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CV updated on February 3, 2023

Pavel Petráček

Personal information

Nationality	Czech
Date of birth	November 26, 1994
Languages	Czech (mothertongue), English
Work address	Karlovo namesti 13, 121 35 Prague 2

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
— **supervisor**: doc. Ing. Martin Saska, Dr. rer. nat.
— **publication count** (since 2019): 11 impacted journals, 3 conference proceedings
— **h-index**: 5 in WoS, 8 in Google Scholar, **citations count**: 73 in WoS, 185 in Google Scholar

2017–2019 **Ing. (= Master of Science), Cybernetics and robotics,** FEE CTU

2014–2017 **Bc. (= Bachelor of Science), Cybernetics and robotics,** FEE CTU

Experience

2019–present **Doctoral candidate at Multi-Robot Systems research group,** FEE CTU
— **general research on:** lightweight yet robust localization and mapping of mobile robots in perception-degraded environments, decentralized swarming systems, robustness maximization in aerial robotics
— **responsibilities:** general research; co-development of MRS UAV system; transferring research ideas into the real-world (design and realization of robotic experiments, participation in robotic competitions); robotic demos for investors, industrial partners, students and media; supervision of students; popularization of the university and the field; academic courses, workshops, and summer school preparations and organization

Research projects & competitions

2020–2022 **DARPA Subterranean Challenge:** Exploration of unknown subterranean environments with a cooperative team of ground and aerial autonomous robots
— **contributions & responsibilities:** Development of novel methods of lightweight 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. Research published in several journal publications.

2018–present **Dronument:** Documentation of interiors of historical structures with autonomous aerial robots
— **contributions & responsibilities:** Development of a robust HW & SW system capable of deploying a fully autonomous UAV team within interiors of historical structures. Focus on on-board UAV localization and prevention of its degeneracy in geometrically featureless environments. Deployment of the system for documenting 17 historical objects (including 2 UNESCO sites) with direct use for heritage preservation. Research published in several journal publications.

2017-present **Swarming:** Decentralized control of UAV teams in obstacle-filled environments
— **contributions:** Novel bio-inspired algorithms for communication-less perception-aware coordination of UAV teams in environments with obstacles. Research published in several academic publications.

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

Industry

2016-2017 **Software testing,** *CertiCon a.s.,* Learned how to properly think about and write automated software tests. Gained experience in corporate project management and scheduling

2012-2014 **Robotic automation,** *KD planeta s.r.o.,* First-hand experience with robotic automation — interaction between human operators, robotic manipulators, and CNC machinery

Honors & awards

2021 **DARPA Subterranean Challenge:** Part of team CTU-CRAS-NORLAB competing with well-known foreign universities and companies (e.g., Caltech, MIT, ETH Zürich, NTNU) 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:** FEE CTU. Related to the Dronument project:
— topic: Design, localization and position control of a specialized UAV platform for documentation of historical monuments

2017 **Dean's price for astounding Bachelor thesis:** FEE CTU
— topic: Decentralized model of a swarm behavior Boids in ROS

Peer-reviewed publications

Journal articles

- **P. Petracek**, V. Kratky, M. Petrlik, T. Baca, R. Kratochvil, and M. Saska, "Large-Scale Exploration of Cave Environments by Unmanned Aerial Vehicles," *IEEE Robotics and Automation Letters*, vol. 6, no. 4, pp. 7596–7603, Oct. 2021.
- **P. Petracek**, V. Kratky, and M. Saska, "Dronument: System for Reliable Deployment of Micro Aerial Vehicles in Dark Areas of Large Historical Monuments," *IEEE Robotics and Automation Letters*, 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, Dec. 2020.
- V. Kratky, **P. Petracek**, V. Spurny, and M. Saska, "Autonomous Reflectance Transformation Imaging by a Team of Unmanned Aerial Vehicles," *IEEE Robotics and Automation Letters*, 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, May 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," *ISPRS International Journal of Geo-Information*, vol. 10, no. 11, Oct. 2021, **The first two authors had contributed equally.**
- 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.
- T. Manoni, J. Horyna, **P. Petracek**, M. Saska, E. Ferrante, and D. Albani, "Adaptive Arbitration of Aerial Swarms Interactions through a Gaussian Kernel for Coherent Group Motion," 2022, Accepted to Frontiers in Robotics and AI on November 1, 2022, **preprint**.
- K. "Ebadi, L. Bernreiter, H. Biggie, G. Catt, Y. Chang, A. Chatterjee, C. E. Denniston, S.-P. Deschênes, 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. Pomerleau, M. Saska, S. Scherer, R. Siegwart, J. L. Williams, and L. Carlone, "Present and Future of SLAM in Extreme Underground Environments," *preprint arXiv:2208.01787*, 2022, Submitted to Transactions on Robotics (T-RO), **preprint**.

- 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*, 2022. [Online]. Available: `https://arxiv.org/abs/2206.08185`, **preprint**.
- 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

- T. Amorim, T. Nascimento, **P. Petracek**, G. de Masi, E. Ferrante, and M. Saska, "Self-Organized UAV Flocking Based on Proximal Control," in *ICUAS*, 2021, pp. 1374–1382.
- D. Hert, T. Baca, **P. Petracek**, V. Kratky, V. Spurny, M. Petrlik, V. Matous, 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.
- 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*, 2021, pp. 570–576.

Secondary academic activities

Workshop presentations

- Practical seminar tasks introduction, *In IEEE RAS Summer School on Multi-Robot Systems*, 2022.
- Dronument workshop (organizer and speaker), *hosted at FEE CTU*, 2021.
- Decentralized Aerial Swarms Using Vision-Based Mutual Localization, *In IEEE IROS (Second Workshop on Multi-robot Perception-Driven Control and Planning)*, 2018.

Committee at conference proceedings

- Co-chair of session *Micro and Mini UAS I* at ICUAS'22 (chair: prof. Subodh Bhandari).

Referee for journals

- Transactions on Cybernetics
- Robotics and Automation Letters

Referee for conference proceedings

- International Conference on Robotics and Automation (ICRA)
- International Conference on Intelligent Robots and Systems (IROS)

Teaching experience

- Algorithms and Programming: Python and basic programming algorithms for Bachelor students
- Multi-Robot Aerial Systems: for Master students, link to example task

Supervised students

Bc. **Vojtěch Nydrle,** Cybernetics and robotics, FEE CTU
— thesis: Design of a specialized UAV platform for the discharge of a fire extinguishing capsule
— awarded with the Dean's price for astounding Bachelor thesis

Martin Fischer, Cybernetics and robotics, FEE CTU
— thesis: Lidar and multi-camera calibration and fusion
— awarded with the Dean's price for astounding Bachelor thesis