

# Package ‘SubCellBarCode’

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**Type** Package

**Title** SubCellBarCode: Integrated workflow for robust mapping and visualizing whole human spatial proteome

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**Description** Mass-Spectrometry based spatial proteomics have enabled the proteome-wide mapping of protein subcellular localization (Orre et al. 2019, Molecular Cell). SubCellBarCode R package robustly classifies proteins into corresponding subcellular localization.

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---

applyThresholdCompartment

*Apply thresholds to compartments*

---

## Description

Apply thresholds for all predictions to increase the true positive rate and remove poor classification.

## Usage

```
applyThresholdCompartment(all.repA, all.repB, threshold.df)
```

## Arguments

|              |                                                                                     |
|--------------|-------------------------------------------------------------------------------------|
| all.repA     | data.frame; all predictions and probability vectors for each protein in replicate A |
| all.repB     | data.frame; all predictions and probability vectors for each protein in replicate B |
| threshold.df | data.frame; collection of precision and recall values for each compartment          |

## Value

c.cls.df

## Examples

```
{
df <- loadData(SubCellBarCode::hcc827Ctrl)

c.prots <- calculateCoveredProtein(rownames(df), markerProteins[,1])

set.seed(7)
c.prots <- sample(c.prots, 550)
cls <- svmClassification(c.prots, df, markerProteins)

test.A <- cls[[1]]$svm.test.prob.out
test.B <- cls[[2]]$svm.test.prob.out

t.c.df <- computeThresholdCompartment(test.A, test.B)

all.A <- cls[[1]]$all.prot.pred
all.B <- cls[[2]]$all.prot.pred

c.cls.df <- applyThresholdCompartment(all.A, all.B, t.c.df)
}
```

---

applyThresholdNeighborhood

*Apply thresholds to neighborhood classification*

---

## Description

Apply thresholds for all predictions at the neighborhood level to increase the true positive rate and remove poor classification.

## Usage

```
applyThresholdNeighborhood(all.repA, all.repB, threshold.df)
```

## Arguments

|              |                                                                                     |
|--------------|-------------------------------------------------------------------------------------|
| all.repA     | data.frame; all predictions and probability vectors for each protein in replicate A |
| all.repB     | data.frame; all predictions and probability vectors for each protein in replicate B |
| threshold.df | data.frame; collection of precision and recall values for each neighborhood         |

## Value

n.cls.df

## Examples

```
{
df <- loadData(SubCellBarCode::hcc827Ctrl)

c.prots <- calculateCoveredProtein(rownames(df), markerProteins[,1])
```

```

set.seed(7)
c.prots <- sample(c.prots, 600)
cls <- svmClassification(c.prots, df, markerProteins)

test.A <- cls[[1]]$svm.test.prob.out
test.B <- cls[[2]]$svm.test.prob.out

t.n.df <- computeThresholdNeighborhood(test.A, test.B)

all.A <- cls[[1]]$all.prot.pred
all.B <- cls[[2]]$all.prot.pred

n.cls.df <- applyThresholdNeighborhood(all.A, all.B, t.n.df)
}

```

---

calculateCoveredProtein

*Evaluate marker protein coverage*

---

## Description

Given the proteomics data, number of overlapped marker proteins is calculated. Bar plot for each compartment is plotted.

## Usage

```
calculateCoveredProtein(proteinIDs, markerproteins)
```

## Arguments

proteinIDs      character; gene symbol id  
 markerproteins   character; 3365 proteins gene symbol ids

## Value

covered.proteins

## Examples

```

{

df <- loadData(SubCellBarCode::hcc827Ctrl)

c.prots <- calculateCoveredProtein(rownames(df), markerProteins[,1])
}

```

---

|            |                                        |
|------------|----------------------------------------|
| calRowMean | <i>Compute the means of replicates</i> |
|------------|----------------------------------------|

---

### Description

Duplicated fractions A and B are summarized by taking their mean for each protein. After taking the mean, the data log2 transformed. Further, the 5 main fractions are used to check correlation between input datas. It is a helper function.

### Usage

```
calRowMean(d.df)
```

### Arguments

d.df                      data.frame; A data frame of 10 fraction profiles consisting of replicate A and B.

