

SESSION INDEX

Session TuHT24 : Active Perception in Robotics

Active Bayesian Multi-Class Mapping from Range and Semantic Segmentation Observations <i>Asgharivaskasi, Arash; Atanasov, Nikolay</i>	1
Attention-Based Probabilistic Planning with Active Perception <i>Ma, Haoxiang; Fu, Jie</i>	8
Search-Based Planning for Active Sensing in Goal-Directed Coverage Tasks <i>Kusnur, Tushar; Saxena, Dhruv Mauria; Likhachev, Maxim</i>	15
Bearing-Only Active Sensing under Merged Measurements <i>Calkins, Luke; Baldoni, Phillip; McMahon, James; Wilhelmi, Corbin; Zavlanos, Michael M.</i>	22

Session TuT24 : Adaptive Robotic Systems

Robust Adaptive Synchronization of Interconnected Heterogeneous Quadrotors Transporting a Cable-Suspended Load <i>Cardona, Gustavo A.; Arevalo-Castiblanco, Miguel Felipe; Tellez-castro, Duvan; Calderon, Juan; Mojica-Nava, Eduardo</i>	31
Adaptive Failure Search Using Critical States from Domain Experts <i>Du, Peter; Driggs-Campbell, Katherine</i>	38
Policy Transfer Via Kinematic Domain Randomization and Adaptation <i>Exarchos, Ioannis; Jiang, Yifeng; Yu, Wenhao; Liu, Karen</i>	45
Uniform Complete Observability of Mass and Rotational Inertial Parameters in Adaptive Identification of Rigid-Body Plant Dynamics <i>Paine, Tyler; Whitcomb, Louis</i>	52

Session TuDT24 : Aerial Robotics

A Tethered Quadrotor UAV-Buoy System for Marine Locomotion <i>Kourani, Ahmad; Daher, Naseem</i>	59
Power Line Inspection Tasks with Multi-Aerial Robot Systems Via Signal Temporal Logic Specifications <i>Silano, Giuseppe; Baca, Tomas; Penicka, Robert; Liuzza, Davide; Saska, Martin</i>	66
Distributed Formation Estimation Via Pairwise Distance Measurements <i>Ziegler, Thomas; Karrer, Marco; Schmuck, Patrik; Chli, Margarita</i>	74
Distributed Variable-Baseline Stereo SLAM from Two UAVs	82

Session TuET24 : Aerial Robotics: Control I

Fast Sampling-Based Next-Best-View Exploration Algorithm for a MAV	89
<i>Massagué Respall, Victor; Devitt, Dmitry; Fedorenko, Roman; Klimchik, Alexandr</i>	
Neuromorphic Control for Optic-Flow-Based Landing of MAVs Using the Loihi Processor	96
<i>Dupeyroux, Julien; Hagenaars, Jesse Jan; Paredes-Valles, Federico; de Croon, Guido</i>	
Event-Driven Vision and Control for UAVs on a Neuromorphic Chip	103
<i>Vitale, Antonio; Renner, Alpha; Nauer, Céline; Scaramuzza, Davide; Sandamirskaya, Yulia</i>	
Deep Neuromorphic Controller with Dynamic Topology for Aerial Robots	110
<i>Kocer, Basaran Bahadir; Abdul Hady, Hady; Kandath, Harikumar; Pratama, Mahardhika; Kovac, Mirko</i>	

Session TuDT23 : Aerial Robotics: Control II

Adaptive Stiffness Estimation Impedance Control for Achieving Sustained Contact in Aerial Manipulation	117
<i>Markovic, Lovro; Car, Marko; Orsag, Matko; Bogdan, Stjepan</i>	
Model Predictive Control for Dynamic Quadrotor Bearing Formations	124
<i>Erskine, Julian; Balderas Hill, Rafael; Fantoni, Isabelle; Chriette, Abdelhamid</i>	
Direct Force and Pose NMPC with Multiple Interaction Modes for Aerial Push-And-Slide Operations	131
<i>Peric, Lazar; Brunner, Maximilian; Bodie, Karen; Tognon, Marco; Siegwart, Roland</i>	
Motor and Perception Constrained NMPC for Torque-Controlled Generic Aerial Vehicles	138
<i>Jacquet, Martin; Franchi, Antonio</i>	

Session WeAT18 : Aerial Robotics: Control III

Conquering Textureless with RF-Referenced Monocular Vision for MAV State Estimation	146
<i>Zhang, Shengkai; Tang, Sheyang; Wang, Wei; Jiang, Tao; Qian, Zhang</i>	
Control of an Aerial Manipulator Using a Quadrotor with a Replaceable Robotic Arm	153
<i>Ouyang, Zizhen; Mei, Ruidong; Liu, Zisen; Wei, Mingxin; Zhou, Zida; Cheng, Hui</i>	
Self-Triggered Based Coordinate Control with Low Communication for Tethered Multi-UAV Collaborative Transportation	160
<i>Zhang, XiaoZhen; Zhang, Fan; Huang, Panfeng; Gao, Jiale; Yu, Hang; Pei, Chongxu; Zhang, Yizhai</i>	
Flying with Damaged Wings: The Effect on Flight Capacity and Bio-Inspired Coping Strategies of a Flapping Wing Robot	168

Tu, Zhan; Fei, Fan; Liu, Limeng; Zhou, Yiming; Deng, Xinyan

Session TuIT23 : Aerial Robotics: Design and Mechanism I

[Collision-Free Vector Field Guidance and MPC for a Fixed-Wing UAV](#) 176

Pereira, Leonardo A. A.; Dias Nunes, Arthur Henrique; Rezende, Adriano; Gonçalves, Vinicius Mariano; Raffo, Guilherme V.; Pimenta, Luciano

[Toward Impact-resilient Quadrotor Design, Collision Characterization and Recovery Control to Sustain Flight after Collisions](#) 183

Liu, Zhichao; Karydis, Konstantinos

[H-ModQuad: Modular Multi-Rotors with 4, 5, and 6 Controllable DOF](#) 190

Xu, Jiawei; S. D'Antonio, Diego; Saldaña, David

Session TuKT23 : Aerial Robotics: Design and Mechanism II

[The Catenary Robot: Design and Control of a Cable Propelled by Two Quadrotors](#) 197

S. Dantonio, Diego; Cardona, Gustavo A.; Saldaña, David

[Aerial Multi-Camera Robotic Jib Crane](#) 203

Moreno, Patricio; Presenza, Juan Francisco; Mas, Ignacio; Giribet, Juan Ignacio

[Design, Sensing, and Control of a Novel UAV Platform for Aerial Drilling and Screwing](#) 209

Ding, Caiwu; Lu, Lu

[Freyja: A Full Multirotor System for Agile & Precise Outdoor Flights](#) 217

Shankar, Ajay; Elbaum, Sebastian; Detweiler, Carrick

Session TuFT24 : Aerial Robotics: Detection

[Context-Dependent Anomaly Detection for Low Altitude Traffic Surveillance](#) 224

Bozcan, Ilker; Kayacan, Erdal

[GridNet: Image-Agnostic Conditional Anomaly Detection for Indoor Surveillance](#) 231

Bozcan, Ilker; le Fevre Sejersen, Jonas; Pham, Huy; Kayacan, Erdal

[Autonomous Flying into Buildings in a Firefighting Scenario](#) 239

Pritzl, Vaclav; Stepan, Petr; Saska, Martin

[LoLa-SLAM: Low-latency LiDAR SLAM using Continuous Scan Slicing](#) 246

Karimi, Mojtaba; Oelsch, Martin; Stengel, Oliver; Babaian, Edwin; Steinbach, Eckehard

Session TuJT23 : Aerial Robotics: Learning and Adaptive Systems

[Learning-Based Bias Correction for Time Difference of Arrival Ultra-Wideband Localization of Resource-Constrained Mobile Robots](#) 254

Zhao, Wenda; Panerati, Jacopo; Schoellig, Angela P.

