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CV updated on July 29, 2024



# Pavel Petráček

## Personal information

Nationality Czech  
Date of birth November 26, 1994  
Languages Czech (native speaker), great conversational English

## Education

2019–present **Doctoral candidate in Informatics**, Department of Cybernetics, Faculty of Electrical Engineering, Czech Technical University in Prague (FEE CTU)  
— **Ph.D. topic**: Robust UAV localization in perception-degraded environments  
— **thesis defense** scheduled for September, 2024  
— **supervisor**: doc. Ing. Martin Saska, Dr. rer. nat.  
— **publication count** (since 2019): 14 impacted journals, 3 conference proceedings  
— **h-index**: 7 in WoS, 14 in Google Scholar, **citations count**: 157 in WoS, 515 in Google Scholar  
2017–2019 **Ing. — Master degree in Cybernetics and Robotics**, FEE CTU  
2014–2017 **Bc. — Bachelor degree in Cybernetics and Robotics**, FEE CTU

## Experience: Academia

2019–present **Doctoral candidate and research fellow at Multi-Robot Systems research group**, FEE CTU  
— **research**: resilient and reliable autonomy of mobile robots (mostly UAVs) in real-world settings | decentralized swarming  
— **secondary responsibilities**: co-development of the [MRS UAV System](#) | research applied in real world | robotic experiments and competitions | demos for investors, industrial partners, students, and media | student supervision | project management | field popularization | academic teaching | summer schools and workshops organization

## Research projects & competitions

2020–2022 **DARPA Subterranean Challenge**: Exploring unknown subterranean environments with a cooperative team of ground and aerial autonomous robots  
— **contributions & responsibilities**: developing novel methods of onboard perception, localization, and mapping of UAVs in perception-degraded environments | UAV system design | real-time systems integration | system evaluation and testing | key member for in situ deployment of aerial robots  
2018–2022 **Dronument**: Documentation of interiors of historical structures with autonomous aerial robots  
— **contributions & responsibilities**: development of a resilient HW & SW system for deploying a fully **autonomous UAV team within interiors of historical structures** | robustness to geometrical symmetry and other perceptual degradation | deployment of the system for documenting 17 historical objects (including 2 UNESCO sites) with direct use in heritage preservation  
2017–present **Swarming**: Decentralizing communication-less control of UAVs among obstacles  
— **contributions**: novel bio-inspired algorithms for communication-less perception-aware coordination of UAV teams in environments with obstacles

2020–present **DOFEC**: Extinguishing fires in aboveground floors using an autonomous UAV  
— **contributions**: detection and localization of fires from on-board sensors | mission planning

### International stays

- 2023 **Autonomous Robots Lab at NTNU**: 2 months research stay, cooperation on doctoral topic with prof. Kostas Alexis
- 2017 **Aerospace Information Technology at University of Würzburg, Germany**: summer school

## Experience: Industry

- 2023–present **Fly4Future s.r.o.**: R&D | technical consulting | grant writing | employee training  
projects ■ [2024–present, TAČR Trend] Innovating autonomous interior inspection in project INDAIR
- 2016–2017 **CertiCon a.s.**: learned how to properly think about and write automated software tests | gained experience in corporate project management and scheduling
- 2012–2014 **KD planeta s.r.o.**: first-hand experience with robotic automation — interaction between human operators, robotic manipulators, and CNC machinery

## Honors & awards

- 2022 **Methodology M17+**: excellent international evaluation of our **Dronument functional sample**
- 2021 **DARPA Subterranean Challenge**: team CTU-CRAS-NORLAB competing with international universities and companies (e.g., Caltech, MIT, ETH Zürich) in multi-robot search & rescue operations in underground environments  
— 1st place among non-funded teams in the Urban Circuit, real-world deployment (\$500k)  
— 2nd place among all teams in the Final Round, virtual deployment (\$500k)
- 2019 **Dean's price for astounding Master thesis at FEE CTU**  
— **topic**: Design, localization and position control of a specialized UAV platform for documentation of historical monuments
- 2017 **Dean's price for astounding Bachelor thesis at FEE CTU**  
— **topic**: Decentralized model of a swarm behavior Boids in ROS

