

Package ‘PamBinaries’

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Title Read and Process 'Pamguard' Binary Data

Version 1.6.0

Description Functions for easily reading and processing binary data files created by 'Pamguard' (<<https://www.pamguard.org/>>). All functions for directly reading the binary data files are based on 'MATLAB' code written by Michael Oswald.

Depends R (>= 3.4.0)

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Suggests testthat

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contourToFreq	<i>Add Frequency and Time to Pamguard Whistle Binaries</i>
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Description

Adds items freq and time to a Pamguard binary file from the Whistle & Moan Detector

Usage

```
contourToFreq(data, verbose = FALSE)
```

Arguments

data	either a PamBinary class object or just the \$data from a PamBinary object
verbose	logical flag to print calculated parameters

Value

data with items `freq` and `time` added. These use the calculated FFT window length, hop size, and sample rate to compute the frequency and time values of the saved whistle contour

Author(s)

Taiki Sakai <taiki.sakai@noaa.gov>

Examples

```
# load example whistle file
wmFile <- system.file('extdata', 'WM.pgdf', package='PamBinaries')
wmData <- loadPamguardBinaryFile(wmFile)
# converts contour and FFT slice numbers to frequency and time values
wmData <- contourToFreq(wmData)
wmData$data[[1]]$contour
wmData$data[[1]]$freq
wmData$data[[1]]$time
```

convertPgDate

Convert Pamguard Numeric Date to POSIXct

Description

a simple helper to convert Pamguard's numeric date to POSIXct format

Usage

```
convertPgDate(dateNum)
```

Arguments

`dateNum` date as a numeric, seconds since 1970-01-01 per standard Pamguard output. Timezone is UTC

Value

A POSIXct date in UTC

Author(s)

Taiki Sakai <taiki.sakai@noaa.gov>

Examples

```
# load the example click binary data, leaving date as numeric
clickFile <- system.file('extdata', 'Click.pgdf', package='PamBinaries')
clickData <- loadPamguardBinaryFile(clickFile, convertDate = FALSE)
# convert date to POSIXct
convertPgDate(clickData$data[[1]]$date)
```

countChannels

Count Number of Active Channels

Description

Counts the number of active channels given a channel mapping

Usage

```
countChannels(channelMap)
```

Arguments

channelMap Mapping of channels as a binary number

Value

The number of active channels (number of ones)

Note

Altered from original script to loop through 30 instead 32 because R stores only 32 bit integers. Should not ever have enough channels for this to matter.

Author(s)

Taiki Sakai <taiki.sakai@noaa.gov>

dateNumToMillis	<i>Convert Date Number to Milliseconds</i>
-----------------	--

Description

Converts numeric date to millisecond date.

Usage

```
dateNumToMillis(datenum)
```

Arguments

datenum	Numeric value of a date.
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Value

Date as milliseconds

Note

Conversion to milliseconds to match how Java stores dates. Doesn't appear to ever be used.

Author(s)

Taiki Sakai <taiki.sakai@noaa.gov>

loadBackgroundNoise	<i>Load and Format Background Noise Data</i>
---------------------	--

Description

Reads and formats background noise data from Panguard binary files or if not present in the original file will try to read the accompanying .pgnf noise file if it exists

Usage

```
loadBackgroundNoise(x)
```

```
plotBackgroundNoise(x)
```

```
combineBackgroundNoise(x, forPlot = FALSE)
```

Arguments

x	character pointing to a Pamguard binary file, or a PamBinary object created by <code>loadPamguardBinaryFile</code> . For plotting or combining, either of these or the output from <code>loadBackgroundNoise</code>
forPlot	logical flag when combining noise data. If used for plotting purposes this will insert NA columns into background data so that images show up with time gaps as expected. Leave as FALSE unless you are sure you want this.

