

# Package ‘APFr’

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**Type** Package

**Title** Multiple Testing Approach using Average Power Function (APF) and Bayes FDR Robust Estimation

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**Depends** R (>= 3.5.0)

**Imports** stats (>= 3.5.2), graphics (>= 3.5.2)

**Description** Implements a multiple testing approach to the choice of a threshold  $\gamma$  on the p-values using the Average Power Function (APF) and Bayes False Discovery Rate (FDR) robust estimation. Function `apf_fdr()` estimates both quantities from either raw data or p-values. Function `apf_plot()` produces smooth graphs and tables of the relevant results. Details of the methods can be found in Quatto P, Margaritella N, et al. (2019) <[doi:10.1177/0962280219844288](https://doi.org/10.1177/0962280219844288)>.

**License** GPL-3

**Encoding** UTF-8

**LazyData** true

**RoxygenNote** 6.1.1

**NeedsCompilation** no

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apf\_fdr *Implementation of APF and FDR robust estimation*

### Description

apf\_fdr returns robust estimates of the Average Power Function (APF) and Bayes False Discovery Rate (FDR) for each value of the threshold Gamma on the p-value and Tau on the correlation coefficient.

### Usage

```
apf_fdr(data, type = "datf", corr = "spearman", lobs = 0,
        seed = 111, gamm = c(1e-04, 0.1, 0.002))
```

### Arguments

data	Either a vector, matrix or dataframe.
type	Set "datf" if data is a matrix or dataframe containing the raw data (columns); "pv1" for a vector of p-values.
corr	The type of correlation to use when type = "datf". It can be set to either "spearman" or "pearson".
lobs	When type = "pv1", it indicates the number of datapoints used to compute the correlations.
seed	A seed (natural number) for the resampling.
gamm	The threshold gamma on the p-values to explore (typically $\leq 0.05$ or 0.1). A min, max and step length value need to be set.

### Value

A list with four elements. A vector APF\_gamma containing the robust estimates of APF (5th quantiles) for all the gamma values set in gamm. A vector FDR\_gamma with the robust estimates of Bayes FDR (95th quantiles). A vector tau\_gamma with the correlation coefficients *tau* for each gamma value explored and another vector with the relative values gamma (gammaval).

### References

Quatto, P, Margaritella, N, et al. Brain networks construction using Bayes FDR and average power function. *Stat Methods Med Res*. Published online May 14th, 2019; DOI:10.1177/0962280219844288.

**Examples**

```
data("Ex1")
APF_lst <- apf_fdr(Ex1,"pv1",lobs=100)
# The example uses the dataset Ex1 (in the APFr package) which is
# a vector of 100 p-values. The number of datapoints used to
# compute each p-value in this example is set to 100. As a result,
# a list of 4 objects is returned.
```

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apf\_plot

*Generate smooth graphs for the APF and FDR estimates*


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**Description**

apf\_plot returns a graph with Average Power Function (APF), Bayes False Discovery Rate (FDR) and APF vs. FDR. In addition, when tab = TRUE, a table containing APF, FDR, tau and gamma values for a selected subset of APF and FDR is printed.

**Usage**

```
apf_plot(APF_lst, tab = TRUE, APF_inf = 0.5, FDR_sup = 0.05)
```

**Arguments**

APF_lst	The output from the apf_fdr function.
tab	If TRUE, a table with relevant values of APF, FDR, tau and gamma is printed.
APF_inf	Sets the minimum value of APF to appear in the table when tab = TRUE.
FDR_sup	Sets the maximum value of Bayes FDR to appear in the table when tab = TRUE.

**Value**

Smooth graphs for APF vs Gamma (left), FDR vs Gamma (centre) and APF vs FDR (right). Regions where  $FDR \leq FDR\_sup$  and  $APF \geq APF\_inf$  (if presents) are highlighted in yellow and printed in a table (if tab = TRUE) together with the relative values of *gamma* and *tau*.

**References**

Quatto, P, Margaritella, N, et al. Brain networks construction using Bayes FDR and average power function. *Stat Methods Med Res*. Published online May 14th, 2019; DOI:10.1177/0962280219844288.

**Examples**

```
data("Ex2")
apf_plot(Ex2)
# Ex2 is an example of output obtained
# from the apf_fdr() function.
```

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Ex1 *Example dataset 1*

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**Description**

A dataset containing 100 simulated p-values, 70 from a  $N(2,1)$  and 30 from a  $N(0,1)$ .

**Usage**

Ex1

**Format**

A vector containing 100 p-values.

**References**

Quatto, P, Margaritella, N, et al. Brain networks construction using Bayes FDR and average power function. *Stat Methods Med Res*. Published online May 14th, 2019; DOI:10.1177/0962280219844288.

**Examples**

data(Ex1)

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Ex2 *Example 2*

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**Description**

A list containing 4 vectors. This is an example of output obtained with `apf_fdr()` to use with `apf_plot()`.

**Usage**

Ex2

**Format**

A list containing 4 vectors called `APF_gamma`, `FDR_gamma`, `tau_gamma`, `gammaval`.

**References**

Quatto, P, Margaritella, N, et al. Brain networks construction using Bayes FDR and average power function. *Stat Methods Med Res*. Published online May 14th, 2019; DOI:10.1177/0962280219844288.

**Examples**

data(Ex2)

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