

Splay-Method of Model Acquisition Assessment

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We know that the study of an object under investigation using a mathematical model is called modeling. The purpose of modeling will be to determine the properties of the object under study, to model it and to assess its condition. The main objectives of modeling are:

- substantiate the validity of the mathematical interpretation of the object;
- identify functional relationships between model variables;
- compare the strategy of the parties in problematic situations;
- identification of the research object;
- model optimization and selection of target function.

Building a model begins with studying the object and making assumptions about it. To do this, similar model classes are analyzed and the closest prototype is selected. As a result of the analysis of prototypes, a logical scheme is constructed that identifies the properties of the object and allows experiments. Such a logic circuit is called an object model. When the mathematical explanations of the model and the object are consistent, that is, when they are similar, the results of the study of the properties of the model can be assessed as model adequacy.

There are several criteria for determining model adequacy as a result of the application of mathematical modeling to the process of objects subject to mathematical laws (e.g., 3-sigma, residual variance tends to zero, correlation method, T-criterion student, etc.). As a result of the analysis of these criteria in the process of model construction, the possibility of using a new spline method of estimating the adequacy of the model was confirmed in practice. In assessing the adequacy of the model, the application of the spline method to the data obtained from scientific experiments (if given in tabular or analytical form) determines the b_i -coefficient values and, in the main cases, the Δ -grid spline in the following order. There are different ways to find the values of the coefficients: using interpolation and local formulas, spline grinding, interpolation, the least squares method was used.

In many cases, in order to simplify the complexity of the calculation process, the local spline-approximation, some

aspiration value of the spline function, depends on the approximate values of each piece of the function and affects the surrounding pieces. It is possible to determine the level of the spline regardless of the number of Δ -net nodes for computational work of the required size. As a result, there is a small probability that the accuracy of the approximation formula is more difficult than building an interpolation spline method.

It has been proved that the values of the coefficients can be found using a formula $b_i = b(f(x))$. By quoting this formula in accordance with the purpose, it will be possible to organize the evaluation, parallelization and conveying of computational operations. The formula given below can be called a K-point. For the secondary spline:

1. Appearance of three-point formula:

$$b_i = \frac{1}{8}(-f_{i-1} + 10f_i - f_{i+1}) \quad (1)$$

2. Five-point formula view:

$$b_i = \frac{1}{64}(f_{i-2} - 12f_{i-1} + 86f_i - 12f_{i+1} + f_{i+2}) \quad (2)$$

Table 1 below shows the approximation results using the functional local formulas $y = \ln(x+1)$. The last column of the table shows the results for the "three-point" and "five-point" formulas of the approximation method with errors $\Delta 1\%$ and $\Delta 2\%$.

In the process of such methods, it is difficult to determine the boundary regions of the coefficients. The following sources [1, ..., 18] provide methods for overcoming these difficulties:

1. Precise formulas are used to calculate the coefficients in the boundary regions, and as a result, the degree of accuracy of the approximation process decreases.
2. The application of a series of points results in experimental data being located outside the signals (if this is possible).
3. It is recommended to use Newton's secondary polynomials in the boundary regions, not the spline method.

Table 1. Results of approximation of the function $y = \ln(x + 1)$ using local formulas

X	f(x)	S(x)		Error 3-point Δ 1%	Error 5-point Δ 2%
		3-point	5-point		
2.5	1.252	1.245	1.250	0.430	0.124
2.75	1.321	1.311	1.318	0.621	0.187
3	1.386	1.375	1.382	0.683	0.248
3.25	1.447	1.436	1.443	0.683	0.248
3.5	1.500	1.495	1.500	0.31	0.000
3.76	1.560	1.556	1.561	0.248	0.062
4	1.610	1.601	1.605	0.559	0.310

For the third level of the spline method:

3-point formula:

$$b_i = \frac{1}{6}(-f_{i-1} + 8f_i - f_{i+1}) \tag{3}$$

5-point formula:

$$b_i = \frac{1}{36}(f_{i-2} - 10f_{i-1} + 54f_i - 10f_{i+1} + f_{i+2}) \tag{4}$$

7-point formula:

$$b_i = \frac{1}{216}(-f_{i-3} + 12f_{i-2} - 75f_{i-1} + 344f_i - 75f_{i+1} + 12f_{i+2} - f_{i+3}) \tag{5}$$

While these formulas maintain their plane, the coefficient values may not depend on the number of points and the location of the current points at the desired distance.

The results of the approximation of the approximation of the assessment of real diabetes mellitus patients 1 and 2 and the amount of glucose in healthy blood using the local formulas of the regression method and the spline method in the assessment of biochemical analysis are presented in Table 2 [19].

