User Manual BatInspector

SoftwareVersion: **0.1**
Date: **22-08-31**

BatInspector is a software to analyze and manage recordings of bat calls.
It supports Elekon BatCorder projects as well as plain WAV files.

Main Features:

- manage bat recordings
- Analyze bat calls:
  -frequency max
  - frequency min
  - duration
  - many more
- Waterfall diagrams:
  - zoom in and out
  - zoom to detected call
- play recordings in original and 10x stretched speed
- Automatic species detection (experimental)
- Manual species detection
- Powerful data filtering
  - user defined filter expressions
- Generate reports

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1 Document History

Date	Author	Changes
22-03-15	CMU	Initial version

2 Introduction

3 Installation and setup

3.1 Installation

- Install the latest version of R-Studio:
  https://www.rstudio.com/products/rstudio/download/
- Install package bioacoustics
- Install python 3
  https://www.python.org/downloads/
- Install tensorflow 2
  https://www.tensorflow.org/install
- Install BatInspector:
  call setup.exe and follow the instructions

4 Basic Workflow

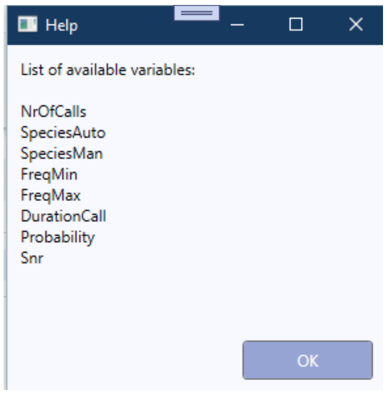
4.1 Copy Data to Workstation

In order to work with the recorded data, they must first be copied to the PC. Copy the data to a folder in your hard disk. Each project or recording session should have its own directory.

4.2 Open a Project

4.3 Analyze calls automatically

4.4 Working with Filters



List of available variables:

NrOfCalls
SpeciesAuto
SpeciesMan
FreqMin
FreqMax
DurationCall
Probability
Snr

4.5 Analyze calls manually

5 Menues and Screens

6 Scripting Language

6.1 Syntax

The syntax of each script line is:

```
<command> <Par₁> <Par₂> … <Parₙ>
```

Each line contains a command with parameters.
A parameter may be

- a fixed value: `22`
- a string enclosed in „“: `„this is a sample string“`
- an expression: `=(cos(a) + 5)`

An expression is surrounded by the start character „=(„ and the end character „)“:

```
SET a =(cos(b) * 2)
```

A detailed description of the expression syntax is provided in chapter 7

Before and between command and parameters abitrary white space (space or tab) is allowed.

A line starting with the character ‚#‘ is considered as a comment

```
# this is a comment and will not be executed
```

6.2 Commands

6.2.1 SET

Function:	Assigns a value to a variable. If the variable does not exist, it will be created
Syntax:	SET <VarName> <Value>
Parameter:	VarName: Name of the variable Value: Value to assign the variable

Example:	SET a 33
	SET b =(a + 5)

6.2.2 CALL

Function:	calls a script. All variables of the calling script are accessible in the called script.
Syntax:	CALL <FileName>
Parameter:	FileName: Name of the script file (full path or only name. If only the name is provided, the file must b located in the directory <ScriptDir> from the application settings.
Example:	CALL C:\scripts\script1.scr CALL script2.scr

6.2.3 FOR … END

Function: For Loop

Syntax:

```
FOR <iteratorName> <start> <end>
   # a block of code
:
END
```

Parameter:

iteratorName:	name of the iterating variable
start:	start value for the iterator
end:	end value for the iterator

Example:

```
FOR i 1 10
        LOG i
END
```

6.2.4 WHILE … END

Function: While Loop

Syntax:

```
WHILE <expression>
   # a block of code
:
END
```

Parameter: expression: an expression with boolen result. As log the expressio is true, the loop will be executed

Example:

```
SET i 0
WHILE =(i <  10)
        LOG i
        SET i =(i + 1)
END
```

6.2.5 BREAK

Function: breaks the execution of a loop (applicable for FOR and WHILE loops
Syntax: BREAK
Parameter: none
Example:

```
WHILE =(a < 100)
  LOG a
  IF =((b >0) && ( a > 50)
    BREAK
  END
  SET a =(a + 1)
END
```

6.2.6 LOG

Function: write a message to the log window
Syntax: LOG <message> <type>
Parameter: message: the message to log (fixed val. Or expression)
type: optional parameter for message type:
- INFO (default)
- ERROR
- WARNING
- DEBUG

Example:

```
LOG „this should never happen“ ERROR
```

7 Expression Parser Syntax

With the integrated formaula parser it is possible to express complex logic formulas or mathematical calculations.
This is useful to create filter expressions and scripts.

