

## Exercise objective:


We can predict missing logs using the log-log prediction tool, which is part of the machine learning plugin. In this case we want to predict the Porosity log.

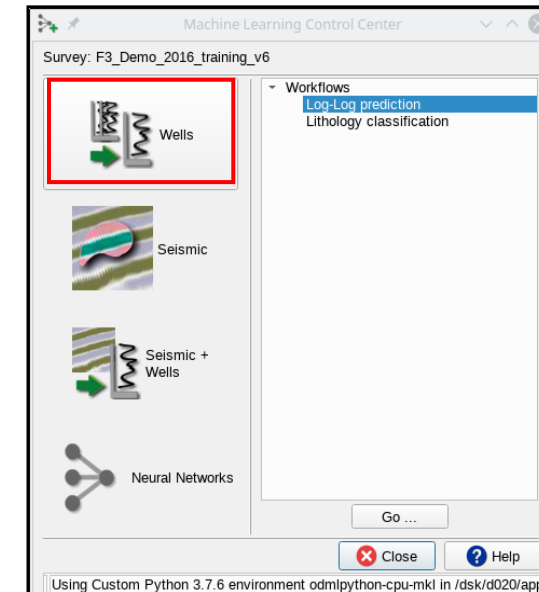
### Well data Preparation

**Well**(s) need to be available in the survey. If they are not available: **import** wells (track, logs, markers, optionally time-depth curve or checkshot).

### Workflow:



1. **Open** the Machine Learning Control Center with the  icon.
2. **Click** on Wells.
3. **Select** Log-Log prediction and **Hit** Go.



## Workflow cont'd:

4. “Log-log prediction” window pops up.

In the **Extract** Data tab

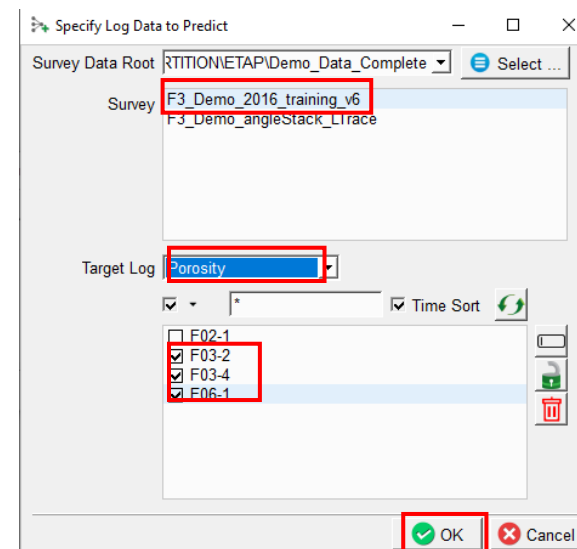
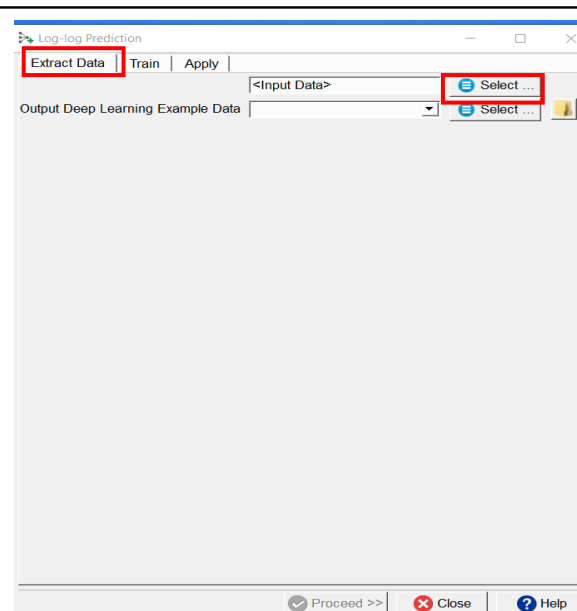
5. **Select** Input Data.

6. **Specify** Log Data to predict window pops up.

7. **Select** Survey, Target Log (e.g. Porosity), and all Wells that will be used for the data extraction as indicated in the window.


Well F02-1 is not selected, and will be used as a blind well.

8. **Press** OK.