Table 2. Results of a comparison of data from the biochemical orthotoliudin method, regression and spline method for type 1 and 2 diabetes mellitus and healthy people

No	Biochemical Orthotoliudin method, mmol / l	Regression model value, mmol / l	Spline method value, mmmol / l	No	Biochemical Orthotoliudin method, mmol / l	Regression model value, mmol / l	Spline method value, mmmol / l
1	5,0	5,05	5.09	31	7,4	7,34	7.75
2	5,1	5,13	5.16	32	7,5	7,77	7.87
3	5,3	5,22	5.27	33	9,0	9,65	8.85
4	5,2	5,29	5.23	34	8,6	8,87	8.93
5	5,3	5,35	5.42	35	9,5	9,56	10.10
6	5,5	5,52	5.21	36	10,5	10,55	9.62
7	5,0	5,05	5.05	37	8,9	8,90	8.07
8	5,1	5,14	5.17	38	7,8	7,87	9.15
9	5,2	5,50	4.96	39	9,6	9,32	10.8
10	4,9	4,90	5.01	40	11,0	11,43	11.50
11	5,0	5,00	5.16	41	11,5	11,54	12.30
12	5,2	5,20	5.15	42	12,0	11,40	12.40
13	5,0	5,50	5.00	43	13,6	13,23	13.30
14	5,0	5,78	4.99	44	12,6	11,60	12.50
15	5,0	5,76	5.09	45	12,4	12,90	12.10
16	5,1	5,45	5.17	46	11,9	10,90	11.90
17	5,2	5,45	5.07	47	12,0	13,25	12.00
18	5,0	5,65	4.98	48	12,0	12,87	12.40
19	5,0	5,54	5.03	49	12,5	12,00	12.50
20	5,0	5,67	6.05	50	12,4	12,98	12.90
21	6,0	6,90	7.52	51	13,0	13,89	12.70
22	7,5	7,89	7.60	52	12,5	10,89	12.80
23	7,8	8,90	7.42	53	14,0	14,35	12.90
24	6,5	6,99	6.07	54	15,6	15,00	14.70
25	5,9	5,91	7.71	55	14,5	13,55	15.10
26	9,6	9,66	10.00	56	15,0	16,79	14.70
27	10,0	10,50	9.20	57	16,0	15,50	15.70
28	8,9	8,98	8.20	58	13,5	12,20	14.20
29	7,9	7,00	7.53	59	13,5	13,50	13.30

Figure 1 shows the results of the approximation and the results of the regression model (Table 2) using the “point” local formulas of the spline method to estimate the approximate real diabetes mellitus type 1.2 and blood glucose levels in healthy people.



Figure 1. Approximation graph of evaluation using the results of biochemical, regression and spline methods of 1,2 species in QD.

LIST OF REFERENCES

- [1] Айфичер, Эммануил С., Джервис, Барри У. Цифровая обработка сигналов: практический подход, 2-е издание. Пер. с англ. – М.: Издательский дом «Вильямс», 2004 г. – 992 с.: ил.
- [2] Зайнидинов Х.Н., Рахимов Б.С. Оценки погрешностей при
- [3] приближении функциональных зависимостей параболическими базисными сплайнами. XVI международная научная конференция «Математические методы в технике и технологиях» (ММТТ-16), Сб. трудов, том.2, секция 2. Санкт-Петербург, 2003. -стр.166-167.
- [4] Зайнидинов Х.Н. Параллельно-конвейерная вычислительная
- [5] структура на основе бикубических сплайнов. Вестник ТГТУ, Ташкент. -2004, № 2., - стр.32-35.
- [6] Зайнидинов Х.Н. Методы и средства цифровой обработки сигналов в
- [7] кусочно-полиномиальных базисах. Монография. Академия Государственного управления при Президенте РУз. – Т.: “Fanvatehnologiya”, 2014., 192 с.
- [8] Зайнидинов Х.Н., Турапов У.У., Маллаев О.У. Сплайн функция -UZ.
- [9] //Агентство по интеллектуальной собственности Республики Узбекистан №. DGU 2018 0411 Регистрационный номер заявки № DGU 05452.Дата поступления документов 17.05.2018 г.
- [10] Turapov U.O', Qarshiboev N.A. Automated non-invasive glucometers sustem based on innovative approaches. Scaintific research of the SCO countries: synergy and integration. MaterialsoftheInternationalConference. May 16-17. Beijing, China 2019.153-157 pp.
- [11] Турапов У.ЎУ., Саурбоев А., Гулиев А.А.Усовершенствования неинвазивного глюкометра на основе инновационных подходов.«Актуальные вопросы документообедения и информационной деятельности: теории и инновации» МАТЕРИАЛЫ V Международной научно-практической конференции студентов, аспирантов и молодых ученых. Одесса, 27-29 март. 2019 г. 310-315 ст.
- [12] Turapov U.U., Isroilov U.B., Guliev A.A., Muldanov F.R. Non-invasive Glucometer of Avtomatic Measurement of the Glucoze Lebel in Blood. International Journal of Engineering and Advanced Technology (IJEAT). ISSN: 2249-8958. Volime 9. Issue-3, February 2020/. 3331-3335 pp.