ADJUSTMENT OF NUMERICAL DATA FOLLOWING SOME MEASUREMENTS

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Abstract

In this paper, we will present a mathematical estimate based on numerical measured temperature and humidity data, from an established area, on consecutive days, in the current year. The method used is called the adjustment of numerical data stability by measurements (x_i,y_i)*, i takes values from 1 to n, which can be done with minimal error. The phenomena in various fields of activity can be represented by a link, which can be determined. This is given by a function between an independent variable x and a dependent variable y,* $f:[a,b]\rightarrow\mathbb{R}$*, this is* $y = f(x)$*. Determining the legitimacy or the trend of variation, is this function f.*

It is possible to research phenomena of human activity, which propose the determination of this function, using values observed and measured by the researcher, be they x_i *and* y_i*, distinct points. There are two steps in adjusting the numerical data. The first stage refers to determining the type of trend, as a graphical representation in the plan of the measured numerical values. The second stage consists in determining the parameters* a_i*, i from 1 to p, by the least squares method, which is the most frequently used.*

Key words: function, temperature, humidity, numerical data

INTRODUCTION

We collected numerical data measured, from a metropolitan area, in five consecutive days of October 2021, characterized by temperature, humidity and other characteristics that we will not talk about in this paper. The processing we will do refers only to the two quantities, which we denote by x = T (outside temperature measured in degrees Celsius), y = H (outside humidity determined as a percentage %). We adjust these numerical data using the two steps listed above, which can be various mathematical descriptions. There are several types of trends, for example exponential, logarithmic, linear, parabolic, e.t.c., which are characterized by functions with real coefficients or parameters $y = f(x; a_1, a_2, a_3,\dots, a_p)$. In the case of the linear trend we have the representative function: $y = f(x;a,b)= ax+b$ where a,b are real unknowns, for the parabolic trend: $y = f(x;a,b,c)$, where a,b,c are real unknowns, for the exponential trend $y = f(x;a,b) = ab^x$,where $b > 0$, $b \neq 1$, a are real unknowns.

In this case, for the graphical representation of the 5 points in the plan that determines the type of trend, we will use the Microsoft Excel program, and then we start the mathematical processing.

MATERIAL AND METHOD

The measured data are represented in the following table 1.

Table 1

Measured data

T (° C)	15	17	19	18	18
U	39%	50%	53%	58%	61%

After drawing the graph, a linear trend is obtained, which can be studied mathematically. The axis of the abscissa OX, is represented by the temperature in degrees Celsius, and the axis of the ordinate OY, is the axis of humidity, as in figure 1:

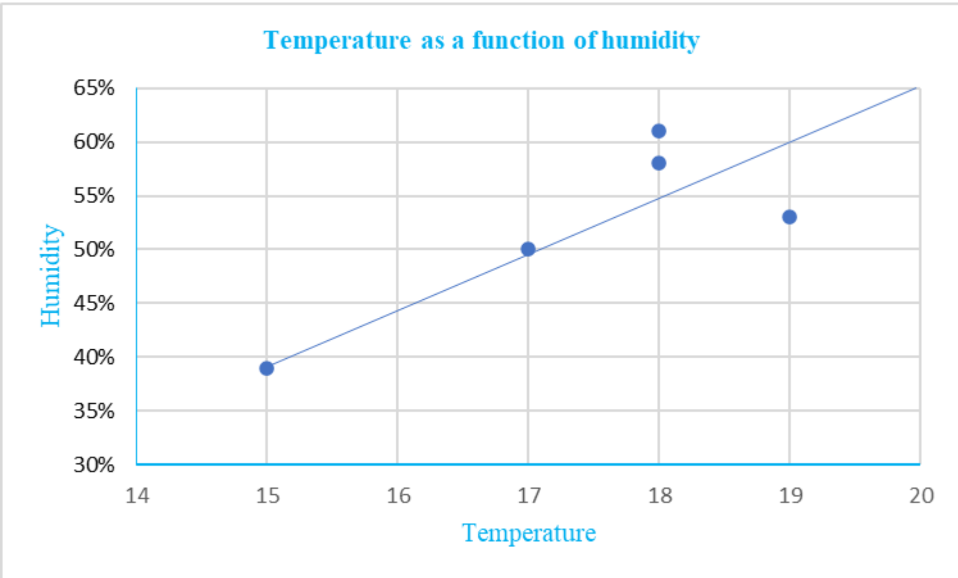

Figure 1. The study of trend

The representative function is U = f (T; a, b) = aT + b, a, b unknown real, U is the dependent quantity, and T is the independent quantity. We want to determine the adjustment function starting from this amount which must be minimum.

$$S(a, b) = \sum_{i=1}^{5} [(a \cdot T_i + b) - U_i]^2 (1)$$

This method consists in determining the coefficients a and b, solving the system of partial differential equations:

$$\begin{cases} \frac{\partial S}{\partial a} = 0 \\ \frac{\partial S}{\partial b} = 0 \end{cases} (2).$$

The system thus replaced becomes:

$$\begin{cases} 2 \cdot \sum_{i=1}^{5} (a \cdot T_i + b - U_i) \cdot T_i = 0 \\ 2 \cdot \sum_{i=1}^{5} (a \cdot T_i + b - U_i) = 0 \end{cases} (3).$$

According to elementary calculations, the form results:

$$\begin{cases} (\sum_{i=1}^{5} T_i^2) \cdot a + (\sum_{i=1}^{5} T_i) \cdot b = \sum_{i=1}^{5} T_i \cdot U_i \\ (\sum_{i=1}^{5} T_i) \cdot a + 5 \cdot b = \sum_{i=1}^{5} U_i \end{cases} (4)$$

Replacing the data in the following table 2,

Table 2

Date de utilizat

	T_i	U_i	$(T_i)^2$	$T_i \cdot U_i$
	15	0,39	225	5,85
	17	0,5	289	8,5
	19	0,53	361	10,07
	18	0,58	324	10,44
	18	0,61	324	10,98
TOTAL	**87**	**2.61**	**1523**	**45,84**

we get:

$$\begin{cases} 1523 \cdot a + 87 \cdot b = 45{,}84 \\ 87 \cdot a + 5 \cdot b = 2{,}61 \end{cases} (5).$$

After solving this elementary system by a correct mathematical method, we obtain:

$$a \cong 0{,}046304 \ldots, \qquad b \cong -0{,}2836896 \ldots \qquad .(6)$$

Therefore the adjustment line has the equation:

$$f(T) = a \cdot T + b \ (7),$$

which becomes by the method applied:

$$f(T) = 0{,}046304 \cdot T - 0{,}28369 = U, (8).$$

RESULTS AND DISCUSSION

The result obtained is an adjustment of the source function of the measured data. In this case, the linear adjustment function has two unknown a, b, real numbers, which by the least squares method approximated the values mentioned above. For a closer evaluation of the approximate results, we can check the estimate for our values. For example, when T is 15 ° C, using the determined linear adjustment function and substituting the temperature in it, we obtain the value of humidity U = 0.41.

The more accurate the numerical data and this refers to the minimization of measurement errors and the more numerous they are, the more accurate the estimation of the adjustment function.

CONCLUSIONS

If we used this adjustment function for a humidity value from another day in October, in the same metropolitan area, we would get the estimated temperature value from that day. For example, if the measured humidity is U = 0.61, it will correspond, after the adjustment function, to a temperature value of T = 19.3 ° C. Obviously, these results can also be used for more laborious and estimated forecasts, with respect to temperature and humidity for other dates, months and years.

This mathematical method can be used for phenomena in any field of human activity, as a research method, which can be used for subsequent estimates.

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