

Package ‘SKNN’

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Type Package

Title A Super K-Nearest Neighbor (SKNN) Classification Algorithm

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Description

It's a Super K-Nearest Neighbor(SKNN) classification method with using kernel density to describe weight of the distance between a training observation and the testing sample. Comparison of performance between SKNN and KNN shows that SKNN is significantly superior to KNN.

Collate SKNN.R Dist.R PCAY.R AllClasses.R KNN.R

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Description

It's a Super K-Nearest Neighbor (SKNN) classification method with using kernel density to describe the weight of the distance between a training observation and the sample to be classified. Comparison of performance between SKNN and KNN shows that SKNN is significantly superior to KNN.

Details

Package: SKNN
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 Version: 4.1.3
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Author(s)

Yarong Yang, Nader Ebrahimi, Yoram Rubin, and Jacob Zhang

References

Yarong Yang, Nader Ebrahimi, Yoram Rubin, and Jacob Zhang.(2025) SKNN: A Super K-Nearest Neighbor Classification Algorithm. technical report in preparation

Yarong Yang, Matt Over, and Yoram Rubin.(2012) Strategic Placement of Localization Devices (such as Pilot Points and Anchors) in Inverse Modeling Schemes. Water Resources Research, 48, W08519, doi:10.1029/2012WR011864.

B.B.W. Silverman.(1986) Density Estimation for Statistics and Data Analysis. London: Chapman and Hall.

Examples

```
Sepal.Length<-c(4.8, 5.1, 4.6, 5.3, 5.0, 5.7, 5.7, 6.2, 5.1, 5.7, 6.7, 6.3, 6.5, 6.2, 5.9)
Sepal.Width<-c(3.0, 3.8, 3.2, 3.7, 3.3, 3.0, 2.9, 2.9, 2.5, 2.8, 3.0, 2.5, 3.0, 3.4, 3.0)
Petal.Length<-c(1.4, 1.6, 1.4, 1.5, 1.4, 4.2, 4.2, 4.3, 3.0, 4.1, 5.2, 5.0, 5.2, 5.4, 5.1)
Petal.Width<-c(0.3, 0.2, 0.2, 0.2, 0.2, 1.2, 1.3, 1.3, 1.1, 1.3, 2.3, 1.9, 2.0, 2.3, 1.8)
Species<-as.factor(c(rep("red",5),rep("blue",5),rep("green",5)))
iris<-cbind(Sepal.Length,Sepal.Width,Petal.Length,Petal.Width)
Res<-length(nrow(iris))
k<-10
for(i in 1:nrow(iris))
  Res[i]<-SKNN(data=iris,Class=as.vector(Species),k=k,test=iris[i,],ker="GK")
```

```

accuracy<-length(which(Res==Species))/length(Species)
plot(x=1:15,y=rep(1,15),col=as.vector(Species),lwd=4,ylim=c(0,3),xlab="",ylab="",
yaxt = "n",xaxt="n")
par(new=TRUE)
plot(x=1:15,y=rep(2,15),col=Res,lwd=4,ylim=c(0,3),xlab="",ylab="",yaxt = "n",xaxt="n")
ind<-which(Res!=Species)
if(length(ind)>0) {
  for(j in 1:length(ind))
    lines(x=c(ind[j],ind[j]),y=c(1+0.05,2-0.05))
}
text(5,0.3,paste("SKNN Misclassified:",length(ind)))
axis(2,at=2,labels="SKNN",las=1)
text(10,2.5,paste("k: ",k))

```

Dist

Finding the distance between two observations.

Description

It's a function of finding the distance between two observations.

Usage

```
Dist(x,y)
```

Arguments

x	Numeric. A vector denoting an observation.
y	Numeric. A vector denoting an observation.

Value

A list.

Author(s)

Yarong Yang

KNN

*K-Nearest Neighbor Classification***Description**

It's implementation of the K-Nearest Neighbor classification method for data of any number of dimentionions.

Usage

```
KNN(data, Class, k, test)
```

Arguments

data	Numeric. The training data set, matrix.
Class	Character. Class of the training observations, vector.
k	Integer. The number of K to be used.
test	Numeric. The sample to be classified.

Value

A character.

