Package 'toolmaRk'

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Type Package

Title Tests for Same-Source of Toolmarks

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Description
Implements two tests for same-source of toolmarks. The chumbley_non_random() test follows the paper ``An Improved Version of a Tool Mark Comparison Algorithm'' by Hadler and Morris (2017) <doi:10.1111/1556-4029.13640>. This is an extension of the Chumbley score as previously described in ``Validation of Tool Mark Comparisons Obtained Using a Quantitative, Comparative, Statistical Algorithm'' by Chumbley et al (2010) <doi:10.1111/j.1556-4029.2010.01424.x>. fixed_width_no_modeling() is based on correlation measures in a diamond shaped area of the toolmark as described in Hadler (2017).

Depends R (>= 3.3), plyr (>= 1.8.4), dplyr (>= 0.7.2), reshape2 (>= 1.4.2)

Imports ggplot2 (>= 2.2.1)

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LazyData true

RoxygenNote 6.0.1

NeedsCompilation no

Repository CRAN

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R topics documented:

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ameslab	*Toolmark profiles dataset*

Description

Data set of toolmarks (profiles) created by screwdrivers under different angles. Tool mark data included here were produced by Prof. Scott Chumbley, Mr. Stephen Davis, Ms. Taylor Grieve, Mr. Ryan Spotts, and Dr. Jeremy Hadler. These data were produced as part of research performed at the Ames Laboratory, located on the Iowa State University campus. Ames Laboratory is operated for the U.S. Department of Energy by Iowa State University under Contract No. DE-Ac02-07CH11358.

Usage

```
ameslab
```

Format

the dataset consists of a sample of 16 toolmark profiles and descriptors. Toolmarks with the same toolmark identifier are known matches, all other profiles are known non-matches.

ID toolmark identifier. Factor variable.

side A or B, indicates the side of the screwdriverused to create the toolmark. Factor variable.

angle degree under which the toolmark was created.

rep replicate number for a toolmark, side, angle composition. Note that the data here provided is not complete. For a more complete data set or more information please contact the references given below.

profile list of data sets with one profile each. Measurements are taken at equispaced intervals across the toolmark. .

References

Tool mark data included here were produced by Prof. Scott Chumbley, Mr. Stephen Davis, Ms. Taylor Grieve, Mr. Ryan Spotts, and Dr. Jeremy Hadler. These data were produced as part of research performed at the Ames Laboratory, located on the Iowa State University campus. Ames Laboratory is operated for the U.S. Department of Energy by Iowa State University under Contract No. DE-Ac02-07CH11358.

Examples

```
data(ameslab)
plot(ameslab$profile[[1]]$V1)
chumbley_non_random(ameslab$profile[[1]], ameslab$profile[[2]])

res14 <- fixed_width_no_modeling(ameslab$profile[[1]], ameslab$profile[[4]])
res14$dist_pval
```

chumbley_non_random *Chumbley Non-Random*

Description

This function computes the Chumbley U-Statistic on systemically chosen pairs of windows rather than the original method which selects randomly chosen pairs of windows

Usage

```
chumbley_non_random(data1, data2, window_opt = 500, window_val = 50,
  coarse = 0.25)
```

Arguments

data1	The first tool mark as a 1-column matrix
data2	The second tool mark as a 1-column matrix
window_opt	size of the window to be used in the optimization step
window_val	Size of the window to be used in the validation step
coarse	smoothing parameter for the normalization smooth

Value

list with

- same_shift_n Number of same shift offsets used
- diff_shift_n Number of different shift offsets used
- U observed U statistic
- p_value Corresponding p-value

fixed_width_no_modeling
Distance/threshold test for toolmarks

Description

Compute all possible correlations for windows of length n between the class components. Determine the location of the maximized correlation. Given this location, create a diamond around it in the individual matrix of correlations For each offset in this diamond, compute the maximized correlation (1) Determine the distance between the offset for the class and indiviudal components (2) Compute the Threshold test statistics

Usage

```
fixed_width_no_modeling(dat1, dat2, coarse = 0.25, fine = 0.01,
  window.size = 0.6, M = 500)
```

Arguments

dat1	a one column matrix representing a digitized tool mark
dat2	a one column matrix representing a second digitized tool mark
coarse	normalization smoothing parameter
fine	decomposition smoothing parameter
window.size	desired window size for the correlations to compute
M	search area restriction

Value

list with

- "max_corr"maximized indiviudal component correlation
- "Smooth_offset"optimal Class offset
- "Resid_offset"optimal individual offset
- "dist_pval" distance p-value
- "thresh_pval" threshold p-value
- "Above" Number of offsets with correlation bigger than threshold
- "total_thresh" 2*M+1
- "mark1_decompostion" plot of decomposition d1
- "mark2_decompostion" plot of decomposition d2
- "class_correlations" plot of class correlation
- "individual_correlations" plot of individual correlation
- "distance_plot" distance_plot
- "threshold_plot" threshold_plot

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