## Academic activities

- Teaching ■ Algorithms and Programming: Python and basic programming algorithms for Bachelor students  
■ Multi-Robot Aerial Systems: for Master students, author of UAV swarming task #3
- Workshops ■ Seminar tasks introduction, *In IEEE RAS Summer School on Multi-Robot Systems*, 2022.  
■ **Dronument workshop** (organizer and speaker), *hosted at FEE CTU*, 2021.  
■ Importance Sampling: Degradation-Aware Alternative to Voxelization in Robot Pose Estimation, *In IEEE IROS IPPC and ROPEM workshops*, 2023.  
■ Cooperative UAV Autonomy of Dronument: New Era in Cultural Heritage Preservation, *In IEEE IROS IPPC workshop*, 2023.  
■ Decentralized Aerial Swarms Using Vision-Based Mutual Localization, *In IEEE IROS (Workshop on Integrated Perception, Planning, and Control for Physically and Contextually-Aware Robot Autonomy)*, 2018.
- Conference committee ■ Co-chair of session *Micro and Mini UAS I* at ICUAS'22 (chair: prof. Subodh Bhandari).

- Reviewer for journals and conferences
- Transactions on Cybernetics
  - Transactions on Robotics (T-RO)
  - Robotics and Automation Letters (RA-L)
  - International Conference on Robotics and Automation (ICRA)
  - International Conference on Intelligent Robots and Systems (IROS)

## Supervised students

- Ing. **Vojtěch Nydrle**, Cybernetics and robotics, FEE CTU  
 — thesis: Extinguishing of indoor fires by an autonomous UAV
- Martin Fischer**, Cybernetics and robotics, FEE CTU  
 — thesis: Matching of multimodal features
- Bc. **Vojtěch Nydrle**, Cybernetics and robotics, FEE CTU  
 — thesis: Design of a specialized UAV platform for the discharge of a fire extinguishing capsule (Dean's price for astounding Bachelor thesis)
- Martin Fischer**, Cybernetics and robotics, FEE CTU  
 — thesis: Lidar and multi-camera calibration and fusion (Dean's price for astounding Bachelor thesis)
- Azat Mukhametshin**, Open informatics, FEE CTU  
 — thesis: World management and coverage path planning in the MRS UAV System

## Peer-reviewed publications

### Journal articles

- **P. Petracek**, V. Kratky, and M. Saska, "Dronument: System for Reliable Deployment of Micro Aerial Vehicles in Dark Areas of Large Historical Monuments," *IEEE RA-L*, vol. 5, no. 2, pp. 2078–2085, Apr. 2020.
- **P. Petracek**, V. Walter, T. Baca, and M. Saska, "Bio-Inspired Compact Swarms of Unmanned Aerial Vehicles without Communication and External Localization," *Bioinspiration & Biomimetics*, vol. 16, no. 2, p. 026 009, Mar. 2021.
- **P. Petracek**, V. Kratky, M. Petrlik, T. Baca, R. Kratochvil, and M. Saska, "Large-Scale Exploration of Cave Environments by Unmanned Aerial Vehicles," *IEEE RA-L*, vol. 6, no. 4, pp. 7596–7603, Oct. 2021.
- **P. Petracek**, V. Kratky, T. Baca, M. Petrlik, and M. Saska, "New Era in Cultural Heritage Preservation: Cooperative Aerial Autonomy for Fast Digitalization of Difficult-to-Access Interiors of Historical Monuments," *IEEE Robotics & Automation Magazine*, pp. 2–19, 2023.
- **P. Petracek**, K. Alexis, and M. Saska, "RMS: Redundancy-Minimizing Point Cloud Sampling for Real-Time Pose Estimation," *IEEE Robotics and Automation Letters*, vol. 9, no. 6, pp. 5230–5237, 2024. DOI: 10.1109/LRA.2024.3389820.
- V. Kratky, **P. Petracek**, V. Spurny, and M. Saska, "Autonomous Reflectance Transformation Imaging by a Team of Unmanned Aerial Vehicles," *IEEE RA-L*, vol. 5, no. 2, pp. 2302–2309, Apr. 2020.
- V. Kratky, **P. Petracek**, T. Baca, and M. Saska, "An Autonomous Unmanned Aerial Vehicle System for Fast Exploration of Large Complex Indoor Environments," *Journal of Field Robotics*, vol. 38, no. 8, pp. 1036–1058, Dec. 2021.
- V. Kratky, **P. Petracek**, T. Nascimento, M. Cadilova, M. Skobrtal, P. Stoudek, and M. Saska, "Safe Documentation of Historical Monuments by an Autonomous Unmanned Aerial Vehicle," *JGI*, vol. 10, no. 11, p. 738, Oct. 2021.
- M. Petrlik, **P. Petracek**, V. Kratky, T. Musil, Y. Stasinchuk, M. Vrba, T. Baca, D. Hert, M. Pecka, T. Svoboda, and M. Saska, "UAVs Beneath the Surface: Cooperative Autonomy for Subterranean Search and Rescue in DARPA SubT," *Field Robotics*, vol. 3, no. 1, pp. 1–68, Jan. 2023.
- D. Hert, T. Baca, **P. Petracek**, V. Kratky, R. Penicka, V. Spurny, M. Petrlik, M. Vrba, D. Zaitlik, P. Stoudek, V. Walter, P. Stepan, J. Horyna, V. Pritzl, M. Sramek, A. Ahmad, G. Silano, D. B. Licea, P. Stibinger, T. Nascimento, and M. Saska, "MRS Drone: A Modular Platform for Real-World Deployment of Aerial Multi-Robot Systems," *Journal of Intelligent & Robotic Systems*, vol. 108, no. 4, p. 64, Jul. 2023.
- F. Novak, V. Walter, **P. Petracek**, T. Baca, and M. Saska, "Fast Collective Evasion in Self-Localized Swarms of Unmanned Aerial Vehicles," *Bioinspiration & Biomimetics*, vol. 16, no. 6, p. 066 025, Nov. 2021.

