Training the machine-learning models for avalanche prediction

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The Python scripts used in the random forest optimisation and feature selection procedure are briefly presented. See section 3.3 in the paper for the five steps of this procedure.

1. Execute the script `ML_Model_Validation.py` with the following parameter settings:

   ```
   n_best = 0
   feats = ''all''
   ```

   and `a_p` to the desired avalanche problem. Read the optimal values for the hyperparameters `min_samples_leaf` (MSL) and `min_samples_split` (MSS) from the generated plots.

2. Train a first model with the script `Train_Model_with_SNOWPACK.py`. Be sure to have the parameters in the script set to:

   ```
   n_best = 0
   feats = ''all''
   ```

   and set the hyperparameters MSS (`min_split`) and MSP (`min_leaf`) to the values found in step 1. This produces a feature ranking based on feature importances. Based on this, the script

   `Iterative_Feature_Search.py`

   is used to exclude those features that are well-correlated (Pearson R > 0.9, but this can be adjusted in the script) with a feature of higher importance.

3. Step 1 is repeated, but only with the best predictive features to find the new MSL and MSS. Thus, set the parameters to:

```
n_best = 0
feats = ‘‘best’’
```

4. Repeat step 2, but with:

   ```
   n_best = 0
   feats = ‘‘best’’
   ```

   and the MSP and MSS parameters set to the values found in step 3.

5. Find the optimal number of features using `Feature_Number_Test.py`. In the script make sure to set the MSL and MSS parameters to the correct values (i.e., the ones found in step 3).

Using the hyperparameters and feature numbers found in the above procedure, the machine-learning models for the individual avalanche problems can be trained with the script

```
Train_Model_with_SNOWPACK.py
```

Again, make sure to set the parameters according to the values found in the above procedure. As an example, the following presents the parameter combination for the wind slab problem:

```
n_best = 30
feats = ‘‘best’’
a_p = ‘‘wind_slab’’
min_leaf = 15
min_split = 15
```