Package 'RTextureMetrics'

February 19, 2015

Type Package

Title Functions for calculation of texture metrics for Grey Level Co-occurrence Matrices

Version 1.1

Date 2014-04-18

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Description
This package contains several functions for calculation of texture metrics for Grey Level Co-occurrence matrices

License GPL (>= 2)

NeedsCompilation no

Repository CRAN

Date/Publication 2014-04-19 18:49:32

R topics documented:

RTextureMetrics-package

Calculation of texture metrics for Grey Level Co-occurrence matrices

Description

This package contains several functions for calculation of important texture metrics for Grey Level Co-occurrence matrices

Details

Package:	RTextureMetrics
Type:	Package
Version:	1.1
Date:	2013-04-18
License:	GPL (>=2)
LazyLoad:	yes

Read in Image (e.g. using readJPEG in biOps-package or readJPEG in rimage-package) and transform Image to a Grey-Image (e.g. using rgb2Grey-function of biOps or RGB2GREY in rimage). Use afterwards genGLCM of this package to generate a GLC-Matrix and calculate afterwards (more than) one of the measures.

Author(s)

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References

Toennies, D., 2005: Grundlagen der Bildverarbeitung, 341 S., Pearson Studium Harralick, R.M., Shanmugam, K., Dinstein, I., 1973: Textural Features for image classification. IEEE Transactions on Systems, Man and Cybernetics, SMC vol. 3 no. 6, pp. 610-620.

Examples

```
data<-c(0,0,1,1,0,0,1,1,0,2,2,2,2,2,3,3)
mat<-matrix(data, nrow=4, byrow=TRUE)
(mat)
GLCM<-genGLCM(2,1,mat)
(GLCM)
calcCON(GLCM)
calcHOM(GLCM)
calcDIS(GLCM)
```

```
calcASM(GLCM)
calcENT(GLCM)
findMaxPropability(GLCM)
plotGLCM(GLCM)
```

`calcASM` *ASM (Angular Second Moment)*

Description

calculates Angular Second Moment (ASM) measure

Usage

```
calcASM(rawmat)
```

Arguments

`rawmat`	assigns the Grey Level Co-occurrence Matrix for ASM calculation

Details

Angular Second Moment (ASM) measure belongs to the orderlines group of texture measures. It is sometimes also called Energy or Uniformity. High values occur when the window ist very orderly

Value

returns ASM value

Author(s)

H.-J. Klemmt

References

Toennies, D., 2005: Grundlagen der Bildverarbeitung, 341 S., Pearson Studium Harralick, R.M., Shanmugam, K., Dinstein, I., 1973: Textural Features for image classification. IEEE Transactions on Systems, Man and Cybernetics, SMC vol. 3 no. 6, pp. 610-620.

See Also

The GLCM-Tutorial by Mryka Hall-Beyer, http://www.fp.ucalgary.ca/mhallbey/asm.htm

Examples

```
data<-c(0,0,1,1,0,0,1,1,0,2,2,2,2,2,3,3)
mat<-matrix(data, nrow=4, byrow=TRUE)
(mat)
GLCM<-genGLCM(2,1,mat)
(GLCM)
(calcASM(GLCM))
##-- ==>  Define data, use random,
##--or do  help(data=index)  for the standard data sets.

## The function is currently defined as
function (rawmat)
{
    return(sum(rawmat^2))
  }
```

`calcCON` *CON Contrast*

Description

calculates CONTRAST measure for Grey-Level Co-occurrence Matrices

Usage

```
calcCON(rawmat)
```

Arguments

`rawmat`	assigns Grey Level Co-occurrence Matrix for calculation of CONTRAST measure

Details

CONTRAST measure belongs to the Contrast group of texture metrics. CONTRAST measure is also called sum of square variances

Value

returns CONTRAST measure

Author(s)

H.-J. Klemmt

References

Toennies, D., 2005: Grundlagen der Bildverarbeitung, 341 S., Pearson Studium Harralick, R.M., Shanmugam, K., Dinstein, I., 1973: Textural Features for image classification. IEEE Transactions on Systems, Man and Cybernetics, SMC vol. 3 no. 6, pp. 610-620.

See Also

The GLCM Tutorial by Mryka Hall-Beyer, http://www.fp.ucalgary.ca/mhallbey/contrast.htm

Examples

```
data<-c(0,0,1,1,0,0,1,1,0,2,2,2,2,2,3,3)
mat<-matrix(data, nrow=4, byrow=TRUE)
(mat)
GLCM<-genGLCM(2,1,mat)
(GLCM)
(calcCON(GLCM))
##-- ==>  Define data, use random,
##--or do  help(data=index)  for the standard data sets.

## The function is currently defined as
function (rawmat)
{
    size <- dim(rawmat)[1]
    matconweights <- matrix(0, nrow = size, ncol = size)
    for (i in 1:size) {
        for (a in 1:size) {
            matconweights[i, a] <- (a - i)^2
        }
    }
    con <- rawmat * matconweights
    return(sum(con))
  }
```

`calcDIS` *DIS Dissimilarity*

Description

calculates DISSIMILARITY measure for Grey Level Co-occurrence Matrices

Usage

```
calcDIS(rawmat)
```

Arguments

`rawmat`	assigns the GLC-Matrix for DISSIMILARITY calculation

Details

DISSIMILARITY measure belongs to the Contrast group of texture metrics. In the DISSIMILARITY measure weights increase linearly.