Author(s)

Yarong Yang

References

A.T. Covert and P. Hart. Nearest Neighbor Pattern Classification. IEEE Transactions on Information Theory, 13(1): 21-27, 1967.

Examples

```
Sepal.Length<-c(4.8, 5.1, 4.6, 5.3, 5.0, 5.7, 5.7, 6.2, 5.1, 5.7, 6.7, 6.3, 6.5, 6.2, 5.9)
Sepal.Width<-c(3.0, 3.8, 3.2, 3.7, 3.3, 3.0, 2.9, 2.9, 2.5, 2.8, 3.0, 2.5, 3.0, 3.4, 3.0)
Petal.Length<-c(1.4, 1.6, 1.4, 1.5, 1.4, 4.2, 4.2, 4.3, 3.0, 4.1, 5.2, 5.0, 5.2, 5.4, 5.1)
Petal.Width<-c(0.3, 0.2, 0.2, 0.2, 0.2, 1.2, 1.3, 1.3, 1.1, 1.3, 2.3, 1.9, 2.0, 2.3, 1.8)
Species<-as.factor(c(rep("red",5),rep("blue",5),rep("green",5)))
iris<-cbind(Sepal.Length,Sepal.Width,Petal.Length,Petal.Width)
Res<-length(nrow(iris))
k<-10
for(i in 1:nrow(iris))
  Res[i]<-KNN(data=iris,Class=as.vector(Species),k=k,test=iris[i,])
accuracy<-length(which(Res==Species))/length(Species)
plot(x=1:15,y=rep(1,15),col=as.vector(Species),lwd=4,ylim=c(0,3),xlab="",ylab="",
yaxt = "n",xaxt="n")
par(new=TRUE)
```

```

plot(x=1:15,y=rep(2,15),col=Res,lwd=4,ylim=c(0,3),xlab="",ylab="",yaxt = "n",xaxt="n")
ind<-which(Res!=Species)
if(length(ind)>0) {
  for(j in 1:length(ind))
    lines(x=c(ind[j],ind[j]),y=c(1+0.05,2-0.05))
}
text(5,0.3,paste("KNN Misclassified:",length(ind)))
axis(2,at=2,labels="KNN",las=1)
text(10,2.5,paste("k: ",k))

```

PCAy

Revised PCA analysis

Description

It's a revised PCA analysis.

Usage

```
PCAy(data)
```

Arguments

data Numeric. Data matrix for revised PCA analysis.

Value

An object of class "PCAy".

Author(s)

Yarong Yang and Yoram Rubin

References

Yarong Yang, Matt Over, and Yoram Rubin.(2012) Strategic Placement of Localization Devices (such as Pilot Points and Anchors) in Inverse Modeling Schemes. *Water Resources Research*, 48, W08519, doi:10.1029/2012WR011864.

Yarong Yang, Nader Ebrahimi, Yoram Rubin, and Jacob Zhang.(2025) SKNN: A Super K-Nearest Neighbor Classification Algorithm. technical report in preparation

Examples

```

Sepal.Length<-c(4.8, 5.1, 4.6, 5.3, 5.0, 5.7, 5.7, 6.2, 5.1, 5.7, 6.7, 6.3,
6.5, 6.2, 5.9)
Sepal.Width<-c(3.0, 3.8, 3.2, 3.7, 3.3, 3.0, 2.9, 2.9, 2.5, 2.8, 3.0, 2.5,
3.0, 3.4, 3.0)
Petal.Length<-c(1.4, 1.6, 1.4, 1.5, 1.4, 4.2, 4.2, 4.3, 3.0, 4.1, 5.2, 5.0,
5.2, 5.4, 5.1)
Petal.Width<-c(0.3, 0.2, 0.2, 0.2, 0.2, 1.2, 1.3, 1.3, 1.1, 1.3, 2.3, 1.9,
2.0, 2.3, 1.8)
dat<-cbind(Sepal.Length,Sepal.Width,Petal.Length,Petal.Width)
Res<-PCAy(dat)

```

PCAy_d

Class to contain the results from revised PCA analysis.

Description

The function PCAY returns object of class PCAY_d.