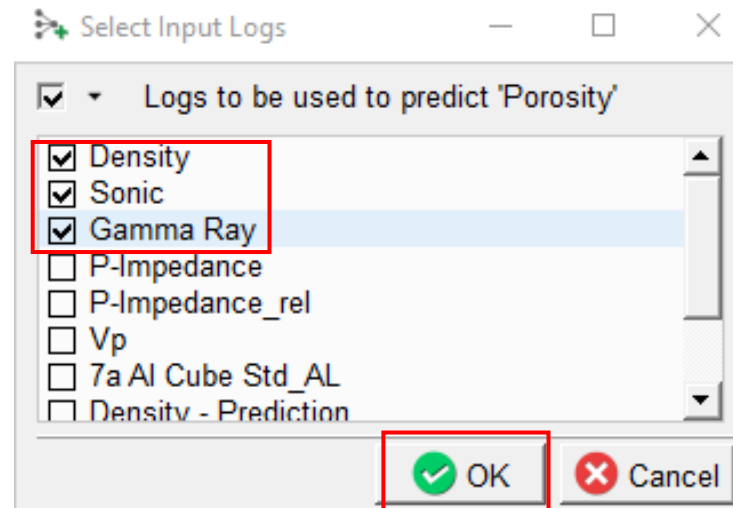
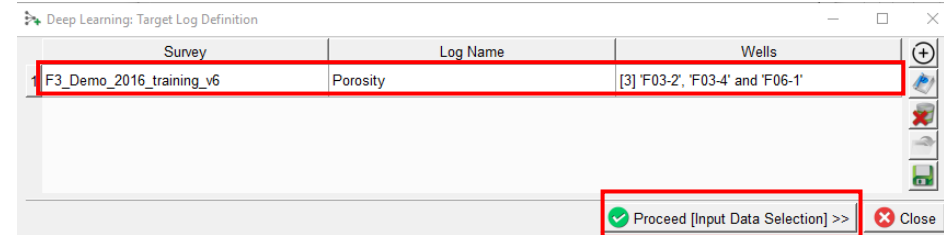
## Workflow cont'd:

9. The “*Deep Learning Target Log definition*” window pops up next.

New data from different survey can be added by clicking on the icon  Target log and input wells can be edited in this window.

Once we are satisfied that we have enough data for training,

10. **Keep** the default parameters and **Press** Proceed [Input Data Selection].
11. *Select Input Logs* window pops up.
12. **Select** the Density, *Sonic* and *Gamma Ray* logs that will be used to predict the ‘Porosity’ log.
13. **Press** OK.



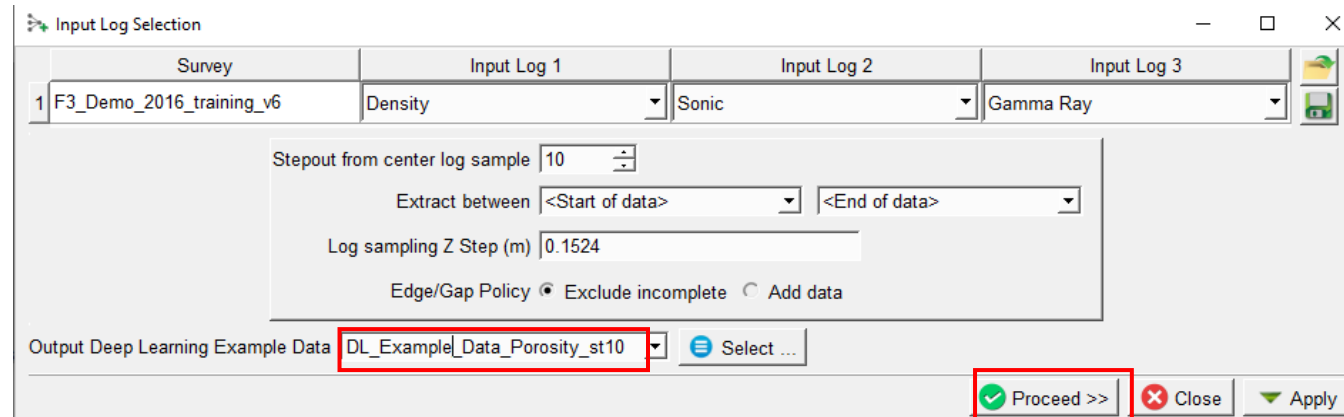
## Workflow cont'd:

14. *Input Log Selection* window pops up.

Input Logs can be modified. Keep the default parameters as indicated in this window.

15. **Type** a new name for the *Output Deep Learning Example Data* (e.g. *DL\_Example\_Data\_Porosity\_st10*).

16. **Press** Proceed.



