matlab assignment: predicting the compressive strength of concrete

description

Concrete is the most important material in civil engineering. The concrete compressive strength (CCS) is a function of age and ingredients. These ingredients include cement, blast furnace slag, fly ash, water, super-plasticizer, coarse aggregate, and fine aggregate[1]. The ability to predict the value of CCS accurately from these easily obtained variables is advantageous and potentially money saving.

The data for this are provided in matrix, **`D`**, in the mat-file, **`concrete.mat`**[2]. The first seven columns correspond to the ingredients (kg in a 1 m^3 mixture) as follows: Cement; Blast Furnace Slag; Fly Ash; Water; Super-plasticizer; Coarse Aggregate; Fine Aggregate; followed by Age[3] in days, in the eighth column. The target is CCS (MPa), in the ninth column. **Remember**: zero is a number.

task

The task is to build a *fully-validated*, predictive model for CCS using whatever model you prefer according to currently accepted best-practice. You can use any of the models we have looked at and developed in class or something else (if you are feeling confident) but it *must* be in **matlab**. The use of automatic model-building tools such as the matlab in-built neural network fitting tool is **NOT** permitted – I need to see your model-building strategy.

1. Prepare a report describing clearly what you have done and *why*, summarizing your results in a convincing way and justifying any choices made. You should include performance indicators[4] and plots of the kind we have used in the labs. Things you might consider include: what kind of data normalization is needed, if any, and why?; why did you choose the particular structure/model/approach?; how does your result compare to a simple benchmark?; how did you control complexity?; what was your strategy for validation and final testing?; how do you know your final model is acceptable?; what would you recommend to your client or boss?. Analyse and discuss the graphs. Critical evaluation and going beyond what was done in the lab classes will attract higher scores. The reader should be able to repeat your experiments unambiguously from your description. Do **NOT** restate the task description: it wastes space. There are plenty of choices such as LASSO, PCA or something else you've researched for yourself.

Study the marking criteria before you begin.

2. Prepare a matlab script that loads the data, runs your code and presents your results. The results should be in a clear and easily comprehended form with adequate documentation in the form of comments. Your code will be run by the examiner as part of the assessment. You must also save the final versions of any models produced.

If your code doesn't run you will lose marks so test it carefully.

See below for details of how to save your work.

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[1] I-Cheng Yeh, (1998) "Modeling of strength of high performance concrete using artificial neural networks", Cement and Concrete Research, 28, 1797-1808.

[2] Download from MOLE.

[3] The length of time the concrete has been set.

[4] You are free to choose any performance indicators that you think appropriate but you must explain why.

rules

In addition to your ability to carry out the data modelling task, this assignment is testing your professional engineering skills: working to a specification, providing tested, commented, operational code, providing what the client has asked for and justifying your method.

report: you are permitted a **maximum** of four A4 sides of 11 point type and 25mm margins. If you exceed the limit[5] you will be penalized. You must save your document as a **pdf** file *only* - **no other** format is acceptable. You will be penalized and may be asked to re-submit (once only) if you do not adhere to this.

Your registration number **must** appear at the top of each page. Do **not** include your name.

code: you must save the script and **all** additional functions that are needed for it to run[6] (use zip[7] format if more than one).

Do **not** include **dmmilab**.

If the code does not run, you will be penalized and may be asked to re-submit (once only).

You can assume that I have the full, current version of Matlab[8] and dmmilab installed:

it is your responsibility to test your code

models: you must save your final models in a MAT file, they should be called **`myglm`**, **`mymlp`**, **`myrbf`** **my...** etc. along with **`x_star`** & **`z_star`**

e.g. **`save dm123456789 myglm mymlp x_star z_star`**

files: You ***must*** use your nine digit registration number to name your report, matlab script and MAT files as per the following examples:

dm123456789.pdf, dm123456789.m & dm123456789.mat

or

dm123456789.pdf, dm123456789.zip & dm123456789.mat

Failure to do so incurs a penalty and you may be asked to re-submit (once only).

submission: submit the three files via the MOLE assignment system.

penalties: see marking scheme

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[5] if pdf reader indicates more than four pages, the remainder will be lost - don't waste space on cover sheets or unnecessary descriptions of the problem domain.

[6] this includes all additional m-files that are not part of the matlab installation or dmmilab (these must be either your own or be freely available).

[7] other compression formats are not permitted.

[8] as provided on the university managed service.