# Javier Felip León

## Summary

AI and Robotics Scientist (Ph.D.) with over a decade of experience in applied AI methods for robotics perception, prediction, planning, and human-robot collaboration. Currently leading an AI-driven collaborative robotics initiative at Intel Labs projected to generate $98M in savings by optimizing preventive maintenance workflows. Recognized innovator with 52 granted patents (+23 approved for filing) and over 20 peer-reviewed conference and journal publications.

## Work Experience

**Jun 2016 – current**
**AI/ML Research Scientist**, Intel Labs, Intel Corporation, Full-time senior AI/ML research scientist position.

Research in applied AI methods for robotics perception, prediction, planning, actuation and human-robot collaboration.

**Feb 2012 – Apr 2016**
**Contact driven robotic manipulation**, Universitat Jaume I *Avda. Sos Baynat s/n*, PREDOC/2010/23, P.I.: MSc. Javier Felip. Director: PhD. Antonio Morales. Four-year research grant to develop the PhD. thesis. Full-time research scientist position 37,5h/week..

Developed algorithms for perception and manipulation of unknown objects. As a result, using my control and reactive manipulation framework, our team qualified for the finals of the Amazon Picking Challenge 2015. More details in the PhD section.

**Nov 2008 – Feb 2012**
**GRASP: Emergence of Cognitive Grasping through Emulation, Introspection and Surprise**, European Commission, IST-FP7-IP-215821, P.I.: PhD. Antonio Morales. Full-time research scientist position 37,5h/week.

Worked with a multi-disciplinary team of roboticists and neuroscientists. Developed robot manipulation planning and control algorithms to grasp unknown objects under uncertainty.

**Sep 2008 – Nov 2008**
**EYESHOTS: Heterogeneous 3D perception across visual fragments**, European Commission, FP7-ICT, grant no. 217077, P.I.: Prof. Angel P. del Pobil. Full-time research scientist position 37,5h/week.

Developed a neuroscience-based system to perceive and manipulate objects. See Chinellato et al. (2011)

**Mar 2008 – Sep 2008**
**GUARDIANS: Group of unmanned assistant robots deployed in aggregative navigation supported by scene detection**, European Commission, IST-FP6-IP-045269, P.I.: PhD. Enric Cervera i Mateu. Full-time research scientist position 37,5h/week.

Developed and integrated mobile robot simulation frameworks.

**Jun 2007 – Dec 2007**
**Full service robotics manipulation system based in sensor fusion and learning**, Spanish science ministry, CICYT PI2004-01920, P.I.: Prof. Pedro José Sanz Valero. Part-time research grant 20h/week.

Developed algorithms for small humanoid robots. Set the foundation for the team participation in the Spanish humanoid robot competition which we won in the '07, '08 and '09 editions.

# Selected AI Software Projects

- **Sim-to-Real scalable perception:** Developed a Blender-based synthetic dataset generator for robotics and vision tasks, using probabilistic 'randomizers' and relational 'anchors' to create diverse and composable scenes. SegFormer models trained on these datasets, detected DIMM slots on motherboards showing zero-shot sim-to-real transfer. This AI system enabled the robot to insert DIMM modules autonomously, demonstrating end-to-end perception-to-action capability.

  Code    Talk

- **Sampling algorithms research:** Introduced Tree-Pyramidal Adaptive Importance Sampling (TP-AIS), a parameter-free method that automatically adapts proposal distributions for efficient sampling. Developed a benchmarking framework to rigorously compare TP-AIS against state-of-the-art methods, showing that it consistently delivers higher efficiency and accuracy across diverse target distributions and dimensions without the need for manual tuning.

  Code    Talk    Paper

- **Human-robot collaboration:** Developed a system that enables safe and effective human–robot collaboration by making real-time human intent prediction feasible. By optimizing Approximate Bayesian Computation, human actions are anticipated at interactive rates, improving task fluency and safety in real-world cooperative tasks such as warehouse packing.

  Code    Talk    Paper    Video

- **Manipulability analysis:** Developed a system to evaluate and optimize robot manipulability using PyBullet. The system optimizes the best robot base poses for target areas by computing reachability and manipulability scores via inverse kinematics and manipulability ellipsoids. The system includes a full pipeline, including scene visualization, automated analysis, and results benchmarking, enabling efficient assessment and planning of robot configurations in complex environments.

