Barnabas Gavin Cangan

https://bgav.in | bcangan@ethz.ch | +41 766 730 370 | ⏻ gavincangan | 🔗 cangan

SUMMARY

Roboticist, PhD candidate specializing in sensor fusion, computer vision, machine learning. Demonstrated expertise in developing prototypes and algorithms, with a solid foundation in systems engineering.

EDUCATION

ETH ZÜRICH
Ph.D. - Mechanical and Process Engineering
Exp. Grad. 2025 | Zürich, Switzerland

VIRGINIA TECH
M.S. - Electrical and Electronics Engineering
Grad. July 2019 | Blacksburg, VA, USA | Cum. GPA: 3.85/4.0
Thesis: Risk-Aware Human-In-The-Loop Multi-Robot Path Planning for Search and Rescue

ANNA UNIVERSITY
B.Eng. - Electrical and Electronics Engineering
Grad. May 2014 | Government College of Technology | Coimbatore, India | Cum. GPA: 8.09/10.0
Project: Vector Control of a 3-phase Induction Motor

RESEARCH

SOFT ROBOTICS LABORATORY | Doctoral Candidate
Sept 2021 – Now | Zürich, Switzerland
Working with **Prof. Dr. Robert Katzschmann** on sensing and learning-based control for dexterous manipulation.

Dexterous Manipulation
- State estimation and control of a **dexterous robotic hand**
- Online **hand pose tracking and retargeting** of human hand poses to robot hands
- **Offline RL policy** for in-hand dexterous manipulation (*Humanoids 2023*)
- Task-specific **pulley design generation** for tendon-driven systems (*RoboSoft 2024*)

Model-based Sensing
- FEM **model-based disturbance sensing** in soft robots (*IROS 2022*)
- Multi-tap **resistive sensing** for proprioception in soft robots (*RA-L/ICRA 2024*)
- Vision-controlled 3D printing of functional soft-rigid hybrid systems (*Nature*)
- Proprioception in soft robots using **capacitive touch sensing**

Vision-based Reconstruction
- Online **key point estimation** of deformable robots (*Adv. Intelligent Sys.*)
- Vision-based rapid aerial grasping (*IROS 2022*)

COORDINATION AT SCALE LAB | Research Assistant - Path Planning
Dec 2018 – July 2019 | Blacksburg, VA, USA
Worked on my thesis with **Prof. Dr. Ryan Williams** on a multi-robot multi-human **search and rescue** project.
- Developed an adaptive **path planning** algorithm for **multi-robot multi-human** search teams (*IROS 2019 Workshop*)
- Built simulations to **model lost person and human searcher** behavior based on nature of the surrounding terrain
- Introduced a **measurement uncertainty** model to accurately represent vision systems with a **limited field-of-view**

BIOCOMPLEXITY INSTITUTE | Research Assistant - Machine Learning
May 2018 – Dec 2018 | Blacksburg, VA, USA
Analyzing large volumes of genomic data and developing models to make threat predictions for the **FunGCAT** project.
- Built a model to predict Gene Ontology from amino acid sequences using **RNN**s
- Wrote a data **pipeline in C++** to reduce model inference time by **>50%**
- Co-taught an **Introduction to Machine Learning** class for undergraduate Bio-Informatics students

WORK EXPERIENCE

MIMIC ROBOTICS | Founding Roboticist/Consultant
Oct 2022 – Now | Zürich, Switzerland
- Developed **initial set of robot hand prototypes** (*2 patents pending*)
- Pitched to VCs, and at various competitions, events
- **Helped with fundraising (2.5M USD)** and with acquiring **pilot projects**

DEXAI ROBOTICS | Robotics Engineer
Aug 2019 – Aug 2021 | Boston, MA, USA
Early **employee (#10)** at a **Draper Labs spin-off** later acquired by *major corporation*. Led multiple sub-system level initiatives.
- Engineered **multi-robot coordination** algorithms, enabling seamless kitchen automation
- Created an **automated calibration system** that enhanced robot precision and reliability
- Implemented **vision-guided tool switching** for food safety compliance
- Designed and deployed an advanced **human detection system** for worker safety
- Built **core infrastructure** including **custom robotic arm drivers** and auxiliary device controls

VIRGINIA TECH TRANSPORTATION INSTITUTE | Engineering Intern
Feb 2018 – May 2018 | Blacksburg, VA, USA
- Developed software for an **RTK-GPS** transmitter module
- **Reverse-engineered** raw vehicle CAN bus data to **leverage built-in vehicle sensors** for a research project

BOSCH | Software Engineer
Jun 2016 – Jun 2017 | Plymouth, MI, USA
- Led **software integration**, and delivery to production and OEM for the **Jeep Cherokee 2019**.
- Built a **custom bootloader** as a workaround solution to save >$100K.