	Survey	Input Log 1	Input Log 2	Input Log 3
1	F3_Demo_2016_training_v6	Density	Sonic	Gamma Ray

Stepout from center log sample 10

Extract between <Start of data> <End of data>

Log sampling Z Step (m) 0.1524

Edge/Gap Policy ☒ Exclude incomplete ☐ Add data

Output Deep Learning Example Data DL\_Example\_Data\_Porosity\_st10 Select ...

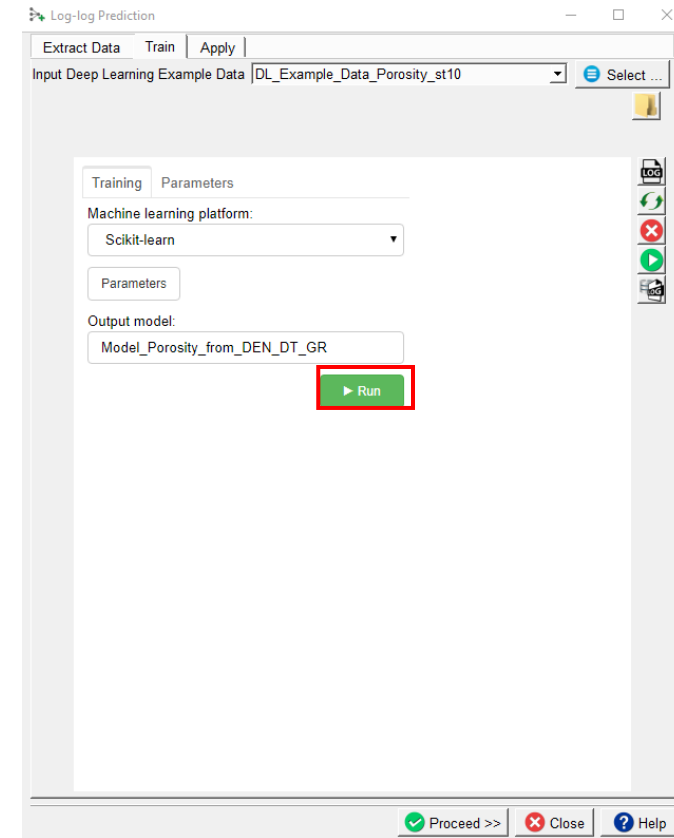
Proceed >> Close Apply

## Workflow cont'd:

17. The *Train* tab opens. Select the Machine learning platform: Scikit-learn (Random Forests).

Different machine learning platforms and parameters can be tested.

18. **Keep** the defaults parameters. **Enter** new *Output model* name (e.g. Model\_Porosity\_from\_DEN\_DT\_GR).
19. **Press** Run.

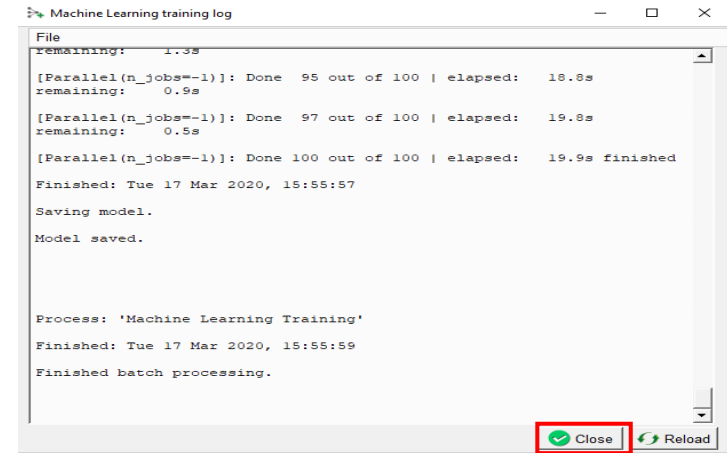


## Workflow cont'd:

20. The 'ML training log' window pops up. When the process finish, **Click** Close.
21. In the 'Apply tab' of the Log-log Prediction window, verify all defaults selected data are correct.

The Survey and the Training Model can be modified in this window.

