

```
## Load libraries
library(splines)
library(MASS)
library(xtable)
library(qvalue)

##Source functions
source("../functions.R")
```

Simulations are performed for a variety of alternative distributions:

```
alts <- c("alt_beta", "alt_chisq_large_3_3", "alt_chisq_large",
          "alt_chisq_small_3_3", "alt_chisq_small",
          "alt_t_large", "alt_t_small",
          "alt_z_large",
          "alt_z_small")
```

Make FDR-TPR table:

```
for(a in 1:9)
{
  alt <- alts[a]

  print(alt)

  ##For each simulation, get the FDR-TPR table: (BL = Boca-Leek method)
  scen5 <- NULL

  ##-----Set 5-----##

  ##don't use Scott methods unless distribution of test statistics is normal or t
  if(a %in% 6:9)
  {
    #Load p-values and  $\hat{\pi}_0(x)$  estimates for the simulations:
    for(l in listSimRes(alt, 5))
    {
      load(l)
    }
  } else {
    load(paste(alt, "/simResults_", 5, ".RData", sep=""))
    load(paste(alt, "/simResults_pi0x_thresh_", 5, "_full.RData", sep=""))

    FDR.ScottMat <- NULL
    FDR.ScottMat_emp <- NULL
  }
}
```

```

##Get BH and Storey q-values for each simulation:
qValuesSimsBH <- getQValuesSimsBH(pValuesSims)
qValuesSimsStorey <- getQValuesSimsStorey(pValuesSims)

print(mean(qValuesSimsStorey))

##Get estimated FDR for each simulation for the final estimates
FDRreg <- getFDRregSims(pi0EstSim, qValuesSimsBH)

##get FDR-TPR table
scen5 <- estFDR.TPR(FDR.BL = FDRreg,
                    FDR.BH = qValuesSimsBH, FDR.Storey = qValuesSimsStorey,
                    FDR.Scott = FDR.ScottMat, FDR.Scott_emp = FDR.ScottMat_emp, nullHypSim

print("Scenario 5")
print(scen5)

save(list=c("scen5"),
     file=paste(alt,"FDR_TPR_sims_additional.RData",sep="/"))

##-----Set 6-----##

##don't use Scott methods at all (at least for now) since main comparison is with Storey
load(paste(alt,"/simResults_", 6, ".RData",sep=""))
load(paste(alt,"/simResults_pi0x_thresh_", 6, "_full.RData",sep=""))

FDR.ScottMat <- NULL
FDR.ScottMat_emp <- NULL

##Get BH and Storey q-values for each simulation:
qValuesSimsBH <- getQValuesSimsBH(pValuesSims)
qValuesSimsStorey <- getQValuesSimsStorey(pValuesSims)

print(mean(qValuesSimsStorey))

##Get estimated FDR for each simulation for the final estimates
FDRreg <- getFDRregSims(pi0EstSim, qValuesSimsBH)

##get FDR-TPR table
scen6 <- estFDR.TPR(FDR.BL = FDRreg,
                    FDR.BH = qValuesSimsBH, FDR.Storey = qValuesSimsStorey,
                    FDR.Scott = FDR.ScottMat, FDR.Scott_emp = FDR.ScottMat_emp, nullHypSim

print("Scenario 6")
print(scen6)