  Code    Video

- **PM Cobotics:** Since its inception in early 2024, lead the PM Buddy efforts in the AI and Robotics front. This project is pioneering AI-driven collaborative robotics to transform preventive maintenance in industrial settings. Our cobot system integrates AI for collaboration, motion planning, and smart navigation, assisting technicians by efficiently delivering parts and tools. Through computer vision and anomaly detection, the cobot will perform detailed inspections and support active processes, ensuring high-quality maintenance. The project aims to significantly reduce technician workload, enhance efficiency, and achieve widespread adoption across Intel Foundry, with an estimated $98M in savings by reducing technicians needed for LAM tools PMs from two to one. By expanding use cases and engaging external partners, PM Buddy is set to advance collaborative robotics and preventive maintenance industry-wide.

  Code    Talk    Video

## Hands-On Robotics Experience

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| Manufacturing cobotics | **Fanuc CRX20ia, UR20**, Tech lead in the design of the PM Buddy cobot both for hardware and software stacks.. |
| Collaborative robotics | **UR5, UR5e and Franka Emika Panda**, Mounted, installed, integrated, written control algorithms, perception pipelines using those platforms for research, internal tech transfers, corporate demo presentations and external demos. |
| Industrial robotics | **Baxter collaborative robot**, Experience with Baxter, a ROS based dual arm manipulator robot from Rethink Robotics. Member of the RobInLab UJI team that participated in the Amazon Picking Challenge 2015. |
| Robotics and system integration | **Dual arm manipulation system**, Main contributor to the design of the UJI humanoid torso 'Tombatossals' composed of two Mitsubishi PA10-7C arms, a Schunk SDH2 7DOF dexterous hand, a Barrett Hand and a stereo pan-tilt-verge head. Member of the development team of the Tombatossals' ROS based control architecture and former administrators and maintainers of the platform. |

## Education

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| Oct 2010 – Apr 2016 | **PhD. degree in Computer Science in the doctorate program "Advanced Intelligent Systems"**, *Universitat Jaume I*. <br> Awarded with a four-year research grant under the project name: "Contact based robotic manipulation" with "Cum Laude" qualification. |
| Sep 2008 – Oct 2010 | **Master of Science in Intelligent Systems**, *Universitat Jaume I*, *GPA − 9.13/10*. <br> Specialized in A.I. and Robotics |
| Sep 2004– Jul 2007 | **B.S. in Computer Science**, *Universitat Jaume I*, Castellón, *GPA − 8.2/10*. |
| Sep 2001 – Jul 2004 | **B.S. in Technical Engineering in Computer Systems**, *Universitat Jaume I*, Castellón, *GPA − 8.19/10*. <br> Graduated Valedictorian |

### PhD Thesis

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| Title | *Contact based robotic manipulation* |
| Supervisors | Associate professor Antonio Morales |
| Description | This thesis studies and develops a framework that enables robots to perform manipulation tasks in unstructured and changing environments. Inspiration is taken from neuroscience studies about the human sensorimotor control of manipulation and the visual stimuli processing. In the implemented reactive contact based manipulation system: sensory feedback, adaptive control, contact detection, contact prediction, object detection and object recognition are key. |
| Qualification | Cum laude with international mention. |

### Research stays

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| Jun 2012 – Oct 2012 | **Institute for Anthropomatics**, Karlsruhe Institute of Technology, Supervisor: Prof. Tamim Asfour. <br> Developed a sensor fusion technique to improve the ARMAR-III robot sensing skills. |
| Jul 2015 – Oct 2015 | **Emerging Platform Solutions Lab - IAS - SSR**, Intel Labs, Hillsboro, OR, Supervisor: Shahrokh Shahidzadeh. <br> Participated on the Labs research projects, demos and presentations and developed artificial vision and robotics software. |

## Research interests

- Reinforcement Learning
- Sensor fusion
- Motion planning and control
- Large Behavioral Models (LBM)
- Bayesian Inference
- Robot Perception
- Contact-based manipulation
- Human-Robot Collaboration

