Least Squares approximation for humidity sensor

Robbert Hofman

July 2016

1 Introduction

In the table below, *hum* stands for the humidity measured by a gehaka measuring device that is calibrated correctly. This is the reference humidity that we are trying to calibrate on. The variable *cycles* is the amount of cycles measured by our device.

Sample number	Cycles	Humidity
0	3497	11.1
1	3994	11.9
2	4511	13.0
3	4913	14.1
...	...	...
n	2900	10.1

$$y_n(x) = {\sum_{k=0}^{n}}' a_k T_k(x) \tag{1}$$

We will attempt to make a function of the following form, making the *error* term as small as possible

$$a * cycles + b = hum + error \tag{2}$$

The function that yealds the distance between the real and estimated humidities is denoted as follows

$$f(a,b) = [hum_0 - (a*cyclos_0 + b)]^2 + [hum_1 - (a*cyclos_1 + b)]^2 + ... + [hum_n - (a*cyclos_n + b)]^2 \tag{3}$$

$$f(a,b) = hum_0^2 - 2*hum_0*(a*cyclos_0 + b) + a^2*cyclos_0^2 + 2*a*b*cyclos_0 + b^2 + hum_1^2 - 2*hum_1*(a*cyclos_1 + b) + a^2*cyclos_1^2 \tag{4}$$

To minimize this distance function, we need to set all first partial derivatives to zero:

$$\frac{\partial}{\partial a} f(a,b) = 0 \tag{5a}$$

$$\frac{\partial}{\partial b} f(a,b) = 0 \tag{5b}$$

$$
\begin{aligned}
\frac{\partial}{\partial a} f(a,b) = -2 * hum_0 * cyclos_0 + 2 * a * cyclos_0^2 + 2 * b * cyclos_0 \\
-2 * hum_1 * cyclos_1 + 2 * a * cyclos_1^2 + 2 * b * cyclos_1 \\
+ \cdots - 2 * hum_n * cyclos_n + 2 * a * cyclos_n^2 + 2 * b * cyclos_n \\
= 0
\end{aligned}
\tag{6a}
$$

$$
\begin{aligned}
\frac{\partial}{\partial b} f(a,b) = -2 * hum_0 + 2 * a * cylos_0 + 2 * b \\
-2 * hum_1 + 2 * a * cylos_1 + 2 * b \\
+ \cdots - 2 * hum_n + 2 * a * cylos_n + 2 * b \\
= 0
\end{aligned}
\tag{6b}
$$

Or equivalently,

$$
b = \frac{\sum_{i=0}^{n} hum_n}{n} = jeuleu \tag{7a}
$$

2 Conclusion

Mathieu is nen tank

lol swag koe
bobs

$45 + 6 =$
7

$$lol+ = equazeppersmetbobellelzeolnronosfdnsfdndfnndfgndgofjgoisjgiprzgpirpjrepj = 5*okpokpojlnonljnoiuoi \tag{8}$$

yolo swag