```

```

save(list=c("scen6"),
      file=paste(alt,"FDR_TPR_sims_additional_6.RData",sep="/"))

##-----Set 7-----##

##don't use Scott methods at all (at least for now) since main comparison is with Storey j
load(paste(alt,"/simResults_", 7, ".RData",sep=""))
load(paste(alt,"/simResults_pi0x_thresh_", 7, "_full.RData",sep=""))

FDR.ScottMat <- NULL
FDR.ScottMat_emp <- NULL

##Get BH and Storey q-values for each simulation:
qValuesSimsBH <- getQValuesSimsBH(pValuesSims)
qValuesSimsStorey <- getQValuesSimsStorey(pValuesSims)

print(mean(qValuesSimsStorey))

##Get estimated FDR for each simulation for the final estimates
FDRreg <- getFDRregSims(pi0EstSim, qValuesSimsBH)

##get FDR-TPR table
scen7 <- estFDR.TPR(FDR.BL = FDRreg,
                    FDR.BH = qValuesSimsBH, FDR.Storey = qValuesSimsStorey,
                    FDR.Scott = FDR.ScottMat, FDR.Scott_emp = FDR.ScottMat_emp, nullHypSim

print("Scenario 7")
print(scen7)

save(list=c("scen7"),
      file=paste(alt,"FDR_TPR_sims_additional_7.RData",sep="/"))

##-----Set 8-----##

##don't use Scott methods at all (at least for now) since main comparison is with Storey j
load(paste(alt,"/simResults_", 8, ".RData",sep=""))
load(paste(alt,"/simResults_pi0x_thresh_", 8, "_full.RData",sep=""))

FDR.ScottMat <- NULL
FDR.ScottMat_emp <- NULL

##Get BH and Storey q-values for each simulation:
qValuesSimsBH <- getQValuesSimsBH(pValuesSims)
qValuesSimsStorey <- getQValuesSimsStorey(pValuesSims)

```

```

##Get estimated FDR for each simulation for the final estimates
FDRreg <- getFDRregSims(pi0EstSim, qValuesSimsBH)

##get FDR-TPR table
scen8 <- estFDR.TPR(FDR.BL = FDRreg,
                    FDR.BH = qValuesSimsBH, FDR.Storey = qValuesSimsStorey,
                    FDR.Scott = FDR.ScottMat, FDR.Scott_emp = FDR.ScottMat_emp, nullHypSim)

print("Scenario 8")
print(scen7)

save(list=c("scen8"),
     file=paste(alt,"FDR_TPR_sims_additional_8.RData",sep="/"))

print("")
print("")
}

## [1] "alt_beta"
## [1] 0.1904079
## [1] "Scenario 5"
##           FDR           TPR Percent used
## BL          0.03509819 0.666023276         100
## Scott              NA              NA         NA
## Scott_emp         NA              NA         NA
## Storey          0.04902803 0.205625136         100
## BH              0.03110532 0.003907651         100
## [1] 0.3040391
## [1] "Scenario 6"
##           FDR           TPR Percent used
## BL          0.03789968 0.152102529         100
## Scott              NA              NA         NA
## Scott_emp         NA              NA         NA
## Storey          0.05344717 0.013312878         100
## BH              0.03543452 0.002818597         100
## [1] 0.4520901
## [1] "Scenario 7"
##           FDR           TPR Percent used
## BL          0.05375509 0.006429634         100
## Scott              NA              NA         NA
## Scott_emp         NA              NA         NA
## Storey          0.05058730 0.003291047         100
## BH              0.03875000 0.001574233         100
## [1] "Scenario 8"
##           FDR           TPR Percent used
## BL          0.05375509 0.006429634         100

```

```

## Scott      NA      NA      NA
## Scott_emp  NA      NA      NA
## Storey     0.05058730 0.003291047      100
## BH         0.03875000 0.001574233      100
## [1] ""
## [1] ""
## [1] "alt_chisq_large_3_3"
## [1] 0.2248454
## [1] "Scenario 5"
##           FDR      TPR Percent used
## BL         0.04046494 0.6284943      100
## Scott      NA      NA      NA
## Scott_emp  NA      NA      NA
## Storey     0.04596821 0.5525751      100
## BH         0.02381384 0.4616947      100
## [1] 0.3425003
## [1] "Scenario 6"
##           FDR      TPR Percent used
## BL         0.04558010 0.5187484      100
## Scott      NA      NA      NA
## Scott_emp  NA      NA      NA
## Storey     0.04757975 0.4837041      100
## BH         0.03049566 0.4279655      100
## [1] 0.4828958
## [1] "Scenario 7"
##           FDR      TPR Percent used
## BL         0.04981424 0.4305682      100
## Scott      NA      NA      NA
## Scott_emp  NA      NA      NA
## Storey     0.05022457 0.4137541      100
## BH         0.03889448 0.3804580      100
## [1] "Scenario 8"
##           FDR      TPR Percent used
## BL         0.04981424 0.4305682      100
## Scott      NA      NA      NA
## Scott_emp  NA      NA      NA
## Storey     0.05022457 0.4137541      100
## BH         0.03889448 0.3804580      100
## [1] ""
## [1] ""
## [1] "alt_chisq_large"
## [1] 0.2020087
## [1] "Scenario 5"
##           FDR      TPR Percent used
## BL         0.04351032 0.7891245      100