Value

returns the DISSIMILARITY measure

Author(s)

H.-J. Klemmt

References

Toennies, D., 2005: Grundlagen der Bildverarbeitung, 341 S., Pearson Studium Harralick, R.M., Shanmugam, K., Dinstein, I., 1973: Textural Features for image classification. IEEE Transactions on Systems, Man and Cybernetics, SMC vol. 3 no. 6, pp. 610-620.

Examples

```
data<-c(0,0,1,1,0,0,1,1,0,2,2,2,2,2,3,3)
mat<-matrix(data, nrow=4, byrow=TRUE)
(mat)
GLCM<-genGLCM(2,1,mat)
(GLCM)
(calcDIS(GLCM))
##-- ==>  Define data, use random,
##--or do  help(data=index)  for the standard data sets.

## The function is currently defined as
function (rawmat)
{
    size <- dim(rawmat)[1]
    matconweights <- matrix(0, nrow = size, ncol = size)
    for (i in 1:size) {
        for (a in 1:size) {
            matconweights[i, a] <- abs(a - i)
        }
    }
    dis <- rawmat * matconweights
    return(sum(dis))
  }
```

---

calcENT *ENT Entropy*

Description

calculates ENTROPY measure for Grey Level Co-occurrence Matrices

Usage

```
calcENT(rawmat)
```

Arguments

rawmat	assigns the GLC-Matrix

Details

Entropy is a texture measure related to the orderline group. Entropy characterizes 'energy' values for pixel combinations.

Value

returns Entropy value

Author(s)

H.-J. Klemmt

References

Toennies, D., 2005: Grundlagen der Bildverarbeitung. 341 S., Pearson Studium Harralick, R.M., Shanmugam, K., Dinstein, I., 1973: Textural Features for image classification. IEEE Transactions on Systems, Man and Cybernetics, SMC vol. 3 no. 6, pp. 610-620.

See Also

The GLCM Tutorial by Myrka Hall-Beyer, http://www.fp.ucalgary.ca/mhallbey/oderlines_group.htm

Examples

```
data<-c(0,0,1,1,0,0,1,1,0,2,2,2,2,2,3,3)
mat<-matrix(data, nrow=4, byrow=TRUE)
(mat)
GLCM<-genGLCM(2,1,mat)
(GLCM)
(calcENT(GLCM))
##-- ==>  Define data, use random,
##--or do  help(data=index)  for the standard data sets.

## The function is currently defined as
function (rawmat)
{
    lnrawmat <- log(rawmat)
    size <- dim(lnrawmat)[1]
    for (i in 1:size) {
        for (a in 1:size) {
            if (lnrawmat[a, i] == "-Inf") {
                lnrawmat[a, i] <- 0
            }
        }
    }
    return(sum(rawmat * lnrawmat))
  }
```

calcHOM *HOM Homogeinity*

Description

calculates HOMOGENEITY measure for Grey Level co-occurrence matrices

Usage

```
calcHOM(rawmat)
```

Arguments

rawmat	assigns the GLC-Matrix to use

Details

Homogeneity weigths values by the inverse of the Contrast weight with weights decreasing exponentially away from diagonal Homogeneity measure is sometimes also called 'Inverse Difference Moment'.

Value

returns Homogeneity value

Author(s)

H.-J. Klemmt

References

Toennies, D., 2005: Grundlagen der Bildverabeitung, 341 S., Pearson Studium Harralick, R.M., Shanmugam, K., Dinstein, I., 1973: Textural Features for image classification. IEEE Transactions on Systems, Man and Cybernetics, SMC vol. 3 no. 6, pp. 610-620.

See Also

GLCM Tutorial by Mryka-Hall-Beyer, http://www.fp.ucalgary.ca/mhallbey/homogeneity.htm

Examples

```
data<-c(0,0,1,1,0,0,1,1,0,2,2,2,2,2,3,3)
mat<-matrix(data, nrow=4, byrow=TRUE)
(mat)
GLCM<-genGLCM(2,1,mat)
(GLCM)
(calcHOM(GLCM))
##-- ==>  Define data, use random,
##--or do  help(data=index)  for the standard data sets.
```

```
## The function is currently defined as
function (rawmat)
{
    size <- dim(rawmat)[1]
    mathomweights <- matrix(0, nrow = size, ncol = size)
    for (i in 1:size) {
        for (a in 1:size) {
            mathomweights[i, a] <- 1/(1 + (a - i)^2)
        }
    }
    hom <- rawmat * mathomweights
    return(sum(hom))
  }
```

`findMaxPropability` *findMaxPropability*

Description

finds and assings the largest Pij value found in a picture

Usage

```
findMaxPropability(rawmat)
```

Arguments

`rawmat`	assigns the Grey Level Co-occurrence Matrix for Maximum Propability characterization

Details

Maximum Probabilty is a simple statistic which records in the central pixel of a picture or window the largest found Pij value. High values occur if one combination of pixels dominate the pixel pairs.