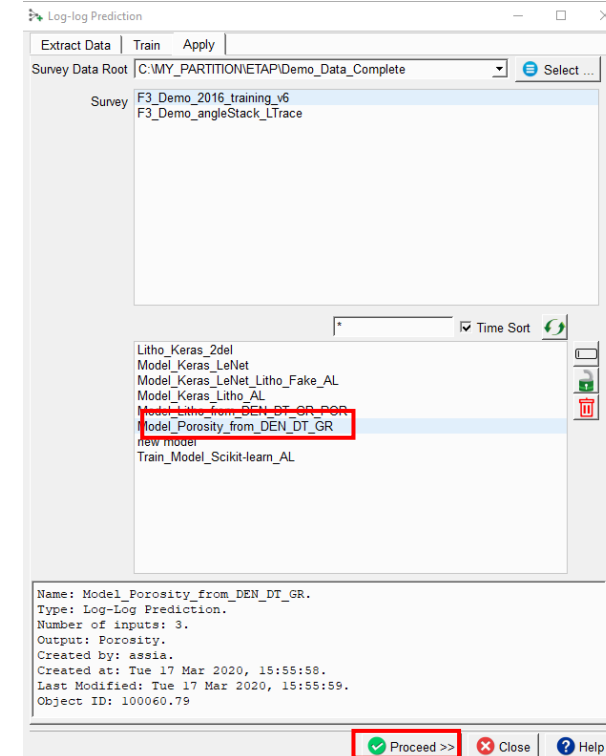
22. **Press** Proceed.



A screenshot of a 'Machine Learning training log' window. The window displays a log of training progress, including parallel processing status and completion time. At the bottom right, there are two buttons: 'Close' (with a green checkmark icon) and 'Reload' (with a circular arrow icon). The 'Close' button is highlighted with a red rectangle.

```
File
remaining: 1.3s
[Parallel(n_jobs=-1)]: Done 95 out of 100 | elapsed: 18.8s
remaining: 0.9s
[Parallel(n_jobs=-1)]: Done 97 out of 100 | elapsed: 19.8s
remaining: 0.5s
[Parallel(n_jobs=-1)]: Done 100 out of 100 | elapsed: 19.9s finished
Finished: Tue 17 Mar 2020, 15:55:57
Saving model.
Model saved.

Process: 'Machine Learning Training'
Finished: Tue 17 Mar 2020, 15:55:59
Finished batch processing.
```



## Workflow cont'd:

23. The 'Apply' created training model window pops up.

In this window we will select a log (or logs) on which we will apply the trained model and predict the target log.

24. **Apply** the trained model to a blind well (not used in the training process). **Select** F02-1.

25. **Keep** default parameters and **Press** Run to continue.

26. When the computation finishes, **Press** Close.

The screenshot shows a software window titled "Apply 'Model\_Porosity\_from\_DEN\_DT\_GR'". It contains several input fields and a list of logs. The "Input log for 'Density'" is set to "Density", "Input log for 'Sonic'" is set to "Sonic", and "Input log for 'Gamma Ray'" is set to "Gamma Ray". Below these, there is a section for "Apply to" with a checked checkbox and a dropdown menu showing "\*". To the right of this is a "Time Sort" checkbox, which is also checked, and a refresh icon. A list of logs is displayed below, with "F02-1" selected and highlighted in blue. The other logs in the list are "F06-1", "F03-2", and "> F03-4 <". To the right of the list are icons for a folder, a document, and a trash can. Below the list, there are two dropdown menus for "Extract between" and "Extract to", both set to "<Start of data>" and "<End of data>". Below these is a text field for "Log sampling Z Step (m)" with the value "0.1524". At the bottom, there is a text field for "Log name for 'Porosity'" with the value "Porosity\_from\_DEN\_DT\_GR". At the bottom right, there are two buttons: "Run" (with a green checkmark icon) and "Close" (with a red X icon). Both buttons are highlighted with red rectangles.

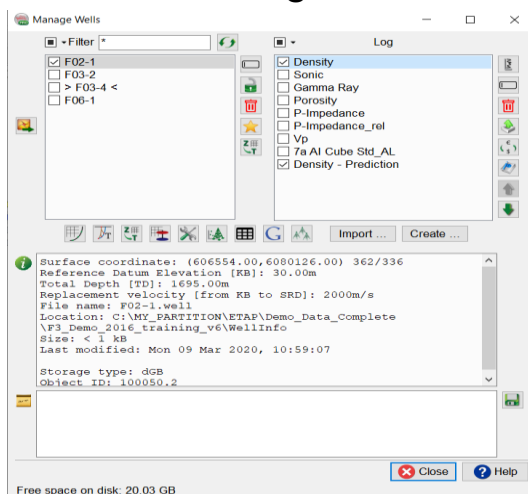
## Workflow cont'd:

QC results by displaying the predicted log adjacent to the recorded log.

