

# SmartWare™ Module Programming Guide

Version 1.02

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All SmartWare™ components referred to in this documentation are Microsoft ActiveX COM components unless stated otherwise. SmartWare™ components are compatible with all languages that support Microsoft ActiveX.

## Data types

BYTE	1 byte	0 to 255
BOOL	2 bytes	True or False
INT	2 bytes	-32,768 to 32,767
LONG	4 bytes	-2,147,483,648 to 2,147,483,647
DOUBLE	8 bytes	-1.79769313486232E308 to 4.94065645841247E-324
STR	10 bytes + string length	0 to approximately 2 billion

Any arrays referred to herein are OLE SafeArrays<sup>1</sup>

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# SmartWare™ Fuzzy Logic Principle Component Analysis Module FZ50.DLL

## PROPERTIES

<b>FileName</b>	Read/Write	STR	Fully qualified path to ASCII data
<b>RecordCount</b>	Read Only	LONG	Record count (available after <b>loadFile</b> )
<b>ColumnCount</b>	Read Only	INT	Column count (available after <b>loadFile</b> )

## FUNCTIONS

Function      VOID **loadFile** (STR InFileName, STR OutFileName, OPTIONAL LONG StartRecord, OPTIONAL LONG EndRecord, OPTIONAL STR Delimiter = “, ”)

Description    Loads an ASCII file (comma, tab, space or custom delimited) into memory. InFileName specifies the ASCII file to be loaded and analyzed. OutFileName specifies a fully qualified path to output calculations to. StartRecord, EndRecord and Delimiter are optional arguments.

Example        FPCA.**loadFile**("C:\Test.csv", "C:\TestOutput.csv")

Function      VOID **Analyze** (LONG Cycles)

Description    The **Analyze()** function is called to perform principle component analysis on the ASCII file which has been loaded into memory via the **loadFile()** function. Cycles may be a long integer from 1 to 2,147,483,647. The accuracy of the principle component analysis results is proportional to the number of cycles.

Example        FPCA.**Analyze**(1000)

Function      VOID **Cancel**

Description    Cancels all operations

Example        FPCA.**Cancel**()

## EVENTS

Event         **AnalysisUpdate**(LONG Cycle, DOUBLE Variation)

Description    This event notifies the client of progress made by the **Analyze()** function. Cycle returns the current cycle of total cycles specified by the Cycles argument set in the Analyze function. Variation returns a DOUBLE value ranging between 0 and 1.

# SmartWare™ Genetic Algorithm Module GA50.DLL

## PROPERTIES

<b>FileName</b>	Read/Write	STR	Fully qualified path to ASCII data
<b>RecordCount</b>	Read Only	LONG	Record count (available after <b>loadFile</b> )
<b>ColumnCount</b>	Read Only	INT	Column count (available after <b>loadFile</b> )

## FUNCTIONS

Function      VOID **loadFile** (STR InFileName, STR OutFileName, OPTIONAL LONG StartRecord, OPTIONAL LONG EndRecord, OPTIONAL STR Delimiter = “, ”)

Description    Loads an ASCII file (comma, tab, space or custom delimited) into memory. InFileName specifies the ASCII file to be loaded and analyzed. OutFileName specifies a fully qualified path to output calculations to. StartRecord, EndRecord and Delimiter are optional arguments.

Example        GA.**loadFile**("C:\Test.csv", "C:\TestOutput.csv")

Function      VOID **CreateGA**(INT NumParams, DOUBLE SearchSpace, DOUBLE Mutation)

Description    This function is the first function called to instantiate a new genetic algorithm object. Where NumParams is the number of input vectors, SearchSpace is the problem search space and mutation is the genetic algorithm mutation coefficient.

VBA Example    Dim GA As New GeneticAlgorithm  
  
                GA.CreateGA 5, 1.5, 0.5  
  
                Do  
                  Set Chromosome = GA.GetChromosome()  
                  CALL Evaluate() 'Internal evaluation function  
                  DoEvents 'Yield to operating system  
                  Debug.Print Chromosome.ABSError 'Show the chromosome error  
                Loop While Chromosome.ABSError > 0.01  
  
                GA.ReleaseObjects  
                Set GA = Nothing

Function      Chromosome **GetChromosome** ()

Description    Returns the current Chromosome object in queue.