7.1 Operators

Operator	**Description**
+	Addition
-	Subtraction
*	Multiplication
/	Division
&&	Logical AND
||	Logical OR
!	Logical NOT
<	Lesser than
<=	Lesser or equal than
>	Greater than
>=	Greater or equal than
==	Equal
!=	Not equal
()	Braces for math terms or function arguments
[]	Square braces for array index
„“	Double quotes to enclose strings

7.2 Data Types of Expressions

Data Type	**Range**	**Examples**
RT_BOOL	True, False	(a <= 3.0)
RT_INT64	- 2^{63} … 2^{63}	-236, 224
RT_UINT64	0 … 2^{64}	23456
RT_HEX	0x0 …. 0xFFFFFFFFFFFFFFFF	0xFA10
RT_FLOAT	64 bit floating point number	-3.5, 66.8767, -3.23E-12
RT_COMPLEX	Complex numbers	1+2.0i, -4.5 – 3i, 2.3 + 1i
RT_STR	String	„this is a string“, „1.0“

7.3 Supported Functions

7.3.1 Trigonometrical Functions

sin(x)

Function	returns sinus of a number",
Params	x: a number
Returns	sinus of x

asin(x)

Function	returns arcus sinus of a number
Params	x: a number
Returns	arcus sinus of x

sinh(x)

Function	returns sinus hyperbolicus of a number",
Params	x: a number
Returns	sinus hyperbolicus of x

cos(x)

Function	returns cosinus of a number",
Params	x: a number
Returns	cosinus of x

acos(x)

Function	returns arcus cosinus of a number",
Params	x: a number
Returns	arcus cosinus of x

cosh(x)

Function	returns cosinus hyperbolicus of a number",
Params	x: a number

Returns	cosinus hyperbolicus of x

tan(x)

Function	returns tangens of a number",
Params	x: a number
Returns	tangens of x

atan(x)

Function	returns arcus tangens of a number",
Params	x: a number
Returns	arcus tangens of x

7.3.2 Mathematical Functions

sqrt(x)

Function	returns square root of a number
Params	x: a number
Returns	square root of x

pow(x, e)

Function	calculate power of a number",
Params	x: a number
	e: exponent
Returns	x^e (x to the power of e)

exp(x)

Function	calculate power of e",
Params	x: a number
Returns	e^x (e to the power of x)

ln(x)

Function	calculate the natural logarithm of a number
Params	x: a number
Returns	natural logarithm of x

abs(x)

Function	calculate the absolute value of a number (real or complex)
Params	x: a number
Returns	absolute value of x

arg(x)

Function	calculate the argument of a complex number
Params	x: a complex number
Returns	arg x

7.3.3 String functions

strlen(s)

Function	calculate the length of a string
Params	s: a string
Returns	length of string s

substr(str, start, length)

Function	calculate the substring of a string
Params	str: a string start: start character (0... <length of str – 1>) length: length od substr (0... <length of str – 1 - start>)
Returns	the sub string

7.3.4 Miscellanous Functions

cast(exp, type)

Function	cast an expression to a specific type
Params	exp: an expression type: a type („RT_BOOL“, „RT_FLOAT“, „RT_INT64“, „RT_UIN64“, „RT_STR“, „RT_HEX“ „RT_COMPLEX“)
Returns	length of string s

if(exp, argTrue, argFalse)

Function	evaluate boolean expression and return corresponding argument
Params	exp: a boolean expression argTrue: an expression for exp == true argFalse: an expression for exp == false
Returns	argTrue or argFalse depending on result of exp

vars()

Function	return a list of variables and their values
Params	none
Returns	list of all defined variables and their values

consts()

Function	return a list of constants and their values
Params	none
Returns	list of all defined constants and their values

