ASSESSMENT OF LOCAL INFLUENCE FOR THE ANALYSIS OF AGREEMENT

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DESCRIPTION. Functions to perform estimation and local influence for Lin's (1989, 2000) concordance correlation coefficient and the probability of agreement

CONFINT.CCC: CONFIDENCE INTERVALS FOR THE CONCORDANCE CORRELATION COEFFICIENT

Description.

It produces confidence intervals for the Lin's concordance correlation coefficient.

Usage.

```
confint.ccc(object, method = "z-transform", level = 0.95)
```

Argument.

object An object of class 'ccc' representing the estimation of the concordance correlation coefficient.

method a character string, indicating the method to be used. Options available are `"z-transform"` or `"asymp"`.

level the confidence level, must be a single number between 0 and 1.

Value.

It returns a matrix with the estimation, standard error and the lower and upper bounds for the CCC.

References.

Lin, L. (1989). A concordance correlation coefficient to evaluate reproducibility. *Biometrics* **45**, 255-268.

Lin, L. (2000). A note on the concordance correlation coefficient. *Biometrics* **56**, 324-325.

Examples.

```
load("PSG.rda")
fm <- fit.ccc(~ manual + automated, data = PSG)
confint.ccc(fm, method = "asymp") # print asymptotic 95% CI
# Output:
   parameter          SE     lower      upper
CCC 0.6744407 0.05626925 0.564155 0.7847264
```

CONFINT.POA: CONFIDENCE INTERVALS FOR THE PROBABILITY OF AGREEMENT

Description.

It produces confidence intervals for the probability of agreement.

Usage.

```
confint.poa(object, level = 0.95, cad = 2)
```

Argument.

object An object of class 'ccc' representing the estimation of the concordance
        correlation coefficient.
 level the confidence level, must be a single number between 0 and 1.
   cad clinically acceptable difference (CAD), defined as $CAD = (-c, c)$. By de-
        fault, $CAD = (-2, 2)$.

Value.

It returns a vector with the estimation, standard error and the lower and upper
bounds for the probability of agreement.

References.

Stevens, N.T., Steiner, S.H., MacKay, R.J. (2017). Assessing agreement between two
measurement systems: An alternative to the limits of agreement approach. *Statistical
Methods in Medical Research* **26**, 2487-2504.

Leal, C., Galea, M., Osorio, F. (2018). Assessment of local influence for the analysis of
agreement. *Unpublished manuscript.*

Examples.

```
load("PSG.rda")
fm <- fit.ccc(~ manual + automated, data = PSG)
confint.poa(fm, cad = 2) # print asymptotic 95% CI
# Output:
parameter         SE     lower     upper
PoA 0.9753448 0.03410157 0.908507 1.042183
```

**DERIVATIVES.CCC: DERIVATIVES OF THE CONCORDANCE CORRELATION
COEFFICIENT**

Description.

Computes first- and second-order derivatives of CCC objective function, which is
used as an influence function.

Note: this function is not pretended to be used directly by the user.

Usage.

```
derivatives.ccc(object, which =  1:2)
```

Argument.

object an object of class 'ccc' representing the estimation of the concordance correlation coefficient.

which integer vector, order of the required derivatives.

Value.

Funtion 'derivatives.ccc' returns first and/or second derivatives of the CCC objective function with respect to the *perturbation* parameter.

References.

Leal, C., Galea, M., Osorio, F. (2018). Assessment of local influence for the analysis of agreement. *Unpublished manuscript.*

DERIVATIVES.POA: DERIVATIVES OF THE PROBABILITY OF AGREEMENT

Description.

Computes first- and second-order derivatives of probability of agreement objective function, which is used as an influence function.

Note: this function is not pretended to be used directly by the user.

Usage.

```
derivatives.poa(object, cad = 2, which =  1:2)
```

Argument.

object an object of class 'ccc' representing the estimation of the concordance correlation coefficient.

cad clinically acceptable difference (CAD), defined as $CAD = (-c, c)$. By default, $CAD = (-2, 2)$.

which integer vector, order of the required derivatives.

Value.

Funtion 'derivatives.poa' returns first and/or second derivatives of the probability of agreement objective function with respect to the *perturbation* parameter.

References.

Leal, C., Galea, M., Osorio, F. (2018). Assessment of local influence for the analysis of agreement. *Unpublished manuscript.*

FIT.CCC: LIN'S CONCORDANCE CORRELATION COEFFICIENT

Description.

Calculates Lin's (1989, 2000) concordance correlation coefficient for evaluationg the degree of agreement between measurements generated by two different methods.

Usage.

```
fit.ccc(x, data, subset, na.action)
```

Argument.

> x a formula or a numeric matrix or an object that can be coerced to a numeric matrix.
>
> data an optional data frame (or similar: see `model.frame`), used only if `x` is a formula. By default the variables are taken from `environment(formula)`.
>
> subset an optional expression indicating the subset of the rows of data that should be used in the fitting process.
>
> na.action a function that indicates what should happen when the data contain `NA`s.

Value.

