

# Package ‘GAprediction’

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**Type** Package

**Title** Prediction of gestational age with Illumina HumanMethylation450 data

**Version** 1.39.0

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**Description** [GAprediction] predicts gestational age using Illumina HumanMethylation450 CpG data.

**License** GPL (>=2)

**LazyData** TRUE

**Depends** R (>= 3.3)

**Imports** glmnet, stats, utils, Matrix

**biocViews** ImmunoOncology, DNAMethylation, Epigenetics, Regression, BiomedicalInformatics

**Suggests** knitr, rmarkdown

**VignetteBuilder** knitr

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`extractSites`*Extract CpG sites for gestational age prediction*

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### Description

The function allows the user to extract CpG sites used for gestational age prediction with the function `predictGA`.

### Usage

```
extractSites(type="se")
```

### Arguments

The argument `type=c("se", "min", "all")` can be used to specify which CpGs are to be extracted. "se" designates the CpGs needed by the `predictGA` function if the penalty term `lambda` is to be set to one standard error within the minimum, "min" specifies the minimum `lambda`, while "all" returns the complete sets of CpGs in the `UL.mod.cv` object.

`type` - a string that can be "se" (default), "min" or "all", depending on which CpGs is wanted by the user.

### Details

Use this function if `predictGA` fails due to missing predictor CpGs, or to see which CpGs are used by `predictGA` for gestational age prediction.

### Value

Returns a vector with the requested CpG sites.

### Author(s)

Jon Bohlin

### See Also

`predictGA`, `UL.mod.cv`

### Examples

```
CpGs <- extractSites( type="se" )
```

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predictGA

*Predict gestational age in days from conception*

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### Description

The function predictGA takes a matrix with Illumina HumanMethylation450 type DNA methylation data. Column names must designate CpG sites (i.e. 'cgXXXXXX', X=number) and row names samples IDs.

### Usage

```
predictGA(mldat, transp=TRUE, se=TRUE)
```

### Arguments

mldat	A matrix containing DNA methylation beta values ( $0 \leq \text{beta} \leq 1$ )
transp	If TRUE (default), the transpose is automatically taken if the number of rows is greater than the number of columns.
se	If se=TRUE, the estimated coefficients are based on the prediction model with the lambda penalty term being allowed to vary up to one standard error within the minimum. If se=FALSE, the minimum lambda is assumed.

### Details

The minimum lambda (se=FALSE) may result in slightly better predictions, however substantially more CpG sites are needed for estimation. Since the prediction difference is hardly noticeable se=TRUE is the default option.

### Value

The function returns estimated gestational age predictions, together with samples IDs as row names, in a data.frame object.

### Note

Requires quite a bit of memory due to the large DNA methylation matrix required for the prediction model.

### Author(s)

Jon Bohlin

### References

Jon Bohlin, Siri E. Haaberg, Per Magnus, et al. (2016). Prediction of gestational age based on genome-wide differentially methylated regions. *Genome Biology* (in review)

Jerome Friedman, Trevor Hastie, Robert Tibshirani (2010). Regularization Paths for Generalized Linear Models via Coordinate Descent. *Journal of Statistical Software*, 33(1), 1-22. URL <http://www.jstatsoft.org/v33/i01/>.

## Examples

```
## Make a mock Illumina HumanMethylation450 type DNA methylation matrix
cpgs <- extractSites( type="se" )
allcpgs <- extractSites( type="all" )
numsamples <- 100
mlmatr <- matrix( NA, ncol=length( allcpgs ), nrow=numsamples )
mlmatr <- data.frame( mlmatr )
for( i in cpgs )
  mlmatr[,i] <- runif( numsamples, min=0, max=1 )
## Perform gestational age prediction
mypred <- predictGA( mlmatr )
```

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UL.mod.cv

*A glmnet-object trained to perform gestational age prediction.*

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## Description

The glmnet-object consists of a Lasso-regression model 'trained' to perform gestational age predictions. It is called by the wrapper function `predictGA`, which is more user-friendly.

## Details

The trained Lasso-model contains cross-validated estimates of the penalty term lambda that regulates the number of CpG sites needed for gestational age prediction. It is called by the glmnet-inherited predict function with a matrix of CpG betas (with values between 0 and 1) that conforms to the Illumina HumanMethylation450 platform. The gestational age estimates used to train the regression model were taken from the MoBa cohort and are based on ultrasound.

## Source

Magnus P, Irgens LM, Haug K, Nystad W, Skjaerven R, Stoltenberg C, MoBa Study Group. Cohort profile: the Norwegian mother and child cohort study (MoBa). *International journal of epidemiology*. 2006 Oct 1;35(5):1146-50.

## References

Jerome Friedman, Trevor Hastie, Robert Tibshirani (2010). Regularization Paths for Generalized Linear Models via Coordinate Descent. *Journal of Statistical Software*, 33(1), 1-22. URL <http://www.jstatsoft.org/v33/i01/>.

## Examples

```
## Extract all non-zero regression coefficients
temp <- as.matrix( coef( UL.mod.cv ) )
allNonZeroCoefs <- rownames( temp )[ temp[,1]!=0 ]
allNonZeroCoefs[ -1 ]
```

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