### Value

r.df

### Examples

```
{
  r.df <- calRowMean(SubCellBarCode::hcc827Ctrl)
}
```

---

|                            |                                              |
|----------------------------|----------------------------------------------|
| candidateRelocatedProteins | <i>Identify candidate relocated proteins</i> |
|----------------------------|----------------------------------------------|

---

### Description

Identify candidate condition-dependent relocated proteins by comparing neighborhood classifications with respect to protein-protein pearson correlation and mininum PSM, peptide spectrum matching, count.

### Usage

```
candidateRelocatedProteins(
  sampleCls1,
  s1PSM,
  s1Quant,
  sampleCls2,
  s2PSM,
  s2Quant,
  annotation = FALSE,
  min.psm = 2,
  pearson.cor = 0.8
)
```

**Arguments**

|             |                                                                                                |
|-------------|------------------------------------------------------------------------------------------------|
| sampleCls1  | data.frame; merged classification, combination of compartment and neighborhood classification. |
| s1PSM       | data.frame; minimum PSM count table across ten TMT channel                                     |
| s1Quant     | data.frame; fractionation quantification data                                                  |
| sampleCls2  | data.frame; merged classification, combination of compartment and neighborhood classification. |
| s2PSM       | data.frame; minimum PSM count table across ten TMT channel                                     |
| s2Quant     | data.frame; fractionation quantification data                                                  |
| annotation  | boolean; labeling the selected proteins                                                        |
| min.psm     | numeric; minimum psm, peptide spectra matching value                                           |
| pearson.cor | numeric; pearson correlation threshold                                                         |

**Value**

candidate.df

**Examples**

```
{
  candidate.df <- candidateRelocatedProteins(hcc827GEFClass, hcc827GefPSMCount,
    hcc827GEF, hcc827GEFClass, hcc827GefPSMCount, hcc827GEF,
    annotation = FALSE)
}
```

---

compareCls

*Compare exon and gene centric classifications*

---

**Description**

Comparison of the gene centric and exon centric classification. Additionally, correlation analysis is performed using quantification data.

**Usage**

```
compareCls(geneCls, exonCls)
```

**Arguments**

|         |                                               |
|---------|-----------------------------------------------|
| geneCls | data frame gene centric classification output |
| exonCls | data frame exon centric classification output |

**Value**

c.df

**Examples**

```

{

exon.cls <- data.frame(Protein = c("ENSE00000331854",
                                   "ENSE00000331855",
                                   "ENSE00000331859"),
                      NeighborhoodCls = c("Cytosol",
                                           "Cytosol",
                                           "Cytosol"),
                      CompartmentCls = c("C1", "C1", "C1"),
                      Secretary = c(0.1, 0.1, 0.1),
                      Nuclear = c(0.2, 0.2, 0.2),
                      Cytosol = c(0.2, 0.2, 0.2),
                      Mitochondria = c(0.2, 0.2, 0.2),
                      S1 = c(0.2, 0.2, 0.2),
                      S2 = c(0.2, 0.2, 0.2),
                      S3 = c(0.2, 0.2, 0.2),
                      S4 = c(0.2, 0.2, 0.2),
                      N1 = c(0.2, 0.2, 0.2),
                      N2 = c(0.2, 0.2, 0.2),
                      N3 = c(0.2, 0.2, 0.2),
                      N4 = c(0.2, 0.2, 0.2),
                      C1 = c(0.2, 0.2, 0.2),
                      C2 = c(0.2, 0.2, 0.2),
                      C3 = c(0.2, 0.2, 0.2),
                      C4 = c(0.2, 0.2, 0.2),
                      C5 = c(0.2, 0.2, 0.2),
                      M1 = c(0.2, 0.2, 0.2),
                      M2 = c(0.2, 0.2, 0.2),
                      GeneSymbol = c("COPB1", "COPB1", "COPB1"),
                      PeptideCount = c(2, 4, 7))

gene.cls <- data.frame(Protein = c("COPB1"),
                      NeighborhoodCls = c("Cytosol"),
                      CompartmentCls = c("C1"),
                      Secretary = c(0.1),
                      Nuclear = c(0.2),
                      Cytosol = c(0.2),
                      Mitochondria = c(0.2),
                      S1 = c(0.2),
                      S2 = c(0.2),
                      S3 = c(0.2),
                      S4 = c(0.2),
                      N1 = c(0.2),
                      N2 = c(0.2),
                      N3 = c(0.2),
                      N4 = c(0.2),
                      C1 = c(0.2),
                      C2 = c(0.2),
                      C3 = c(0.2),
                      C4 = c(0.2),
                      C5 = c(0.2),
                      M1 = c(0.2),
                      M2 = c(0.2))

comp.df <- compareCls(gene.cls, exon.cls)

```

```
}
```

---

```
computeThresholdCompartment
```

```
Probability threshold for compartment classification
```

---

## Description

Thresholds for each compartment are decided to get confident predictions.

