



Thessaloniki (Greece) October 2023 – OpenDR "Open Deep Learning Toolkit for Robotics" is a research project funded by the **EU Horizon 2020** research and innovation program. **The project was launched in January 2020 and since then develops a modular, open and non-proprietary toolkit for core robotic functionalities by harnessing AI, more specifically deep learning, to provide advanced perception and cognition capabilities, meeting in this way the general requirements of robotics applications in numerous areas including healthcare, agri-food and agile production, which are the project's three use-case areas.** The project brings together 5 top-ranked academic and research institutes: Aristotle University of Thessaloniki (Greece), Tampere University (Finland), Aarhus University (Denmark), Delft University of Technology (Netherlands), University of Freiburg (Germany) and 3 leading industry partners: Cyberbotics (Switzerland), PAL Robotics (Spain) and AgrolIntelli (Denmark). **The project is coordinated by Prof. Anastasios Tefas, Aristotle University of Thessaloniki.**

Five versions of the OpenDR toolkit have been publicly released so far. The first one was released in December 2021 providing more than 20 methods related to core robotic functionalities, an intuitive and easy-to-use Python interface, a C language API (Application Programming Interface) for selected tools, a wealth of usage examples and supporting tools, as well as ready-to-use ROS (Robot Operating System) nodes. Since then, 4 additional versions were released, expanding the number of available methods, as well as providing performance improvements to existing ones. In addition, several other improvements were made, including the addition of modular installation options, the support for newer CUDA versions, the implementation of a refined ROS/ROS2 interface, etc. The latest version was released on 3rd of July and provides, among others, tools for high resolution analysis, object detection and tracking, efficient LiDAR-based panoptic segmentation, continual inference transformers, facial emotion estimation and multi-object search, along with several bug fixes and a more rich C API for several tools. The toolkit is freely accessible in [GitHub](#), the world's most popular software development and sharing platform.

Through the toolkit and the respective research, OpenDR aims, and so far succeeds, in having a significant impact by improving the technical capabilities in robotics through the provision of easily deployable, efficient and novel Deep Learning tools, as well as by lowering the technical barriers by providing a modular and open platform for developing Deep Learning for Robotics tools. Concerning industry, the project's expected impact is to enable a greater range of applications in agri-food, healthcare robotics and agile production, as well as to strengthen the competitiveness of companies by lowering the cost to access robotics-oriented Deep Learning tools. Usage statistics seem to verify that these targets will be achieved. Indeed, the acceptance of the toolkit from the robotics, deep learning and computer vision communities has been extremely encouraging so far, the GitHub repository was awarded more than 540 stars from its users, whereas the toolkit as a whole or individual tools have been downloaded more than 17000 times since its first release.

In addition, **an impressive number of scientific journal and conference papers, more than 90 so far**, have been generated throughout this almost four-year period. Indeed, OpenDR has published the results of its groundbreaking research in prestigious robotics and AI journals, including IEEE (Institute of Electrical and Electronics Engineers), such as IEEE Transactions on Neural Networks and Learning Systems, IEEE Transactions on Artificial Intelligence, IEEE Transactions on Image processing, IEEE Robotics and Automation Letters and Neurocomputing, as well as highly influential conferences

including IEEE Conference on Computer Vision and Pattern Recognition (CVPR), IEEE International Conference on Multimedia and Expo (ICME), IEEE International Conference on Image Processing (ICIP), IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) etc.

The project has also organized two very successful Summer Schools one on “Continuous Engineering and Deep Learning for Autonomous Trustworthy Systems” in Thessaloniki, Greece, in cooperation with FOCETA H2020 Project and one on “Deep Learning for Autonomous Systems and Smart Cities”, in Aarhus, Denmark, in cooperation with Aarhus University. Both Summer Schools were very well attended. These events brought together AI experts and enthusiasts to share knowledge and foster learning in the areas of deep learning and robotics. **Other significant dissemination activities** included organization of a tutorial on Open And Trustworthy Deep Learning for Robotics in the highly esteemed International Conference on Intelligent Robots and Systems (IROS 2022), a workshop on Open Deep Learning Toolkit for Robotics: Towards Democratizing Artificial Intelligence at IROS 2021, organization of special sessions in conferences, invited talks etc.

The very good progress achieved by the consortium was verified in the two review meetings that have been conducted by the EU so far. In these meetings the consortium had the opportunity to present its results to external experts (reviewers) that praised the project’s achievements and provided constructive comments for its forthcoming activities.

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For more information visit **OpenDR’s** website: www.opendr.eu

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