Value

A list with times storing the POSIXct time of each background measurement, and background a matrix of background values. For binary data based on spectrogram measurements, there will also be freq the frequency in Hertz for each column of background measurement

Author(s)

Taiki Sakai <taiki.sakai@noaa.gov>

Examples

```
# load the example click binary data, leaving date as numeric
gplFile <- system.file('extdata', 'GPL.pgdf', package='PamBinaries')
gplNoise <- loadBackgroundNoise(gplFile)
plotBackgroundNoise(gplNoise)
```

loadPamguardBinaryFile

Load Pamguard Binary File

Description

This function will load in the data from a Pamguard binary file. It will figure out the type of data being read based on the header of the file. All functions based on Matlab code written by Michael Oswald.

Usage

```
loadPamguardBinaryFile(
  fileName,
  skipLarge = FALSE,
  skipData = FALSE,
  debug = FALSE,
  keepUIDs = NULL,
  convertDate = FALSE,
  ...
)
```

Arguments

fileName	The name of the binary file to be read
skipLarge	Should we skip large parts of binaries? Currently only applicable to whistle, click, and DIFAR data
skipData	Should we skip all data and only read headers and footers?
debug	logical flag to show more info on errors
keepUIDs	If not NULL, a vector of UIDs to read. All UIDs not in this vector will not be read.
convertDate	logical flag to convert date from numeric to POSIXct. Defaults to FALSE for speed, can reduce time by
...	Arguments passed to other functions

Value

This function returns a list containing two objects. Data contains all the binary data read. fileInfo contains metadata information for the file.

Author(s)

Taiki Sakai <taiki.sakai@noaa.gov>

Examples

```
# read example whistle data
wmFile <- system.file('extdata', 'WM.pgdf', package='PamBinaries')
whistleData <- loadPamguardBinaryFile(wmFile)
# works the same for different kinds of binary files
clickFile <- system.file('extdata', 'Click.pgdf', package='PamBinaries')
clickData <- loadPamguardBinaryFile(clickFile)
# convert date to POSIXct (default does not because it is faster)
clickPOSIX <- loadPamguardBinaryFile(clickFile, convertDate = TRUE)
clickData$data[[1]]$date
clickPOSIX$data[[1]]$date
# read only the fileInfo portion, has empty $data item
clickInfo <- loadPamguardBinaryFile(clickFile, skipData = TRUE)
# skip reading the large click waveforms, much faster if you dont need them
clickLess <- loadPamguardBinaryFile(clickFile, skipLarge = TRUE)
object.size(clickData)
object.size(clickLess)
# only read specific UID numbers
clickSpecific <- loadPamguardBinaryFile(clickFile, keepUIDs = c(4000006, 4000007))
names(clickSpecific$data)
```

millisToDateNum *Convert Java Millisecond Time to R*

Description

Converts Java millisecond time into numeric time that R uses.

Usage

```
millisToDateNum(millis)
```

Arguments

millis Millisecond time from Java

Value

Numeric time used by R.

Note

Original function was more relevant as Matlab and Java use different time origins. Java & R both use 1970-01-01, but Java stores as milliseconds vs seconds in R.

Author(s)

Taiki Sakai <taiki.sakai@noaa.gov>

pamBinRead *Read Pamguard Binary Data*

Description

A wrapper for reading various types of binary data.

Usage

```
pamBinRead(  
  fid,  
  what = c("int8", "int16", "int32", "int64", "uint8", "uint16", "float", "double",  
           "character"),  
  n,  
  seek = FALSE  
)
```

Arguments

fid	The binary file being read
what	The type of data to read. Int64 is not handled natively by R, see note.
n	The number of objects to read.
seek	Whether or not to just seek instead of reading

Value

Data of the type and number specified.

Note

R does not natively support 64-bit integers. Current implementation is to read an int64 as 8 separate 1-byte raw pieces. These are converted from hexadecimal, shifted by the appropriate power of 2, then summed. Currently cannot read more than one int64 at a time, shouldn't be necessary.