Objects from the Class

```
new("PCAyd",Var=new("numeric"),PC=new("matrix"),Scores=new("matrix"),IScores=new("numeric"))
```

Slots

Var: An numeric vector giving the variance of each PC.

PC: A numeric matrix about the coefficients of each PC.

Scores: A numeric matrix showing the loading coefficients of each PC.

IScores: A numeric vector with each element being the rowsum of Scores.

Author(s)

Yarong Yang and Yoram Rubin

References

Yarong Yang, Matt Over, and Yoram Rubin.(2012) Strategic Placement of Localization Devices (such as Pilot Points and Anchors) in Inverse Modeling Schemes. Water Resources Research, 48, W08519, doi:10.1029/2012WR011864.

Yarong Yang, Nader Ebrahimi, Yoram Rubin, and Jacob Zhang.(2025) SKNN: A Super K-Nearest Neighbor Classification Algorithm. technical report in preparation

Examples

```
showClass("PCAyd")
```

SKNN	<i>Super K-Nearest Neighbor (SKNN) Classification</i>
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Description

It's a Super K-Nearest Neighbor classification method with using kernel density to describe weight of the distance between a training observation and the testing sample.

Usage

```
SKNN(data, Class, k, test, ker)
```

Arguments

data	Numeric. The training data set, matrix.
Class	Character. Class of the training observations, vector.
k	Integer. The number of K to be used.
test	Numeric. The sample to be classified.
ker	Character. 'GK', 'EK', or 'TK'. The kernel function to be used.

Value

A character.

Author(s)

Yarong Yang, Nader Ebrahimi, Yoram Rubin, and Jacob Zhang

References

Yarong Yang, Nader Ebrahimi, Yoram Rubin, and Jacob Zhang.(2025) SKNN: A Super K-Nearest Neighbor Classification Algorithm. technical report in preparation

Yarong Yang, Matt Over, and Yoram Rubin.(2012) Strategic Placement of Localization Devices (such as Pilot Points and Anchors) in Inverse Modeling Schemes. Water Resources Research, 48, W08519, doi:10.1029/2012WR011864.

B.B.W. Silverman. Density Estimation for Statistics and Data Analysis. London: Chapman and Hall, 1986.

Examples

```
Sepal.Length<-c(4.8, 5.1, 4.6, 5.3, 5.0, 5.7, 5.7, 6.2, 5.1, 5.7, 6.7, 6.3, 6.5, 6.2, 5.9)
Sepal.Width<-c(3.0, 3.8, 3.2, 3.7, 3.3, 3.0, 2.9, 2.9, 2.5, 2.8, 3.0, 2.5, 3.0, 3.4, 3.0)
Petal.Length<-c(1.4, 1.6, 1.4, 1.5, 1.4, 4.2, 4.2, 4.3, 3.0, 4.1, 5.2, 5.0, 5.2, 5.4, 5.1)
Petal.Width<-c(0.3, 0.2, 0.2, 0.2, 0.2, 1.2, 1.3, 1.3, 1.1, 1.3, 2.3, 1.9, 2.0, 2.3, 1.8)
Species<-as.factor(c(rep("red",5),rep("blue",5),rep("green",5)))
iris<-cbind(Sepal.Length,Sepal.Width,Petal.Length,Petal.Width)
```

```

Res<-length(nrow(iris))
k<-10
for(i in 1:nrow(iris))
  Res[i]<-SKNN(data=iris,Class=as.vector(Species),k=k,test=iris[i,],ker="GK")
accuracy<-length(which(Res==Species))/length(Species)
plot(x=1:15,y=rep(1,15),col=as.vector(Species),lwd=4,ylim=c(0,3),xlab="",ylab="",
yaxt = "n",xaxt="n")
par(new=TRUE)
plot(x=1:15,y=rep(2,15),col=Res,lwd=4,ylim=c(0,3),xlab="",ylab="",yaxt = "n",xaxt="n")
ind<-which(Res!=Species)
if(length(ind)>0) {
  for(j in 1:length(ind))
    lines(x=c(ind[j],ind[j]),y=c(1+0.05,2-0.05))
}
text(5,0.3,paste("SKNN Misclassified:",length(ind)))
axis(2,at=2,labels="SKNN",las=1)
text(10,2.5,paste("k: ",k))

```


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