[CVaR-Based Flight Energy Risk Assessment for Multirotor UAVs Using a Deep Energy Model](#) 262

Choudhry, Arnav; Moon, Brady; Patrikar, Jay; Samaras, Constantine; Scherer, Sebastian

[Hypergame-Based Adaptive Behavior Path Planning for Combined Exploration and Visual Search](#) 269

Dharmadhikari, Mihir Rahul; Deshpande, Harshal; Dang, Tung; Alexis, Kostas

[Morphologically Adapative Quad-Rotor Towards Acquiring High-Performance Flight: A Comparative Study and Validation](#) 276

Zhao, Na; Yang, Weixin; Peng, Cong; Wang, Gang; Shen, Yantao

Session TuBT24 : Aerial Robotics: Mechanics and Control I

[Fixed-root Aerial Manipulator: Design, Modeling, and Control of Multilink Aerial Arm to Adhere Foot Module to Ceilings using Rotor Thrust](#) 283

Nishio, Takuzumi; Zhao, Moju; Anzai, Tomoki; Kojima, Kunio; Okada, Kei; Inaba, Masayuki

[Aerial Manipulator Pushing a Movable Structure Using a DOB-Based Robust Controller](#) 290

Lee, Dongjae; Seo, Hoseong; Jang, Inkyu; Lee, Seung Jae; Kim, H. Jin

[Data-Driven MPC for Quadrotors](#) 298

Torrente, Guillem; Kaufmann, Elia; Foehn, Philipp; Scaramuzza, Davide

[Singularity-Free Aerial Deformation by Two-Dimensional Multilinked Aerial Robot with 1-DoF Vectorable Propeller](#) 306

Zhao, Moju; Anzai, Tomoki; Okada, Kei; Kawasaki, Koji; Inaba, Masayuki

Session TuCT24 : Aerial Robotics: Mechanics and Control II

[Underwater Stability of a Morphable Aerial-Aquatic Quadrotor with Variable Thruster Angles](#) 314

Tan, Yu Heng; Chen, Ben M.

[Development of Flapping Robot with Self-Takeoff from The Ground Capability](#) 321

Afakh, Muhammad Labiyb; Sato, Terukazu; Sato, Hidaka; Takesue, Naoyuki

[Fast-Tracker: A Robust Aerial System for Tracking Agile Target in Cluttered Environments](#) 328

Han, Zhichao; Zhang, Ruibin; Pan, Neng; Xu, Chao; Gao, Fei

[Teach-Repeat-Replan: A Complete and Robust System for Aggressive Flight in Complex Environments](#) 335

Gao, Fei; Wang, Luqi; Zhou, Boyu; Zhou, Xin; Pan, Jie; Shen, Shaojie

Session TuGT24 : Aerial Robotics: Optimization

[Practical and Accurate Generation of Energy-Optimal Trajectories for a Planar Quadrotor](#) 355

Morbidi, Fabio; Pisarski, Dominik

Optimization-Based Trajectory Planning for Tethered Aerial Robots <i>Martinez-Rozas, Simon; Alejo, David; Caballero, Fernando; Merino, Luis</i>	362
A Novel Robust Hexarotor Capable of Static Hovering in Presence of Propeller Failure <i>Baskaya, Elgiz; Hamandi, Mahmoud; Bronz, Murat; Franchi, Antonio</i>	369
Optimal Tuning of the Lateral-Dynamics Parameters for Aerial Vehicles with Bounded Lateral Force <i>Horla, Dariusz; Hamandi, Mahmoud; Giernacki, Wojciech; Franchi, Antonio</i>	377
Session TuAT24 : Aerial Robotics: Planning and Control	
Estimation and Adaption of Indoor Ego Airflow Disturbance with Application to Quadrotor Trajectory Planning <i>Wang, Luqi; Zhou, Boyu; Liu, Chuhao; Shen, Shaojie</i>	384
Real-Time Active Detection of Targets and Path Planning Using UAVs <i>Chen, Fangping; Lu, Yuheng; Li, Yunyi; Xie, Xiaodong</i>	391
EVA-Planner: Environmental Adaptive Quadrotor Planning <i>Quan, Lun; Zhang, Zhiwei; Zhong, Xingguang; Xu, Chao; Gao, Fei</i>	398
EGO-Planner: An ESDF-Free Gradient-Based Local Planner for Quadrotors <i>Zhou, Xin; Wang, Zhepei; Xu, Chao; Gao, Fei</i>	405
Session TuHT23 : Aerial Robotics: Sensing and Control I	
MorphEyes: Variable Baseline Stereo for Quadrotor Navigation <i>J Sanket, Nitin; Singh, Chahat; Asthana, Varun; Fermuller, Cornelia; Aloimonos, Yiannis</i>	413
A Drive-Through Recharging Strategy for a Quadrotor <i>Wang, Yafeng; Sun, Qinbo; Berger, Tristan; Qi, Weimin</i>	420
Continuous-time State & Dynamics Estimation Using a Pseudo-Spectral Parameterization <i>Agrawal, Varun; Dellaert, Frank</i>	426
Use of a MEMS Differential Pressure Sensor to Detect Ground, Ceiling, and Walls on Small Quadrotors <i>Britcher, Victoria; Bergbreiter, Sarah</i>	433
Session TuIT21 : Aerial Robotics: Sensing and Control II	
UAV Localization Using Autoencoded Satellite Images <i>Bianchi, Mollie; Barfoot, Timothy</i>	441
Cooperative Transportation of Cable Suspended Payloads with MAVs Using Monocular Vision and Inertial Sensing	449

Li, Guanrui; Ge, Rundong; Loianno, Giuseppe

Tracking and Relative Localization of Drone Swarms with a Vision-Based Headset 458
Pavliv, Maxim; Schiano, Fabrizio; Reardon, Christopher M.; Floreano, Dario; Loianno, Giuseppe

SelfDeco: Self-Supervised Monocular Depth Completion in Challenging Indoor Environments 467
Choi, Jaehoon; Jung, Dongki; Lee, Yonghan; Kim, Deokhwa; Manocha, Dinesh; Lee, Donghwan

Session TuHT21 : Aerial Robotics: Space Robotics and Automation

An Anytime Algorithm for Chance Constrained Stochastic Shortest Path Problems and Its Application to Aircraft Routing 475
Hong, Sungkweon; Lee, Sang Uk; Huang, Xin; Khonji, Majid; Alyassi, Rashid; Williams, Brian

An Intention Guided Hierarchical Framework for Trajectory-Based Teleoperation of Mobile Robots 482
Yang, Xuning; Cheng, Jasmine; Michael, Nathan

Distance Estimation Using Self-Induced Noise of an Aerial Vehicle 489
Calkins, Luke; Lingeitch, Joseph; Coffin, Joe; McGuire, Loy; Geder, Jason; Kelly, Matthew; Zavlanos, Michael M.; Sofge, Donald; Lofaro, Daniel

Session WeBT18 : Aerial Robotics: Tracking

ADTrack: Target-Aware Dual Filter Learning for Real-Time Anti-Dark UAV Tracking 496
Li, Bowen; Fu, Changhong; Ding, Fangqiang; Ye, Junjie; Lin, Fuling

Mutation Sensitive Correlation Filter for Real-Time UAV Tracking with Adaptive Hybrid Label 503
Zheng, Guangze; Fu, Changhong; Ye, Junjie; Lin, Fuling; Ding, Fangqiang

Siamese Anchor Proposal Network for High-Speed Aerial Tracking 510
Fu, Changhong; Cao, Ziang; Li, Yiming; Ye, Junjie; Feng, Chen

Computationally Efficient Trajectory Planning for High Speed Obstacle Avoidance of a Quadrotor with Active Sensing 517
Chen, Gang; Sun, Dongxiao; Dong, Wei; Sheng, Xinjun; Zhu, Xiangyang; Ding, Han

Session TuET22 : Aerial Systems: Mechanics and Control

Novel Omnidirectional Aerial Manipulator with Elastic Suspension: Dynamic Control and Experimental Performance Assessment 525
Yigit, Arda; Arpa Perozo, Miguel; Cuvillon, Loic; Durand, Sylvain; Gangloff, Jacques

Improving Dynamics of an Aerial Manipulator with Elastic Suspension Using Nonlinear Model Predictive Control 533
Yigit, Arda; Arpa Perozo, Miguel; Cuvillon, Loic; Durand, Sylvain; Gangloff, Jacques

[Design of the High-Payload Flapping Wing Robot E-Flap](#) 540
Zufferey, Raphael; Tormo Barbero, Jesus; Guzmán García, María del Mar; Maldonado Fernández, Francisco Javier; Sanchez-Laulhe, Ernesto; Grau, Pedro; Perez Capote, Martin; Acosta, Jose Angel; Ollero, Anibal