```

```

## Scott      NA      NA      NA
## Scott_emp  NA      NA      NA
## Storey     0.04794901 0.7387021      100
## BH         0.02473943 0.6677584      100
## [1] 0.3099688
## [1] "Scenario 6"
##           FDR      TPR Percent used
## BL         0.04758440 0.7138709      100
## Scott      NA      NA      NA
## Scott_emp  NA      NA      NA
## Storey     0.04821570 0.6870556      100
## BH         0.02955238 0.6372482      100
## [1] 0.449931
## [1] "Scenario 7"
##           FDR      TPR Percent used
## BL         0.04879528 0.6375918      100
## Scott      NA      NA      NA
## Scott_emp  NA      NA      NA
## Storey     0.04834939 0.6238253      100
## BH         0.03616979 0.5916728      100
## [1] "Scenario 8"
##           FDR      TPR Percent used
## BL         0.04879528 0.6375918      100
## Scott      NA      NA      NA
## Scott_emp  NA      NA      NA
## Storey     0.04834939 0.6238253      100
## BH         0.03616979 0.5916728      100
## [1] ""
## [1] ""
## [1] "alt_chisq_small_3_3"
## [1] 0.5866154
## [1] "Scenario 5"
##           FDR      TPR Percent used
## BL         0.03137096 0.02360570      100
## Scott      NA      NA      NA
## Scott_emp  NA      NA      NA
## Storey     0.03704322 0.02101822      100
## BH         0.02928332 0.01668347      100
## [1] 0.6732825
## [1] "Scenario 6"
##           FDR      TPR Percent used
## BL         0.03613692 0.01761401      100
## Scott      NA      NA      NA
## Scott_emp  NA      NA      NA
## Storey     0.03702937 0.01621985      100

```

```

## BH          0.03027314 0.01351034          100
## [1] 0.7579781
## [1] "Scenario 7"
##              FDR          TPR Percent used
## BL          0.04784529 0.01288998          100
## Scott          NA          NA          NA
## Scott_emp      NA          NA          NA
## Storey        0.03733043 0.01244050          100
## BH          0.03101190 0.01122368          100
## [1] "Scenario 8"
##              FDR          TPR Percent used
## BL          0.04784529 0.01288998          100
## Scott          NA          NA          NA
## Scott_emp      NA          NA          NA
## Storey        0.03733043 0.01244050          100
## BH          0.03101190 0.01122368          100
## [1] ""
## [1] ""
## [1] "alt_chisq_small"
## [1] 0.5166579
## [1] "Scenario 5"
##              FDR          TPR Percent used
## BL          0.02598941 0.09236973          100
## Scott          NA          NA          NA
## Scott_emp      NA          NA          NA
## Storey        0.03112042 0.08352149          100
## BH          0.02314429 0.06877721          100
## [1] 0.600227
## [1] "Scenario 6"
##              FDR          TPR Percent used
## BL          0.03382276 0.06688296          100
## Scott          NA          NA          NA
## Scott_emp      NA          NA          NA
## Storey        0.03601766 0.06202859          100
## BH          0.02996313 0.05376132          100
## [1] 0.7024464
## [1] "Scenario 7"
##              FDR          TPR Percent used
## BL          0.04456410 0.05169684          100
## Scott          NA          NA          NA
## Scott_emp      NA          NA          NA
## Storey        0.04443698 0.04965593          100
## BH          0.04031130 0.04520887          100
## [1] "Scenario 8"
##              FDR          TPR Percent used

