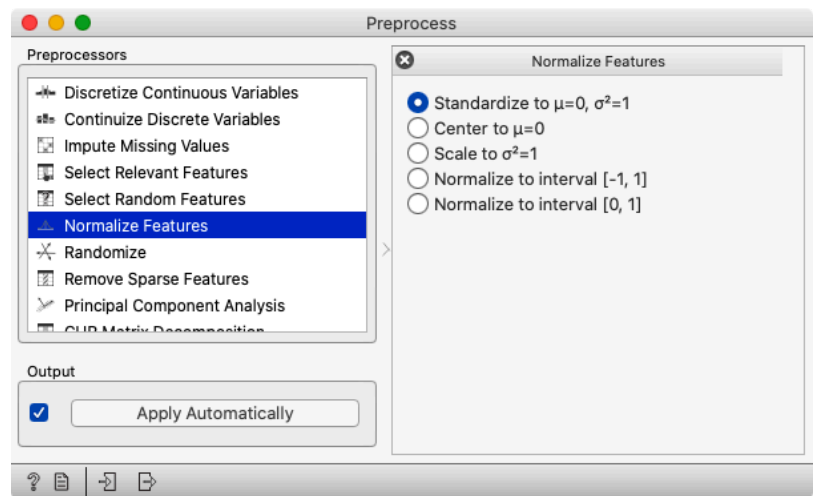


## Homework #6: Linear Regression

Download the data about body fat measurements from <http://file.biolab.si/files/fat.xlsx>. You can find the description of this data set at <http://ww2.amstat.org/publications/jse/datasets/fat.txt>. We use “Percent body fat using Brozek’s equation” as the target, and we have removed its near-duplicate “Percent body fat using Siri’s equation.” From the original features, we have also removed the feature “Density”, which cannot be routinely measured by GPs.

1. Build a linear regression model to predict the body fat from the given measurements. Report on its accuracy and compare it with the baseline model.
2. Use the Predictions widget and a Scatter Plot to show the relation between the actual and predicted values.
3. Which variables have the highest coefficients (parameters) in the linear regression model? Consider their absolute values, ignoring the direction of influence.

4. Instead of feeding the raw data to the linear regression model, develop the model on normalized data. To normalize the data, feed it to the Preprocess widget, and use the preprocessing by “Normalize Feature” (see the screenshot of this widget with the proper setting). Normalization will subtract the mean from all columns and divide them by their standard deviations. Then train the linear model on the output data from Preprocess widget. Does normalization affect the coefficients of the linear model? Does normalization affect the predictive performance of the model? Explain!



5. Both sets of coefficients - those for items (3) and (4) - are useful for something. What can you read from the former (coefficients in question 3) that you can't get from the latter (coefficients in question 4) and vice-versa?
6. Use Lasso regularization with a suitable strength to identify a subset of three to five most important independent variables. How well does this model perform compared to the one on all features? Explain the workflow that you used in sufficient detail, including the relevant settings in the widgets and the way the widgets are connected.
7. Show a scatter plot that relates the dependent variable's value and predictions for your most accurate predictor and discuss the figure's results. Rather than using Predict widget, use the Test & Score widget outcome, which outputs the predicted values when a data instance was used in the test set. Use 10-fold cross-validation in Test & Score. In this way, you will avoid reporting results that would be the outcome of overfitting.

Submit the homework as a short report in PDF where you answer the above questions. Organize your report so that you number the answers according to question numbering above. Use 11 pt Calibre or Arial or similar sans-serif font, and 1.2 spacing between lines. Use 6 pt separation between paragraphs. Limit the number of pages in the report to two. Name your PDF document as lastname-firstname-6.pdf (like smith-mary-6.pdf; notice there are no spaces in the name, all letters are lowercase, and the dash is used to

separate the first and last name) where the last name is your last name, and the firstname is your first name. Email the report to [bzupan@gmail.com](mailto:bzupan@gmail.com) with subject DM-HW6 (copy the subject title and then paste it into the email title field; notice there are no spaces in the subject title). The deadline for this homework is 9:00 am on Friday, February 18.