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Method For Constructing Correlation Dependences For Functions Of Many Variables Used Finite Differences

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ABSTRACT

The article considers a method for constructing correlation models for finite-type functions using a set of variables. The use of the method of unknown squares in the construction of correlation models and the construction of higher-quality models is also justified. The proposed correlation models are considered on the example of statistical data of the Bukhara region of the Republic of Uzbekistan.

KEYWORDS

Correlation method, unknown squares method, functional dependence, forecasting, economic and mathematical models, operational factors, mathematical education, alternative method, traditional method

INTRODUCTION

When it comes to the method of constructing correlation models, researchers usually use the method of unnamed squares and get the dependence Y = f(x), but these obtained dependences do not give the real Parin of the actual process. Of course, correlation dependences are not functional dependence.

But sometimes the model values are so different from the real ones that make it difficult to use them in planning and forecasting practice, this explains the not very wide use of economic and mathematical models in forecasting practice and other calculations of the economy.

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In our works [1,2,3,4], some attempts were made to obtain a better quality dependence of the type ϒ = $f(x)$; namely, the rejection of traditional methods based on obtaining the relationship between the factors of feathering; namely, rejection of traditional methods based on obtaining the relationship between factors operating in advance known βx mathematical formulas such as ϒ = a_0= $в_x$, γ = Ae, γ = A - L nx etc. we proposed to find the relationship from the nature of the most data available to us. In mathematical analysis, we know that $\lim_{\Delta n \to 0} \frac{f(x_0+\Delta x)-f(x_0)}{\Delta x} = f^1(x_0)$ or $\frac{f(x_0+\Delta x)-f(x_0)}{\Delta x} \approx f^1(x_0)$ in other words.

Instead of what we have γ_i at our disposal, we can obtain finite differences of a certain order or we can calculate the value $\frac{y_{i-1-}y_i}{\Delta x} \approx f^1(x)$ Now, instead of getting the dependency ϒ = $f(x)$, we will build a function of $\gamma^1 = g(x)$ based on this data. Integrating this function and solving the Cauchy problem, we obtain the desired correlation dependence of the type ϒ = $f(x)$.

We will consider the methodology for constructing correlations using the proposed method using a specific example, using the example of real statistical data of the Bukhara region of the Republic of Uzbekistan in the period 2014-2019.

Let Y = (t) the volume of GDP in the region $x_1(t)$ - the number of households producing agricultural products (thousand) x_2 (t) the volume of production by farms.

All data for calculating carrying out in table No. 1 Table No. 1

t	The volume of GDP ϒ	ΔX (thousand) x_1	ϕx x_2	$\Delta\gamma$ $(ϒ_{i-1-}ϒ_i)$	Δx_1 $x_{i+1-}x_i$	Δx_2 $x^2{}_{i+1} - x^2$	$\frac{\Delta y}{\Delta x_i}$	$\frac{\Delta y}{\Delta x_i}$
2014	9723	401	4301,8	-	-	-	-	-
2015	11816	409.7	5267,8	2093	8,7	965	240,57	2,17
2016	13780	417,6	6006,4	1964	7,9	738,6	248,6	2,64
2017	16504	421	7713,9	2724	5	1707	544,8	1,595
2018	21158	430,8	10003,5	4654	8,8	2289	528,86	2,03
2019	26695	438,5	11262	5537	7,7	1259	719,1	4,39

For the $\frac{\Delta\gamma_1}{\Delta x_1}$ calculation, we use the data in table No. 1 of the city (8) as well as columns (3) as. Using traditional methods, the dependence $\frac{\Delta\gamma_1}{\Delta x_1}$ = 16,89 x_1- 6702,46. was obtained. Integrating this under the condition $\Upsilon(401) = 9723$ we get the dependence $\frac{\Delta\gamma_1}{\Delta x_1}$ = 16,89 x_1-6702,46. This is integrated, provided $\Upsilon(401) = 9723$ we get a real function.

$$\Upsilon_1 = 8{,}44\ x_1^2\text{-}66702{,}46\ x_1 + 1340249$$

A thorough methodology for calculating these functions is given in [1,2,3]

By repeating these calculation algorithms, we get Υ_2= 0,000117 x_2^2 + 0,682 x_2 +4984.

Since $dy\ (x_1, x_2) = \frac{\partial y\ (X1\ X1)}{\partial x_1}\ \Delta x_1 + \frac{\partial y\ (X1\ X1)}{\partial x_2}\ \Delta x_2$ we find the correlation function $y\ (x_1; x_2)$ according to this formula. And so, the final dependency function is as follows.

$$y = 4{,}22\ x_1^2 - 0{,}3351, 23\ x, +0{,}0000585\ x_2^2 + 0{,}341\ x_2 + 672616{,}5\ \ (1)$$

Let's compare the calculated and actual values γ_ρ и γ_ϕ

Table No. 2

x_1	x_2	γ_ρ	γ_ϕ	γ_ρ - γ_ϕ
409,7	5267,8	11381,5	11816	434,5
417,6	6006,4	13226,3	13780	553,5
422	7714	16023,5	16504	480,6
430,8	1003,5	21491,78	21158	333,7
438,5	11262	25793,3	26695	901,8

