Kolnogorov A. V. (Yaroslav-the-Wise-Novgorod State University, Veliky Novgorod, Russia). **Using multi-armed bandit algorithms in distributed optimization problems**[1]**.**

We consider a problem of minimizing a random function $L(w_1, \ldots, w_d)$ which values belong to the segment $[0, 1]$ and values of its arguments belong to the bounded d-dimensional lattice, i.e., $w_i \in \{0, 1, \ldots, k-1\}$, $i = 1, \ldots, d$. To minimize the function, we use d finite automata with linear tactic [1], each of which has k actions numbered as $j = 0, 1, \ldots, k-1$ and controls its own argument. At the input of the ith automaton at step number n, we feed a binary random process $\xi_{i,n}$ generated by the rule $\Pr(\xi_{i,n} = 1) = 1 - L(w_1, \ldots, w_d)$, $\Pr(\xi_{i,n} = 0) = L(w_1, \ldots, w_d)$, where $w_1, \ldots, w_d$ are the current argument values; all processes $\xi_{1,n}, \ldots, \xi_{d,n}$ are independent of each other. If the ith automaton has chosen the action j then $w_i = j$. The change of actions by each automaton is carried out in such a way that the corresponding transition probabilities generate a symmetric random walk between neighboring points of the lattice with reflection at the boundaries at $j \in \{0, k-1\}$.

Theorem. *The algorithm generates a stationary Markov chain which has a limiting distribution. If* $\mathbf{E}\,(L(w_1, \ldots, w_d)) \ll 1$ *and all automata have a memory depth of* 1*, then the limiting distribution is approximately*

$$\Pr(w_1, \ldots, w_d) \approx \frac{\{\mathbf{E}\,(L(w_1, \ldots, w_d))\}^{-1}}{\sum\limits_{w_1, \ldots, w_d} \{\mathbf{E}\,(L(w_1, \ldots, w_d))\}^{-1}}.$$

this formula is exact if $d = 1$ *without constraint* $\mathbf{E}\,(L(w_1, \ldots, w_d)) \ll 1$.

The results can be used for training neural networks.

REFERENCES

[1] M.L. Tsetlin, "Automation theory and modeling of biological systems", New York: Academic Press (1973)

[1]The research was carried out during the implementation of the research "Mathematical modeling of natural processes" performed within the framework of the state assignment in the field of scientific activity.