User´s Manual for Downloading the Matlab® Computer Scripts:
To be used in the training simulations of ANN

Computer server site: https://github.com/ANNGroup/GasG-Scripts-ANNs.git

D. Pérez-Zárate, E. Santoyo, A. Acevedo-Anicasio, C. García-López, L. Díaz-González (2018) Evaluation of Artificial Neural Networks for the Prediction of Deep Reservoir Temperatures using the Gas-Phase Composition of Geothermal Fluids. *Computers & Geosciences (Submitted)*.

A quick User's Manual for running the ANN simulations is briefly described. Six numerical codes or scripts written in Matlab® for the training of several Artificial Neural Networks (ANN) were used to estimate the bottomhole temperatures (BHT) of production geothermal wells. These scripts use the chemical composition of the gas-phase of geothermal fluids as main input data whereas BHT measurements were used as a target variable (BHT_m) to be predicted by the ANN (BHT_{ANN}).

A standard or academic use license for Matlab® software is required for running all the ANN simulations. Six Matlab® computer scripts or codes are available for downloading from public repository: https://github.com/ANNGroup/GasG-Scripts-ANNs.git. To install and to run effectively the Matlab® software and the computer scripts or codes, the following hardware specifications are suggested:

- Operating system: Windows 7 Home Premium 64 bits
- Processor: Intel Core i5-2300, 2.80GHz
- RAM memory: 4 GB (minimum requirements)
- Hard Drive: 500 GB (minimum requirements)

Depending on the hardware specifications, the CPU times elapsed during the ANN simulations are shown in the following Table:

Matlab® Computer Scripts or Codes		Geochemical Databases (used)	Computing Iterations	CPU time intervals elapsed for running the ANN simulations (days)
Script_ANN12.m		WG_SubDB$_1$ (n=527)	1,000	2 – 3
Script_ANN13.m		WG_SubDB$_1$ (n=527)	1,000	2 – 3
Script_ANN22.m		WG_SubDB$_2$ (n=498)	1,000	2 – 3
Script_ANN25.m		WG_SubDB$_2$ (n=498)	1,000	2 – 3
Script_ANN33.m		WG_SubDB$_3$ (n=97)	1,000	1 – 2
Script_ANN38.m		WG_SUbDB$_3$ (n=97)	1,000	1 – 2

Computer running instructions. After running the computer scripts or codes, a full report is printed as a txt file. The report will contain the input data used for the ANN simulations, and either the preliminary or final results obtained from the ANN evaluation for predicting the output variable (BHT_{ANN}). Thus, the report will include the following ANN parameters:

- Number of input data (or variables),
- Number of neurons in the hidden layer,
- Number of iterations used for the ANN training,
- The learning rate initialized used for the ANN training,
- As evaluation criteria, the following statistical parameters are also reported after completing each ANN simulation:
    - the minimum correlation coefficient (r_{min}) achieved between the target (BHT_m) variable and the output or simulated variable (BHT_{ANN}),
    - the coefficient of correlation (median value),
    - the maximum or Global correlation coefficient (r_{max}) reached between BHT_m and BHT_{ANN},
    - the correlation coefficient (r_{Train}) reached between BHT_m and BHT_{ANN}, for the training set,
    - the correlation coefficient (r_{Val}) reached between BHT_m and BHT_{ANN}, for the validation set,
    - the correlation coefficient (r_{Test}) reached between BHT_m and BHT_{ANN}, for the testing set,
    - the Root Mean Square Error (RMSE) between BHT_m and BHT_{ANN},
    - the Mean Absolut Error (MAE) between BHT_m and $BHT_{ANN,}$
    - the slope and intercept parameters (calculated from a linear regression analysis between BHT_m and BHT_{ANN}),
    - the sensitivity or Garson analysis results in terms of the relative contribution (%) of each input variable on the prediction of the output or simulated variable (BHT_{ANN}) for each ANN architecture, and

- the iteration number in which the best results were obtained from the ANN simulations.

From these results, a summary of all the ANN architectures evaluated for the prediction of reservoir temperature is finally printed in an output report (see Tables 10 - 12).