A list with class 'ccc' containing the following components:

> call a list containing an image of the `fit.ccc` call that produced the object.
>
> x `data.frame` used in the estimation process.
>
> xbar estimate of the mean vector.
>
> S estimate of the covariance matrix.
>
> ccc estimate of the concordance correlation coefficient.
>
> var.ccc asymptotic variance of the concordance correlation coefficient estimate.
>
> accuracy estimate of the accuracy coefficient.
>
> precision estimate of the precision coefficient.

References.

Lin, L. (1989). A concordance correlation coefficient to evaluate reproducibility. *Biometrics* **45**, 255-268.

Lin, L. (2000). A note on the concordance correlation coefficient. *Biometrics* **56**, 324-325.

Examples.

```
load("PSG.rda")
fm <- fit.ccc(~ manual + automated, data = PSG)
fm
# Output:
Call:
fit.ccc(x = ~manual + automated, data = PSG)

Coefficients:
  estimate   variance   accuracy precision
    0.6744     0.0032     0.9430    0.7152
```

INFLUENCE.CCC: LOCAL INFLUENCE FOR THE CONCORDANCE CORRELATION COEFFICIENT

Description.

Computes influence measures for the concordance correlation coefficient.

Usage.

```
influence.ccc(object, method = "FI")
```

Argument.

object an object of class 'ccc' representing the estimation of the concordance correlation coefficient.

method character string specifying the 'method' to use. The default method is first order influence "FI" measure. Other possible values are "SI", "normal" and "conformal" for second order influence measure, normal and conformal curvatures, respectively.

Value.

A list with class 'influence.ccc' containing the following components:

hmax direction of maximum local slope ("FI") or largest curvature ("SI", "normal" or "conformal").

vectors (generalized) eigenvectors associated with the non-null (generalized) eigenvalues of the (relative) curvature matrix (only present if method !="FI").

gradient gradient of CCC objective function (only present if method = "FI").

References.

Leal, C., Galea, M., Osorio, F. (2018). Assessment of local influence for the analysis of agreement. *Unpublished manuscript.*

Examples.

```
load("PSG.rda")
fm <- fit.ccc(~ manual + automated, data = PSG)
z  <- influence.ccc(fm, method = "FI")
z
## Output:
Call:
influence.ccc(object = fm)

Cutoff: 0.2481488
Influential observations:
[1]  1 30 79

## index plot of maximum local slope
plot(z, idn = 3)
```

INFLUENCE.POA: LOCAL INFLUENCE FOR THE PROBABILITY OF AGREEMENT

Description.

Computes influence measures for the probability of agreement.

Usage.

```
influence.poa(object, cad = 2, method = "FI")
```

Argument.

object an object of class 'ccc'.

  cad clinically acceptable difference (CAD), defined as $CAD = (-c, c)$. By default, $CAD = (-2, 2)$.

method character string specifying the 'method' to use. The default method is first order influence "FI" measure. Other possible values are "SI", "normal" and "conformal" for second order influence measure, normal and conformal curvatures, respectively.

Value.

A list with class 'influence.poa' containing the following components:

   hmax direction of maximum local slope ("FI") or largest curvature ("SI", "normal" or "conformal").

vectors (generalized) eigenvectors associated with the non-null (generalized) eigenvalues of the (relative) curvature matrix (only present if method !="FI").

gradient gradient of probability of agreement objective function (only present if method = "FI").

References.

Leal, C., Galea, M., Osorio, F. (2018). Assessment of local influence for the analysis of agreement. *Unpublished manuscript.*

Examples.

```
load("PSG.rda")
fm <- fit.ccc(~ manual + automated, data = PSG)
z  <- influence.poa(fm, method = "FI")
## index plot of maximum local slope
plot(z, idn = 3)
```

PSG: CLINICAL TRIAL ON TRANSIENT SLEEP DISORDER

Description.

Data from a clinical study to comparing automated and semi-automated scoring of Polysomnographic (PSG) recordings used to diagnose transient sleep disorder. The study considered 82 patients who were given a sleep inducing drug (Zolpidem 10 mg). Measurements of latency to persistent sleep (LPS: lights out to the beginning of 10 consecutive minutes of uninterrupted sleep) were obtained using six different methods.

Usage.

```
load("PSG.rda")
```

Format.

A data frame with 82 observations on the following 3 variables.

`manual` full manual scoring
`automated` automated scoring by Morpheus software.
`partial` automated scoring by Morpheus with partial manual review.

References.

Feng, D., Baumgartner, R., Svetnik, V. (2015). A robust bayesian estimate of the concordance correlation coefficient. *Journal of Biopharmaceutical Statistics* **25**, 490-507.

Svetnik, V., Ma, J., Soper, K.A., Doran, S., Renger, J.J., Deacon, S., Koblan, K.S. (2007). Evaluation of automated and semi-automated scoring of polysomnographic recordings from a clinical trial using zolpidem in the treatment of insomnia. *SLEEP* **30**, 1562-1574.

Lin, L. (2000). A note on the concordance correlation coefficient. *Biometrics* **56**, 324-325.

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