```

```

## BL      0.04456410 0.05169684      100
## Scott      NA      NA      NA
## Scott_emp  NA      NA      NA
## Storey     0.04443698 0.04965593      100
## BH         0.04031130 0.04520887      100
## [1] ""
## [1] ""
## [1] "alt_t_large"
## [1] 0.2186075
## [1] "Scenario 5"
##           FDR      TPR Percent used
## BL      0.04097697 0.6635325      100.0
## Scott    0.07442871 0.8025987      100.0
## Scott_emp 0.07753015 0.5003052      99.5
## Storey    0.04749691 0.5706391      100.0
## BH        0.02512397 0.4333298      100.0
## [1] 0.3298567
## [1] "Scenario 6"
##           FDR      TPR Percent used
## BL      0.04475862 0.5190926      100
## Scott    NA      NA      NA
## Scott_emp NA      NA      NA
## Storey    0.04768117 0.4673258      100
## BH        0.03059938 0.3700457      100
## [1] 0.4709022
## [1] "Scenario 7"
##           FDR      TPR Percent used
## BL      0.04866816 0.3767956      100
## Scott    NA      NA      NA
## Scott_emp NA      NA      NA
## Storey    0.04888940 0.3466882      100
## BH        0.03614976 0.2882490      100
## [1] "Scenario 8"
##           FDR      TPR Percent used
## BL      0.04866816 0.3767956      100
## Scott    NA      NA      NA
## Scott_emp NA      NA      NA
## Storey    0.04888940 0.3466882      100
## BH        0.03614976 0.2882490      100
## [1] ""
## [1] ""
## [1] "alt_t_small"
## [1] 0.5548625
## [1] "Scenario 5"
##           FDR      TPR Percent used

```



```

## BL      0.03366474 0.012596842      100
## Scott   0.07877977 0.167576260      100
## Scott_emp 0.06094482 0.067351993      100
## Storey  0.04126545 0.009220934      100
## BH      0.03406214 0.005868908      100
## [1] 0.6463085
## [1] "Scenario 6"
##              FDR              TPR Percent used
## BL      0.04360317 0.006250330      100
## Scott      NA      NA      NA
## Scott_emp  NA      NA      NA
## Storey  0.03578409 0.005271697      100
## BH      0.03550000 0.004168329      100
## [1] 0.7386805
## [1] "Scenario 7"
##              FDR              TPR Percent used
## BL      0.06059524 0.004259146      100
## Scott      NA      NA      NA
## Scott_emp  NA      NA      NA
## Storey  0.05744048 0.004102854      100
## BH      0.05500000 0.003629360      100
## [1] "Scenario 8"
##              FDR              TPR Percent used
## BL      0.06059524 0.004259146      100
## Scott      NA      NA      NA
## Scott_emp  NA      NA      NA
## Storey  0.05744048 0.004102854      100
## BH      0.05500000 0.003629360      100
## [1] ""
## [1] ""
## [1] "alt_z_large"
## [1] 0.1999295
## [1] "Scenario 5"
##              FDR              TPR Percent used
## BL      0.04350982 0.7922555      100.0
## Scott   0.04808287 0.8322982      100.0
## Scott_emp 0.21403880 0.7341054      98.5
## Storey  0.04709194 0.7412002      100.0
## BH      0.02437240 0.6708273      100.0
## [1] 0.3045205
## [1] "Scenario 6"
##              FDR              TPR Percent used
## BL      0.04822249 0.7151670      100
## Scott      NA      NA      NA
## Scott_emp  NA      NA      NA