## Awards

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| 2022 | IROS'22 Best paper award finalist in cognitive robotics category. |
| 2020 | SHPE Awards Finalist. Young researcher category. |
| 2017 | Ranked 6th in the euRobotics Georges Giralt PhD award. |
| 2009 | Winner of the Spanish humanoid robot contest CEABOT'09. Valladolid. Spain. |
| 2008 | City of Castellón youth awards. I+D+i Category. |
| 2008 | Winner of the Spanish humanoid robot contest CEABOT'08. Tarragona. Spain. |
| 2007 | Winner of the Spanish humanoid robot contest CEABOT'07. Huelva. Spain. |
| 2004 | Best student award of the B.S. in Technical Engineering in Computer Systems. |
| 2004 | Academic excellence award for the Technical Engineering in Computer Systems degree. |

## Technical skills

### Programming

| | |
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| Advanced | Python, C++, Linux, Git, Pytorch, ROS1/2, MoveIt, Pybullet |
| Intermediate | LaTeX, Matlab, OpenCV, SQL, Gazebo, Continuous Integration |
| Basic | C#, BASIC, URScript |

### Design

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| Advanced | Blender, SolidWorks, 3D printing |
| Intermediate | Autodesk Fusion, Manim |
| Basic | Gimp, Inkscape |

## Invited talks

1. Enabling Real-Time Performance for Approximate Bayesian Computation. CIMAT-INAOE Deep Learning and Data Science Workshop. Guanajuato, September 2019.

2. Robust Scene Understanding via Real-Time Approximate Bayesian Computation. IWSSIP'20. The 27th International Conference on Systems, Signals and Image Processing. Online, July 2020.

## Conference and journals

1. Felip, J. and Morales, A. (2009). Robust sensor-based grasp primitive for a three-finger robot hand. In *Intelligent Robots and Systems, 2009. IROS 2009. IEEE/RSJ International Conference on*, pages 1811–1816

2. Laaksonen, J., Felip, J., Morales, A., and Kyrki, V. (May). Embodiment independent manipulation through action abstraction. In *Robotics and Automation (ICRA), 2010 IEEE International Conference on*, pages 2113–2118

3. Chinellato, E., Felip, J., Grzyb, B. J., Morales, A., and del Pobil, A. P. (2011). Hierarchical object recognition inspired by primate brain mechanisms. In *Computational Intelligence for Visual Intelligence (CIVI), 2011 IEEE Workshop on*, pages 1–8

4. Bohg, J., Johnson-Roberson, M., Leon, B., Felip, J., Gratal, X., Bergstrom, N., Kragic, D., and Morales, A. (2011). Mind the gap - robotic grasping under incomplete observation. In *Robotics and Automation (ICRA), 2011 IEEE International Conference on*, pages 686–693

5. Felip, J., Bernabe, J., and Morales, A. (2012a). Contact-based blind grasping of unknown objects. In *12th IEEE-RAS International Conference on Humanoid Robots, HUMANOIDS*, pages 396–401

6. Felip, J., Laaksonen, J., Morales, A., and Kyrki, V. (2012b). Manipulation primitives: A paradigm for abstraction and execution of grasping and manipulation tasks. *Robotics and Autonomous Systems*

7. Leon, B., Felip, J., Marti, H., and Morales, A. (2012). Simulation of robot dynamics for grasping and manipulation tasks. In *12th IEEE-RAS International Conference on Humanoid Robots, HUMANOIDS*, pages 291–296

8. del Pobil, A. P., Duran, A. J., Antonelli, M., Felip, J., Morales, A., Prats, M., and Chinellato, E. (2013). Integration of visuomotor learning, cognitive grasping and sensor-based physical interaction in the uji humanoid torso. *Designing Intelligent Robots: Reintegrating AI*, pages pp. 6–11

9. Bernabe, J., Felip., J., del Pobil, A. P., and Morales, A. (2013). Contact localization through robot and object motion from point clouds. In *13th IEEE-RAS International Conference on Humanoid Robots, HUMANOIDS*, Atlanta, GA, USA. IEEE

10. Morales, A., Prats, M., and Felip, J. (2013). Sensors and methods for the evaluation of grasping. In Carbone, G., editor, *Grasping in Robotics*, volume 10 of *Mechanisms and Machine Science*, pages 77–104. Springer London