For traditional methods, we look for the dependence $y = p\ (x_1; x_2)$ in the form $y = a_o + a_1x_1 + a_2x_2$ and find the specific form of the function γ by the name-squares method γ= –26477,3+68,2x_1+1,94x_2 (2)

R = 0.98

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And so we have two functions of the correlation dependence $y = p\ (x_1 x_2)$ formula (1) is obtained by the proposed method and formula (2) by the traditional method. For a drive comparison, all the calculations in the following table are here γ_ϕ- the actual value of GDP in the area, γ_p- obtained by the proposed method and the value γ_T – obtained by the traditional method

Table No. 3

x_1	x_2	γ_p	γ_ϕ	γ_T	$\gamma_\phi - \gamma_p$	$\gamma_\phi - \gamma_T$
401	430,8	9723	9903,8	9218,3	180,8	504,6
409,7	5287,8	11816	11381,5	11683,7	435,5	132,2
417,6	6006,4	13780	13226,3	13655,4	563,7	124,5
422	7713,9	16504	16423,4	17268,6	480,6	764,06
430,8	10003,5	21156	21491,7	22310,05	333,7	115,05
0438,5	11212	26695	25793	85276,6	901,8	1418,32

Here $\frac{\Sigma\ |\gamma_\phi - \gamma_p\ |}{n} = 480$ and $\frac{\Sigma\ |\gamma_\phi - \gamma_T\ |}{n} = 682{,}6$

The proposed method is an alternative method for constructing correlation dependences to the existing ones.

CONCLUSION

The main task set before us when writing work [1; 2; 3] and this work is the development of alternative methods to the existing one, such as the method of unnamed squares and others. Here, the correlation between the factors is not known in advance for specific mathematical functions, but is determined based on the nature of the available data.

In mathematical analysis it is assumed that the derivative function gives the saw characteristics of the antiderivative of the function. Fully determined by interns of growth and descent, maximum value and minimum value and minimum. And based on this, you can configure the very antiderivative function

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without any difficulty. To solve many problems in mechanics and theoretical physics, to obtain the desired dependence Υ = $f(x)$, the equation $\frac{dy}{dx}$= φ (x) or $\frac{d^2y}{dx^2}$ = $f(x)$ is first constructed.

Then, after integration, the desired dependence is obtained. So, for example, when obtaining a mixing formula for a mathematical pendulum, first one obtains an equation for accelerating a process of the type Ẍ = - Ax. And after twice integration, the mixing formulas X = A sin$\left(\frac{2\pi t}{T} + \varphi\right) = A\sin(wt + \varphi_0)$ are obtained

The formulas for radioactive decay are obtained in the same way (M.S. Curie's Law).

$N_x = N_o * 2^{-\frac{t}{T}}$ where N_x is the number of radioactively non-herded atoms and N_o the number of atoms before the calculation of the process of herding. T-half-life. And N_o is determined by a simple $N_o = \frac{m}{\mu} * N_a$formula.

Based on the methods of obtaining functional dependencies in other industries at uni, we also wanted to apply this method in mathematical statistics. And the conducted research has shown the possibility and effectiveness of this attempt.

Here is one of the simplest examples of which gives hope to use the proposed method in mathematical statistics and econometrics.

Let the following data be obtained as a result of observation, which are given in the following table. The task is to obtain the dependence y= f (x) by the finite difference method.

X	y	$\frac{dy}{dx}$	$\frac{\Delta^2 y}{\Delta x^2}$	$\frac{\Delta^3 y}{\Delta x^3}$
0	0	-		
1	1	1		
2	8	07	6	
3	27	19	12	6
4	64	37	18	6

And so we have $\frac{\Delta^3 y}{\Delta x^3}$ = 6

With $y''_{(0)} = 0$ or

$\frac{\Delta^2 y}{\Delta x^2}$ = 6x+c_1 and

$y''_{(0)} = 0\ 6 * 0 + c_1 = 0$

$c_1 = 0$

Further $\frac{\Delta^2 y}{\Delta x^2}$ = 6x $\frac{dy}{dx}$ =6 * $\frac{x^2}{2}$ + c_2 and $\frac{\Delta^2 y}{\Delta x^2}$ = 6x $\frac{dy}{dx}$ =6 * $\frac{x^2}{2}$ + c_2 and y' (0) = 0, therefore y= x^3.

In our work, for simplicity, we basically stopped the computation process at the first step. And having received $\frac{dy}{dx}$ = (x) immediately after integration, we obtained the required dependence y= f (x). With

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this method, as indicated above for the example of obtaining the dependence $y = x^3$, you can continue the calculation algorithm until $\frac{\Delta^n y}{\Delta x^n} = const$ the return by integration has reached the goal.

Sometimes, stopping the process after receiving the data $\frac{dy}{dx}$, we apply some methods of obtaining correlation functions, for example, the method of least squares.

The authors propose in the future to increase the need for correlation functions to use a dependence of the type $\frac{dy}{dx} = (px) = a_0 + a_1\,(x - a_1) + a_3(x - x_1)(x - x_2) + a_3(x - x_1)(x_3) + \ldots\ldots + a_{n-1}(x - x_1)(x - x_2)\ldots\ (x - x_{2n-1})$.

The coefficients are calculated by simple methods of mathematical analysis. And after integration we get the required function. The only drawback of this approach is the difficulty of mathematical calculations.

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