PhD

David Puljiz

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Robotics Engineer with over 10 years of experience in developing novel **Human-Robot Interaction** methods through the use of **Mixed Reality**, **Head-Mounted Displays** and **Machine Vision**. I have worked on numerous projects and supervised over 15 Bachelor and Master students.

Experience

Research Assistant
10/2022 - 09/2024

🔗 Institute for Robotics and Autonomous Systems

🔗 Karlsruhe University of Applied Sciences (HKA), Germany

Supervisor   Prof. Dr.-Ing. Fahmi Bellalouna - ✉ fahmi.bellalouna@h-ka.de

- Development of an educational framework to improve robotics teaching.
- Integration of immersive virtual reality environments.
- Implementation of gamification concepts to enhance student engagement.
- Design of interactive learning modules that bridge theoretical concepts with practical applications.
- Prepared and conducted numerous project demonstrations in the "XR Lab" of the University

Projects: 🔗 RoLe4D - "Robot Learning in 4-Dimensions"

Software: C#, Unity3D

Hardware: HTC Vive Pro

Research Assistant
06/2014 - 09/2022

🔗 Intelligent Process Automation and Robotics Lab

🔗 Karlsruhe Institute of Technology (KIT), Germany

Supervisors   Prof. Dr.-Ing. habil. Björn Hein - ✉ bjoern.hein@h-ka.de, Prof. Dr. Sc. Ivan Petrovic - ✉ ivan.petrovic@fer.unizg.hr

- Developed an end-to-end portable system for human-robot interaction based on the Microsoft HoloLens, focused on industrial robot arms.
- Created comprehensive solution enabling intuitive robot workspace definition, programming, and safe interaction.
- 3D mapping of surroundings via depth sensors and stereo cameras.
- 3D object recognition systems for workspace awareness.
- Interactive tools for static obstacles and no-go zones definitions.
- Versatile robot programming methods (holographic waypoints, hand guidance, tracked input devices)
- Human tracking and safety systems within robot workspace.
- Human intention estimation algorithms adapted from SafeLog work.
- Real-time moving object detection.

Projects: 🔗 **ReApp - "Reusable robot applications for flexible robot systems based on ROS Industrial";**, 🔗 **SafeLog - "Safe human-robot interaction in logistic applications for highly flexible warehouses"**, 🔗 SkillPro, 🔗 QBIIK, 🔗 ROBDEKON, and other initiatives.

Software: C++, C#, CMake Python, Unity3D, OpenCV, PCL, ROS, Moveit, PyTorch

Hardware: **HMDs:** Microsoft HoloLens 1, HoloLens 2, HTC Vive; **Robots:** KUKA KR-16, KR-5, Universal Robotics UR-10; **Sensors:** ART DTRACK3, SICK PIM-60/Inspector, TriSpector1000; **Custom Hardware**

Teaching tasks   "Seminar on Intelligent Industry Robotics" and "Project Practical in Robotics and Automation" at KIT

Internship Corporate Research

08/2013 - 12/2013

CR/APA2, Advanced Production and Automation

Bosch GmbH, Germany

Supervisor   Dr. Axel Wendt

- Engineering of an automated part inspection system using random forest classifiers for defect detection and quality control
- Reconstruction of digital 3D models of industrial parts using multi-view silhouette technique
- Digitization of physical components for inspection and analysis

Software: C++, CMake, HALCON

Hardware: Precision Turntable, HD Monocular Grayscale Camera, Monochromatic Illumination with diffusion plate

M.Sc Thesis

10/2011 - 07/2013

Faculty of Electrical Engineering and Computing   University of Zagreb, Croatia

Supervisor   Prof. Dr. Sc. Stjepan Bogdan - ✉ stjepan.bogdan@fer.unizg.hr

- Implemented insect-like swarm exploration and aggregation on a fleet of simple, small educational mobile robots.
- Incorporated infrared emitters to robots enabling simple message passing between units.
- Developed stochastic finite state machines with transitions governed by sensor signals and probability distributions.