The following pictures are shown to demonstrate the use of the computer scripts or codes in the Matlab® Software environment:

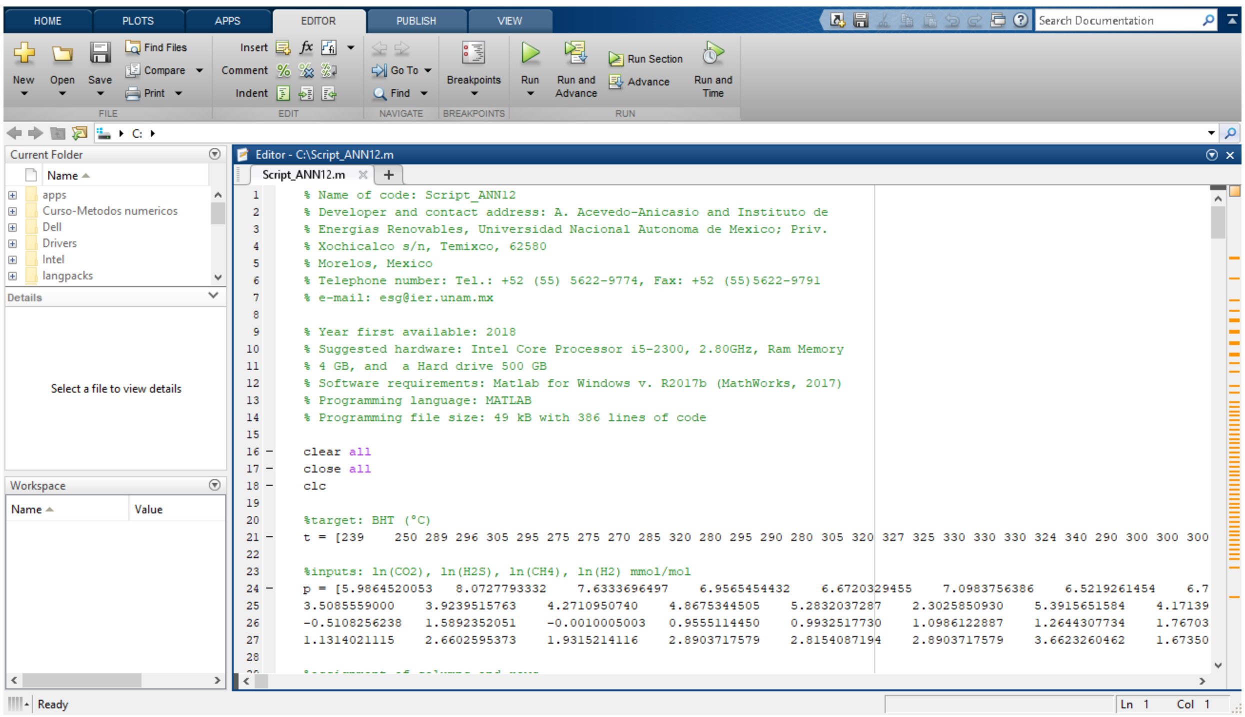

Fig. 1 Schematic uploading process of the Script_ANN12 by using in Matlab® computing environment