Author(s)

Taiki Sakai <taiki.sakai@noaa.gov>

pbToDf

Convert a PamBinary Object to Data Frame

Description

Converts a PamBinary object into a data frame. The data.frame will combine all of the data from the data part of the PamBinary object, but will not include annotations data, click waveforms, DIFAR demux data, or contours from the WMD detector. These are skipped because they are either inconsistent in their size, or are large objects. The function pbToDf is also called when `as.data.frame` is called on a PamBinary class object.

Usage

```
pbToDf(pb, templateNames = NULL)
```

Arguments

pb	a PamBinary class object created by loadPamguardBinaryFile
templateNames	if using the click template classifier, the names of the species for the click templates. These will be used as the names of the columns in the dataframe, and the length of this must exactly match the number of templates used. Will add columns for the threshold, match, and reject correlation values for each template name provided

Value

a data.frame containing most of the binary data read in. Will not contain most annotation data, click waveforms, DIFAR demux data, or contour information from WMD detector. These are skipped because they are either inconsistent in their size, or are large objects. Click template classifier information will be included if `templateNames` are supplied. If binary is from noise band monitor, noise data will be stored in columns `noiseMean`, `noisePeak`, and `octaveBands`, and the resulting dataframe will have a row for each separate octave band stored

Author(s)

Taiki Sakai <taiki.sakai@noaa.gov>

Examples

```
# load the data
clickFile <- system.file('extdata', 'Click.pgdf', package='PamBinaries')
clickData <- loadPamguardBinaryFile(clickFile)
# two methods to convert to a dataframe
head(pbToDf(clickData))
head(data.frame(clickData))
```

plotWMD

Plot Whistle Contour

Description

Plots the entire whistle contour saved in a Pamguard Whistle & Moan Detector binary file, highlighting the selected contour

Usage

```
plotWMD(data, id = 1, ...)
```

Arguments

<code>data</code>	either a PamBinary class object, or just the <code>\$data</code> from a PamBinary object, or a single detection from the <code>\$data</code>
<code>id</code>	the id of the whistle to plot, either an index or Pamguard UID
<code>...</code>	parameters to pass to other functions

Value

A ggplot object

Author(s)

Taiki Sakai <taiki.sakai@noaa.gov>

Examples

```
# load example whistle file
wmFile <- system.file('extdata', 'WM.pgdf', package='PamBinaries')
wmData <- loadPamguardBinaryFile(wmFile)
plotWMD(wmData, 1)
plotWMD(wmData, 2)
```

readAISData

Read AIS Data

Description

Reads binary data stored by the AIS Processing module.

Usage

```
readAISData(fid, fileInfo, data, debug = FALSE, ...)
```

Arguments

fid	binary file identifier
fileInfo	structure holding the file header and module header
data	a structure containing standard data
debug	logical flag to show more info on errors
...	Arguments passed to other functions

Value

a structure containing data from a single object, and a logical flag if an error has occurred

Author(s)

Taiki Sakai <taiki.sakai@noaa.gov>

readClickBackground *Read Click Detector Background data*

Description

Reads in the background data saved by the Click Detector

Usage

```
readClickBackground(fid, fileInfo, data)
```

Arguments

fid	binary file identifier
fileInfo	structure holding the file header, module header, and the appropriate function to read module specific data
data	a structure containing standard data

Value

a structure containing data from a single object

Author(s)

Michael Oswald <taiki.sakai@noaa.gov>

readClickClsfrAnnotation
 Read Click Classifier Annotation

Description

Reads binary data stored by Click Classifier annotations

Usage

```
readClickClsfrAnnotation(fid, fileInfo, debug = FALSE)
```

Arguments

fid	binary file identifier
fileInfo	structure holding the file header and module header
debug	logical flag to show more info on errors

Value

a vector of click classifiers, represented by the click type flag

Author(s)

Taiki Sakai <taiki.sakai@noaa.gov>

readClickData	<i>Read Click Data</i>
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Description

Reads binary data stored by the Click Detector module.

