Postolova D. V. (InWise Systems, LLC, Southern Federal University, Rostov-on-Don, Russia), **Kudryavtsev O. E.** (InWise Systems, LLC, Southern Federal University, Rostov-on-Don, Russia). **Application of artificial neural networks to option pricing.**[1]

Let $F(S, K, \sigma, r, T)$ be the price of a call option calculated using the Black-Scholes formula [1], where S is the current stock price, K is the strike price, T is the time to maturity of the option, r is the risk-free rate, and σ is the volatility. Let $s(x)$ denote the logistic function. In the study, the efficiency of approximating $F(S, K, \sigma, r, T)$ using neural networks of various architectures has been investigated. In particular, we constructed a feedforward one hidden layer artificial neural network of the form

$$G(\mathbf{x}) = (G_1(\mathbf{x}), G_2(\mathbf{x}))\,, \text{ where } G_k(\mathbf{x}) = \left(\sum_{i=1}^{10} \alpha_i^k s(\mathbf{w}_i^k \cdot \mathbf{x} + \theta_i^k) + \beta_i^k\right), \; k = 1, 2;$$

$\mathbf{x} = \left(\frac{\log(S/K)}{\sigma\sqrt{T}}, \frac{r\sqrt{T}}{\sigma}, \sigma\sqrt{T}\right)$, for which the following theorem is proven.

Theorem 1. Based on a test sample of size $N = 2000$, with a confidence level of 99.9%, it can be stated that for $K = 1$ and

$$(S, \sigma, r, T) \in [0.5, 2] \times [0.1, 1.0] \times [0.0, 0.1] \times [0.1, 1.0]$$

the estimation $\left|SG_1(\mathbf{x}) + Ke^{-rT}G_2(\mathbf{x}) - F(S, K, \sigma, r, T)\right| < 0.001$ holds with a probability of at least 0.998.

REFERENCES

[1] F. Black, M. Scholes, The Pricing of Options and Corporate Liabilities, *Journal of Political Economy*, v. 81, pp. 637–654, 1973.

[1] The research was supported by the Russian Science Foundation (project no. 23-21-00474).