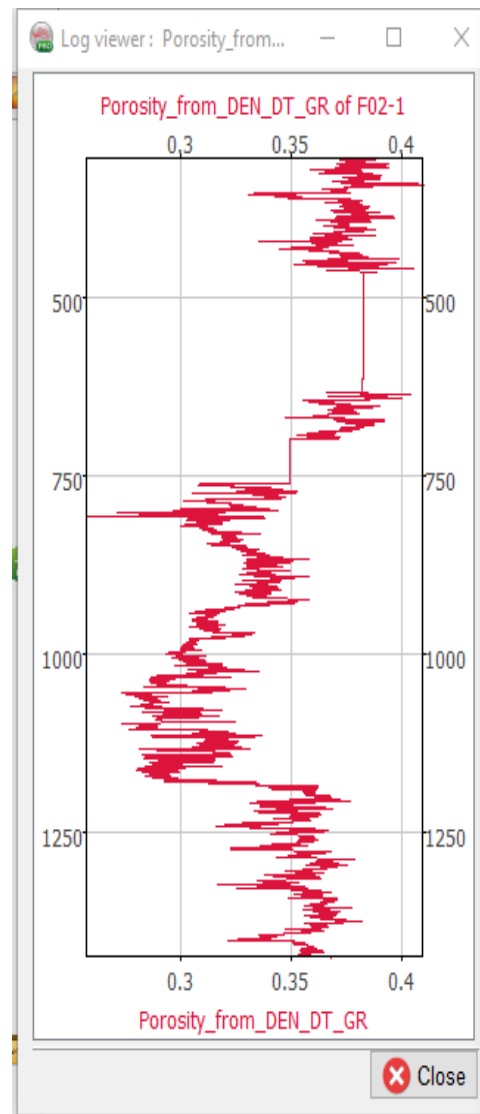
27. **Click** on the Well Manager  icon.

28. **Select** the well F02-1, and the logs Porosity and predicted porosity: Porosity-from\_DEN\_DT\_GR.

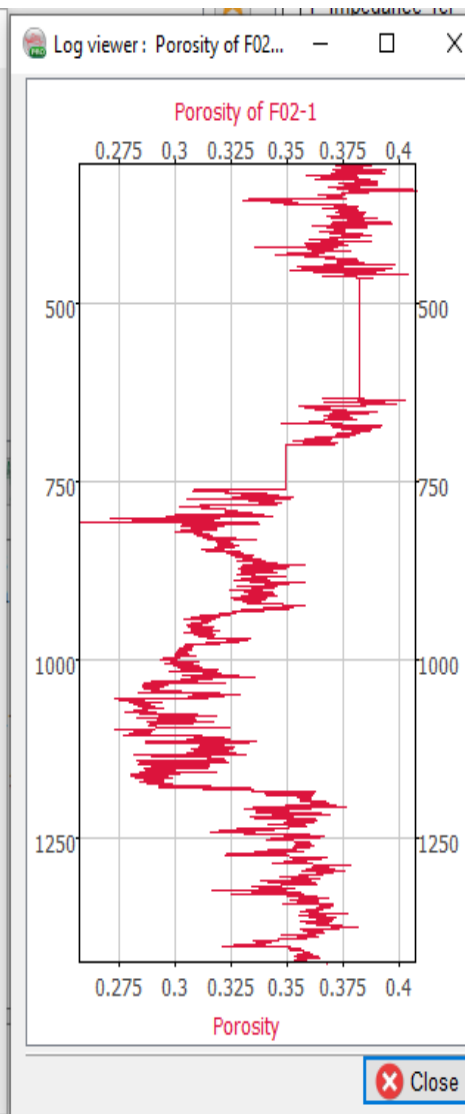
29. **Click** on view logs.



Porosity



Predicted-Porosity





## Workflow cont'd:

If the results are satisfactory, go back to the “Apply training” window, and apply the trained model to all the wells where you want to predict porosity log.

30. **Select** all wells where you want to predict porosity.
31. **Keep** default parameters and **Press** Run to continue.
32. **QC** the predicted well porosity logs as in the previous step.

Apply 'Train\_Model\_Scikit-learn\_AL'

Input log for 'Sonic' Sonic

Input log for 'Gamma Ray' Gamma Ray

Apply to ☒ \* ☒ Time Sort

- ☒ F02-1
- ☒ F06-1
- ☒ F03-2
- ☒ > F03-4 <

Extract between <Start of data> <End of data>

Log sampling Z Step (m) 0.1524

Log name for 'Density' rain Model Scikit-learn AL

Run Close