Usage

```
readClickData(  
  fid,  
  fileInfo,  
  data,  
  skipLarge = FALSE,  
  debug = FALSE,  
  getWave,  
  onlyWave  
)
```

Arguments

fid	binary file identifier
fileInfo	structure holding the file header and module header
data	a structure containing standard data
skipLarge	a flag for whether or not to skip reading large wave file
debug	logical flag to show more info on errors
getWave	DEPRECATED: see skipLarge
onlyWave	DEPRECATED: see skipLarge

Value

a structure containing data from a single object, and a logical flag if an error has occurred

Author(s)

Taiki Sakai <taiki.sakai@noaa.gov>

readClickFooter	<i>Read Click Footer</i>
-----------------	--------------------------

Description

Reads module footer information for the Click Detector module. Note that sometimes there is no additional footer information, so check first whether or not the binaryLength variable is 0.

Usage

```
readClickFooter(file)
```

Arguments

file	binary file to be read
------	------------------------

Value

footer information for Click Detector module

Author(s)

Taiki Sakai <taiki.sakai@noaa.gov>

readClickTriggerData	<i>Read Click Trigger Level</i>
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Description

Reads binary data stored by the click detector trigger

Usage

```
readClickTriggerData(fid, fileInfo, data, debug = FALSE, ...)
```

Arguments

fid	binary file identifier
fileInfo	structure holding the file header and module header
data	a structure containing standard data
debug	logical flag to show more info on errors
...	Arguments passed to other functions

Value

a structure containing data from a single object, and a logical flag if an error has occurred

Author(s)

Taiki Sakai <taiki.sakai@noaa.gov>

readClickTriggerHeader
Read Click Trigger Header

Description

Reads file header information specific to the click trigger module

Usage

```
readClickTriggerHeader(file)
```

Arguments

file binary file to be read

Value

header information for the click trigger

Author(s)

Taiki Sakai <taiki.sakai@noaa.gov>

readClipData *Read Clip Data*

Description

Reads binary data stored by the Clip Generator module.

Usage

```
readClipData(fid, fileInfo, data, debug = FALSE, ...)
```

Arguments

fid binary file identifier
fileInfo structure holding the file header and module header
data a structure containing standard data
debug logical flag to show more info on errors
... Arguments passed to other functions

Value

a structure containing data from a single object, and a logical flag if an error has occurred

Author(s)

Taiki Sakai <taiki.sakai@noaa.gov>

readDbHtData

Read DbHt Data

Description

Reads binary data stored by the DbHt module.

Usage

```
readDbHtData(fid, fileInfo, data, debug = FALSE, ...)
```

Arguments

fid	binary file identifier
fileInfo	structure holding the file header and module header
data	a structure containing standard data
debug	logical flag to show more info on errors
...	Arguments passed to other functions

Value

a structure containing data from a single object, and a logical flag if an error has occurred

Author(s)

Taiki Sakai <taiki.sakai@noaa.gov>

readDifarData	<i>Read Difar Data</i>
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Description

Reads binary data stored by the Difar Processing module.

Usage

```
readDifarData(fid, fileInfo, data, skipLarge = FALSE, debug = FALSE)
```

Arguments

fid	binary file identifier
fileInfo	structure holding the file header and module header
data	a structure containing standard data
skipLarge	a flag of whether or not to skip reading the waveform
debug	logical flag to show more info on errors

Value

a structure containing data from a single object, and a logical flag if an error has occurred

Author(s)

Taiki Sakai <taiki.sakai@noaa.gov>

readFileFooterInfo	<i>Read File Footer</i>
--------------------	-------------------------

Description

Reads in the binary file footer. The input variable version is the file format read in from the file header. As of version 3, the file footer includes the lowest and highest UID values in the file.