11. Felip, J. and Morales, A. (2014). Dual arm sensor-based controller for the cap unscrewing task. In *14th IEEE-RAS International Conference on Humanoid Robots, HUMANOIDS*, Madrid, Spain. IEEE

12. Felip, J., Morales, A., and Asfour, T. (2014). Multi-sensor and prediction fusion for contact detection and localization. In *14th IEEE-RAS International Conference on Humanoid Robots, HUMANOIDS*, Madrid, Spain. IEEE

13. Felip, J., Durán, A. J., Antonelli, M., Morales, A., and del Pobil, A. P. (2015). Tombatossals: A humanoid torso for autonomous sensor-based task execution research. In *15th IEEE-RAS International Conference on Humanoid Robots, HUMANOIDS*, Seoul, South Korea. IEEE

14. Felip, J. (2016). Contact driven robotic manipulation. PhD Thesis

15. Gonzalez-Aguirre, D., Felip, J., and Shahidzadeh, S. (2016). Infinite-Resolution 3D Modeling from a Single Image for Free-Form Revolution Objects. In *2016 IEEE International Symposium on Multimedia (ISM)*, pages 253–260. IEEE

16. Felip, J., Gonzalez-Aguirre, D., and Tickoo, O. (2017). Towards Intuitive Rigid-body Physics Through Parameter Search. *IEEE-RAS 17th International Conference on Humanoid Robotics (Humanoids)*, pages 0–7

17. Felip, J., Ahuja, N. A., Gómez-Gutiérrez, D., Tickoo, O., and Mansinghka, V. (2019). Real-time approximate bayesian computation for scene understanding. *NeurIPS 2019. Workshop in Perception as generative reasoning: structure, causality, probability*

18. Felip, J., Ahuja, N., and Tickoo, O. (2020). Tree pyramidal adaptive importance sampling. *https://arxiv.org/abs/1912.08434*

19. Felip, J., Gonzalez-Aguirre, D., and Nachman, L. (2022). Intuitive & efficient human-robot collaboration via real-time approximate bayesian inference. In *Intelligent Robots and Systems, 2022. IROS 2022. IEEE/RSJ International Conference on*. Best paper award finalist

## Patents

1. Felip Leon, J. et al. (U.S. Patent 20180286119 A1, 2018). Technologies for autonomous three-dimensional modeling

2. Gonzalez Aguirre, D. I. et al. (U.S. Patent 20180211438 A1, 2018). Generating three dimensional models using single two dimensional images

3. Gonzalez Aguirre, D. et al. (U.S. Patent 20190051015 A1, 2019a). Post-incident management for autonomous vehicles

4. Felip Leon, J. et al. (U.S. Patent 20190051158 A1, 2019). Intelligent traffic management for vehicle platoons

5. Aguirre, D. G. et al. (U.S. Patent 20190156663 A1, 2019). Obstacle localization based on probabilistic consensus

6. Gonzalez Aguirre, D. I. et al. (U.S. Patent 20190135300 A1, 2019c). Methods and apparatus for unsupervised multimodal anomaly detection for autonomous vehicles

7. Gonzalez Aguirre, D. I. et al. (U.S. Patent 20190138848 A1, 2019e). Realistic sensor simulation and probabilistic measurement correction

8. Gonzalez Aguirre, D. I. et al. (U.S. Patent 20190197029 A1, 2019d). Methods, systems and apparatus to improve spatial-temporal data management

9. Turek, J. S. et al. (U.S. Patent 20190325108 A1, 2019b). Systems and methods for determining a configuration for a microarchitecture

10. Gonzalez Aguirre, D. I. et al. (U.S. Patent 20190324977 A1, 2019f). Technologies for management of data layers in a heterogeneous geographic information system map

11. Leon, J. F. et al. (U.S. Patent 20190321974 A1, 2019a). Apparatus and methods for object manipulation via action sequence optimization

12. Remis, L. C. M. et al. (U.S. Patent 20190325292 A1, 2019b). Methods, apparatus, systems and articles of manufacture for providing query selection systems

13. Turek, J. S. et al. (U.S. Patent 20190317739 A1, 2019a). Methods and apparatus to automatically generate code for graphical user interfaces

14. Leon, J. F. et al. (U.S. Patent 20190317455 A1, 2019b). Methods and apparatus to generate acceptability criteria for autonomous systems plans