## Usage

```
computeThresholdCompartment(test.repA, test.repB)
```

## Arguments

|           |                                                                                                   |
|-----------|---------------------------------------------------------------------------------------------------|
| test.repA | data.frame; test predictions, observation and probability vectors for each protein in replicate A |
| test.repB | data.frame; test predictions, observation and probability vectors for each protein in replicate B |

## Value

```
threshold.compartment.df
```

## Examples

```
{
df <- loadData(SubCellBarCode::hcc827Ctrl)

c.prots <- calculateCoveredProtein(rownames(df), markerProteins[,1])

set.seed(7)
c.prots <- sample(c.prots, 550)
cls <- svmClassification(c.prots, df, markerProteins)

test.A <- cls[[1]]$svm.test.prob.out
test.B <- cls[[2]]$svm.test.prob.out

t.c.df <- computeThresholdCompartment(test.A, test.B)
}
```

---

computeThresholdNeighborhood

*Probability threshold for neighborhood classification*


---

**Description**

Thresholds for each neighborhood are decided to get confident predictions.

**Usage**

```
computeThresholdNeighborhood(test.repA, test.repB)
```

**Arguments**

|           |                                                                                                   |
|-----------|---------------------------------------------------------------------------------------------------|
| test.repA | data.frame; test predictions, observation and probability vectors for each protein in replicate A |
| test.repB | data.frame; test predictions, observation and probability vectors for each protein in replicate B |

**Value**

threshold.neighborhood.df

**Examples**

```
{
df <- loadData(SubCellBarCode::hcc827Ctrl)

c.prots <- calculateCoveredProtein(rownames(df), markerProteins[,1])

set.seed(7)
c.prots <- sample(c.prots, 600)
cls <- svmClassification(c.prots, df, markerProteins)

test.A <- cls[[1]]$svm.test.prob.out
test.B <- cls[[2]]$svm.test.prob.out

t.n.df <- computeThresholdNeighborhood(test.A, test.B)
}
```

---

convert2symbol

*Convert identifier to gene symbol*


---

**Description**

Identifier for each feature should be converted into gene symbols unless they are not gene symbols

**Usage**

```
convert2symbol(df, id = "UNIPROT")
```

Arguments

- df data.frame; fractionated proteomics data where data contains 10 columns of duplicated 5 fractionations and rownames must be identifier e.g. UNIPROT, Entrez ID
- id caharacter; identifier id for each protein

Value

- df

Examples

```
{
df <- data.frame(Uniprot = c("A4D0S4","A8TX70","O00305","O00337"),
Organism = rep("Homo Sap.", 4))

rownames(df) <- df$Uniprot
}
```

---

|            |                                 |
|------------|---------------------------------|
| hcc827Ctrl | <i>HCC827 Control Cell Line</i> |
|------------|---------------------------------|

---

Description

Subcellular fractionated cell line.

Usage

```
hcc827Ctrl
```

Format

A data frame where 10480 protein gene-centric ids and 5 replicated subcellular fractions.

References

Orre et al. 2019 Cell 73, 1-17

Examples

```
{
head(hcc827Ctrl)
}
```

---

|                    |                                                   |
|--------------------|---------------------------------------------------|
| hcc827CtrlPSMCount | <i>Minimum PSM Count in HCC827Ctrl Cell Line.</i> |
|--------------------|---------------------------------------------------|

---

**Description**

Minimum PSM, Peptide Sequence Match, Count table for HCC827Ctrl Cell Line.

**Usage**

```
hcc827CtrlPSMCount
```

**Format**

A data frame where 10480 protein gene-centric ids minimum PSM count.

