Package ‘Omixer’

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Type Package

Title Omixer: multivariate and reproducible sample randomization to proactively counter batch effects in omics studies

Version 1.12.0

Description Omixer - an Bioconductor package for multivariate and reproducible sample randomization, which ensures optimal sample distribution across batches with well-documented methods. It outputs lab-friendly sample layouts, reducing the risk of sample mixups when manually pipetting randomized samples.

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Encoding UTF-8

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Imports dplyr, ggplot2, forcats, tibble, gridExtra, magrittr, readr, tidyselect, grid, stats, stringr

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VignetteBuilder knitr

biocViews DataRepresentation, ExperimentalDesign, QualityControl, Software, Visualization

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Author Lucy Sinke [cre, aut]

Maintainer Lucy Sinke <l.j.sinke@lumc.nl>
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**Omixer**

*Multivariate Randomization*

Description

Omixer provides functions to perform optimal randomization of sample lists prior to omic profiling. This minimizes the correlation between biological factors and technical covariates, whilst ensuring there is insufficient evidence for any of these associations.

Details

Following this multivariate randomization, Omixer can also be used to smoothly bridge the gap between dry and wet labs, by creating visually intuitive sample sheets.

With clear documentation and the possibility to reproduce any output sample list, Omixer sets the standard for transparency and reproducibility in this often vague methodological step.

Author(s)

Lucy Sinke <l.j.sinke@lumc.nl>

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**omixerCorr**

*Correlation Tests*

Description

This function uses appropriate tests of correlation between two variables and stores the estimate and p-value in a list.

Usage

omixerCorr(x, y)

Arguments

- **x**
  - Randomization variable (e.g. age)
- **y**
  - Technical covariate (e.g. plate number)
omixerRand

Details

For two categorical variables, the Cramer's V estimate is stored alongside chi-square p-value. For all other combinations of variables, Pearson's correlation coefficient and p-value are stored.

Please note: variables will be converted to numeric class within this function.

Value

List of correlation estimate and p-value

Examples

```r
library(tibble)
library(forcats)
library(stringr)

sampleList <- tibble(sampleId=str_pad(1:48, 4, pad="0"),
  sex=as_factor(sample(c("m", "f"), 48, replace=TRUE)),
  age=round(rnorm(48, mean=30, sd=8), 0),
  smoke=as_factor(sample(c("yes", "ex", "never"), 48, replace=TRUE)),
  date=sample(seq(as.Date('2008/01/01'), as.Date('2016/01/01'),
                  by="day"), 48))

omixerCorr(sampleList$age, sampleList$sex)
```

omixerRand

**Multivariate Randomization**

Description

As the main function of the Omixer package, this function outputs a randomized sample list that minimizes correlations between biological factors and technical covariates.

Usage

```r
omixerRand(
  df,
  sampleId = "sampleId",
  block = "block",
  iterNum = 1000,
  wells, 
  div = "none",
  positional = FALSE,
  plateNum = 1,
  layout,
  mask = 0,
  techVars, 
  randVars
)
```
Arguments

df        Sample list
sampleId  String specifying sample ID variable
block     Paired sample identifier
iterNum   Number of layouts to generate
wells     Number of wells on a plate
div       Plate subdivisions
positional Logical indicator of positional batch effects
plateNum  Number of plates
layout    Custom plate layout as data frame
mask      Wells to be left empty
techVars  Technical covariates
randVars  Randomization variables

Value

Selected randomized sample list as a data frame
Randomization environment of optimal list generation

Examples

library(tibble)
library(forcats)
library(stringr)

sampleList <- tibble(sampleId=str_pad(1:48, 4, pad="0"),
sex=as_factor(sample(c("m", "f"), 48, replace=TRUE)),
age=round(rnorm(48, mean=30, sd=8), 0),
smoke=as_factor(sample(c("yes", "ex", "never"), 48, replace=TRUE)),
date=sample(seq(as.Date('2008/01/01'), as.Date('2016/01/01'),
by="day"), 48))

randVars <- c("sex", "age", "smoke", "date")

omixerLayout <- omixerRand(sampleList, sampleId="sampleId",
block="block", iterNum=10, wells=48, div="row",
plateNum=1, randVars=randVars)
**omixerSheet**  

**Sample Sheet Generation**

**Description**

This function will generate visually intuitive plate layouts for the wet lab, with the option to colour code different types of samples (e.g. for studies investigating multiple tissues).

**Usage**

omixerSheet(omixerLayout = omixerLayout, group)

**Arguments**

- `omixerLayout`: Randomized sample list
- `group`: Colour-coding indicator

**Value**

PDF of sample layout in working directory

**Examples**

```r
library(tibble)
library(forcats)
library(stringr)

sampleList <- tibble(sampleId=str_pad(1:48, 4, pad="0"),
                      sex=as_factor(sample(c("m", "f"), 48, replace=TRUE)),
                      age=round(rnorm(48, mean=30, sd=8), 0),
                      smoke=as_factor(sample(c("yes", "ex", "never"), 48, replace=TRUE)),
                      date=sample(seq(as.Date('2008/01/01'), as.Date('2016/01/01'),
                                       by="day"), 48))

randVars <- c("sex", "age", "smoke", "date")

omixerLayout <- omixerRand(sampleList, sampleId="sampleId",
                            block="block", iterNum=10, wells=48, div="row",
                            plateNum=1, randVars=randVars)

omixerSheet(omixerLayout)
```
omixerSpecific Sample List Regeneration

Description
Regenerate an Omixer-produced randomized sample list quickly, after setting up the random environment from omixerRand

Usage
omixerSpecific(
  df,
  sampleId = "sampleId",
  block = "block",
  wells,
  div = "none",
  positional = FALSE,
  plateNum = 1,
  layout,
  mask = 0,
  techVars,
  randVars
)

Arguments
df Sample list
sampleId String specifying sample ID variable
block Paired sample identifier
wells Number of wells on a plate
div Plate subdivisions
positional Logical indicator of positional batch effects
plateNum Number of plates
layout Custom plate layout as data frame
mask Wells to be left empty
techVars Technical covariates
randVars Randomization variables

Value
Chosen layout as a data frame
Examples

```r
library(tibble)
library(forcats)
library(stringr)

sampleList <- tibble(sampleId=str_pad(1:48, 4, pad="0"),
                     sex=as_factor(sample(c("m", "f"), 48, replace=TRUE)),
                     age=round(rnorm(48, mean=30, sd=8), 0),
                     smoke=as_factor(sample(c("yes", "ex", "never"), 48, replace=TRUE)),
                     date=sample(seq(as.Date('2008/01/01'), as.Date('2016/01/01'),
                        by="day"), 48))

randVars <- c("sex", "age", "smoke", "date")

omixerLayout <- omixerSpecific(sampleList, sampleId="sampleId",
                                block="block", wells=48, div="row",
                                plateNum=1, randVars=randVars)
```
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