COMPUTER VISION METHODS AND THEIR APPLICATIONS FOR ROBOTIC PLATFORMS

Moscow Institute of Physics and Technology (National Research University)

Degree or qualification is awarded: **PhD (Candidate of Science)**

Language of study: **English**
Mode of study: **full-time**
Duration: **4 years**
Availability of free education: **yes**
Price: **375 000 RUB**

Programme curator: **Denis Ustyuzhaninov**
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Entry requirements:

- Master's degree / equivalent in a related field
- B2 level of English
- Good track record of publications related to the topic of the intended research
- Strong research proposal 1,500 - 3,500 words

Research supervisor:
Dmitry Yudin
PhD

Supervisor's research interests:

- Computer vision methods based on deep neural networks.
- Autonomous vehicles and intelligent transport systems.
- Modern methods of simultaneous localization and mapping.
- Onboard systems of unmanned vehicles and mobile robots.
- Algorithms for automated labeling of 2D and 3D scenes.
- 3D reconstruction methods and their applications for virtual and augmented reality.
- Application of computer vision in control systems.

Research highlights:

- The research program is devoted to a wide range of modern computer vision methods used in on-board systems of robotic platforms: small educational robots, drones, service robots and courier robots, full-size unmanned vehicles.
- PhD students have the opportunity to work with the most modern server and robotic equipment at the disposal of the Intelligent Transport Laboratory of the MIPT Center for Cognitive Modeling and the Scientific and Design Bureau of Computing Systems.
- Research of the developed methods and algorithms is carried out on the basis of embedded energyefficient platforms NVidia Jetson Nano, TX2 and Xavier, Server GPU NVidia Tesla V100, the Clearpath Husky robot with UR5 manipulator and mobile autonomous vehicle based on KIA SOUL.

Supervisor's specific requirements:

- Mathematical analysis, Linear algebra, Probability theory.
- High skills in Python and C++.
- Deep learning frameworks PyTorch and/or Tensorflow.
- Robotic Operating System (ROS).

Main publications:

- Staroverov, D. A. Yudin, I. Belkin, V. Adeshkin, Y. K. Solomentsev, and A. I. Panov. Real-Time Object Navigation with Deep Neural Networks and Hierarchical Reinforcement Learning. IEEE Access, 2020.
- Yudin D., Adeshkin V., Dolzhenko A., Polyakov A., Naumov A. Roof Defect Segmentation on Aerial Images using Neural Networks. Advances in Neural Computation, Machine Learning, and Cognitive Research IV. Studies in Computational Intelligence, Vol. 925, 2020.
- Rezanov A., Yudin D. Deep Neural Networks for Orthophoto-based Vehicle Localization. Advances in Neural Computation, Machine Learning, and Cognitive Research IV. Studies in Computational Intelligence, Vol. 925, 2020.
- Yudin D. A., Skrynnik A., Krishtopik A., Belkin I., and Panov A. I. Object Detection with Deep Neural Networks for Reinforcement Learning in the Task of Autonomous Vehicles Path Planning at the Intersection. Optical Memory & Neural Networks (Information Optics), Vol. 28 № 4, 2019.
- Yudin D., Slavioglo D. Usage of Fully Convolutional Network with Clustering for Traffic Light Detection. 7th Mediterranean Conference on Embedded Computing, MECO’2018, 2018, pp. 242-247.

Specializations within this programme