



Ejemplo MEPX

En este ejemplo, tenemos un problema de regresión en el que se busca predecir el consumo de energía eléctrica en un edificio.

0110
1001
1010

Data

Parameters

Results

Training data

Validation data

Test data

Advanced commands

Problem description

- regression problem
- prediction of the electrical energy consumption in a building.
- taken from PROBEN 1.
- I have removed the last 2 columns from the initial data (containing the results for hot and cold water consumption).

References:

Lutz Prechelt, Proben1: A Set of Neural Network Benchmark Problems and Benchmarking Rules, 1994

Tenemos los datos de entrenamiento. Según [la fuente](#) de donde se obtiene el problema, se busca una “predicción del consumo energético de un edificio. Tratar de predecir el consumo horario de energía eléctrica, agua caliente y agua fría, en función de la fecha, la hora del día, la temperatura exterior, la humedad del aire exterior, la radiación solar y la velocidad del viento.” Sin embargo, como dice en la imagen anterior, las columnas de agua caliente y fría fueron removidas, por lo que el sistema tiene solo una salida (el consumo de energía) representada por Target0:

Multi Expression Programming X - D:\Downloads\mepx_win64\mepx-projects\symbolic regression\single output\building1-energy.xml

Start

Stop

New project

Load project

Save project

Save project as

About

Updates

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Data

Parameters

Results

Load training data

Delete training data

Export training data

Find values

Replace values

Shuffle

Move to test

Move to validation

Paste from Clipboard

Num. outputs

Training data	Validation data	Test data	Advanced commands	Problem description											
#	+x0	+x1	+x2	+x3	+x4	+x5	+x6	+x7	+x8	+x9	+x10	+x11	+x12	+x13	Target0
263	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	1.000000	-1.000000	1.000000	0.774000	0.696000	0.009434	0.044643	0.405242
264	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.916667	-0.913043	1.000000	0.767000	0.712000	0.009528	0.071429	0.376532
265	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.833333	-0.826087	1.000000	0.764000	0.732000	0.009528	0.098571	0.368003
266	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.750000	-0.739130	1.000000	0.760000	0.740000	0.009528	0.071786	0.359107
267	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.666667	-0.652174	1.000000	0.757000	0.744000	0.009528	0.115000	0.351651
268	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.583333	-0.565217	1.000000	0.753000	0.756000	0.009528	0.123571	0.348383
269	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.500000	-0.478261	1.000000	0.753000	0.752000	0.009528	0.138929	0.351145
270	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.416667	-0.391304	1.000000	0.746000	0.748000	0.009528	0.136786	0.381240
271	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.333333	-0.304348	1.000000	0.744000	0.740000	0.033491	0.149286	0.448588
272	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.250000	-0.217391	1.000000	0.755000	0.768000	0.130000	0.198571	0.565089
273	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.166667	-0.130435	1.000000	0.772000	0.776000	0.239057	0.239643	0.606655
274	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.083333	-0.043478	1.000000	0.804000	0.740000	0.550377	0.133214	0.616756
275	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.000000	0.043478	-1.000000	0.852000	0.652000	0.670943	0.178929	0.620799
276	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.083333	0.130435	-1.000000	0.882000	0.552000	0.689906	0.159643	0.617947
277	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.166667	0.217391	-1.000000	0.901000	0.480000	0.796226	0.191786	0.623506
278	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.250000	0.304348	-1.000000	0.923000	0.444000	0.840377	0.193214	0.636563
279	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.333333	0.391304	-1.000000	0.931000	0.440000	0.740943	0.188929	0.633475
280	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.416667	0.478261	-1.000000	0.934000	0.424000	0.569245	0.254286	0.608040
281	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.500000	0.565217	-1.000000	0.916000	0.480000	0.161698	0.336786	0.531492
282	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.583333	0.652174	-1.000000	0.906000	0.472000	0.107830	0.226429	0.478198
283	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.666667	0.739130	-1.000000	0.894000	0.516000	0.023868	0.245357	0.455241
284	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.750000	0.826087	-1.000000	0.875000	0.548000	0.008774	0.210000	0.454230
285	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.833333	0.913043	-1.000000	0.864000	0.568000	0.008868	0.220357	0.432104
286	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.916667	1.000000	-1.000000	0.846000	0.620000	0.008962	0.235000	0.415253
287	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	1.000000	1.000000	-1.000000	1.000000	0.825000	0.668000	0.009151	0.178929	0.404280
288	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.916667	-0.913043	1.000000	0.814000	0.688000	0.009245	0.114643	0.386259
289	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.833333	-0.826087	1.000000	0.802000	0.708000	0.009340	0.087500	0.384743
290	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.750000	-0.739130	1.000000	0.788000	0.736000	0.009340	0.132857	0.379205
291	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.666667	-0.652174	1.000000	0.779000	0.760000	0.009340	0.117500	0.374075
292	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.583333	-0.565217	1.000000	0.770000	0.792000	0.009340	0.127143	0.371520
293	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.500000	-0.478261	1.000000	0.767000	0.800000	0.009434	0.141071	0.370495
294	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.416667	-0.391304	1.000000	0.767000	0.804000	0.009717	0.135714	0.402840
295	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.333333	-0.304348	1.000000	0.772000	0.812000	0.035849	0.163571	0.456044
296	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.250000	-0.217391	1.000000	0.783000	0.800000	0.165849	0.105357	0.564743
297	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.166667	-0.130435	1.000000	0.818000	0.764000	0.332075	0.160714	0.615434
298	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.083333	-0.043478	1.000000	0.842000	0.724000	0.460566	0.200357	0.634126