**References**

Orre et al. 2019 Cell 73, 1-17

**Examples**

```
{  
  head(hcc827CtrlPSMCount)  
}
```

---

|            |                                      |
|------------|--------------------------------------|
| hcc827exon | <i>HCC827 Control Exon Cell Line</i> |
|------------|--------------------------------------|

---

**Description**

Exon-centric sub data of hcc827 fractionated data.

**Usage**

```
hcc827exon
```

**Format**

A data frame where 500 exon-centric ensemble identifiers, corresponding gene symbols, 5 replicated subcellular fractions and number of unique peptides matched to associated exon.

**References**

Orre et al. 2019 Cell 73, 1-17

**Examples**

```
{  
  head(hcc827exon)  
}
```

---

`hcc827GEF`*Gefitinib treated HCC827 Cell Line*

---

**Description**

HCC827 cell line was treated with Gefitinib which is EGFR inhibition.

**Usage**`hcc827GEF`**Format**

A data frame where 10398 protein gene-centric ids and 5 replicated subcellular fractions with duplicates.

**References**

Orre et al. 2019 Cell 73, 1-17

**Examples**

```
{  
  head(hcc827GEF)  
}
```

---

`hcc827GEFClass`*Gefitinib treated HCC827 Cell Line Classification*

---

**Description**

Gefitinib treated HCC827 cell line classification contains both neighborhood and compartment level. The data will be used for the relocalization analysis.

**Usage**`hcc827GEFClass`**Format**

A data frame where 10398 protein gene-centric ids and corresponding compartment and neighborhood classification along with classification probabilities.

**References**

Orre et al. 2019 Cell 73, 1-17

**Examples**

```
{  
  head(hcc827GEFClass)  
}
```

---

|                   |                                                         |
|-------------------|---------------------------------------------------------|
| hcc827GefPSMCount | <i>Minimum PSM Count in HCC827 Gefitinib Cell Line.</i> |
|-------------------|---------------------------------------------------------|

---

**Description**

Minimum PSM, Peptide Sequence Match, Count table for HCC827 Gefitinib Cell Line.

**Usage**

```
hcc827GefPSMCount
```

**Format**

A data frame where 10398 protein gene-centric ids minimum PSM count.

**References**

Orre et al. 2019 Cell 73, 1-17

**Examples**

```
{
  head(hcc827GefPSMCount)
}
```

---

|          |                                              |
|----------|----------------------------------------------|
| loadData | <i>Load the fractionated proteomics data</i> |
|----------|----------------------------------------------|

---

**Description**

Sampled median normalized TMT ratios are checked if there is any "NA" value. If any, the corresponding row is filtered out. Later, the data is normalized by taking log2.

**Usage**

```
loadData(protein.data)
```

**Arguments**

|              |                                                                                                                                                        |
|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| protein.data | data.frame; fractionated proteomics data where data contains 10 columns of duplicated 5 fractionations and rownames must be gene-centric protein names |
|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|

**Value**

```
protein.data.df
```

**Examples**

```
{
  df <- loadData(SubCellBarCode::hcc827Ctrl1[1:20,])
}
```

---

|                |                               |
|----------------|-------------------------------|
| markerProteins | <i>Marker Proteins Source</i> |
|----------------|-------------------------------|

---

### Description

Data for the proteins whose localizations were well characterized. It also contains color codes for each compartment and median fractionation profiles for 5 fractions which are Cyto., Nsol., NucI., Horg., Lorg., with replicates A and B. These fractionation profiles will be used for the marker protein quality control.

### Usage

```
markerProteins
```

### Format

A data frame of 3365 proteins as rows and 13 columns headers.

### References

Orre et al. 2019 Cell 73, 1-17

---

|                      |                                                    |
|----------------------|----------------------------------------------------|
| markerQualityControl | <i>Evaluate the quality of the marker proteins</i> |
|----------------------|----------------------------------------------------|

---

### Description

Given the proteomics data, quality of the overlapped marker proteins are evaluated by correlating replicates of fractions.