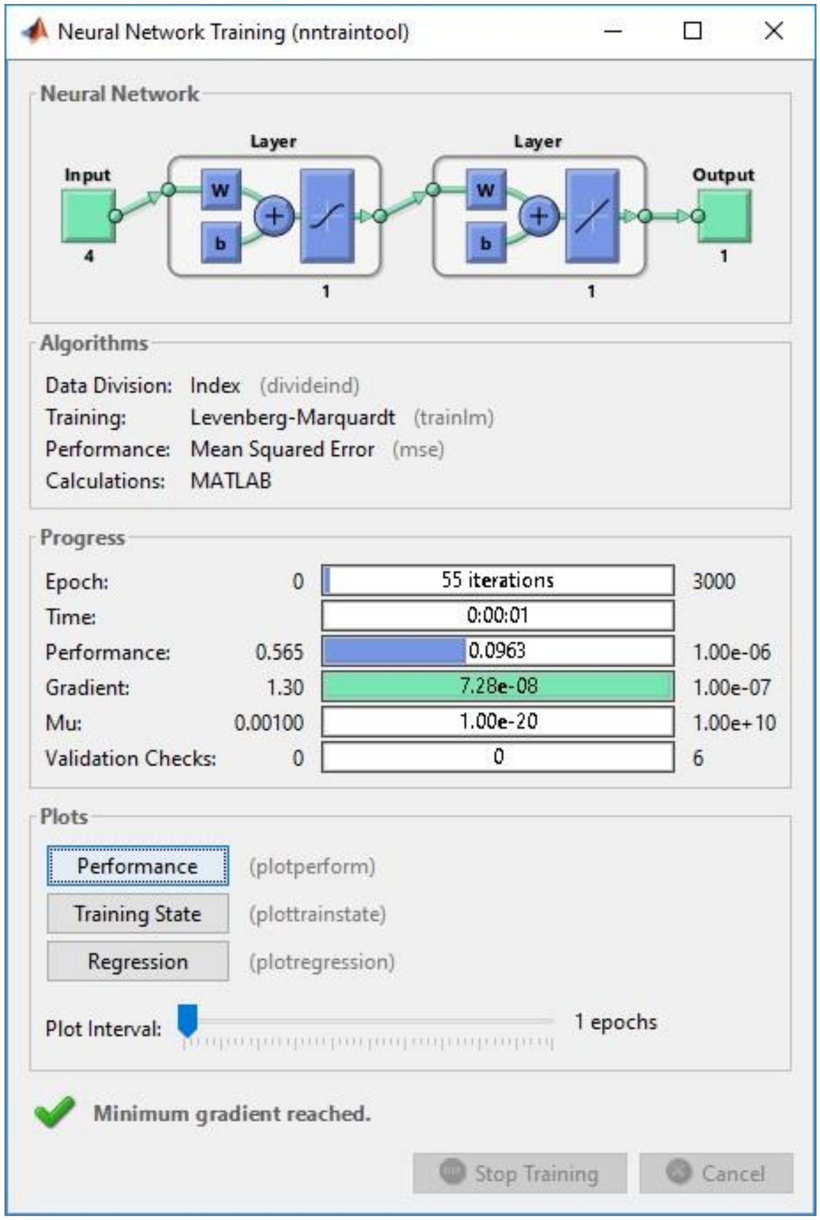

Fig. 2 An example of the Matlab® computer module used for a typical training process of an ANN architecture

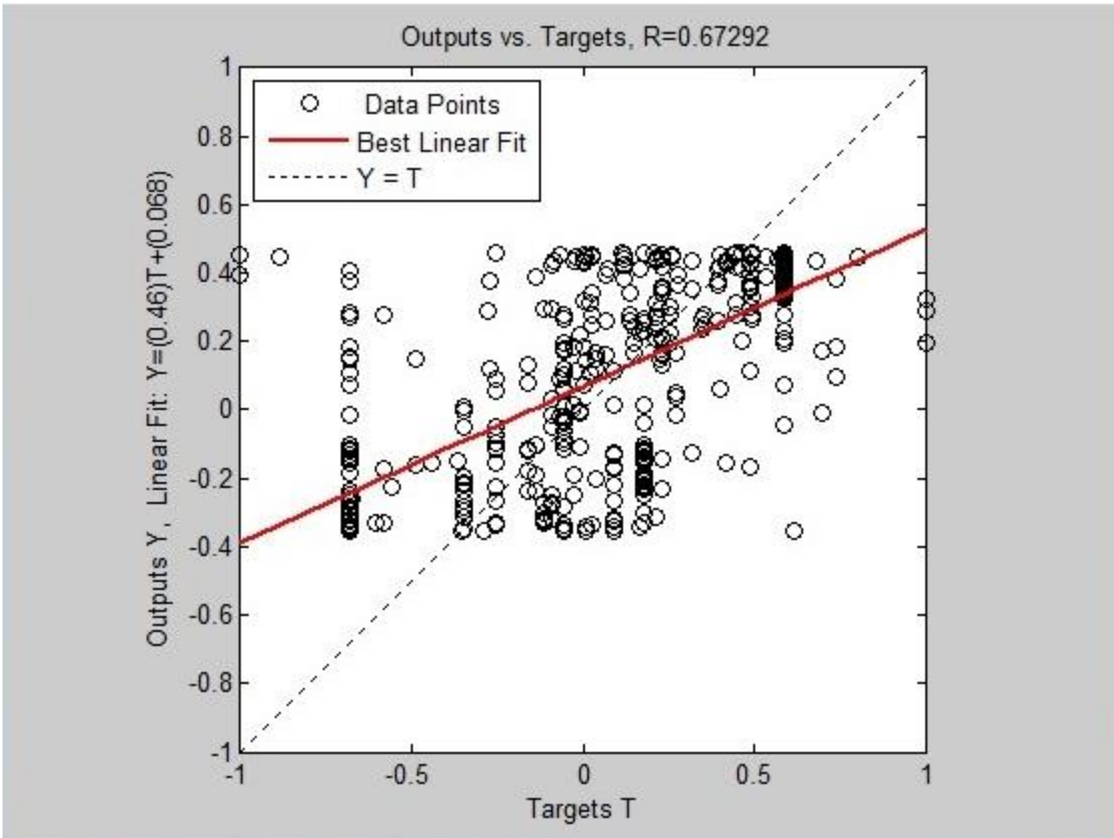

Fig. 3 The preliminary regression analysis between the BHT_m and the simulated BHT_{ANN}

Developers and contact e-mail address:

If some instructions or doubts are still needed from the users, all the authors of the submitted manuscript are available to provide some additional hints for a successful application of the script codes.

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