

Application of computer vision technologies for plasma flow diagnostics

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Pulsed plasma accelerators are devices that accelerate plasma under the action of ponderomotor forces, which can be used as a propulsion system for small spacecraft along with such analogues as [1], [2]. To use an IPU as a remote control, it is necessary to conduct a number of tests to determine the geometric characteristics of the plasma flow, such as: the angle of divergence of the flow and the angle of deflection of the flow, since it is necessary to determine the direction of the thrust vector. In this paper, the possibilities of detecting and classifying plasma formations using AI methods are demonstrated. Based on the resulting data array, a convolutional neural network was trained [3], which allows detecting the plasma flow on the frames and classifying two separate areas in it. The Object detection model has been trained to detect the plasma flow and classify its individual regions. A code module has also been prepared along with a user interface for remote operation with the experimental stand, in order to determine the angle of flow divergence and the angle of its deviation from the horizontal axis of the engine in real time. The work was performed at the unique scientific installation (UNU) "Puchok-M" of the Bauman Moscow State Technical University, with the support of the Ministry of Science and Higher Education of the Russian Federation under the state assignment FSN-2024-0007.

- [1] Shumeiko A I, Telekh V D and Mayorova V I 2022 *Acta Astronautica* **191** 431–437
- [2] Shumeiko A I and Telekh V D 2023 *AIP Advances* **13**
- [3] Kozłowski P M, Kim Y, Haines B M, Robey H, Murphy T J, Johns H M and Perry T S 2021 *Review of Scientific Instruments* **92**