USING OF NEURAL NETWORKS IN AVIATION

Bezverkha K.S.
National Aviation University, Kyiv
Supervisor – Kholyavkina T. V., PhD, Associate Professor

Annotation – the use of neural network technologies in aviation is analyzed in the work and the prospects for their development of aviation systems.

Keywords – neural networks; aircraft systems; deep learning; artificial intelligence; learning algorithms

I. INTRODUCTION

Aviation equipment diagnostics today is one of the most difficult tasks in the technical operation of airplanes. Classical methods make it possible to diagnose aviation equipment on the ground, for which, in order to detect defects in a timely manner, individual objects of diagnostics are dismantled and installed on special stands, on which performance indicators are taken with the help of sensors. At the same time, in order to increase the level of aviation safety, it is necessary to continuously monitor and diagnose the most important parts of the aircraft during the flight. Applying modern technologies in the process of creating information systems is very important. One of such technologies can be the use of neural networks.

II. FORMULATION OF THE PROBLEM

A neural network is either a system software or hardware that works similar to the tasks performed by neurons of human brain. Neural networks include various technologies like deep learning, and machine learning as a part of Artificial Intelligence (AI). Their main difference from other methods, for example, such as expert systems, is that neural networks, in principle, do not need a previously known model, but build it themselves only on the basis of the information offered.

The problems in developing AI systems for aviation stem from the critical nature of aviation in terms of safety. It requires validation of AI performance, including understanding failure modes, verifying that the AI is safe to use, and understanding how the AI makes decisions. Since the start of work on artificial intelligence, companies have realized that not all data for AI is useful, and that data for AI must be preprocessed and labeled.[1]

III. MAIN PART

Neural networks perform best where there is a large amount of input data, between which there are implicit relationships and patterns, for example, in aviation. Calculations and mathematical modeling are required to design an airplane and determine its operational constraints, including an assessment of the safety margins of the airplane's behavior. Recent developments in aircraft simulations applied to real-time flight data analysis enable accident prevention and require a reliable mathematical representation of the aircraft's behavior and its systems. [1]

The problem of diagnostics using artificial neural networks is reduced to choosing the type of network, determining the parameters of the architecture and training it. The AI and machine learning community has classified two main forms of neural networks. Feedforward neural networks are the most common, where data, after input, is transformed by neural layers and then the results in a forward unidirectional layer. Another, more advanced form is a recurrent neural network, which uses memory and feedback loops to function in such a way that the network continuously uses key data and events from a more dynamic process.

Each of these networks makes it possible to cope with such diagnostic problems as incomplete and noisy input data. At the same time, the use of neural networks can significantly reduce the number of measured parameters, which accordingly reduces the number of installed sensors.[2]

Neural networks make it possible to perform very complex tasks related to aircraft technical diagnostics using continuous real-time monitoring methods. With their help, it is possible to assess mechanical damage in flight and on the ground.

IV. CONCLUSIONS

The potential for using neural networks in aviation systems is very high. Image recognition, segmentation and data processing for visual guidance during landing are the most likely uses for neural networks in the near future. For example, the images analyzed by the network are defined as four corners or as an outline of a runway that can be safely landed on.[3] Neural network algorithms are also successfully used in pilot training. In fighter aircraft, neural computers are responsible for the most accurate maneuver against the target, pilot errors are corrected and external conditions are taken into account. Despite the very beginning of its development, neural networks in aviation have already found their niche in solving problems such as choosing the optimal flight route, flying around obstacles, recognizing ground and air targets, etc.

References:

1. Soumitra P., Kunal K., Devashish J., Rachit D. (2008) - Application of Artificial Neural Networks in Aircraft Maintenance, Repair and Overhaul Solutions

2. Kalan R. Basic concepts of neural networks - M: Publishing house "Williams", 2003.

3. Web resource: http://www.modern-avionics.ru/ date of request 15.03.2021