### Usage

```
markerQualityControl(coveredProteins, protein.data)
```

### Arguments

|                 |                                                                                             |
|-----------------|---------------------------------------------------------------------------------------------|
| coveredProteins | character; list of marker proteins, gene symbols, that are covered in 3365 marker proteins. |
| protein.data    | data.frame; fractionated proteomics data, rownames are gene symbols associated protein.     |

### Value

```
robustMarkers
```

**Examples**

```
{
  df <- loadData(SubCellBarCode::hcc827Ctrl)

  c.prots <- calculateCoveredProtein(rownames(df), markerProteins[,1])

  r.markers <- markerQualityControl(c.prots[1:5], df)
}
```

mergeCls

*Merge compartment and neighborhood classification***Description**

Compartment and neighborhood classifications are merged for the single output.

**Usage**

```
mergeCls(compartmentCls, neighborhoodCls)
```

**Arguments**

**compartmentCls** data.frame; all predictions, including unclassified as well, and probability vectors for each protein in compartment classification

**neighborhoodCls** data.frame; all predictions, including unclassified as well, and probability vectors for each protein in compartment classification

**Value**

```
cls.df
```

**Examples**

```
{
  #create mock data
  com.df <- data.frame(Proteins = "TP53",
    svm.pred = "N1",
    S1 = as.numeric(0.02),
    S2 = as.numeric(0.02),
    S3 = as.numeric(0.02),
    S4 = as.numeric(0.02),
    N1 = as.numeric(0.72),
    N2 = as.numeric(0.02),
    N3 = as.numeric(0.02),
    N4 = as.numeric(0.02),
    C1 = as.numeric(0.02),
    C2 = as.numeric(0.02),
    C3 = as.numeric(0.02),
    C4 = as.numeric(0.02),
    C5 = as.numeric(0.02),
```

```

M1 = as.numeric(0.02),
M2 = as.numeric(0.02))

rownames(com.df) <- "TP53"

neig.df <- data.frame(Proteins = "TP53",
  svm.pred.all = "Nuclear",
  Secretory = as.numeric(0.01),
  Nuclear = as.numeric(0.95),
  Cytosol = as.numeric(0.02),
  Mitochondria = as.numeric(0.02))

rownames(neig.df) <- "TP53"

cls.df <- mergeCls(com.df, neig.df)

}

```

---

mergeProbability

---

Merge compartment probabilities to neighborhood probabilities

---

### Description

Compartment levels classifications are summed up to associated neighborhood levels. It is a helper function.

### Usage

```
mergeProbability(df)
```

### Arguments

**df** data.frame; all predictions at the neighborhood level and probability vectors for each protein

### Value

merged.df

### Examples

```

{

#create mock data
df <- data.frame(Protein = "TP53",
  S1 = as.numeric(0.02),
  S2 = as.numeric(0.02),
  S3 = as.numeric(0.02),
  S4 = as.numeric(0.02),
  N1 = as.numeric(0.72),
  N2 = as.numeric(0.02),
  N3 = as.numeric(0.02),
  N4 = as.numeric(0.02),
  C1 = as.numeric(0.02),

```

```

C2 = as.numeric(0.02),
C3 = as.numeric(0.02),
C4 = as.numeric(0.02),
C5 = as.numeric(0.02),
M1 = as.numeric(0.02),
M2 = as.numeric(0.02))

rownames(df) <- "TP53"

merged.df <- mergeProbability(df)

}

```

plotBarcode

*Visualize the SubCellBarCode***Description**

Stacked bar plot are plotted for compartment and neighborhood level with respect to classification probabilities.

**Usage**

```
plotBarcode(sampleClassification, protein, s1PSM)
```

**Arguments**

|                      |                                                                                                |
|----------------------|------------------------------------------------------------------------------------------------|
| sampleClassification | data.frame; merged classification, combination of compartment and neighborhood classification. |
| protein              | character; protein gene symbol name                                                            |
| s1PSM                | data.frame; minimum PSM count table. Row names should be gene centric protein id.              |

**Value**

proteinPlot

**Examples**

```

{

#create mock data
plot.df <- data.frame(Protein = "TP53",
NeighborhoodCls = "Nuclear",
CompartmentCls = "N1",
Secretory = as.numeric(0.01),
Nuclear = as.numeric(0.95),
Cytosol = as.numeric(0.02),
Mitochondria = as.numeric(0.02),
S1 = as.numeric(0.02),
S2 = as.numeric(0.02),
S3 = as.numeric(0.02),