- K. Ebadi, L. Bernreiter, H. Biggie, G. Catt, Y. Chang, A. Chatterjee, C. E. Denniston, S.-P. Deschenes, K. Harlow, S. Khattak, L. Nogueira, M. Palieri, **P. Petracek**, M. Petrlik, A. Reinke, V. Kratky, S. Zhao, A.-a. Agha-mohammadi, K. Alexis, C. Heckman, K. Khosoussi, N. Kottege, B. Morrell, M. Hutter, F. Pauling, F. c. Pomerleau, M. Saska, S. Scherer, R. Siegwart, J. L. Williams, and L. Carlone, "Present and Future of SLAM in Extreme Underground Environments," 2022.
- T. Manoni, D. Albani, J. Horyna, **P. Petracek**, M. Saska, and E. Ferrante, "Adaptive Arbitration of Aerial Swarm Interactions through a Gaussian Kernel for Coherent Group Motion," *Frontiers in Robotics and AI*, vol. 9, 2022.
- T. Roucek, M. Pecka, P. Cizek, T. Petricek, J. Bayer, V. Salansky, T. Azayev, D. Hert, M. Petrlik, T. Baca, V. Spurny, V. Kratky, **P. Petracek**, D. Baril, M. Vaidis, V. Kubelka, F. Pomerleau, J. Faigl, K. Zimmermann, M. Saska, T. Svoboda, and T. Krajnik, "System for Multi-Robotic Exploration of Underground Environments CTU-CRAS-NORLAB in the DARPA Subterranean Challenge," *Field Robotics*, vol. 2, pp. 1779–1818, 2022.

#### Conference articles

- A. Ahmad, V. Walter, **P. Petracek**, M. Petrlik, T. Baca, D. Zaitlik, and M. Saska, "Autonomous Aerial Swarming in GNSS-denied Environments with High Obstacle Density," in *IEEE ICRA*, May 2021, pp. 570–576.
- T. Amorim, T. Nascimento, **P. Petracek**, G. de Masi, E. Ferrante, and M. Saska, "Self-Organized UAV Flocking Based on Proximal Control," in *ICUAS*, Jun. 2021, pp. 1374–1382.
- D. Hert, T. Baca, **P. Petracek**, V. Kratky, V. Spurny, M. Petrlik, M. Vrba, D. Zaitlik, P. Stoudek, V. Walter, P. Stepan, J. Horyna, V. Pritzl, G. Silano, D. Bonilla Licea, P. Stibinger, R. Penicka, T. Nascimento, and M. Saska, "MRS Modular UAV Hardware Platforms for Supporting Research in Real-World Outdoor and Indoor Environments," in *ICUAS*, Jun. 2022, pp. 1264–1273.