SDA up-skill project (sensors)

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The main **goal** of the study was to predict characteristics of a working sensor in water and isopropanol based on measured characteristics in air.

The main **assumption** for conducting this project is as following – all the 10 sensors are the items of one type of sensor.

The general idea to solve this problem based on defining correction function for the given environment:

$$f_{corr,env} = \bar{y}_{env} - \bar{y}_{air}$$

where:

env = {*water, isopropanol*}

Thus the obtaining the prediction of measurement for water and isopropanol based on measurement in air would be obtained as following:

$$y_{pred,i,env} = y_{i,air} + f_{corr,i,env}$$

where:

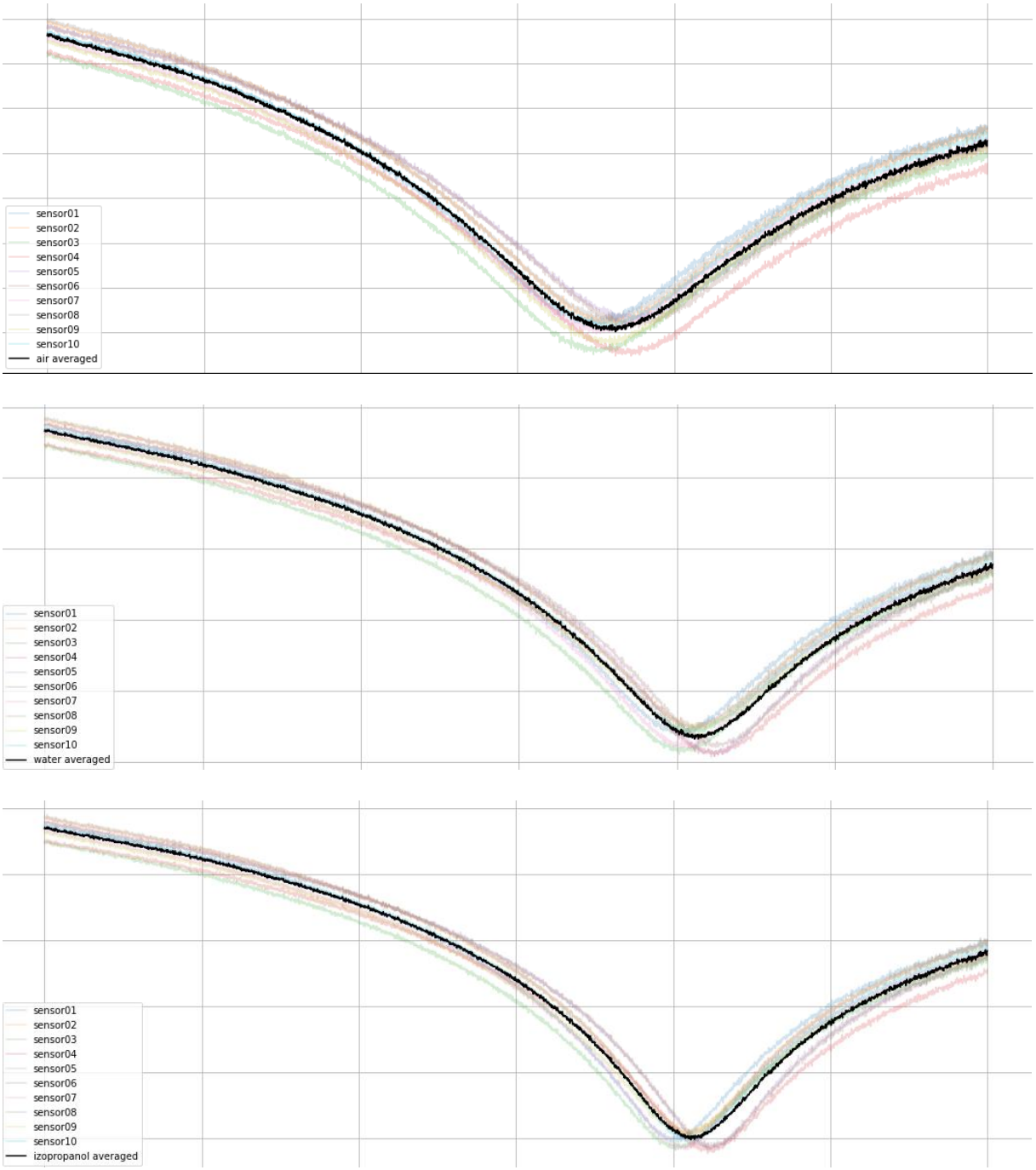
$y_{pred,i,env}$ - prediction of measurement *i* for sensor in *env* = {*water*, *isopropanol*}