[Pneumatic-Mechanical Systems in UAVs: Autonomous Power Line Sensor Unit Deployment](#) 548
Iversen, Nicolai; Kramberger, Aljaz; Bowen Schofield, Oscar; Ebeid, Emad

Session TuDT22 : Aerial Systems: Multi-Robots

[A Multi-UAV System for Detection and Elimination of Multiple Targets](#) 555
Stasinchuk, Yurii; Vrba, Matous; Petrlik, Matej; Baca, Tomas; Spurny, Vojtech; Hert, Daniel; Žaitlík, David; Nascimento, Tiago; Saska, Martin

[Optic Flow-Based Reactive Collision Prevention for MAV Using Fictitious Obstacle Hypothesis](#) 562
Xiao, Feng; Zheng, Peter; Di Tria, Julien; Kocer, Basaran Bahadir; Kovac, Mirko

[Autonomous Aerial Swarming in GNSS-denied Environments with High Obstacle Density](#) 570
Ahmad, Afzal; Walter, Viktor; Petráček, Pavel; Petrlik, Matej; Baca, Tomas; Žaitlík, David; Saska, Martin

[Forceful Aerial Manipulation Based on an Aerial Robotic Chain: Hybrid Modeling and Control](#) 577
Nguyen, Huan; Alexis, Kostas

Session TuET23 : Aerial Systems: Perception and Autonomy

[Combined System Identification and State Estimation for a Quadrotor UAV](#) 585
Böhm, Christoph; Brommer, Christian; Hardt-Stremayr, Alexander; Weiss, Stephan

[Geometry-Aware Compensation Scheme for Morphing Drones](#) 592
Fabris, Amedeo; Kleber, Kevin; Falanga, Davide; Scaramuzza, Davide

[Autonomous Quadrotor Flight despite Rotor Failure with Onboard Vision Sensors: Frames vs. Events](#) 599
Sun, Sihao; Cioffi, Giovanni; de Visser, Coen; Scaramuzza, Davide

[SplatPlanner: Efficient Autonomous Exploration Via Permutohedral Frontier Filtering](#) 608
Brunel, Anthony; Bourki, Amine; Demonceaux, Cédric; Strauss, Olivier

Session TuAT22 : Applications of Micro and Nano Robotics I

[Parallel Actuation of Nanorod Swarm and Nanoparticle Swarm to Different Targets](#) 616
Du, Xingzhou; Jin, Dongdong; Wang, Qianqian; Yang, Shihao; Chiu, Philip, Wai-yan; Zhang, Li

[Robotic Micromanipulation for Active Pin Alignment in Electronic Soldering Industry](#) 623
Ren, Hao; Wu, Xinyu; Shang, Wanfeng

In-Situ Bonding of Multilayer Microfluidic Devices Assisted by a Fully-Automated Aligning System 629
Li, Pengyun; Liu, Xiaoming; Liu, Dan; Tang, Xiaoqing; Kojima, Masaru; Huang, Qiang; Arai, Tatsuo

Robotic Handling of Micro-Objects Using Stochastic Optically-Actuated End-Effector 635
Ta, Quang Minh; Cheah, C. C.

Session TuBT22 : Applications of Micro and Nano Robotics II

Design of Soft Sensor for Feedback Control of Bio-Actuator Powered by Skeletal Muscle 643
Kim, Eunhye; Takeuchi, Masaru; Ohira, Ryosuke; Nomura, Takuto; Hasegawa, Yasuhisa; Huang, Qiang; Fukuda, Toshio

Molecular Transport of a Magnetic Nanoparticle Swarm towards Thrombolytic Therapy 649
Manamanchaiyaporn, Laliphat; Tang, Xiuzhen; Yan, Xiaohui; Zheng, Yuanyi

Efficient Single Cell Mechanical Measurement by Integrating a Cell Arraying Microfluidic Device with Magnetic Tweezer 657
Tang, Xiaoqing; Liu, Xiaoming; Li, Pengyun; Liu, Dan; Kojima, Masaru; Huang, Qiang; Arai, Tatsuo

A Portable Acoustofluidic Device for Multifunctional Cell Manipulation and Reconstruction 664
Zhang, Wei; Song, Bin; Bai, Xue; Guo, Jingli; Feng, Lin; Arai, Fumihito

Session TuBT23 : Applications of Robotic Exploration

Design and Soft-Landing Control of a Six-Legged Mobile Repetitive Lander for Lunar Exploration 670
Yin, Ke; Gao, Feng; Sun, Qiao; Liu, Jimu; Xiao, Tao; Yang, Jianzhong; Jiang, Shuiqing; Chen, Xianbao; Sun, Jing; Liu, Renqiang; Qi, Chenkun

LEAF: Latent Exploration Along the Frontier 677
Bharadhwaj, Homanga; Garg, Animesh; Shkurti, Florian

LAFFNet: A Lightweight Adaptive Feature Fusion Network for Underwater Image Enhancement 685
Yang, Hao-Hsiang; Huang, Kuan-Chih; Chen, Wei-Ting

Ultrasound Doppler Imaging and Navigation of Collective Magnetic Cell Microrobots in Blood 693
Wang, Qianqian; Tian, Yuan; Du, Xingzhou; Chan, Kai Fung; Zhang, Li

Session TuFT23 : Automation and Industrial Robotics

Automated Generation of Robot Trajectories for Assembly Processes Requiring Only Sparse Manual Input 700
Madsen, Steffen; Jami, Milad; Petersen, Henrik Gordon

Benchmarking Real-Time Capabilities of ROS 2 and OROCOS for Robotics Applications 708
Barut, Sinan; Boneberger, Marco; Mohammadi, Pouya; Steil, Jochen J.

[The KIT Gripper: A Multi-Functional Gripper for Disassembly Tasks](#) 715
Klas, Cornelius; Hundhausen, Felix; Gao, Jianfeng; Dreher, Christian R. G.; Reither, Stefan; Zhou, You; Asfour, Tamim

[In-Process Workpiece Geometry Estimation for Robotic Arc Welding Based on Supervised Learning for Multi-Sensor Inputs](#) 722
Schmidt, Alexander; Kotschote, Christian; Riedel, Oliver

Session TuAT0 : Automation Award Session

[A General-Purpose Anomalous Scenario Synthesizer for Rotary Equipment](#) 729
Yeung, Yip Fun; Alshehri, Ali; Wampler, Lois; Mikio, Furokawa; Takayuki, Hirano; Youcef-Toumi, Kamal

Session WeAT17 : Automation I

[Viko: An Adaptive Gecko Gripper with Vision-Based Tactile Sensor](#) 736
Pang, Cho Hei; Mak, Kin Wing; Zhang, Yazhan; Yang, Yang; Tse, Yu Alexander; Wang, Michael Yu

[POIS: Policy-Oriented Instance Segmentation for Ambidextrous Robot Picking](#) 743
Xu, Guagnyun; Tao, Yi; Jiang, Bowen; Wang, Peng; Luo, Yongkang; Zhong, Jun

[Learning-Based Predictive Path Following Control for Nonlinear Systems under Uncertain Disturbances](#) 750
Yang, Rui; Zheng, Lei; Pan, Jiesen; Cheng, Hui

[Thrust Enhancement of Wave-Driven Unmanned Surface Vehicle by Using Asymmetric Foil](#) 758
Gao, Yan; Xie, Lyucheng; Lam, Tin Lun

Session WeBT17 : Automation II

[Proactive Action Visual Residual Reinforcement Learning for Contact-Rich Tasks Using a Torque-Controlled Robot](#) 765
Shi, Yunlei; Chen, Zhaopeng; Liu, Hongxu; Riedel, Sebastian Danilo; Gao, Chunhui; Feng, Qian; Deng, Jun; Zhang, Jianwei

[ParametricNet: 6DoF Pose Estimation Network for Parametric Shapes in Stacked Scenarios](#) 772
Zeng, Long; Lv, Weijie; Zhang, Xinyu; Liu, Yong-Jin

[Optimal Online Dispatch for High-Capacity Shared Autonomous Mobility-On-Demand Systems](#) 779
Li, Cheng; Parker, David; Hao, Qi

[An Improved Magnetic Spot Navigation for Replacing the Barcode Navigation in Automated Guided Vehicles](#) 786
Dai, Houde; Guo, Pengfei; Chen, Hongyu; Zhao, Silin; Liu, PengHua; Lin, Guijuan