```

```

## Storey      0.04911128 0.6894753      100
## BH          0.03106585 0.6399167      100
## [1] 0.4451739
## [1] "Scenario 7"
##           FDR          TPR Percent used
## BL          0.05071310 0.6438547      100
## Scott        NA          NA          NA
## Scott_emp    NA          NA          NA
## Storey      0.04965365 0.6295688      100
## BH          0.03693065 0.5975540      100
## [1] "Scenario 8"
##           FDR          TPR Percent used
## BL          0.05071310 0.6438547      100
## Scott        NA          NA          NA
## Scott_emp    NA          NA          NA
## Storey      0.04965365 0.6295688      100
## BH          0.03693065 0.5975540      100
## [1] ""
## [1] ""
## [1] "alt_z_small"
## [1] 0.5132457
## [1] "Scenario 5"
##           FDR          TPR Percent used
## BL          0.02882126 0.09174515     100.0
## Scott        0.01912140 0.16419725     100.0
## Scott_emp    0.01194474 0.07427958      99.5
## Storey      0.03271840 0.08222247     100.0
## BH          0.02487638 0.06820185     100.0
## [1] 0.5983246
## [1] "Scenario 6"
##           FDR          TPR Percent used
## BL          0.03506825 0.06997224      100
## Scott        NA          NA          NA
## Scott_emp    NA          NA          NA
## Storey      0.03878232 0.06607361      100
## BH          0.03135079 0.05732136      100
## [1] 0.6959853
## [1] "Scenario 7"
##           FDR          TPR Percent used
## BL          0.04397300 0.04972446      100
## Scott        NA          NA          NA
## Scott_emp    NA          NA          NA
## Storey      0.04402595 0.04771506      100
## BH          0.03789294 0.04322530      100
## [1] "Scenario 8"

```

```
##           FDR           TPR Percent used
## BL          0.04397300 0.04972446          100
## Scott          NA          NA          NA
## Scott_emp      NA          NA          NA
## Storey        0.04402595 0.04771506          100
## BH            0.03789294 0.04322530          100
## [1] ""
## [1] ""
```

Session info:

```
devtools::session_info()

## Session info -----
##   setting  value
##   version  R version 3.3.1 (2016-06-21)
##   system   x86_64, mingw32
##   ui       RTerm
##   language (EN)
##   collate   English_United States.1252
##   tz        America/New_York
##   date      2018-09-05

## Packages -----
##   package * version date          source
##   colorspace 1.2-6 2015-03-11 CRAN (R 3.3.1)
##   devtools   1.12.0 2016-06-24 CRAN (R 3.3.3)
##   digest     0.6.12 2017-01-27 CRAN (R 3.3.3)
##   evaluate    0.10 2016-10-11 CRAN (R 3.3.1)
##   ggplot2     2.2.1 2016-12-30 CRAN (R 3.3.3)
##   gtable      0.2.0 2016-02-26 CRAN (R 3.3.1)
##   highr       0.6 2016-05-09 CRAN (R 3.3.1)
##   knitr       * 1.17 2017-08-10 CRAN (R 3.3.3)
##   lazyeval    0.2.0 2016-06-12 CRAN (R 3.3.1)
##   magrittr    1.5 2014-11-22 CRAN (R 3.3.1)
##   MASS        * 7.3-45 2016-04-21 CRAN (R 3.3.1)
##   memoise     1.0.0 2016-01-29 CRAN (R 3.3.1)
##   munsell     0.4.3 2016-02-13 CRAN (R 3.3.1)
##   plyr        1.8.4 2016-06-08 CRAN (R 3.3.1)
##   qvalue      * 2.4.2 2016-05-16 Bioconductor
##   Rcpp        0.12.13 2017-09-28 CRAN (R 3.3.3)
##   reshape2    1.4.1 2014-12-06 CRAN (R 3.3.1)
##   rlang       0.1.4 2017-11-05 CRAN (R 3.3.3)
##   scales      0.4.1 2016-11-09 CRAN (R 3.3.3)
##   stringi     1.1.1 2016-05-27 CRAN (R 3.3.0)
```

##	stringr	1.2.0	2017-02-18	CRAN (R 3.3.3)
##	tibble	1.3.3	2017-05-28	CRAN (R 3.3.3)
##	withr	1.0.2	2016-06-20	CRAN (R 3.3.1)
##	xtable	* 1.8-2	2016-02-05	CRAN (R 3.3.1)