Value

returns Maximum Propability value

Author(s)

H.-J. Klemmt

References

Toennies, D., 2005: Grundlagen der Bildverarbeitung, 341 S., Pearson Studium Harralick, R.M., Shanmugam, K., Dinstein, I., 1973: Textural Features for image classification. IEEE Transactions on Systems, Man and Cybernetics, SMC vol. 3 no. 6, pp. 610-620.

See Also

The GLCM Tutorial by Mryka Hall-Beyer, http://www.fp.ucalgary.ca/mhallbey/max_propabilty.htm

Examples

```
data<-c(0,0,1,1,0,0,1,1,0,2,2,2,2,2,3,3)
mat<-matrix(data, nrow=4, byrow=TRUE)
(mat)
GLCM<-genGLCM(2,1,mat)
(GLCM)
(findMaxPropability(GLCM))
##-- ==>  Define data, use random,
##--or do  help(data=index)  for the standard data sets.

## The function is currently defined as
function (rawmat)
{
    return(max(rawmat))
  }
```

---

genGLCM *genGLCM (generate GLC-Matrix)*

Description

genGLCM generates a Grey Level Co-occurrence Matrix (GLCM)

Usage

```
genGLCM(direction, distance, rawmat)
```

Arguments

direction	assigns the direction of the neighbour (1=east, right), (2=south, down), (3=west, left), (4=north, up)
distance	assigns the number of pixels between reference and neighbour
rawmat	assigns the grey level [0..255] pixel matrix of a picture

Details

GLCM is a tabulation of how often different combinations of pixel brightness values (grey levels) occur in an image.

Value

returns a normalized propability matrix of the occurrence of different grey values

Author(s)

H.-J. Klemmt

References

Toennies, D., 2005: Grundlagen der Bildverarbeitung. Pearson Studium, 341 S. Harralick, R.M., Shanmugam, K., Dinstein, I., 1973: Textural Features for image classification. IEEE Transactions on Systems, Man and Cybernetics, SMC vol. 3 no. 6, pp. 610-620.

Examples

```
data<-c(0,0,1,1,0,0,1,1,0,2,2,2,2,2,3,3)
mat<-matrix(data,nrow=4, byrow=TRUE)
GLCM<-genGLCM(2,1,mat)
(GLCM)


## The function is currently defined as
function (direction, distance, rawmat)
{
    number_coloums <- max(rawmat) + 1
    number_rows <- max(rawmat) + 1
    GLCM <- matrix(0, ncol = 255, nrow = 255)
    (GLCM)
    if (direction == 1) {
        for (i in 1:number_coloums - 1) {
            for (a in 1:number_rows) {
                GLCM[rawmat[a, i] + 1, rawmat[a, i + 1] + 1] <- GLCM[rawmat[a,
                  i] + 1, rawmat[a, i + 1] + 1] + 1
            }
        }
    }
    if (direction == 2) {
        for (i in 1:number_coloums) {
            for (a in 1:number_rows - 1) {
                GLCM[rawmat[a, i] + 1, rawmat[a + 1, i] + 1] <- GLCM[rawmat[a,
                  i] + 1, rawmat[a + 1, i] + 1] + 1
            }
        }
    }
    transGLCM <- t(GLCM)
    print("INVERTIERT")
    GLCM <- GLCM + transGLCM
    GLCMprob <- round(GLCM/sum(GLCM), digits = 4)
    return(GLCMprob)
  }
```

plotGLCM *plot (plot GLC-Matrix)*

Description

plotGLCM plots a Grey Level Co-occurrence Matrix (GLCM)

Usage

```
plotGLCM(GLCM)
```

Arguments

GLCM	data frame with GLCM data

Details

GLCM is a tabulation of how often different combinations of pixel brightness values (grey levels) occur in an image.

Value

no return value

Author(s)

H.-J. Klemmt

References

Toennies, D., 2005: Grundlagen der Bildverarbeitung. Pearson Studium, 341 S. Harralick, R.M., Shanmugam, K., Dinstein, I., 1973: Textural Features for image classification. IEEE Transactions on Systems, Man and Cybernetics, SMC vol. 3 no. 6, pp. 610-620.

Examples

```
data<-c(0,0,1,1,0,0,1,1,0,2,2,2,2,2,3,3)
mat<-matrix(data,nrow=4, byrow=TRUE)
GLCM<-genGLCM(2,1,mat)
plotGLCM(GLCM)
```

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