15. Alvarez, I. J. et al. (U.S. Patent 20190318244 A1, 2019). Methods and apparatus to provide machine programmed creative support to a user

16. Gonzalez Aguirre, D. I. et al. (U.S. Patent 20190314984 A1, 2019b). Automatic robot perception programming by imitation learning

17. Remis, L. C. M. et al. (U.S. Patent 20190317965 A1, 2019a). Methods and apparatus to facilitate generation of database queries

18. Felip Leon, J. et al. (U.S. Patent 20200149898 A1, 2020b). System and method for acceleration-based vector field maps

19. Gonzalez Aguirre, D. I. et al. (U.S. Patent 20200143551 A1, 2020c). Technologies for thermal enhanced semantic segmentation of two-dimensional images

20. Gomez Gutierrez, D. et al. (U.S. Patent 20200133281 A1, 2020). Safety system for a vehicle

21. Elli, M. S. et al. (U.S. Patent 20200130570 A1, 2020). Self-adaptive multiresolution digital-plate for multimodal enhanced safety of vehicles

22. Turek, J. et al. (U.S. Patent 20200130711 A1, 2020). Autonomous vehicle system for detecting safety driving model compliance status of another vehicle, and planning accordingly

23. Gutierrez, D. G. et al. (U.S. Patent 20200023842 A1, 2020). Potential collision warning system based on road user intent prediction

24. Perez-Ramirez, J. et al. (U.S. Patent 20200018814 A1, 2020b). Locating radio transmission source by scene reconstruction

25. Alvarez, I. et al. (U.S. Patent 20200326696 A1, 2020b). Technology to handle ambiguity in automated control systems

26. Felip Leon, J. et al. (U.S. Patent 20200327415 A1, 2020a). Neural network verification based on cognitive trajectories

27. Perez-Ramirez, J. et al. (U.S. Patent 20200329386 A1, 2020a). Automated network control systems that adapt network configurations based on the local network environment

28. Zamora Esquivel, J. et al. (U.S. Patent 20200327731 A1, 2020). Artificial imagination engine using 5d information descriptors

29. Gonzalez Aguirre, D. I. et al. (U.S. Patent 20200324409 A1, 2020b). Affordance-aware, multi-resolution, free-form object manipulation planning

30. Oliver, D. et al. (U.S. Patent 20200327802 A1, 2020). Object tracking technology based on cognitive representation of a location in space

31. Guzman, M. et al. (U.S. Patent 20200322528 A1, 2020). Camera orchestration technology to improve the automated identification of individuals

32. Ahuja, N. et al. (U.S. Patent 20200226430 A1, 2020). Devices and methods for accurately identifying objects in a vehicle's environment

33. Gonzalez Aguirre, D. et al. (U.S. Patent 20200223443 A1, 2020a). Safety system for a vehicle

34. Alvarez, I. et al. (U.S. Patent 20200200869 A1, 2020a). Compensating for a sensor deficiency in a heterogeneous sensor array

35. Alvarez, I. J. et al. (U.S. Patent 20210001884 A1, 2021d). Technology to generalize safe driving experiences for automated vehicle behavior prediction

36. Alvarez, I. J. et al. (U.S. Patent 20210403031 A1, 2021a). Disambiguation of vehicle navigation actions

37. Alvarez, I. J. et al. (U.S. Patent 20210402898 A1, 2021b). Methods and devices for a vehicle

38. Felip Leon, J. et al. (U.S. Patent 20210309264 A1, 2021a). Human-robot collaboration

39. Felip Leon, J. et al. (U.S. Patent 20210299866 A1, 2021b). Robotic manipulation planning based on probabilistic elastoplastic deformation material point method

40. Datta, P. et al. (U.S. Patent 20210279506 A1, 2021). Systems, methods, and devices for head pose determination

41. Turek, J. S. et al. (U.S. Patent 20210150323 A1, 2021). Methods and apparatus to implement a neural network

42. Guim Bernat, F. et al. (U.S. Patent 20210116261 A1, 2021). Systems and methods for vehicle-occupancy-based and user-preference-based smart routing and autonomous volumetric-occupancy measurement