Usage

```
readFileFooterInfo(fid, version)
```

Arguments

fid	binary file to be read
version	binary file version

Value

footer information common to all files

Author(s)

Taiki Sakai <taiki.sakai@noaa.gov>

readFileHeader *Read File Header*

Description

Reads file header information common to all files

Usage

```
readFileHeader(file, readExtra = FALSE)
```

Arguments

file	binary file to be read
readExtra	flag if there is extra information to read

Value

header information common to all files

Author(s)

Taiki Sakai <taiki.sakai@noaa.gov>

readGPLDetections *Read GPL Detections*

Description

Reads binary data stored by the GPL Module.

Usage

```
readGPLDetections(fid, fileInfo, data, debug = FALSE, ...)
```

Arguments

fid	binary file identifier
fileInfo	structure holding the file header and module header
data	a structure containing standard data
debug	logical flag to show more info on errors
...	Arguments passed to other functions

Value

a structure containing data from a single object, and a logical flag if an error has occurred

Author(s)

Michael Oswald <mo55@st-andrews.ac.uk>

readJavaUTFString *Read Java UTF-8 String*

Description

Reads a Java UTF-8 string. The first 2 bytes are the length of the string, then the string itself.

Usage

```
readJavaUTFString(file)
```

Arguments

file	binary file to be read
------	------------------------

Value

the string and its length

Author(s)

Taiki Sakai <taiki.sakai@noaa.gov>

readLTSAData	<i>Read LTSA Data</i>
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Description

Reads binary data stored by the LTSA module.

Usage

```
readLTSAData(fid, fileInfo, data, debug = FALSE, ...)
```

Arguments

fid	binary file identifier
fileInfo	structure holding the file header and module header
data	a structure containing standard data
debug	logical flag to show more info on errors
...	Arguments passed to other functions

Value

a structure containing data from a single object, and a logical flag if an error has occurred

Author(s)

Taiki Sakai <taiki.sakai@noaa.gov>

readLTSAHeader	<i>Read LTSA Header</i>
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Description

Reads file header information specific to the LTSA module

Usage

```
readLTSAHeader(file)
```

Arguments

file	binary file to be read
------	------------------------

Value

header information for the LTSA module

Author(s)

Taiki Sakai <taiki.sakai@noaa.gov>

readMatchClsfrAnnotation

Read Matched Classifier Annotation

Description

Reads annotations from the matched click classifier. The matched matched click classifier annotates click detections with a threshold, matchcorr and rejectcorr values. The threshold value is used in the binary classification process. If it exceeds a hard value then the click is classified with the set type. The matchcorr and rejectcorr values are simply the correlation values of the match and reject templates with the click.

Usage

```
readMatchClsfrAnnotation(fid, fileInfo, anVersion, debug = FALSE)
```

Arguments

fid	binary file identifier
fileInfo	structure holding the file header and module header
anVersion	version id of annotation module
debug	logical flag to show more info on errors

Value

a vector with the threshold, matchcorr, and rejectcorr values. See description.

Author(s)

Taiki Sakai <taiki.sakai@noaa.gov>

readNoiseBandData *Read Noise Band Data*

Description

Reads binary data stored by the Noise Band Monitor.

Usage

```
readNoiseBandData(fid, fileInfo, data, debug = FALSE, ...)
```

Arguments

fid	binary file identifier
fileInfo	structure holding the file header and module header
data	a structure containing standard data
debug	logical flag to show more info on errors
...	Arguments passed to other functions

Value

a structure containing data from a single object, and a logical flag if an error has occurred

Author(s)

Taiki Sakai <taiki.sakai@noaa.gov>

readNoiseMonData *Read Noise Monitor Data*

Description

Reads binary data stored by the Noise Monitor.

