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INNOVATIVE TECHNOLOGY OF FLOOD ALARM AND FORECASTING

Polishchuk Volodymyr,
Ph.D., Associate Professor
Uzhhorod National University

In the life of modern society, the problems associated with overcoming the consequences of emergencies, which lead to huge material losses and sometimes human losses, play a significant role. A special place among many emergencies belongs to floods of man-made and natural origin, catastrophic flooding and flooding of territories, which are one of the main socio-environmental problems of our time [1].

In the context of crisis management and security of citizens, there is a complex and urgent task of developing a mobile software product that allows, according to the geolocation data of the smartphone, to warn the user about the level of flood risk..

Thus, the aim of the study is to develop an innovative technology that contains a generalized algorithm and software support (mobile application) for flood signaling and forecasting, on the example of the Transcarpathian region. The innovation is that the algorithm is based on a hybrid intelligent model, using the analysis of reasoning and the experience of water experts.

Here is a generalized algorithm for flood signaling and forecasting.

Suppose we have n measuring stations, which each period of time t send data on the actual water level in n. To analyze the measurement data, we use the method of regression analysis, namely the method of pairwise linear regression. We present a general algorithm for flood signaling and forecasting based on a hybrid intelligent model [2] for determining the level of flood risk. The model is able to derive a normalized assessment of water level rise, uses the analysis of reasoning and experience of water management experts, reveals the vagueness of input estimates, increases the degree of validity of further management decisions based on the results. The output of the model is a normalized assessment of the danger of a flood situation and a linguistic interpretation of the level of danger of a flood situation.

1 step. Obtaining data and building a time series

In the first step, we construct a time series where y is the water level, *x* is the fixation time.

2 step. Determination of regression coefficients

In the second step, the least squares method (LSM) is used to determine the regression parameters. Find the values of the regression coefficients. LSM allows to obtain such estimates of parameters at which the sum of the squares of the deviations of the actual values of the resultant characteristic y, from the theoretical values of y at x is minimal.

3 step. Obtaining predicted values

In the third step, we construct a pairwise linear regression equation to predict the water level. To do this, we substitute future periods x into the equation to obtain the predicted values.

4 step. Fuzzification of input data

In the fourth step, we will phase the input data, based on the predicted data, the maximum and minimum allowable water level in the area (stations) $p_{it(max)}$ and $p_{it(min)}$, according to the formula:

$$\mu(p_{it}) = \begin{cases} 0, & p_{it} < a; \\ \frac{1}{2} + \frac{1}{2} cos\left(\frac{p_{it}-b}{b-a} \cdot \pi\right), & a \leq p_{it} \leq b;\ i = \overline{1,n} \\ 1, & p_{it} > b. \end{cases} \quad (1)$$

Where to put $a = p_{it(min)}$ safe (lowest) level, $b = p_{it(max)}$ accordingly - dangerous (highest) level. The concept of constructing membership functions assumes the following meaning: the higher the water level, the greater the risk of flooding, and the value of the membership function goes to one [3].

5 step. Estimation of water level projection

In the fifth step, we estimate the water level projection for the relevant area over a period of time:

$$P_{it} = \mu(p_{it}) \cdot 100. \quad (2)$$

The value obtained P_{it} characterizes the assessment of the water level projection for the relevant area in a certain period of time [3].

6 step. Obtaining a flood risk assessment

The sixth step requires the water expert to assess the risk of flooding and select one of the proposed options for linguistic variables:

H {Low risk of flooding};

C {Medium risk of flooding};

B {High risk of flooding}.

After that, we calculate the normalized assessment of the risk of flood situation by the formula:

$$\mu(Z_{it}) = \begin{cases} 0, & P_{it} < 0; \\ \left(\mu(p_{it})\right)^k, & 0 \leq P_{it} \leq 100; \\ 1, & P_{it} > 100. \end{cases} \quad (3)$$

Where k is the degree of risk of flooding. For example, set: for low risk of flooding k = 1/3, for medium risk k = 1, and for high risk of flooding k = 3/5.

According to the obtained normalized assessment, it is possible to present a linguistic interpretation of the level of danger of a flood situation.

7 step. Decision-making on flood signaling

In the seventh step, based on the linguistic interpretation, the decision maker (water management expert) can signal and / or inform users about the dangerous situation, respectively, through the mobile application.

As a result of the implementation of smart crisis management technologies, the provision of protection against the harmful effects of water on settlements, minimization of damage and creation of safe living conditions for the communities of the region is being strengthened.

Thus, the technology of flood signaling and forecasting has been developed, the output of which is a mobile application that allows to widely disseminate information about the danger in the region closest to the user and provide additional information, based on the developed algorithm for risk assessment and modeling.

References:

1. Kelemen M. (2019). Safety and Knowledge Alliance of Aviation Education: Human factors in Aviation Safety and Air Law. AMELIA Aneta Siewiorek, Poland, 2019.

2. Polishchuk V. (2019). Technology to Improve the Safety of Choosing Alternatives by Groups of Goals. *Journal of Automation and Information Sciences*, 51 (9), 66-76. DOI: 10.1615/JAutomatInfScien.v51.i9.60

3. Kelemen, M., Polishchuk, V., Gavurová, B., Andoga, R., & Matisková, D. (2020). The Expert Model for Safety Risks Assessment of Aviation Environmental Projects' Implementation Within the Investment Phase of the Project. *IREASE*, Vol 13, No 6, 198-207. doi: https://doi.org/10.15866/irease.v13i6.18268