Digital clones: Scientists discover new way to perform diagnostics of technical equipment

Siberian Federal University scientists have recently proposed using digital clones technology to perform online diagnostics of technical equipment and presented a new neurocomputing diagnostics model.

A simple inspection used to be enough to monitor the state of technical equipment some time ago. Nowadays this task is turned over to the equipment itsself, for example to the computers that can use artificial neural networks to perform a wide range of tasks related to non-destructive testing and online diagnostics.

The new approach proposed by the SibFU scientists is based on developing and training artificial neural networks and modeling the monitored technical equipment with the help of numerous patterns, or test cases, of the observed system's reactions. The reactions can include changes in the state of tension or structural heating of the equimpent.

> "*Artificial neural networks and modeling make it possible to create digital clones, or structural elements, that would allow online monitoring of all information regarding the state of the technical equipment under observation,*" **Vladimir Koshur** and **Sergei Chentsov**, Professors at SibFU School of Space and Information Technologies revealed.

According to their research project, digital clones can operate in passive or active modes. The clone in passive mode just reflects the state of the physical object without interfering with its operations. When clone in active mode "feels the pain" it generates the configuration of available parameters in order to "relieve the pain", or eliminate it altogether.

> "*The clone in active mode is a new intelligent system that performs the equipment's basic functions and aims to prolong the 'lifetime' of the adaptive adjusting technical equipment as long as possible,*" **Koshur** said.

Koshur stated that the configuring of neural network blocks is based on the principles of reducing the controlled output error of neural network system and pattern response received. It is especially important to find the global minimum of the combined error function, the best parameters for the given model.

The SibFU researchers' findings were presented at the 20th international conference "Neuroinformatics 2018". The researchers continue studying adaptive algorithms that optimize the neural network control.

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