$y_{i,air}$ - real measurement *i* for sensor in *water*

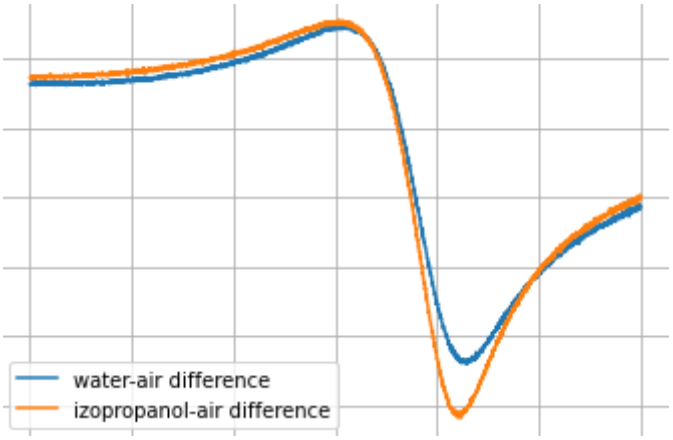
Because of the noise in measurements, the environment correction function was approximated using cubic spline in order to reduce the noise from measurements.

The main steps of the proposed solution are as following:

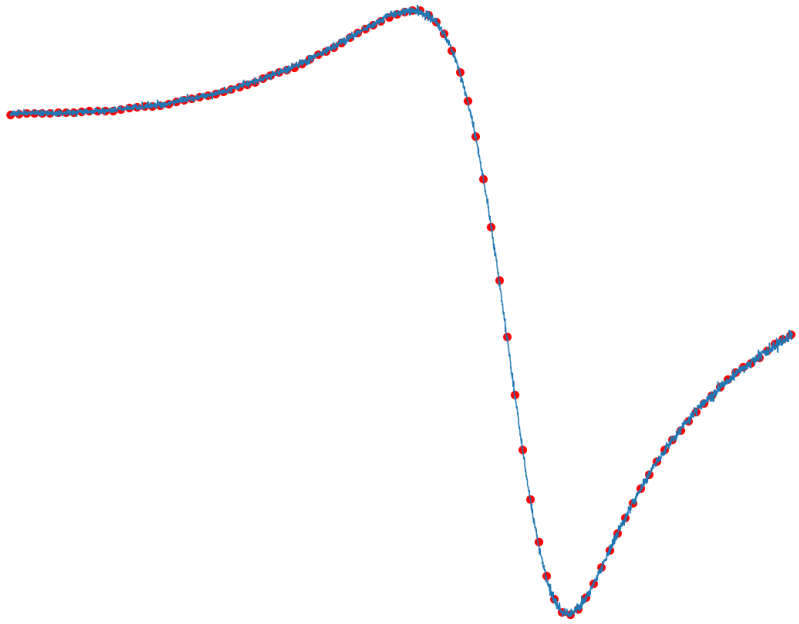
1. Load the measurements data from set of files into appropriate data structure (dictionary of pandas dataframes) in order to easy manipulate the data.
2. Calculate average measurement for each environment.