```

```

S4 = as.numeric(0.02),
N1 = as.numeric(0.72),
N2 = as.numeric(0.02),
N3 = as.numeric(0.02),
N4 = as.numeric(0.02),
C1 = as.numeric(0.02),
C2 = as.numeric(0.02),
C3 = as.numeric(0.02),
C4 = as.numeric(0.02),
C5 = as.numeric(0.02),
M1 = as.numeric(0.02),
M2 = as.numeric(0.02))

rownames(plot.df) <- "TP53"

psm.df <- data.frame(Protein = "TP53",
  PSMs.for.quant = as.numeric(31))

rownames(psm.df) <- "TP53"

proteinPlot <- plotBarcode(plot.df, "TP53", psm.df)
}

```

---

plotMultipleProtein      *Visualization of multiple protein localizations*

---

## Description

Distributions of subcellular localizations of multiple proteins both at the compartment and neighborhood level are plotted.

## Usage

```
plotMultipleProtein(sampleClassification, proteinList)
```

## Arguments

|                      |                                                                                                             |
|----------------------|-------------------------------------------------------------------------------------------------------------|
| sampleClassification | data.frame; merged classification, combination of compartment and neighborhood classifications per protein. |
| proteinList          | vector; protein gene symbol names.                                                                          |

## Value

multipleProt.df

## Examples

```

{
  proteasome26s <- c("PSMA7", "PSMC3", "PSMB1", "PSMA1", "PSMA3", "PSMA4",
    "PSMA5", "PSMB4", "PSMB6", "PSMB5", "PSMC2", "PSMC4", "PSMB3", "PSMB2",
    "PSMD4", "PSMA6", "PSMC1", "PSMC5", "PSMC6", "PSMB7", "PSMD13")
}

```

```
exp.cls.df <- SubCellBarCode::hcc827GEFCClass

multipleProt.df <- plotMultipleProtein(exp.cls.df, proteasome26s )

}
```

---

|                   |                                                                    |
|-------------------|--------------------------------------------------------------------|
| replacePrediction | <i>Replace compartment predictions to neighborhood predictions</i> |
|-------------------|--------------------------------------------------------------------|

---

## Description

Compartment level classifications are replaced with neighborhood level assignment. It is a helper function.

## Usage

```
replacePrediction(df, column = c("svm.pred.all", "Observation", "svm.pred"))
```

## Arguments

|        |                                                                                               |
|--------|-----------------------------------------------------------------------------------------------|
| df     | data.frame; all predictions at the compartment level and probability vectors for each protein |
| column | character; selected column in the data frame, df                                              |

## Value

replaced.df

## Examples

```
{

#define mock data frame
df <- data.frame(svm.pred.all = c("S1","S2","S3","S4",
"N1","N2","N3","N4",
"C1","C2","C3","C4","C5",
"M1","M2"))

df$svm.pred.all <- as.character(df$svm.pred.all)
df$Prob <- "1"

df <- replacePrediction(df, column = "svm.pred.all")
}
```

---

|            |                                                               |
|------------|---------------------------------------------------------------|
| sankeyPlot | <i>Sankey plot for condition-dependent protein relocation</i> |
|------------|---------------------------------------------------------------|

---

**Description**

Identify candidate condition-dependent relocated proteins by comparing neighborhood classifications.

**Usage**

```
sankeyPlot(sampleCls1, sampleCls2)
```

**Arguments**

|            |                                                                                                |
|------------|------------------------------------------------------------------------------------------------|
| sampleCls1 | data.frame; merged classification, combination of compartment and neighborhood classification. |
| sampleCls2 | data.frame; merged classification, combination of compartment and neighborhood classification. |

**Value**

label.link.df

**Examples**

```
{
  exp.cls.df <- SubCellBarCode::hcc827GEFCClass
  sankeyData <- sankeyPlot(exp.cls.df, exp.cls.df)
}
```

---

|                |                                                                              |
|----------------|------------------------------------------------------------------------------|
| sumProbability | <i>Sum compartment test data probabilities to neighborhood probabilities</i> |
|----------------|------------------------------------------------------------------------------|

---

**Description**

Compartment levels classifications on the test data are summed up to associated neighborhood levels. It is a helper function.