Software: C, ASM

Hardware: Fleet of Small Educational Mobile Robots, Overhead Monocular Camera, IR Emmiters and Detectors

B.Sc. Thesis

2009 - 12/2012

Faculty of Electrical Engineering and Computing   University of Zagreb, Croatia

Supervisor   Prof. Dr. Sc. Stjepan Bogdan - ✉ stjepan.bogdan@fer.unizg.hr

- Performed simulations of different search strategies for autonomous robots with limited sensor coverage and computational power.
- Compared of stochastic (Brownian motion, Levy walk) and deterministic methods (spiral and zig-zag patterns)
- Laboratory exercises Assistant in Elements of Automation systems, Electromagnetic fields, and Electronics.

Software: Matlab, Simulink

Education

Ph.D. in Robotics and Informatics

01/2017 - 11/2024

Karlsruhe Institute of Technology

Karlsruhe, Germany

Thesis: "Adapting the Human. Human-Robot Interaction mediated by Wearables and Augmented Reality."

M.Sc in Electrical Engineering and Information Technology

10/2011 - 07/2013

University of Zagreb-FE

Zagreb, Croatia

Thesis: "Swarm Decision Making Based on Simple Rules"

B.Sc in Electrical Engineering and Information Technology

10/2008 - 06/2011

University of Zagreb-FER

Zagreb, Croatia

Thesis: "Search of 2D Space with Agents with Limited Perception"

Skills

Robotics

- C++, Python, Unix, Simulink, ROS, MoveIT
- Vision-based Control
- Trajectory Generation
- Workflows
- Human-Robot Interaction

Mixed Reality

- C#, Unity3D, MRTK
- Picking Assistance
- Situational Awareness
- AR visualization of robot States and Data
- VR Digital Twins
- VR Robot Teleoperation

Machine Vision

- C++, OpenCV, PCL
- Depth, Monocular and Stereo Camera
- Mapping
- 3D Object Detection
- Tracking of Objects, Hands, IR Markers

Machine Learning

- Python PyTorch, TensorFlow
- Classifiers - Random Forests, SVMs
- CNNs for Object and Hand Detection
- Data Analysis
- Feature Engineering

Documentation and Editing

- GitHub
- LaTeX, Office Suite
- GIMP

Languages

- **Croatian** (Mother Tongue)
- **English** (Near-native proficiency)
- **German** (Proficient, B2)
- **Italian** (Proficient)
- **Spanish** (Proficient)

Selected Publications

Full List of Publications: ⬀ **Google scholar**

Petkovic, T., **Puljiz, D.**, Markovic, I. and Hein, B., 2019. Human intention estimation based on hidden Markov model motion validation for safe flexible robotized warehouses. Robotics and Computer-Integrated Manufacturing, 57, pp.182-196. ⬀ Full Paper

Kohn, S., Blank, A., **Puljiz, D.**, Zenkel, L., Bieber, O., Hein, B. and Franke, J., 2018, October. Towards a real-time environment reconstruction for VR-based teleoperation through model segmentation. In 2018 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) (pp. 1-9). IEEE. ⬀ IEEE Xplore

Puljiz, D., Stöhr, E., Riesterer, K.S., Hein, B. and Kröger, T., 2019, November. General Hand Guidance Framework using Microsoft HoloLens. In 2019 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) (pp. 5185-5190). IEEE. ⬀ Full Paper

Puljiz, D., Krebs, F., Bosing, F. and Hein, B., 2020. What the HoloLens Maps Is Your Workspace: Fast Mapping and Set-up of Robot Cells via Head Mounted Displays and Augmented Reality. In 2020 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) (pp. 11445-11451). IEEE. ⬀ Full Paper

Alves-Oliveira, P., Lupetti, M.L., Luria, M., Löffler, D., Gamboa, M., Albaugh, L., Kamino, W., K. Ostrowski, A., **Puljiz, D.**, Reynolds-Cuéllar, P. and Scheunemann, M., 2021, June. Collection of Metaphors for Human-Robot Interaction. In Designing Interactive Systems Conference 2021 (pp. 1366-1379). ⬀ Full Paper

Review Duties

- **Journals:** ACM Transactions on Human-Robot Interaction, IEEE Transaction on Robotics, IEEE Robotics and Automation Magazine, Robotics and Autonomous Systems
- **Conferences:** CASE 2018, ISER 2018, IROS 2018, IROS 2022, ICRA 2023, ICRA 2025