43. Gonzalez Aguirre, D. et al. (U.S. Patent 20210117649 A1, 2021). Systems and methods for privacy-preserving facemask-compliance-level measurement

44. Alvarez, I. J. et al. (U.S. Patent 20210114606 A1, 2021c). Systems and methods for intrusion detection in vehicle systems

45. Campos Macias, L. E. et al. (U.S. Patent 20210110264 A1, 2021). Methods and apparatus to facilitate efficient knowledge sharing among neural networks

46. Felip Leon, J. et al. (U.S. Patent 20220111526 A1, 2022). Localization system and method

47. Elli, M. S. et al. (U.S. Patent 20220114458 A1, 2022). Multimodal automatic mapping of sensing defects to task-specific error measurement

48. Campos Macias, L. et al. (U.S. Patent 20220009439 A1, 2022). Enhanced occupant collision safety system

49. Leon, J. F. et al. (U.S. Patent 20220274251 A1, 2022). Apparatus and methods for industrial robot code recommendation

50. Oboril, F. et al. (U.S. Patent 20220242452 A1, 2022). Vehicle occupant monitoring

51. Galeev, M. T. et al. (U.S. Patent 20220200920 A1, 2022). Dynamic adaptation of time-aware communications in time-sensitive systems

52. Gomez Gutierrez, D. et al. (U.S. Patent 20240217103 A1, 2024). Trajectory planning systems and methods

53. Gonzalez Aguirre, D. et al. (U.S. Patent 20240112369 A1, 2024a). Human-robot interactive workspace

54. Gonzalez Aguirre, D. et al. (U.S. Patent 20240025042 A1, 2024b). Neuro-capability plug-ins for robot task planning

55. Macias, L. C. et al. (U.S. Patent 20230259665 A1, 2023). Occupancy mapping based on geometric entities with hierarchical relationships

56. Campos Macias, L. E. et al. (U.S. Patent 20230048578 A1, 2023). Real-time predictor of human movement in shared workspaces

57. Aguirre, D. G. et al. (U.S. Patent 20240416510 A1, 2024). Object-agnostic fast grasping-points estimation via geometric-algebra

58. Felip Leon, J. et al. (U.S. Patent 20240326254 A1, 2024). Camera and end-effector planning for visual servoing

59. Gonzalez Aguirre, D. I. et al. (U.S. Patent 20240314290 A1, 2024c). Methods and apparatus to model volumetric representations

60. Turek, J. et al. (U.S. Patent 20240293931 A1, 2024). Human-collaborative robot ergonomic interaction system

61. De La Guardia Gonzalez, R. et al. (U.S. Patent 20250060729 A1, 2025). Hierarchical polytope workspace mapping for human-robot collaboration

62. Felip Leon, J. et al. (U.S. Patent 20250001605 A1, 2025b). Probabilistic autocomplete system for robot programming

63. Gonzalez Aguirre, D. et al. (U.S. Patent 20250004820 A1, 2025a). Edge-based end device control using asynchronous adaptive motion primitives

64. Turek, J. S. et al. (U.S. Patent 20250001597 A1, 2025b). Collaborative human-robot error correction and facilitation

65. Felix Rendon, J. et al. (U.S. Patent 20250128560 A1, 2025). Transport system with self-lifting wheel units for floor obstacle traversal

66. Zamora Esquivel, J. et al. (U.S. Patent 20250121493 A1, 2025). Differential kinematics control using conformal geometric entity modeling

67. Gonzalez Aguirre, D. et al. (U.S. Patent 20250135663 A1, 2025c). Illumination control in robotic end effector manipulation

68. Gonzalez Aguirre, D. et al. (U.S. Patent 20250135655 A1, 2025b). Human-robot interface system with bidirectional haptic feedback

69. Felip Leon, J. et al. (U.S. Patent 20250187181 A1, 2025a). Energy efficient robotic arm

70. Ruiz Fernandez, L. et al. (U.S. Patent 20250202788 A1, 2025). Controller parameter adaptation for non-differentiable communication conditions

71. Felip Leon, J. et al. (U.S. Patent 20250214788 A1, 2025c). Smart sensing for pallet loading and unloading

72. Turek, J. S. et al. (U.S. Patent 20250238664 A1, 2025a). Adaptation of quantization of neural network models during inference