Session TuJT22 : Automation: Machine Learning I

Model-Based Reinforcement Learning with Provable Safety Guarantees Via Control Barrier Functions	792
<i>Zhang, Hongchao; Li, Zhouchi; Clark, Andrew</i>	
Continual Model-Based Reinforcement Learning with Hypernetworks	799
<i>Huang, Yizhou; Xie, Kevin; Bharadhwaj, Homanga; Shkurti, Florian</i>	
Reinforcement Learning Based Temporal Logic Control with Maximum Probabilistic Satisfaction	806
<i>Cai, Mingyu; Xiao, Shaoping; Li, Baoluo; Li, Zhiliang; Kan, Zhen</i>	
Solving Markov Decision Processes with Partial State Abstractions	813
<i>Nashed, Samer; Svegliato, Justin; Brucato, Matteo; Basich, Connor; Grupen, Rod; Zilberstein, Shlomo</i>	
Session TuKT22 : Automation: Machine Learning II	
Exploiting Object Similarity for Robotic Visual Recognition	820
<i>Cai, Hong; Mostofi, Yasamin</i>	
Team Assignment for Heterogeneous Multi-Robot Sensor Coverage through Graph Representation Learning	838
<i>Reily, Brian; Zhang, Hao</i>	
GPR-Based Model Reconstruction System for Underground Utilities Using GPRNet	845
<i>Feng, Jinglun; Liang, Yang; Hoxha, Ejup; Sanakov, Diar; Sotnikov, Stanislav; Xiao, Jizhong</i>	
Replay Overshooting: Learning Stochastic Latent Dynamics with the Extended Kalman Filter	852
<i>Li, Albert H.; Wu, Shiyao; Kennedy, Monroe</i>	
Session TuKT24 : Automation: Manufacturing	
Optimizing Part Placement for Improving Accuracy of Robot-Based Additive Manufacturing	859
<i>Bhatt, Prahar; Kulkarni, Ashish; Malhan, Rishi; Gupta, Satyandra K.</i>	
Automated Mosquito Salivary Gland Extractor for PfSPZ-Based Malaria Vaccine Production	866
<i>Li, Wanze; He, Zhuohong; Vora, Parth; Wang, Yanzhou; Vagvolgyi, Balazs; Leonard, Simon; Goodridge, Anna; Iordachita, Ioan Iulian; Hoffman, Stephen L.; Chakravarty, Sumana; Taylor, Russell H.</i>	
Safe Tumbling of Heavy Objects Using a Two-Cable Crane	873
<i>O'Neill, Cormac; Asada, Harry</i>	
Session TuJT24 : Automation: Performance Metrics	
Beelines: Motion Prediction Metrics for Self-Driving Safety and Comfort	881
<i>Shridhar, Skanda; Ma, Yuhang; Stentz, Tara; Shen, Zhengdi; Haynes, Galen Clark; Traft, Neil</i>	

From Manual Operation to Collaborative Robot Assembly: An Integrated Model of Productivity and Ergonomic Performance 888
Zhang, Yajun; Liu, Li; Huang, Ninja; Radwin, Robert; Li, Jingshan

Performance Metrics Calculation for Assembly Systems with Exponential Reliability Machines 896
Bai, Yishu; Zhang, Liang

Learning Seed Placements and Automation Policies for Polyculture Farming with Companion Plants 902
Avigal, Yahav; Deza, Anna; Wong, William; Oehme, Sebastian; Presten, Mark; Theis, Mark; Chui, Jackson; Shao, Yuqiao; Huang, Huang; Kotani, Atsunobu; Sharma, Satvik; Parikh, Rishi; Luo, Michael; Mukherjee, Sandeep; Carpin, Stefano; Viers, Joshua; Vougioukas, Stavros; Goldberg, Ken

Session TuT22 : Automation: Sensors and Grasping

Detect, Reject, Correct: Crossmodal Compensation of Corrupted Sensors 909
Lee, Michelle; Tan, Matthew; Zhu, Yuke; Bohg, Jeannette

Advanced Sensing Development to Support Robot Accuracy Assessment and Improvement 917
Qiao, Guixiu

Robotic Grasping of Fully-Occluded Objects Using RF Perception 923
Borouhaki, Tara; Leng, Junshan; Clester, Ian; Rodriguez, Alberto; Adib, Fadel

A Simulation-Based Grasp Planner for Enabling Robotic Grasping During Composite Sheet Layup 930
Manyar, Omey Mohan; Desai, Jaaneel Ashok; Deogaonkar, Nimish; Jomy Joseph, Rex; Malhan, Rishi; McNulty, Zachary; Wang, Bohan; Barbic, Jernej; Gupta, Satyandra K.

Session TuCT23 : Autonomous Driving

IDE-Net: Interactive Driving Event and Pattern Extraction from Human Data 938
Jia, Xiaosong; Sun, Liting; Tomizuka, Masayoshi; Zhan, Wei

HD Map Update for Autonomous Driving With Crowdsourced Data 946
Kim, Kitae; Cho, Soohyun; Chung, Woojin

Distributed Dynamic Map Fusion Via Federated Learning for Intelligent Networked Vehicles 953
Zhang, Zijian; Wang, Shuai; Hong, Yuncong; Zhou, Liangkai; Hao, Qi

Ground-Aware Monocular 3D Object Detection for Autonomous Driving 960
Liu, Yuxuan; Yuan, Yixuan; Wang, Lujia; Liu, Ming

Session TuCT22 : Autonomous Manipulation

Precise Multi-Modal In-Hand Pose Estimation Using Low-Precision Sensors for Robotic Assembly	968
<i>von Drigalski, Felix Wolf Hans Erich; Hayashi, Kennosuke; Huang, Yifei; Yonetani, Ryo; Hamaya, Masashi; Tanaka, Kazutoshi; Ijiri, Yoshihisa</i>	
Assembly Sequences Based on Multiple Criteria Against Products with Deformable Parts	975
<i>Kiyokawa, Takuya; Takamatsu, Jun; Ogasawara, Tsukasa</i>	
A Versatile End-Effector for Pick-And-Release of Fabric Parts	982
<i>Yamazaki, Kimitoshi; Abe, Taiki</i>	
A Soft Robotic Hand Based on Bellows Actuators for Dishwashing Automation	990
<i>Wang, Zhongkui; Hirata, Takao; Sato, Takanori; Mori, Tomoharu; Kawakami, Masaru; Furukawa, Hidemitsu; Kawamura, Sadao</i>	
Session TuDT21 : Autonomous Navigation I	
Shared Autonomy for Teleoperated Driving: A Real-Time Interactive Path Planning Approach	999
<i>Schitz, Dmitrij; Bao, Shuai; Rieth, Dominik; Aschemann, Harald</i>	
Comfortable and Safe Decelerations for a Self-Driving Transit Bus	1005
<i>Mifsud, Alexis; Ciocca, Matteo; Wieber, Pierre-Brice</i>	
A Unified Approach for Autonomous Volumetric Exploration of Large Scale Environments under Severe Odometry Drift	1012
<i>Schmid, Lukas Maximilian; Reijgwart, Victor; Ott, Lionel; Nieto, Juan; Siegwart, Roland; Cadena Lerma, Cesar</i>	
Urban Driving Games with Lexicographic Preferences and Socially Efficient Nash Equilibria	1020
<i>Zanardi, Alessandro; Mion, Enrico; Bruschetta, Mattia; Bolognani, Saverio; Censi, Andrea; Frazzoli, Emilio</i>	
Session TuGT22 : Autonomous Navigation II	
Amortized Q-Learning with Model-Based Action Proposals for Autonomous Driving on Highways	1028
<i>Mirchevska, Branka; Huegle, Maria; Kalweit, Gabriel; Werling, Moritz; Boedecker, Joschka</i>	
Decision Making for Autonomous Driving Via Augmented Adversarial Inverse Reinforcement Learning	1036
<i>Wang, Pin; Liu, Dapeng; Chen, Jiayu; Li, Hanhan; Chan, Ching-Yao</i>	
Interpretable Goal-based Prediction and Planning for Autonomous Driving	1043
<i>Albrecht, Stefano; Brewitt, Cillian; Wilhelm, John; Gyevnar, Balint; Eiras, Francisco; Dobre, Mihai; Ramamoorthy, Subramanian</i>	
Encoding Human Driving Styles in Motion Planning for Autonomous Vehicles	1050
<i>Karlsson, Jesper; van Waveren, Sanne; Pek, Christian; Torre, Ilaria; Leite, Iolanda; Tumova, Jana</i>	

Session TuFT22 : Autonomous Navigation III

- [Mesh Manifold Based Riemannian Motion Planning for Omnidirectional Micro Aerial Vehicles](#) 1057
Pantic, Michael; Ott, Lionel; Cadena Lerma, Cesar; Siegwart, Roland; Nieto, Juan
- [What Data Do We Need for Training an AV Motion Planner?](#) 1066
Chen, Long; Platinsky, Lukas; Speichert, Stefanie; Osiński, Błażej; Scheel, Oliver; Ye, Yawei; Grimmer, Hugo; Del Pero, Luca; Ondruska, Peter
- [Learn to Path: Using Neural Networks to Predict Dubins Path Characteristics for Aerial Vehicles in Wind](#) 1073
Phillips, Trevor; Stölzle, Maximilian; Turricelli, Erick; Achermann, Florian; Lawrance, Nicholas Robert Jonathon; Siegwart, Roland; Chung, Jen Jen
- [Where to Go Next: Learning a Subgoal Recommendation Policy for Navigation among Pedestrians](#) 1080
Brito, Bruno; Everett, Michael; How, Jonathan Patrick; Alonso-Mora, Javier

Session TuJT21 : Autonomous Vehicle Navigation I

- [Deep Reinforcement Learning for Mapless Navigation of a Hybrid Aerial Underwater Vehicle with Medium Transition](#) 1088
Grando, Ricardo; Costa de Jesus, Junior; Kich, Victor Augusto; Kolling, Alisson Henrique; Bortoluzzi, Nicolas; Miranda Pinheiro, Pedro; Alves Neto, Armando; Drews-Jr, Paulo
- [NF-iSAM: Incremental Smoothing and Mapping via Normalizing Flows](#) 1095
Huang, Qiangqiang; Pu, Can; Fourie, Dehann; Khosoussi, Kasra; How, Jonathan Patrick; Leonard, John
- [UPSLAM: Union of Panoramas SLAM](#) 1103
Cowley, Anthony; Miller, Ian; Taylor, Camillo Jose
- [RELLIS-3D Dataset: Data, Benchmarks and Analysis](#) 1110
Jiang, Peng; Osteen, Philip; Wigness, Maggie; Saripalli, Srikanth

Session TuKT21 : Autonomous Vehicle Navigation II

- [Fast Path Computation Using Lattices in the Sensor-Space for Forest Navigation](#) 1117
Martinez, Bernardo; Pereira, Guilherme
- [Learning Barrier Functions with Memory for Robust Safe Navigation](#) 1124
Long, Kehan; Qian, Cheng; Cortes, Jorge; Atanasov, Nikolay
- [Hierarchical Object Map Estimation for Efficient and Robust Navigation](#) 1132
Ok, Kyel; Liu, Katherine; Roy, Nicholas
- [Robot Navigation in Constrained Pedestrian Environments Using Reinforcement Learning](#) 1140

Pérez-D'Arpino, Claudia; Liu, Can; Goebel, Patrick; Martín-Martín, Roberto; Savarese, Silvio

Session TuAT4 : Best Paper Award Session

[An Artin Braid Group Representation of Knitting Machine State with Applications to Validation and Optimization of Fabrication Plans](#) 1147

Lin, Jenny; McCann, James

Session TuDT4 : Best Student Paper Award Session

[Unsupervised Learning of Lidar Features for Use in a Probabilistic Trajectory Estimator](#) 1154

Yoon, David Juny; Zhang, Haowei; Gridseth, Mona; Thomas, Hugues; Barfoot, Timothy

Session TuAT21 : Biologically-Inspired Robots

[Multiphysics Simulation of Magnetically Actuated Robotic Origami Worms](#) 1162

Swaminathan, Ruphan; Cai, Catherine; Yuan, Sishen; Ren, Hongliang

[Spherical Magnetic Joint for Inverted Locomotion of Multi-Legged Robot](#) 1170

Sison, Harn; Ratsamee, Photchara; Higashida, Manabu; Mashita, Tomohiro; Uranishi, Yuki; Takemura, Haruo

[An Open-Source Mechanical Design of ALARIS Hand: A 6-DOF Anthropomorphic Robotic Hand](#) 1177

Nurpeissova, Ayaulym; Tursynbekov, Talgat; Shintemirov, Almas

[Biomimetic Operational Space Control for Musculoskeletal Humanoid Optimizing across Muscle Activation and Joint Nullspace](#) 1184

Toshimitsu, Yasunori; Kawaharazuka, Kento; Nishiura, Manabu; Koga, Yuya; Omura, Yusuke; Asano, Yuki; Okada, Kei; Kawasaki, Koji; Inaba, Masayuki

Session TuBT21 : Biomedical Robotics I

[Orientation Control of an Electromagnetically Actuated Soft-Tethered Colonoscope Based on 2OR Pseudo-Rigid-Body Model](#) 1191

Li, Yehui; Li, Weibing; Xin, Wenci; Zhang, Xue; Xian, Yitian; Chiu, Philip, Wai-yan; Li, Zheng

[An Integrated High-Dexterity Cooperative Robotic Assistant for Intraocular Micromanipulation](#) 1198

Jinno, Makoto; Li, Gang; Patel, Niravkumar; Iordachita, Ioan Iulian

[A Sigmoid-Colon-Straightening Soft Actuator With Peristaltic Motion for Colonoscopy Insertion Assistance: Easycolon](#) 1205

Kim, Hansoul; Kim, Joonhwan; You, Jae Min; Lee, Seung Woo; Kyung, Ki-Uk; Kwon, Dong-Soo

[A Miniature Manipulator with Variable Stiffness towards Minimally Invasive Transluminal Endoscopic Surgery](#) 1213

*Li, Changsheng; Yan, Yusheng; Xiao, Xiao; Gu, Xiaoyi; Gao, Huxin; Duan, Xingguang;
Zuo, Xiuli; Li, Yanqing; Ren, Hongliang*

Session WeBT15 : Biomedical Robotics II

[A Magnetic Continuum Robot with Multi-Mode Control Using Opposite-Magnetized Magnets](#) 1221

Lin, Daojing; Jiao, Niandong; Wang, Zhidong; Liu, Lianqing

[Magnetically-Connected Modular Reconfigurable Mini-Robotic System with Bilateral Isokinematic Mapping and Fast On-Site Assembly towards Minimally Invasive Procedures](#) 1229

Xiao, Xiao; Xu, Shilei; Li, Changsheng; Gu, Xiaoyi; Gao, Huxin; Meng, Max Q.-H.; Ren, Hongliang

[Reinforcement Learning Control of a Novel Magnetic Actuated Flexible-Joint Robotic Camera System for Single Incision Laparoscopic Surgery](#) 1236

Xu, Dong; Zhang, Yuanlin; Tan, Wenshuai; Wei, Hongxing

[Muscular Stimulation Based Biological Actuator from Locust's Hindleg](#) 1242

Ma, Songsong; Liu, Peng; Liu, Shen; Li, Yao; Li, Bing

Session WeCT6 : Biomedical Robotics III

[Three-Dimensional Positioning of the Micropipette for Intracytoplasmic Sperm Injection](#) 1249

Hu, Weikang; Liang, Haoyue; Li, Jianjie; Zhan, Zhen; Zhang, Yi; Hu, Chengzhi

[Robotic Cardinal Vein Microinjection of Zebrafish Larvae Based on 3D Positioning](#) 1256

Sun, Mingzhu; Li, Lu; Yao, Yatang; Wang, YiWen; Gong, Huiying; Gao, Qian; Chen, DongYan; Zhao, Xin

[Modeling and Simulation of Running Expansion with Trunk and Pelvic Rotation Assist Suit](#) 1263

Ren, Hongyuan; Tanaka, Takayuki; Murai, Akihiko

[A Bipolar Myoelectric Sensor-Enabled Human-Machine Interface Based on Spinal Module Activations](#) 1269

Yi, Chunzhi; Jiang, Feng; Lu, Guangming; Yang, Chifu; Ding, Zhen; Zhu, Jianfei; Liu, Jie

Session TuHT0 : Cognitive Robotics Award Session

[Learning Task Space Actions for Bipedal Locomotion](#) 1276

Duan, Helei; Dao, Jeremy; Green, Kevin; Apgar, Taylor; Fern, Alan; Hurst, Jonathan

[Learning Sampling Distributions Using Local 3D Workspace Decompositions for Motion Planning in High Dimensions](#) 1283

Chamzas, Constantinos; Kingston, Zachary; Quintero-Peña, Carlos; Shrivastava, Anshumali; Kavraki, Lydia

[Auto-Tuned Sim-To-Real Transfer](#) 1290

Du, Yuqing; Watkins, Olivia; Pathak, Deepak; Abbeel, Pieter; Darrell, Trevor

Session TuET21 : Computer Vision for Automation

- [A Metric Space Perspective on Self-Supervised Policy Adaptation](#) 1297
Bodnar, Cristian; Hausman, Karol; Dulac-Arnold, Gabriel; Jonschkowski, Rico
- [Efficient Recovery of Multi-Camera Motion from Two Affine Correspondences](#) 1305
Guan, Banglei; Zhao, Ji; Barath, Daniel; Fraundorfer, Friedrich
- [Dynamic-Aware Autonomous Exploration in Populated Environments](#) 1312
Cavinato, Valentina; Eppenberger, Thomas; Youakim, Dina; Siegwart, Roland; Dubé, Renaud
- [Goal-Conditioned End-To-End Visuomotor Control for Versatile Skill Primitives](#) 1319
Groth, Oliver; Hung, Chia-Man; Vedaldi, Andrea; Posner, Ingmar

Session TuFT21 : Computer Vision in Medical Robotics

- [Towards Standardized Acquisition with a Dual-Probe Ultrasound Robot for Fetal Imaging](#) 1326
Housden, Richard James; Wang, Shuangyi; Bao, Xianqiang; Zheng, Jia; Skelton, Emily; Matthew, Jackeline; Noh, Yohan; Eltiraifi, Olla; Singh, Anisha; Singh, Davinder; Rhode, Kawal
- [A Kinematic Bottleneck Approach for Pose Regression of Flexible Surgical Instruments Directly from Images](#) 1333
Sestini, Luca; Rosa, Benoît; De Momi, Elena; Ferrigno, Giancarlo; Padoy, Nicolas
- [Robotic instrument segmentation with image-to-image translation](#) 1341
Colleoni, Emanuele; Stoyanov, Danail
- [Surgical Gesture Recognition Based on Bidirectional Multi-Layer Independently RNN with Explainable Spatial Feature Extraction](#) 1350
Zhang, Dandan; Wang, Ruoxi; Lo, Benny Ping Lai

Session TuGT21 : Contact and Collision Control

- [Safe Impacts with Soft Contacts Based on Learned Deformations](#) 1357
Dehio, Niels; Kheddar, Abderrahmane
- [A State-Dependent Damping Method to Reduce Collision Force and Its Variability](#) 1364
Hamid, Elham; Herzig, Nicolas; Abad Guaman, Sara Adela; Nanayakkara, Thrishantha
- [Contact Forces Preintegration for Estimation in Legged Robotics Using Factor Graphs](#) 1372
Fourmy, Mederic; Flayols, Thomas; Léziart, Pierre-Alexandre; Mansard, Nicolas; Solà, Joan
- [Overload Clutch Design for Collision Tolerant High-Speed Industrial Robots](#) 1379

Ostyn, Frederik; Lefebvre, Tom; Vanderborght, Bram; Crevecoeur, Guillaume

Session TuHT19 : Continuum Robotics I

- [Learning-Based Inverse Kinematics from Shape As Input for Concentric Tube Continuum Robots](#) 1387
Liang, Nan; Grassmann, Reinhard M.; Lilge, Sven; Burgner-Kahrs, Jessica
- [Effect of External and Internal Loads on Tension Loss of Tendon-Driven Continuum Manipulators](#) 1394
Liu, Yang; Alambeigi, Farshid
- [Using Euler Curves to Model Continuum Robots](#) 1402
Rao, Priyanka; Peyron, Quentin; Burgner-Kahrs, Jessica
- [Optimal Design of Continuum Robots with Reachability Constraints](#) 1409
Cheong, Hyunmin; Ebrahimi, Mehran; Duggan, Timothy R.

Session TuIT19 : Continuum Robotics II

- [Design Considerations for a Steerable Needle Robot to Maximize Reachable Lung Volume](#) 1418
Fried, Inbar; Hoelscher, Janine; Fu, Mengyu; Emerson, Maxwell; Ertop, Tayfun Efe; Rox, Margaret; Granna, Josephine; Kuntz, Alan; Akulian, Jason; Webster III, Robert James; Alterovitz, Ron
- [An Active Steering Hand-Held Robotic System for Minimally Invasive Orthopaedic Surgery Using a Continuum Manipulator](#) 1426
Ma, Justin; Sefati, Shahriar; Taylor, Russell H.; Armand, Mehran
- [Design of a Reconfigurable Parallel Continuum Robot with Tendon-Actuated Kinematic Chains](#) 1434
Böttcher, Georg; Lilge, Sven; Burgner-Kahrs, Jessica
- [Design and Control of a Hand-Held Concentric Tube Robot for Minimally Invasive Surgery](#) 1442
Girerd, Cedric; Morimoto, Tania

Session TuGT19 : Continuum Robotics III

- [Deep Reinforcement Learning for Concentric Tube Robot Control with a Goal-Based Curriculum](#) 1459
Iyengar, Keshav Kannan; Stoyanov, Danail
- [Optimized 3D Path Planner for Steerable Catheters with Deductive Reasoning](#) 1466
Segato, Alice; Corbetta, Valentina; Zangari, Jessica; Perri, Simona; Calimeri, Francesco; De Momi, Elena
- [Robotic Electrospinning Actuated by Non-Circular Joint Continuum Manipulator for Endoluminal Therapy](#) 1473
Wu, Zicong; Lou, Chuqian; Jin, Zhu; Huang, Shaoping; Liu, Ning; Zou, Yun; Kovac, Mirko; Gao, Anzhu; Yang, Guang-Zhong
- [Autonomous Steering of Concentric Tube Robots Via Nonlinear Model Predictive Control](#) 1480

Khadem, Mohsen; O'Neill, John; Mitros, Zisos; Da Cruz, Lyndon; Bergeles, Christos

Session TuDT19 : Control and Optimization I

[Online Informative Path Planning for Active Information Gathering of a 3D Surface](#) 1488

Zhu, Hai; Chung, Jen Jen; Lawrance, Nicholas Robert Jonathon; Siegwart, Roland; Alonso-Mora, Javier

[EKF-based real-time self-attitude estimation with camera DNN learning landscape regularities](#) 1495

Ozaki, Ryota; Kuroda, Yoji

[Advancing Mixture Models for Least Squares Optimization](#) 1503

Pfeifer, Tim; Lange, Sven; Protzel, Peter

[Online Extrinsic Calibration Based on Per-Sensor Ego-Motion Using Dual Quaternions](#) 1512

Horn, Markus; Wodtke, Thomas; Buchholz, Michael; Dietmayer, Klaus

Session TuAT23 : Control and Optimization II

[A Class of Optimal Switching Mixed Data Injection Attack in Cyber-Physical Systems](#) 1520

Gao, Sheng; Zhang, Hao; Wang, Zhuping; Huang, Chao

[Observation Space Matters: Benchmark and Optimization Algorithm](#) 1527

Kim, Joanne Taery; Ha, Sehoon

[Interleaving Fast and Slow Decision Making](#) 1535

Gulati, Aditya; Soni, Sarthak; Rao, Shrisha

[Multi-output Infinite Horizon Gaussian Processes](#) 1542

Lim, Jaehyun; Park, Jehyun; Nah, Sungjae; Choi, Jongeun

Session TuCT21 : Control Applications

[Faithful Euclidean Distance Field from Log-Gaussian Process Implicit Surfaces](#) 1550

Wu, Lan; Lee, Ki Myung Brian; Liu, Liyang; Vidal-Calleja, Teresa A.

[Force Control of a Hydraulic Actuator with a Neural Network Inverse Model](#) 1558

Kim, Sung-Woo; Cho, Buyoun; Shin, Seunghoon; Oh, Jun Ho; Hwangbo, Jemin; Park, Hae-Won

[An Encoder-Free Joint Velocity Estimation Method for Serial Manipulators Using Inertial Sensors](#) 1566

Xu, Xiaolong; Sun, Yujie; Tian, Xincheng; Zhou, Lelai; Li, Yibin

[D-ACC: Dynamic Adaptive Cruise Control for Highways with Ramps Based on Deep Q-Learning](#) 1572

Das, Lokesh Chandra; Won, Myounggyu

Session TuET19 : Control for Multi-Robot Systems

A Finite-Gain Stable Multi-Agent Robot Control Framework with Adaptive Authority Allocation <i>Balachandran, Ribin; Mishra, Hrishik; Panzirsch, Michael; Ott, Christian</i>	1579
Decentralized Connectivity Maintenance with Time Delays Using Control Barrier Functions <i>Capelli, Beatrice; Fouad, Hassan; Beltrame, Giovanni; Sabattini, Lorenzo</i>	1586
Haptic-Enabled Decentralized Control of a Heterogeneous Human-Robot Team for Search and Rescue in Partially-Known Environments <i>Aggravi, Marco; Elsherif, A. Alaaeldin Said; Robuffo Giordano, Paolo; Pacchierotti, Claudio</i>	1593
Multi-Robot Implicit Control of Herds <i>Sebastián, Eduardo; Montijano, Eduardo</i>	1601
Session TuFT19 : Control of Manipulation I	
Real-Time Friction Estimation for Grip Force Control <i>Khamis, Heba; Redmond, Stephen; Xia, Benjamin</i>	1608
Uncertainty-Aware Deep Learning for Robot Touch: Application to Bayesian Tactile Servo Control <i>Florian Vazquez, Manuel; Lepora, Nathan</i>	1615
Towards Integrated Tactile Sensorimotor Control in Anthropomorphic Soft Robotic Hands <i>Lepora, Nathan; Ford, Christopher; Stinchcombe, Andrew John; Brown, Alfred; Lloyd, John; Catalano, Manuel Giuseppe; Bianchi, Matteo; Ward-Cherrier, Benjamin</i>	1622
Simultaneous Tactile Exploration and Grasp Refinement for Unknown Objects <i>de Farias, Cristiana; Marturi, Naresh; Stolkin, Rustam; Bekiroglu, Yasemin</i>	1629
Session TuFT20 : Control of Manipulation II	
An Efficient Approach to Closed-Loop Shape Control of Deformable Objects Using Finite Element Models <i>Koessler, Adrien; Roca Filella, Nicolas; Bouzgarrou, Chedli; Lequievre, Laurent; Corrales Ramon, Juan Antonio</i>	1637
Learning Stable Normalizing-Flow Control for Robotic Manipulation <i>Abdul Khader, Shahbaz; Yin, Hang; Falco, Pietro; Kragic, Danica</i>	1644
Model Predictive Robot-Environment Interaction Control for Mobile Manipulation Tasks <i>Minniti, Maria Vittoria; Grandia, Ruben; Fäh, Kevin; Farshidian, Farbod; Hutter, Marco</i>	1651
Bilateral Teleoperation with Adaptive Impedance Control for Contact Tasks <i>Michel, Youssef; Rahal, Rahaf; Pacchierotti, Claudio; Robuffo Giordano, Paolo; Lee, Dongheui</i>	1658

Session TuDT20 : Control Theory I

Mathematical Modeling of a Highly Underactuated Tool for Draping Fiber Plies on Double Curved Molds 1666

Gunnarsson, Guðmundur Geir; Petersen, Henrik Gordon

A General Framework to Increase Safety of Learning Algorithms for Dynamical Systems Based on Region of Attraction Estimation 1673

Zhou, Zhehua; Oguz, Ozgur S.; Leibold, Marion; Buss, Martin

A Weighted Method for Fast Resolution of Strictly Hierarchical Robot Task Specifications Using Exact Penalty Functions 1692

Sathya, Ajay Suresha; Pipeleers, Goele; Decré, Wilm; Swevers, Jan

On-Line Force Capability Evaluation Based on Efficient Polytope Vertex Search 1700

Skuric, Antun; Padois, Vincent; Daney, David

Session TuET20 : Control Theory II

Actuating Eigenmanifolds of Conservative Mechanical Systems Via Bounded or Impulsive Control Actions 1707

Della Santina, Cosimo; Calzolari, Davide; Giordano, Alessandro Massimo; Albu-Schäffer, Alin

Robust Frequency-Based Structure Extraction 1715

Kucner, Tomasz Piotr; Luperto, Matteo; Lowry, Stephanie; Magnusson, Martin; Lilienthal, Achim J.

A Hybrid Collision Model for Safety Collision Control 1722

Noël, Thibault; Flayols, Thomas; Mirabel, Joseph; Mansard, Nicolas; Carpentier, Justin

Jerk Control of Floating Base Systems with Contact-Stable Parametrised Force Feedback 1729

Gazar, Ahmad; Nava, Gabriele; Andrade Chavez, Francisco Javier; Pucci, Daniele

Session TuGT23 : Control Theory III

Spherical Multi-Modal Place Recognition for Heterogeneous Sensor Systems 1743

Bernreiter, Lukas; Ott, Lionel; Nieto, Juan; Siegwart, Roland; Cadena Lerma, Cesar

A Multi-Resolution Frontier-Based Planner for Autonomous 3D Exploration 1751

Batinovic, Ana; Petrovic, Tamara; Ivanovic, Antun; Petric, Frano; Bogdan, Stjepan

A Direct Collocation Method for Optimization of EMG-Driven Wrist Muscle Musculoskeletal Model 1759

Zhao, Yihui; Li, Zhenhong; Zhang, Zhiqiang; Asker, Ahmed; Xie, Sheng Quan

A Simple Visual-Servoing Task on a Low-Accuracy, Low-Cost Arm 1766

Bonsignorio, Fabio; Zereik, Enrica

Session TuHT20 : Data-Driven Model Estimation

Efficient Dynamics Estimation with Adaptive Model Sets	1775
<i>Ratner, Ellis; Bajcsy, Andrea; Fong, Terrence; Tomlin, Claire; Dragan, Anca</i>	
Data-Driven Actuator Selection for Artificial Muscle-Powered Robots	1783
<i>Henderson, Taylor; Zhi, Yuheng; Liu, Angela; Yip, Michael C.</i>	
EMG-Based Neural Network Model of Human Arm Dynamics in a Haptic Training Simulator of Sinus Endoscopy	1790
<i>Esfandiari, Mojtaba; Farahmand, Farzam</i>	
Multimodal Dynamics Modeling for Off-Road Autonomous Vehicles	1796
<i>Tremblay, Jean-François; Manderson, Travis; Noca, Aurélio; Dudek, Gregory; Meger, David Paul</i>	

Session TuJT20 : Deep Learning in Robotics and Automation

Stabilizing Neural Control Using Self-Learned Almost Lyapunov Critics	1803
<i>Chang, Ya-Chien; Gao, Sicun</i>	
Regularizing Action Policies for Smooth Control with Reinforcement Learning	1810
<i>Mysore, Siddharth; El Mabsout, Bassel; Mancuso, Renato; Saenko, Kate</i>	
DeepReach: A Deep Learning Approach to High-Dimensional Reachability	1817
<i>Bansal, Somil; Tomlin, Claire</i>	
Deep Reinforcement Learning for Active Target Tracking	1825
<i>Jeong, Heejin; Hassani, Hamed; Morari, Manfred; Lee, Daniel; Pappas, George J.</i>	

Session TuBT20 : Deep Learning in Robotics I

Long-Range Hand Gesture Recognition Via Attention-Based SSD Network	1832
<i>Zhou, Liguang; Du, Chenping; Sun, Zhenglong; Lam, Tin Lun; Xu, Yangsheng</i>	
Spectral Temporal Graph Neural Network for Trajectory Prediction	1839
<i>Cao, Defu; Li, Jiachen; Ma, Hengbo; Tomizuka, Masayoshi</i>	
Dark Reciprocal-Rank: Teacher-To-Student Knowledge Transfer from Self-Localization Model to Graph-Convolutional Neural Network	1846
<i>Takeda, Koji; Tanaka, Kanji</i>	
Efficient SE(3) Reachability Map Generation Via Interplanar Integration of Intra-Planar Convolutions	1854
<i>Han, Yiheng; Pan, Jia; Xia, Mengfei; Zeng, Long; Liu, Yong-Jin</i>	