7.3.5 Functions to Handle CSV Files

`openCsv(fileName,withHeader,separator)`

Function:	opens a csv file and reads it to memory	
Parameter:	fileName:	Name of the script file (full path or only name. If only the name is provided, the file must b located in the directory <ScriptDir> from the application settings.name of the file (full path)
	withHeader:	(optional, default 0) 1: first row contains header with column names. The colums can be accessed via the names if opened in this mode.
	Separator	(optional, default=“;“) separation character in lines for the cells
Returns:	**>=0:** a handle to access the file, <0: error opening the file	

`closeCsv(handle, write)`

Function:	closes a csv file and releases the memory"	
Parameter:	handle:	file handle to access csv file
	write:	(optional, default:0) 1: write file to disk
Returns	nothing	

`getCell(handle, row, col)`

Function:	get cell content of a previously opened file	
Parameter:	handle:	file handle to access csv file
	row	row number (1..n)
	col	col name (if opened with option ‚withHeader‘) or col number(1..n)
Returns	content of cell as string	

`setCell(handle, row, col, value)`

Function:	set a cell content of a previously opened csv file	
Parameter:	handle:	file handle to access csv file
	row	row number (1..n)
	col	col name (if opened with option ‚withHeader‘) or col number(1..n)
	value	value to write to cell (string)

`getRowCount(handle)`

Function:	get row count of a previously opened csv file (including header)	
Parameter:	handle:	file handle to access csv file
Returns:	number of rows in opened file	

7.3.6 Functions to deal with project informations

`GetPrjFileCount()`

Function:	get nr of files in open project
Parameter:	none
Returns:	number of files in currently opened project

`setFileInfo(index, infoType, data)`

Function:	set file specific information in currently opened project		
Parameter:	index:	index of file (0… n)	
	infoType:	type of information to set	
		„SELECT“:	set the state of the checkbox „Select“ („TRUE“ or „FALSE“)
	data:	the data	
Returns:	error code		

`getCallCount(index)`

Function:	get number of calls for a specified file in currently opened project	
Parameter:	index:	index of file (0..n)
Returns:	number of calls	

`getCallInfo(fIndex, cIndex, infoType)`

Function:	get call information for a specified call in a specified file in currently opened project		
Parameter:	fIndex:	index of file (0 … n)	
	cIndex:	index of call (0 … m)	
	infoType:	type of information	
		„SPEC_AUTO“:	automatically detected species
		„SPEC_MAN“:	manually detected species
Returns:	the requested information		

`setCallInfo(fIndex, cIndex, infoType, data)`

Function:	set call information for a specified call in a specified file in currently opened project		
Parameter:	fIndex:	index of file (0 … n)	
	cIndex:	index of call (0 … m)	
	infoType:	type of information	
		„SPEC_MAN“:	manually detected species
	data:	the data	
Returns:	the requested information		

`getNrOfSpecies(fIndex)`

Function:	get number of auto detected species for spec. file in open project	
Parameter:	fIndex:	index of file (0 … n)
Returns:	nr of automatically detected species	

`getRankSpecies(fIndex, rank)`

Function:	get the species name for the specified rank in specified file in open project	
Parameter:	fIndex:	index of file (0 … n)
	rank:	rank (1 … n, 1= most calls)
Returns:	species name for specified rank	

`getRankCount(fIndex, rank)`

Function:	get the nr of calls of species for the specified rank in specified file in open project	
Parameter:	fIndex:	index of file (0 … n)
	rank:	rank (1 … n, 1= most calls)
Returns:	nr species in recording for specified rank	

7.3.7 Functions to deal with WAV files

`getSampleRate(fileName)`

Function:	returns the sampling rate of a file	
Parameter:	fileName:	name of the file (full path)
Returns:	the sampling rate	

`rescaleSampleRate(fileName, factor)`

Function:	multiplies the sampling rate of a file with a factor	
Parameter:	fileName:	name of the file (full path)
	factor:	factor to multiply sampling rate
Returns:	the new sampling rate	

`SetSampleRate(fileName, sampleRate)`

Function:	sets the sampling rate of a file	
Parameter:	fileName:	name of the file (full path)
	sampleRate:	new value for sampling rate
Returns:	nothing	