Generation: 99

Training best error: 0.0433391

Validation error: 0.0729346

Las funciones de las que disponen los individuos y otros parámetros del programa.

Multi Expression Programming X - D:\Downloads\mepx_win64\mepx-projects\symbolic regression\single output\building1-energy.xml

Start Stop New project Load project Save project Save project as About Updates

0110 Data Parameters Results

Data type
☒ Real numbers
☐ Integer numbers

Problem type
☒ Symbolic regression
☐ Binary classification
☐ Multi-class classification
☐ Time-series

Error measure
☒ Mean Absolute Error
☐ Mean Squared Error
☐ Automatic threshold
☐ Winner takes all-Fixed
☐ Winner takes all-Smooth
☐ Winner takes all-Dynamic
☐ Closest center

Time series
Window size: 2
Mode:
☒ Predict on Test set
☐ Predict new data
Num. predictions: 10

Functions
☒ Addition
☒ Subtraction
☒ Multiplication
☒ Division
☒ Power
☒ Sqrt
☒ Exp
☒ Pow10
☒ Ln
☒ Log10
☒ Log2
☒ Floor
☒ Ceil
☒ Abs
☒ Inv (1/x)
☒ Neg (-x)
☒ X^2
☒ Min
☒ Max
☒ Sin
☒ Cos
☒ Tan
☒ ASin
☒ ACos
☒ ATan
☒ If a<0?b:c
☒ If a<0 or b<0 ? c:d
☒ If a<0 xor b<0 ? c:d
☒ Modulus

Parameters
Num. subpopulations: 8
Subpopulation size: 100
Code length: 100
Crossover probability [0..1]: 0.9
Crossover type:
☐ Uniform
☒ One-cutting point
Mutation probability [0..1]: 0.01
Tournament size: 2
Probabilities:
Functions: 0.5
Variables: 0.4
Constants: 0.1
Num. generations: 100

Constants
Type:
☐ User defined
☒ Automatically generated
User defined constants:
Add Delete
Automatically generated constants:
Number of constants: 5
Min initial interval: 0
Max initial interval: 1
☒ May evolve
☐ Evolve outside initial interval
Max delta: 0.1

Runs
Random seed: 0
Num. runs: 10
Num. threads: 8
Training subset:
Random subset size (%): 100
Num. generations for a subset: 1
☒ Use validation data

Generation: 99 Training best error: 0.0433391 Validation error: 0.0729346

Y los resultados del programa, en donde se logra un error relativamente bajo aproximado de 0.0464 luego de 100 generaciones:

