information is available to authorized users without restrictions. Overall, 99 percent of public administrative services are provided online in Estonia [2]. The economic effect of this is the saving of government spending of two percent of the gross national product.

Estonia is a small country that introduces new information technologies, including robotics. Robotics has found application in many spheres of human activity. So, for example, there are robots - couriers, who move freely along the street, delivering parcels. Their movement is regulated at the legislative level. It is expected that robotics will reduce the cost of delivery in comparison with the use of human messengers, which means that the cost price of the service will be reduced, which will serve as an additional incentive for the introduction of such devices. Robots also found their application in the military sphere [3]. The Estonian military presented combat robots that would soon be able to change military affairs in a country with a small population.

Estonia - a country that rose from the economic bottom in 1991, was able to become an advanced center for the introduction of the digital economy. The main merit in the development of information technology is the government, which in every way supports promising IT-technologies.

**References:**

1. Impex Consult. - [Electronic resource]. - Access mode: https://www.start-business-in-estonia.com/estoniya/it-texnologii-v-estonii.html
2. Innotech Technology news. - [Electronic resource]. - Access mode: http://innotechnews.com/reviews/1966.html
3. Sputnic Technology. - [Electronic resource]. - Access mode: https://ru.sputnik-news.ee/technologies/

## EXPERIMENTAL INVESTIGATION OF PROPERTIES OF THE MODIFIED METHOD OF OPTIMAL STOPPING

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Let $D = \{d_1, \dots d_N\}$ be a finite set of alternatives. It is anticipated that the decision-maker (DM) doesn't know in advance the personal qualities of all alternatives, but can consistently compare them. Is considered that for alternatives is fulfilled the traditional property of transitivity [1, p. 26]:

$$\text{if } d_i \succ d_j \text{ and } d_j \succ d_z \text{ then } d_i \succ d_z.$$

The problem of optimal stopping arises when we choosing a car parking place or refueling on a one-way road, a candidate for a position according to the results of consistent audition, etc.

The purpose of the DM is to choose the best of all alternatives of the set $D = \{d_1, \dots d_N\}$ based on a sequential analysis of alternatives that are considered only once in a random manner, provided that at each step the DM can take one of two solutions - continue to search for a better alternative or choose current one.

The traditional formulation of the problem as follows: it is necessary to find the best step $i^*$ on which to make the final choice, in order to maximize the probability of success, namely

$$i^* = \underset{\substack{1 \le i \le N \\ \forall j \ne i}}{\arg\max} P(d_i \succ d_j), \qquad j = 1, \dots, N.$$

In the work [2, c. 18] using the method of dynamic programming, it is proved that the optimal stopping step is determined by the formula

$$i^* = \frac{N}{e},$$

where $e = 2{,}71828$ and the greatest probability of success $P \approx 0{,}368$ is achieved when choosing the first alternative that surpasses all alternatives in the previous steps $1, 2, \dots, i^*$.

The report considered a modified formulation of the problem of optimal stopping, which, unlike the traditional one, is aimed at maximizing the probability $\widetilde{P}$ of choosing an alternative $\widetilde{d^*} \in D$ on a given concessions $\Delta \ge 0$.

To determine probability $\widetilde{P}$ , a program was developed for the experimental evaluation of the probability $\widetilde{P}$ of success for different values of the number of alternatives $N$ and concessions $\Delta \ge 0$.

Figure 1 shows the dependence of the probability $\widetilde{P}$ on a concession $\Delta$ which was evaluated by the Monte Carlo method in series of 1000 trials on sequences of random numbers simulating the value of the some super-criterion.

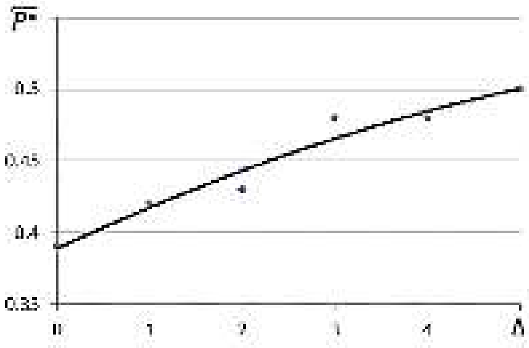


**Figure 1: Dependence of the probability $\widetilde{P}$ on a concession $\Delta$**

Thus, it has been experimentally proved that due to even a small concession, which in experiments did not exceed 3%, it is possible to increase the likelihood of success from 36.8% to 50%.

On the basis of the proposed method was developed an interactive system for choosing a preferential voucher for sanatorium and spa treatment.

**References:**

1. Zhukovska O.A., Fainzilberg L.S. Mathematical models of groupe decision macking. – Kijv: Osvita Ukraini, 2018. – 160 p. (in Ukrainian).
2. Gusein-Zade S.M. Capricious bride. – M.: MCNMO, 2003. – 24 p. (in Russian).

# MACHINE LEARNING FROM BEGINNING TO NOWADAYS

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Talk about machine learning first appeared about 50 years ago, when scientists, exploring the nervous systems of living organisms, thought about its imitation. But only now machine learning turned out to be at the top of the technology maturity curve. Why now can we make such impressive steps in this area?

First of all, humanity has accumulated and continues to collect huge amounts of data. The fact is that the more data is processed, the better the results of machine learning will become. We need large data sets for machine learning, they must "scroll" tens of thousands of iterations. Now there is really a lot of data - visual, text, dialogue, control signals. Secondly, there were technologies of high-performance computing. Now we can quickly process gigabytes of data.[1]

Now machines can be hardily applied in areas that previously were considered only accessible to humans. Although the technologies are still far from ideal, the point is that computers are constantly improving. Theoretically, they can develop indefinitely. This is the basic idea of machine learning. Machines learn to see images and classify them. They can recognize text and numbers in these images, as well as people and places. And computers do not just reveal the written words, but also take into account the context of their use, including positive and negative shades of emotion.[2]

Among other things, machines can listen to us and respond. Virtual assistants in our smartphones - whether they're Siri, Cortana or Google Now - embody breakthroughs in the machine processing of the natural language and continue to