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FORECASTING METHODS ON AIR TRANSPORT

Forecasting methods based on smoothing, exponential smoothing and moving average.

During the creation «naive» models, it is assumed that some recent period of the forecast time series best describes the future of this forecast series, so in these models the forecast is usually a very simple function of the values of the forecast variable in the recent past. The simplest example is:

$$Y \times (t + 1) = Y(T) \quad (1)$$

which corresponds to the assumption that «tomorrow will be like today».

The simplest model based on *simple averaging* is the model:

$$\mathrm{Y(t + 1) = (1(t))[Y(t) + Y(t - 1)+...+Y(1)]} \quad (2)$$

and in contrast to the simplest "naive" model, which corresponded to the principle of «tomorrow will be like today», this model corresponds to the principle of «tomorrow will be as it was on average recently». Such a model, of course, is more resistant to fluctuations, because it smoothes out random emissions relative to the average.

Despite this, this method is ideologically as primitive as «naive» models and has almost the same shortcomings.

In the mentioned above formula, it was assumed that the series averaged over a sufficiently long time interval. However, as a rule, the values of the time series from the recent past better describe the forecast than the older values of the same series. Then you can use the *moving average* to predict:

$$\mathrm{Y(t + 1) = (1(T + 1)[Y(t) + Y(t - 1)+...+Y(t - T)]} \quad (3)$$

Its meaning lies in the fact that the model sees only the nearest past (by T counts in time in depth) and based only on this data it builds a forecast.

During forecasting the method of *exponential means* is often used, which constantly adapts to the data due to new values.

The formula describing this model is written as:

$$\mathrm{Y(t + 1) = aY(t) + (1 - a)Y(t)} \quad (4)$$

where Y(t+1) is the forecast for the next time period; Y(t) is the real value at time t; Y(t)-past forecast at time t; a - smoothing constant $(0 < -a < -1))$.

This method has an internal parameter *a*, which determines the dependence of the forecast on older data, and the influence of the data on the forecast decreases exponentially with the «age» of the data.

Regression forecasting methods

Along with the methods described above, based on exponential smoothing, regression algorithms have been used for forecasting for quite a long time.

Briefly, the essence of algorithms of this class can be described as follows. There is a predicted variable Y (dependent variable) and a pre-selected set of variables on which it depends - $X_1, X_2, \dots, X_N$ (independent variables). The nature of the independent variables can vary. For example, if we assume that Y is the level of demand for a certain product in the next month, then the independent variables can be the level of demand for the same product in the last and the year before last, advertising costs, the level of purchasing power of the population, the economic situation, the activities of competitors, and much more [5]. The main thing is to be able to formalize all external factors on which the level of demand may depend in numerical form [6].

The multiple regression model is generally described by the expression

$$Y = F \times (X_1, X_2, \ldots, X_N) + \varepsilon \quad (5)$$

In a simpler version of the linear regression model [7] the dependence of the dependent variable on the independent ones has the form:

$$Y = \beta_0 + \beta_1 \times X_1 + \beta_2 \times X_2 + \cdots + \beta_N \times X_N + \varepsilon \quad (6)$$

Here are $\beta_0, \beta_1, \beta_2, \ldots \beta_N$ the fitted regression coefficients, - the error component. All errors are assumed to be independent normally distributed.

To build regression models, you need to have a database of observations of approximately the following type (Table 1.).

Table 1.

Database for regression

	Variables				
	Independent				**Depend**
№1	$\mathbf{X_1}$	X_2	…	X_N	Y
1	x_{11}	x_{12}	…	x_{1N}	Y_1
2	x_{21}	x_{22}	…	x_{2N}	Y_2
…	…	…	…	…	…
m	x_{mn}	x_{m2}	…	x_{MN}	Y_m

Using a table of past observation values, you can choose (for example, using the least-squares method) regression coefficients, thereby tuning the model. One of the requirements when building regression models is that the form of dependence is as simple as possible since complex functions create additional difficulties in calculating the parameters of the model and its estimation [8].

Therefore, when forecasting transportation, it is necessary to choose the most important factors that affect transportation.

Conclusion: In this paper, we have compared method predictions based on different methods to forecast the traffic level on new airports.

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