BOSCH | Software Engineer
Jun 2014 – May 2016 | Coimbatore, India
- Worked on the **GM E2xx** and **Ford CD4.3** platform steering projects
- Built **simulation models** of power steering modules to speed up testing.

ZOHO | Project Intern
Dec 2013 – Feb 2014 | Chennai, India
- Engineered high-performance XML to CSV conversion system for **enterprise-scale data processing** in Java
- Benchmarked against publicly available tools

PRASHUB RESEARCH | Research Intern
Jan 2013 – Sep 2013 | Palo Alto, CA, USA (Remote)
- Developed **sound localization** using a microphone array
- Created simulations in **Octave** and built prototypes in **C++**

HACKATHONS & COMPETITIONS

MIT Hacking Medicine - Hacking Dermatology - CureSore
- Won **15K USD top prize** for CureSore, an **AI-powered wound tracking solution** for elderly care
- Secured additional **10K USD seed funding** from Boston University Summer Accelerator
- Led **prototype development** and assisted with pitch, business validation

Graduate Consulting Club - Case Competition
- Won **second place** among 6 finalist teams, developing market **expansion strategy for an NLP startup**
- Analyzed **growth opportunities in UK/DACH** markets, focusing on targeted customer acquisition
- Presented recommendations to **VP Marketing**, emphasizing scalable market penetration

ETH Entrepreneur Club & ETH Juniors - Boost - Faive Robotics (*now Mimic Robotics*)
- Pitched a startup to automate tedious manual labor using **dexterous robot hands** and **generative AI**
- Won the **third prize** among 30 startup teams and a **5K CHF audience favorite** prize

AWARDS & FELLOWSHIPS

- **Swiss Government Excellence Fellowship** for international PhD students
- Research fellowship with **full-tuition scholarship** at Virginia Tech for the second year
- **Innovation Award** at Robert Bosch India for additional contribution to prototype development
- Anna Award with **full-tuition scholarship** from the State Government of Tamil Nadu, India for academic excellence

PUBLICATIONS

∗ denotes shared authorship

[1] E. Bauer, **B. G. Cangan**, and R. K. Katzschmann. Autonomous marker-less rapid aerial grasping. In *2023 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, pages 6395–6402. IEEE, 2023.

[2] T. J. Buchner, S. Rogler, S. Weirich, Y. Armati, **B. G. Cangan**, J. Ramos, S. T. Twiddy, D. M. Marini, A. Weber, D. Chen, et al. Vision-controlled jetting for composite systems and robots. *Nature*, 623(7987):522–530, 2023.

[3] B. G. Cangan, L. Heintzman, A. Hashimoto, N. Abaid, and R. K. Williams. Anticipatory human-robot path planning for search and rescue. *Workshop on Informed Scientific Sampling in Large-scale Outdoor Environments, IROS.*, 2019.

[4] **B. G. Cangan**∗, S. E. Navarro∗, B. Yang, Y. Zhang, C. Duriez, and R. K. Katzschmann. Model-based disturbance estimation for a fiber-reinforced soft manipulator using orientation sensing. *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2022.

[5] S. Tian∗, **B. G. Cangan**∗, S. E. Navarro, A. Beger, C. Duriez, and R. K. Katzschmann. Multi-tap resistive sensing and fem modeling enables shape and force estimation in soft robots. *IEEE Robotics and Automation Letters*, 2023.

[6] Y. Toshimitsu, B. Forrai, **B. G. Cangan**, U. Steger, M. Knecht, S. Weirich, and R. K. Katzschmann. Getting the ball rolling: Learning a dexterous policy for a biomimetic tendon-driven hand with rolling contact joints. In *2023 IEEE-RAS 22nd International Conference on Humanoid Robots (Humanoids)*, pages 1–7. IEEE, 2023.

[7] W. Zhang∗, **B. G. Cangan**∗, T. Buchner, A. M. Kübler, R. Asmus, and R. K. Katzschmann. Task-defined pulley design for nonlinearly coupled tendon-driven actuation. In *2024 7th IEEE-RAS International Conference on Soft Robotics (RoboSoft)*. IEEE, 2024.

[8] H. Zheng, S. Pinzello, **B. G. Cangan**, T. J. Buchner, and R. K. Katzschmann. Vision-based online key point estimation of deformable robots. *Advanced Intelligent Systems*, 2024.