**Usage**

```
sumProbability(df)
```

**Arguments**

|    |                                                                                                           |
|----|-----------------------------------------------------------------------------------------------------------|
| df | data.frame; test data classifications at the neighborhood level and probability vectors for each protein. |
|----|-----------------------------------------------------------------------------------------------------------|

**Value**

summed.df

**Examples**

```
{
  #create mock data
  df <- data.frame(Protein = "TP53",
    svm.pred = "N1",
    S1 = as.numeric(0.02),
    S2 = as.numeric(0.02),
    S3 = as.numeric(0.02),
    S4 = as.numeric(0.02),
    N1 = as.numeric(0.72),
    N2 = as.numeric(0.02),
    N3 = as.numeric(0.02),
    N4 = as.numeric(0.02),
    C1 = as.numeric(0.02),
    C2 = as.numeric(0.02),
    C3 = as.numeric(0.02),
    C4 = as.numeric(0.02),
    C5 = as.numeric(0.02),
    M1 = as.numeric(0.02),
    M2 = as.numeric(0.02))

  rownames(df) <- "TP53"

  sum.df <- sumProbability(df)
}
```

svmClassification

*Protein subcellular localization classification***Description**

Support Vector Machine classifier is trained and used for prediction of protein subcellular localization

**Usage**

```
svmClassification(markerProteins, protein.data, markerprot.df)
```

**Arguments**

|                |                                                                                                           |
|----------------|-----------------------------------------------------------------------------------------------------------|
| markerProteins | character; robust marker proteins along with subcellular localization that are present in the given data. |
| protein.data   | data.frame; fractionated proteomics data                                                                  |
| markerprot.df  | data.frame; collection of marker proteins along with corresponding subcellular localization               |

**Value**

all.classifications

**Examples**

```
{
  df <- loadData(SubCellBarCode::hcc827Ctrl)

  c.prots <- calculateCoveredProtein(rownames(df), markerProteins[,1])

  set.seed(7)
  c.prots <- sample(c.prots, 500)
  cls <- svmClassification(c.prots, df, markerProteins)
}
```

---

svmExternalData

*Peptide/exon/transcript centric or PTM enriched classification*

---

**Description**

Peptide/exon/transcript centric or PTM enriched classification is applied to predict localization of them.

**Usage**

```
svmExternalData(df, modelA, modelB)
```

**Arguments**

|        |                                          |
|--------|------------------------------------------|
| df     | data frame fractionated additional data  |
| modelA | model for the replicate A classification |
| modelB | model for the replicate B classification |

**Value**

c.cls.df

**Examples**

```
{
  df <- loadData(SubCellBarCode::hcc827Ctrl)

  c.prots <- calculateCoveredProtein(rownames(df), markerProteins[,1])

  set.seed(7)
  c.prots <- sample(c.prots, 550)
  cls <- svmClassification(c.prots, df, markerProteins)
  modelA <- cls[[1]]$model
  modelB <- cls[[2]]$model
}
```

```
exon.cls <- svmExternalData(SubCellBarCode::hcc827exon,
modelA = modelA, modelB = modelB)
}
```

---

|                   |                                                      |
|-------------------|------------------------------------------------------|
| tsneVisualization | <i>Visualization of marker proteins by t-SNE map</i> |
|-------------------|------------------------------------------------------|

---

## Description

The marker proteins are visualized in 3D t-SNE map to see the distributions of the marker proteins.

## Usage

```
tsneVisualization(protein.data, markerProteins, dims, theta, perplexity)
```

## Arguments

|                |                                                                                                                                        |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------|
| protein.data   | data.frame; fractionated proteomics data                                                                                               |
| markerProteins | character; robust marker proteins, gene symbols, that are present in the given data and overlapped with package's marker protein list. |
| dims           | integer; dimensionality                                                                                                                |
| theta          | numeric; Speed/accuracy trade-off ,increase for less accuracy                                                                          |
| perplexity     | integer; Perplexity parameter                                                                                                          |

## Value

tsneMap.df

## Examples

```
{
df <- loadData(SubCellBarCode::hcc827Ctrl)

c.prots <- calculateCoveredProtein(rownames(df), markerProteins[,1])

set.seed(21)
tsneMap.df <- tsneVisualization(protein.data = df,
markerProteins = c.prots[1:20],
dims = 2, theta = c(0.4), perplexity = c(5))
}
```

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