

Scientists improve signal and image processing algorithms

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TSU mathematicians have completed a project on mathematical methods for analyzing signals and images in complex telecommunication and navigation systems that are affected by random noise. The methods they created make evaluating information 10 times more accurate and help to restore the image or signal with high quality. The next step will be the application of the algorithm to "big data" analysis.

Mathematical methods for analyzing signals and images apply to the recognition of signals in aviation, decoding of images from an MRI device in medicine, analysis of topographic images for oil and gas growth, and other processes. The results obtained by the mathematicians will be used to build new radar systems for operational analysis and monitoring of the environment, satellite navigation systems, and promising systems for receiving and transmitting information.

"Everything in our project is focused on the tasks of statistical radiophysics—this is the problem of transmitting data over communication channels. For example, a plane flies and transmits a signal. During the transmission of the signal, various noises are superimposed on it and the receiver needs to obtain data that is as close as possible to what was transmitted. Optimal algorithms are being built that filter out these [noise](#) phenomena at the input and get a signal that is as close as possible to the transmitted one. This is used in medicine, finance and the economy," says Professor Evgeny Pchelintsev, head of the laboratory.

The algorithms created at TSU take into account qualitatively more complex noise in models than previously existing ones. From a physical point of view, these are processes with a complex dependence structure, which helps to study the problem of evaluating the signals observed against the background of pulsed noise. At the same time, we consider both processes with memory and

those that quickly lose their dependence on the past. Returning to the example with an airplane: the signal has passed, but the airplane is already flying further, and the factors left behind no longer act on the signal.

Now, the scientists have received two patents for their inventions, and a prototype of a device for receiving information using their algorithm was created at the Moscow Power Engineering Institute (MPEI). Next year, scientists plan to apply their algorithms to the analysis of big data: it can be the data of opinion polls, or physical or financial data.

- "On one hand, from a mathematical point of view, it does not matter to us what exactly to process. But, we see applied tasks that we focus on, and this helps us to accurately create [big data](#) processing algorithms," said Evgeny Pchelintsev.

Provided by Tomsk State University

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