## SmartWare™ Genetic Algorithm Module GA50.DLL (continued)

Example	Dim Chromo As Chromosome Set Chromo = GA. <b>GetChromosome</b> ()
Function	VOID Chromosome. <b>CreateChromosome</b> (INT Length)
Description	Initializes a chromosome for use by the GeneticAlgorithm object. Length is the number of parameters as defined in NumParams argument of the <b>CreateGA</b> function. The GeneticAlgorithm object during initiation normally calls this function.
Example	Chromosome. <b>CreateChromosome</b> (20)
Function	DOUBLE Chromosome. <b>getValue</b> (INT Index)
Description	Returns a double value from the chromosome object.
Example	RetVal = Chromosome. <b>getValue</b> (5)
Function	VOID Chromosome. <b>setValue</b> (INT Index, DOUBLE Value)
Description	Sets a double value in the chromosome object where the location is specified by the Index argument.
Example	Chromosome. <b>setValue</b> (5,4.512)
Function	DOUBLE Chromosome. <b>ABSError</b> ()
Description	Returns a double value specifying the chromosome object's ABS error.
Example	RetVal = Chromosome. <b>ABSError</b> ()
Function	VOID <b>Cancel</b>
Description	Cancels all operations
Example	GA. <b>Cancel</b> ()

### OBJECTS

Object	<b>Chromosome</b>
Description	The <b>Chromosome</b> object encodes a chromosome with real numbers. This object is passed to the client application to be evaluated.

# SmartWare™ Neural Network Module NN50.DLL

## PROPERTIES

<b>FileName</b>	Read/Write	STR	Fully qualified path to ASCII data
<b>RecordCount</b>	Read Only	LONG	Record count (available after <b>loadFile</b> )
<b>ColumnCount</b>	Read Only	INT	Column count (available after <b>loadFile</b> )

## FUNCTIONS

Function VOID **loadFile** (STR InFileName, STR OutFileName, OPTIONAL LONG StartRecord, OPTIONAL LONG EndRecord, OPTIONAL STR Delimiter = “, ”)

Description Loads an ASCII file (comma, tab, space or custom delimited) into memory. InFileName specifies the ASCII file to be loaded and analyzed. OutFileName specifies a fully qualified path to output calculations to. StartRecord, EndRecord and Delimiter are optional arguments.

Example NN.**loadFile**("C:\Test.csv", "C:\TestOutput.csv")

Function INT **Train**(LONG Epochs, BOOL ResetWeights, DOUBLE LearningRate, DOUBLE Momentum, LONG MaxNeurons)

Description Trains the neural network, where Epochs is the duration of training, ResetWeights resets the neural network weights, LearningRate is the neural network learning rate, Momentum is the learning momentum and MaxNeurons specifies the maximum number of neurons to add using cascade correlation. The **Train** function returns 1 for success and -1 for failure.

Function **InputRelevance** (LONG Epochs, DOUBLE LearningRate, DOUBLE Momentum, LONG MaxNeurons)

Description Returns a percentage of contribution to output on each input vector<sup>2</sup>(Neural Network Principle Component Analysis). Where Epochs is the duration of training, ResetWeights resets the neural network weights, LearningRate is the neural network learning rate, Momentum is the learning momentum and MaxNeurons specifies the maximum number of neurons to add using cascade correlation. The **InputRelevance** function returns 1 for success and -1 for failure.

Function INT **loadNetwork**(STR FileName, DOUBLE LearningRate, DOUBLE Momentum, LONG MaxNeurons INTEGER)

Description Reads a pre-trained Neural Network into memory. FileName is a fully qualified path to an existing NN50 Neural Network Weights file, LearningRate is the neural network learning rate and MaxNeurons specifies the maximum number of neurons to add using cascade correlation. The **loadNetwork** function returns 1 for success and -1 for failure.

# SmartWare™ Neural Network Module NN50.DLL (continued)

Function	INT <b>saveNetwork</b> (STR FileName)
Description	Saves a trained neural network weights to disk. The <b>loadNetwork</b> () function returns 1 for success and -1 for failure.
Function	DOUBLE <b>filePredict</b> (STR SaveFile, DOUBLE LearningRate, DOUBLE Momentum, LONG MaxNeurons)
Description	Predicts samples loaded via the <b>loadFile</b> () function and saves the predicted values to a separate file (SaveFile).
Function	VOID <b>Cancel</b>
Description	Cancels all operations
Example	NN. <b>Cancel</b> ()

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## References

<sup>1</sup> Pass a SafeArray of Strings in a VARIANT\*

<http://support.microsoft.com/support/kb/articles/q167/6/68.asp>

Taking Advantage of the Automation Marshaller

[http://msdn.microsoft.com/library/default.asp?url=/library/en-us/dnautoma/html/msdn\\_vtblbind.asp](http://msdn.microsoft.com/library/default.asp?url=/library/en-us/dnautoma/html/msdn_vtblbind.asp)

Passing Structures in OLE Automation

<http://support.microsoft.com/support/kb/articles/q122/2/89.asp>

<sup>2</sup> SAS Institute Principle - Component Analysis using a Neural Network

<ftp://ftp.sas.com/pub/neural/importance.html>

Sample Test Sets from the UCI Machine Learning Repository

<http://www.ics.uci.edu/~mlearn/MLSummary.html>

SAS Neural Network FAQ

<ftp://ftp.sas.com/pub/neural/FAQ.html>