3. Calculate difference between averaged measurements in water and isopropanol and averaged measurement in air.

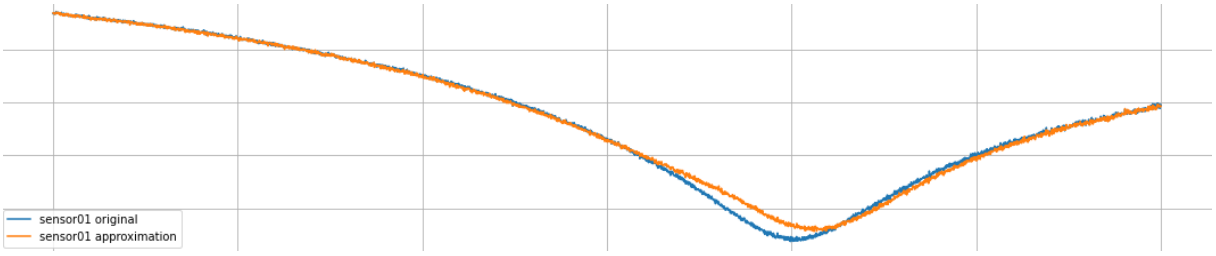


4. Approximate two environment correction functions (for water and isopropanol) from averaged measurement using cubic spline.



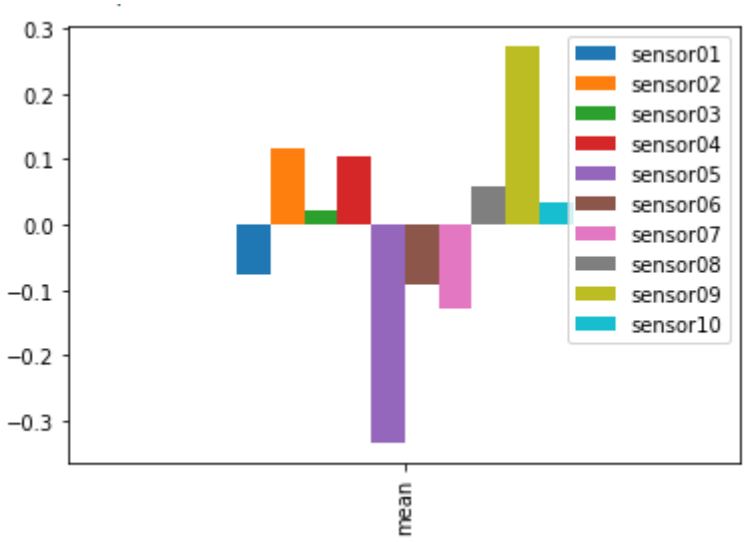
Example approximation of environment correction function for water by cubic spline

5. Calculate predicted measurements for each sensor in water and isopropanol based on air using appropriate environment correction function.

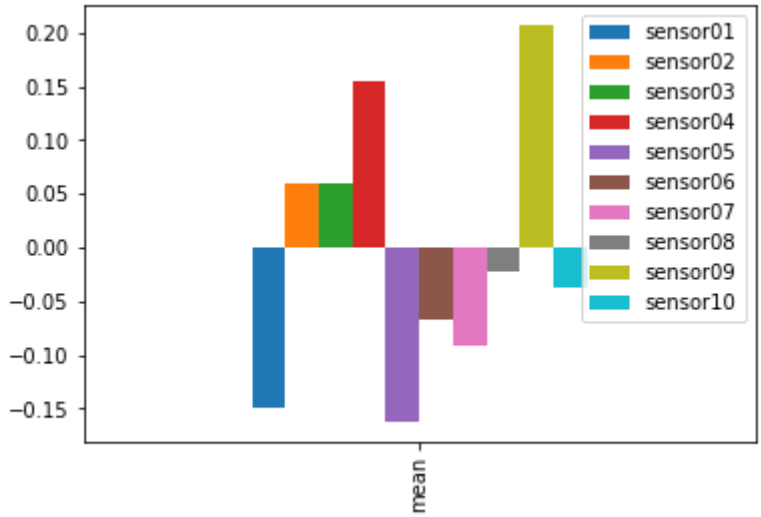


Example difference between real and predicted measurements

6. Calculate mean difference between real and predicted measurements for each sensor.



Average differences between real and predicted measurements for water



Average differences between real and predicted measurements for isopropanol.

The colab with all calculation is available here:

https://colab.research.google.com/drive/1i2n9XBpc4fcmEQ7-d6uNfQbEcldkZ8le?usp=sharing