Usage

```
readNoiseMonData(fid, fileInfo, data, debug = FALSE, ...)
```

Arguments

fid	binary file identifier
fileInfo	structure holding the file header and module header
data	a structure containing standard data
debug	logical flag to show more info on errors
...	Arguments passed to other functions

Value

a structure containing data from a single object, and a logical flag if an error has occurred

Author(s)

Taiki Sakai <taiki.sakai@noaa.gov>

readNoiseMonHeader	<i>Read Noise Monitor Header</i>
--------------------	----------------------------------

Description

Reads file header information specific to the Noise Monitor module

Usage

```
readNoiseMonHeader(file)
```

Arguments

file	binary file to be read
------	------------------------

Value

header information for the Noise Monitor module

Author(s)

Taiki Sakai <taiki.sakai@noaa.gov>

readPamData	<i>Read Pamguard Data</i>
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Description

Reads in the object data that is common to all modules. This reads up to (but not including) the object binary length, and then calls a function to read the module-specific data.

Usage

```
readPamData(fid, fileInfo, skipLarge, debug = FALSE, keepUIDs, ...)
```

Arguments

fid	binary file identifier
fileInfo	structure holding the file header, module header, and the appropriate function to read module specific data
skipLarge	Should we skip large parts of binaries? Currently only applicable to whistle, click, and DIFAR data
debug	logical flag to show more info on errors
keepUIDs	If not NULL, a vector of UIDs to read. All UIDs not in this vector will not be read.
...	Arguments passed to other functions

Value

a structure containing data from a single object

Author(s)

Taiki Sakai <taiki.sakai@noaa.gov>

readRWEDetectorData *Read Right Whale Edge Detector Data*

Description

Reads binary data stored by the Right Whale Edge Detector.

Usage

```
readRWEDetectorData(fid, fileInfo, data, debug = FALSE, ...)
```

Arguments

fid	binary file identifier
fileInfo	structure holding the file header and module header
data	a structure containing standard data
debug	logical flag to show more info on errors
...	Arguments passed to other functions

Value

a structure containing data from a single object, and a logical flag if an error has occurred

Author(s)

Taiki Sakai <taiki.sakai@noaa.gov>

readSpectralBackground *Read Spectral Background data*

Description

Reads in the background data saved by various detectors (e.g WMD, Right Whale Edge Detector, etc) EXCEPT FOR the Click Detector

Usage

```
readSpectralBackground(fid, fileInfo, data)
```

Arguments

fid	binary file identifier
fileInfo	structure holding the file header, module header, and the appropriate function to read module specific data
data	a structure containing standard data

Value

a structure containing data from a single object

Author(s)

Michael Oswald <taiki.sakai@noaa.gov>

readStdModuleFooter *Read Standard Module Footer*

Description

Reads the module footer information common to all modules. Differs from the legacy code in that it does not read in or skip any information specific to a module.

Usage

```
readStdModuleFooter(file)
```

Arguments

file	binary file to be read
------	------------------------

Value

footer information common to all modules

Author(s)

Taiki Sakai <taiki.sakai@noaa.gov>

readStdModuleHeader *Read Standard Module Header*

Description

Reads the module header information common to all modules. Differs from the legacy code in that it does not read in or skip any information specific to a module.

Usage

```
readStdModuleHeader(file)
```

Arguments

file binary file to be read

Value

header information common to all modules

Author(s)

Taiki Sakai <taiki.sakai@noaa.gov>

readWMDData *Read Whistle and Moan Data*

Description

Reads binary data stored by the Whistle & Moan Detector

Usage

```
readWMDData(fid, fileInfo, data, skipLarge = FALSE, debug = FALSE)
```

Arguments

fid	binary file identifier
fileInfo	structure holding the file header and module header
data	a structure containing standard data
skipLarge	a flag for whether or not to skip reading large contours
debug	logical flag to show more info on errors

Value

a structure containing data from a single object, and a logical flag if an error has occurred

Author(s)

Taiki Sakai <taiki.sakai@noaa.gov>

readWMDHeader

Read Whistle & Moan Detector Header

Description

Reads file header information specific to the Whistle & Moan Detector module

Usage

```
readWMDHeader(file)
```

Arguments

file	binary file to be read
------	------------------------

Value

header information for the Whistle & Moan Detector module

Author(s)

Taiki Sakai <taiki.sakai@noaa.gov>

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