

# Package ‘cgmanalysis’

February 12, 2019

**Title** Clean and Analyze Continuous Glucose Monitor Data

**Version** 2.2

**Description** This code provides several different functions for cleaning and analyzing continuous glucose monitor data. Currently it works with 'Dexcom' (<<https://www.dexcom.com>>), 'iPro 2' (<<http://professional.medtronicdiabetes.com/ipro2-professional-cgm>>), Diasend (<<https://diasend.com/us>>), Libre (<<https://www.freestylelibre.us/>>) or Carelink (<<https://www.medtronicdiabetes.com/products/carelink-personal-diabetes-software>>) data. The `cleandata()` function takes a directory of CGM data files and prepares them for analysis. `cgmvariables()` iterates through a directory of cleaned CGM data files and produces a single spreadsheet with data for each file in either rows or columns. The column format of this spreadsheet is compatible with REDCap data upload ("--1" is added to each subject ID automatically for double data entry). `cgmreport()` also iterates through a directory of cleaned data, and produces PDFs of individual and aggregate AGP plots. Please visit <<https://github.com/childhealthbiostatscore/R-Packages/>> to download the new-user guide.

**Depends** R (>= 3.4.0)

**License** CC0

**Encoding** UTF-8

**LazyData** true

**RoxygenNote** 6.1.1

**Imports** ggplot2, lubridate, pracma, zoo, pastecs, tools, gdata, readr

**NeedsCompilation** no

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**Repository** CRAN

**Date/Publication** 2019-02-11 23:53:35 UTC

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cgmreport	<i>Generate AGP</i>
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### Description

This function takes a directory of cleaned CGM data and generates two aggregate AGPs for all of the files combined. One aggregate AGP is produced using Tukey smoothing, and the other uses ggplot's built in LOESS smoothing function. The function also produces an AGP plot with each unique subject plotted individually on the same graph (using LOESS smoothing).

### Usage

```
cgmreport(inputdirectory, outputdirectory = tempdir(), tz = "UTC",
yaxis = c(0,400))
```

### Arguments

inputdirectory	The directory containing all cleaned, formatted CGM data to be analyzed.
outputdirectory	The directory where plot PDF files should be written.
tz	The time zone in which the data were recorded.
yaxis	The range of the yaxis in mg/dL.

### Value

Aggregate and per subject AGP reports based on all of the cleaned CGM data in the input directory.

### Examples

```
cgmreport(system.file("extdata","Cleaned",package = "cgmanalysis"))
```

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cgmvariables	<i>Calculate CGM Variables</i>
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### Description

This function takes cleaned CGM data and returns clinically relevant measures (e.g. percent time spent over 140, MAGE, MODD, etc.).

## Usage

```
cgmvariables(inputdirectory,  
outputdirectory = tempdir(),  
outputname = "REDCap Upload",  
aboveexcursionlength = 35,  
belowexcursionlength = 10,  
magedef = "1sd",  
congan = 1,  
daystart = 6,  
dayend = 22,  
format = "rows")
```

## Arguments

inputdirectory	The directory containing cleaned CSV files for analysis.
outputdirectory	The directory where you would like the results spreadsheet to be written.
outputname	The name of the file containing final CGM variables (without the file extension).
aboveexcursionlength	The number of minutes blood sugar must be above threshold to count an excursion.
belowexcursionlength	The number of minutes blood sugar must be below threshold to count an excursion.
magedef	How large an excursion needs to be in order to count in the MAGE calculation (e.g. greater than 1 standard deviation).
congan	CONGA interval in hours.
daystart	The numeric hour at which daytime should start (e.g. to start counting day time at 6:00am, set daystart = 6).
dayend	The numeric hour at which daytime should end (this parameter uses military time, so to stop counting day time at 10:00pm, set dayend = 22).
format	Whether observations are in rows or columns.

## Details

All files must be saved as a csv, and must have three columns, the first of which contains the subject ID in the first cell and date of CGM placement in the second (see example files). The names of the columns must be "subjectid" "timestamp" and "sensorglucose" (without quotes) respectively. Files can be cleaned and formatted using this package's cleandata() function.

## Value

A data frame containing calculated CGM variables, with each column representing one CGM file.

## Examples

```
cgmvariables(system.file("extdata", "Cleaned", package = "cgmanalysis"))
```

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`cleandata`*Clean CGM Data*

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**Description**

This function returns cleaned CGM files for analysis. Files must not be edited, and should be saved in the original format. If any files need to be edited manually, please save them in the format specified by the `cgmvariables()` function. If this function is unable to read your unedited CGM data, it may help to save your data in the format above.

**Usage**

```
cleandata(inputdirectory,  
outputdirectory = tempdir(),  
removegaps = TRUE,  
gapfill = TRUE,  
maximumgap = 20)
```

**Arguments**

<code>inputdirectory</code>	The directory containing CSV files for cleaning prior to analysis.
<code>outputdirectory</code>	The directory where cleaned CSV files will be written.
<code>removegaps</code>	Determines whether the data are cleaned or not. If set to TRUE, any gaps in the data will be removed along with the 24 hours of data containing the gap(s). The tail end of the data will also be trimmed to ensure the timeseries is in discrete 24 hour chunks.
<code>gapfill</code>	If set to TRUE (and if <code>removegaps = TRUE</code> ), gaps smaller than or equal to <code>maximumgap</code> will be interpolated rather than removed.
<code>maximumgap</code>	Allows the user to determine the longest data gap (in minutes) that will be interpolated.

**Details**

Because Diasend data is exported in an Excel document containing multiple tabs, the CGM data must be in the first tab in order to be read effectively.

**Examples**

```
## Not run: cleandata(system.file("extdata", "De-identified",  
package = "cgmanalysis"))  
## End(Not run)
```

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