  1.4472523 -1.0075074
## [13] -0.5648866  1.6425220 -0.2287906  0.5266085 -1.3547617  0.9001987
## [19] -0.2797871  1.2911898
```

```
par(mar = c(4.5, 4, .1, .1))
hist(x, main=”, xlab='$x$ (how the fonts look like here?)',
  ylab='$\\hat{f}(x) = \\frac{1}{nh}\\sum_{i=1}^n \\cdots$')
```



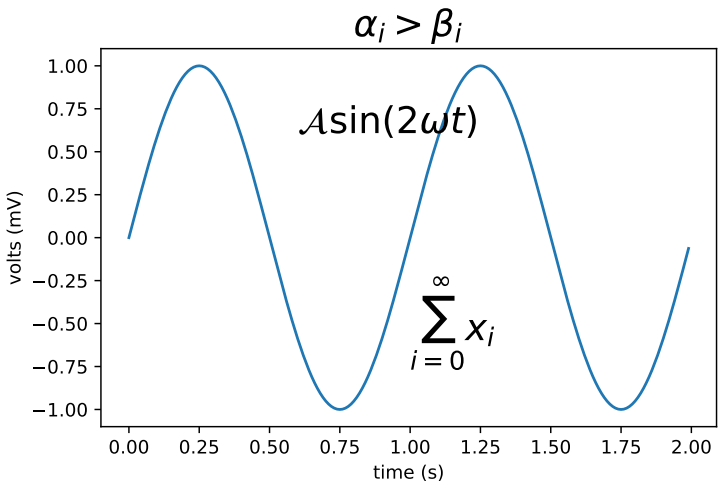
先安装 python-pip

```
sudo apt-get install -y python-pip
pip install numpy matplotlib
```

@ref(fig:math-matplotlib)

```
import numpy as np
import matplotlib.pyplot as plt
plt.switch_backend('agg')
t = np.arange(0.0, 2.0, 0.01)
s = np.sin(2*np.pi*t)
```

```
plt.plot(t,s)
plt.title(r'$\alpha_i > \beta_i$', fontsize=20)
plt.text(1, -0.6, r'$\sum_{i=0}^\infty x_i$', fontsize=20)
plt.text(0.6, 0.6, r'$\mathcal{A}\mathrm{sin}(2 \omega t)$',
         fontsize=20)
plt.xlabel('time (s)')
plt.ylabel('volts (mV)')
plt.show()
```




```
library(reticulate)
os <- import("os")
os$listdir(".")
```

```
## [1] "sglmm.Rmd"              "sglmm.pdf"              "fig.svg"
## [4] "sglmm-tikzDictionary" "fig.pdf"                "sglmm_files"
## [7] "refer.bib"
```

Note that the `echo = FALSE` parameter was added to the code chunk to prevent printing of the R code that generated the plot.[1]

```
Sys.which("gcc")
```

```
##                 gcc
## "/usr/bin/gcc"
```

```
system("gcc --version")
```

```
## gcc (Debian 6.3.0-18+deb9u1) 6.3.0 20170516
```

```
## Copyright (C) 2016 Free Software Foundation, Inc.
## This is free software; see the source for copying conditions.  There is NO
## warranty; not even for MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.
```

```
system("g++ --version")
```

```
## g++ (Debian 6.3.0-18+deb9u1) 6.3.0 20170516
## Copyright (C) 2016 Free Software Foundation, Inc.
## This is free software; see the source for copying conditions.  There is NO
## warranty; not even for MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.
```

```
system2("g++", args = "-v", stderr = TRUE)
```

```
## Using built-in specs.
## COLLECT_GCC=g++
## COLLECT_LTO_WRAPPER=/usr/lib/gcc/x86_64-linux-gnu/6/lto-wrapper
## Target: x86_64-linux-gnu
## Configured with: ../src/configure -v --with-pkgversion='Debian 6.3.0-
18+deb9u1' --with-bugurl=file:///usr/share/doc/gcc-6/README.Bugs --
enable-languages=c,ada,c++,java,go,d,fortran,objc,obj-c++ --prefix=/usr -
-program-suffix=-6 --program-prefix=x86_64-linux-gnu- --enable-
shared --enable-linker-build-id --libexecdir=/usr/lib --without-
included-gettext --enable-threads=posix --libdir=/usr/lib --enable-
nls --with-sysroot=/ --enable-clocale=gnu --enable-libstdcxx-debug -
-enable-libstdcxx-time=yes --with-default-libstdcxx-abi=new --
enable-gnu-unique-object --disable-vtable-verify --enable-libmpx -
-enable-plugin --enable-default-pie --with-system-zlib --disable-
browser-plugin --enable-java-awt=gtk --enable-gtk-cairo --with-java-
home=/usr/lib/jvm/java-1.5.0-gcj-6-amd64/jre --enable-java-home -
-with-jvm-root-dir=/usr/lib/jvm/java-1.5.0-gcj-6-amd64 --with-jvm-
jar-dir=/usr/lib/jvm-exports/java-1.5.0-gcj-6-amd64 --with-arch-
directory=amd64 --with-ecj-jar=/usr/share/java/eclipse-ecj.jar --
with-target-system-zlib --enable-objc-gc=auto --enable-multiarch --
with-arch-32=i686 --with-abi=m64 --with-multilib-list=m32,m64,mx32 -
-enable-multilib --with-tune=generic --enable-checking=release --
build=x86_64-linux-gnu --host=x86_64-linux-gnu --target=x86_64-linux-
gnu
```

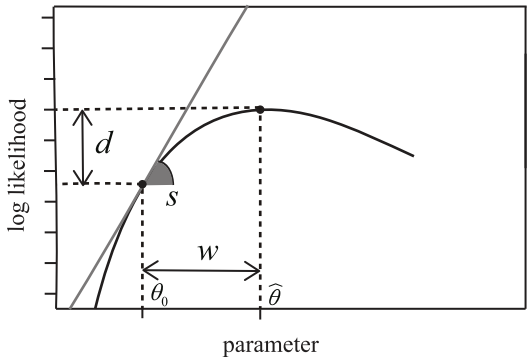


图 1: 未优化

```
## Thread model: posix
## gcc version 6.3.0 20170516 (Debian 6.3.0-18+deb9u1)
```

```
system2("python", args = "--version", stderr = TRUE)
```

```
## Python 2.7.13
```

插入图片

```
knitr::include_graphics(path = "fig.pdf")
```

参考文献

[1] H. Rue, A. I. Riebler, S. H. Sørbye, J. B. Illian, D. P. Simpson, and F. K. Lindgren. Bayesian computing with INLA: A review. Annual Reviews of Statistics and Its Applications, 4(1):395–421, 2017.