Session TuCT20 : Deep Learning in Robotics II

FlowDriveNet: An End-To-End Network for Learning Driving Policies from Image Optical Flow and LiDAR Point Flow	1861
<i>Wang, Shuai; Qin, Jiahui; Li, Menglin; Wang, Yaonan</i>	
PocoNet: SLAM-Oriented 3D LiDAR Point Cloud Online Compression Network	1868
<i>Cui, Jinhao; Zou, Hao; Kong, Xin; Yang, Xueming; Zhao, Xiangrui; Liu, Yong; Li, Wanlong; Wen, Feng; Zhang, Hongbo</i>	
3D Reconstruction of Deformable Colon Structures Based on Preoperative Model and Deep Neural Network	1875
<i>Zhang, Shuai; Zhao, Liang; Huang, Shoudong; Ma, Ruibin; Hu, Boni; Hao, Qi</i>	
DenseLiDAR: A Real-Time Pseudo Dense Depth Guided Depth Completion Network	1882
<i>Gu, Jiaqi; Xiang, Zhiyu; Ye, Yuwen; Wang, Lingxuan</i>	
Session TuGT20 : Distributed Robotic Systems	
Distributed Full-Consensus Control of Multi-Robot Systems with Range and Field-Of-View Constraints	1890
<i>Restrepo, Esteban; Loria, Antonio; Sarras, Ioannis; Marzat, Julien</i>	
Scalable Recursive Distributed Collaborative State Estimation for Aided Inertial Navigation	1896
<i>Jung, Roland; Weiss, Stephan</i>	
Distributed Multi-Target Tracking in Camera Networks	1903
<i>Casao, Sara; Naya, Abel; Murillo, Ana Cristina; Montijano, Eduardo</i>	
GenGrid: A Generalised Distributed Experimental Environmental Grid for Swarm Robotics	1910
<i>Kedia, Pranav; Rao, Madhav</i>	
Session TuIT20 : Dynamic Manipulation	
Nth Order Analytical Time Derivatives of Inverse Dynamics in Recursive and Closed Forms	1918
<i>Kumar, Shivesh; Mueller, Andreas</i>	
Robot Dynamics Identification: A Reproducible Comparison with Experiments on the KINOVA Jaco2	1925
<i>Golluccio, Giacomo; Gillini, Giuseppe; Marino, Alessandro; Antonelli, Gianluca</i>	
Efficient Configuration Exploration in Inverse Dynamics Acquisition of Robotic Manipulators	1934
<i>Khadivar, Farshad; Gupta, Sthithpragya; Amanhoud, Walid; Billard, Aude</i>	
Dynamic Manipulation of Deformable Objects with Implicit Integration	1942
<i>Poranne, Roi; Zimmermann, Simon; Coros, Stelian</i>	
Session TuDT18 : Dynamic Modeling	
Learning to Propagate Interaction Effects for Modeling Deformable Linear Objects Dynamics	1950
<i>Yang, Yuxuan; Stork, Johannes A.; Stoyanov, Todor</i>	

Modal Dynamic Modelling and Experimental Validation of a Curved Extensible Continuum Manipulator 1958
Wang, Hao; Zhang, Xuping

A Hybrid Dynamical Modeling Framework for Shape Memory Alloy Wire Actuated Structures 1966
Mandolino, Michele Arcangelo; Ferrante, Francesco; Rizzello, Gianluca

Session TuET18 : Dynamics and Control I

Switching Control in Two-Wheeled Self-Balancing Robots 1974
Murasovs, Nikita; Giannaccini, Maria Elena; Aphale, Sumeet S.

Smith-Predictor-Based Torque Control of a Rolling Diaphragm Hydrostatic Transmission 1981
Bolignari, Marco; Rizzello, Gianluca; Zaccarian, Luca; Fontana, Marco

A Unified MPC Framework for Whole-Body Dynamic Locomotion and Manipulation 1989
Sleiman, Jean-Pierre; Farshidian, Farbod; Minniti, Maria Vittoria; Hutter, Marco

Speed Gain in Elastic Joint Robots: An Energy Conversion-Based Approach 1997
Mansfeld, Nico; Keppler, Manuel; Haddadin, Sami

Session TuKT20 : Dynamics and Control II

No-Frills Dynamic Planning Using Static Planners 2005
Levy, Mara; Ayyagari, Vasista; Shrivastava, Abhinav

PCMPC: Perception-Constrained Model Predictive Control for Quadrotors with Suspended Loads Using a Single Camera and IMU 2012
Li, Guanrui; Tunches, Alex; Loianno, Giuseppe

Learning Agile Locomotion Skills with a Mentor 2019
Isken, Atil; Yu, George; Escontrela, Alejandro; Jain, Deepali; Tan, Jie; Caluwaerts, Ken

Automating Behavior Selection for Affective Telepresence Robot 2026
Vasyilkiv, Yuri; Zhen, Ma; Li, Guangliang; Sandry, Eleanor; Brock, Heike; Nakamura, Keisuke; Irani, Pourang; Gomez, Randy

Session TuJT19 : Dynamics and Control III

Transition Motion Planning for Multi-Limbed Vertical Climbing Robots Using Complementarity Constraints 2033
Zhang, Jingwen; Lin, Xuan; Hong, Dennis

Inverse Dynamics Control of Compliant Hybrid Zero Dynamic Walking 2040
Reher, Jenna; Ames, Aaron

Advantages of Bilinear Koopman Realizations for the Modeling and Control of Systems with Unknown Dynamics	2048
<i>Bruder, Daniel; Fu, Xun; Vasudevan, Ram</i>	
The Dynamic Effect of Mechanical Losses of Transmissions on the Equations of Motion of Legged Robots	2056
<i>Sim, Youngwoo; Ramos, Joao</i>	
Session TuCT19 : Dynamics and Control IV	
Model Based Evaluation of Human and Lower-Limb Exoskeleton Interaction During Sit to Stand Motion	2063
<i>Bottin-Noonan, Joel; Sreenivasa, Manish</i>	
Efficient Solution Method Based on Inverse Dynamics for Optimal Control Problems of Rigid Body Systems	2070
<i>Katayama, Sotaro; Ohtsuka, Toshiyuki</i>	
Compensation for Undefined Behaviors During Robot Task Execution by Switching Controllers Depending on Embedded Dynamics in RNN	2077
<i>Suzuki, Kanata; Mori, Hiroki; Ogata, Tetsuya</i>	
Reduction of Ground Impact of a Powered Exoskeleton by Shock Absorption Mechanism on the Shank	2085
<i>Park, Jeongsu; Lee, Dae-Ho; Park, Kyeong-Won; Kong, Kyoungchul</i>	
Session TuHT18 : Field Robotics I	
SLIP Walking over Rough Terrain via H-LIP Stepping and Backstepping-Barrier Function Inspired Quadratic Program	2091
<i>Xiong, Xiaobin; Ames, Aaron</i>	
DeepQ Stepper: A Framework for Reactive Dynamic Walking on Uneven Terrain	2099
<i>Meduri, Avadesh; Khadiv, Majid; Righetti, Ludovic</i>	
Wetland Soil Strength Tester and Core Sampler Using a Drone	2106
<i>Montano, Victor; Poyrekar, Shreyas; Ibarra, Marcos; Haikal, Yusef; Jafari, Navid; Becker, Aaron</i>	
Backstepping and Sliding Mode Control for AUVs Aided with Bioinspired Neurodynamics	2113
<i>Xu, Zhe; Yang, Simon X.; Gadsden, Stephen Andrew; Li, Junfei; Zhu, University</i>	
Session TuFT18 : Field Robotics II	
Data-Driven Sea State Estimation for Vessels Using Multi-Domain Features from Motion Responses	2120
<i>Han, Peihua; Li, Guoyuan; Skjong, Stian; Wu, Baiheng; Zhang, Houxiang</i>	
A Fault Tolerant Control Architecture Based on Fault Trees for an Underwater Robot Executing Transect Missions	2127
<i>Hereau, Adrien; Godary-Dejean, Karen; Guiochet, Jeremie; Crestani, Didier</i>	

How to Train Your Heron	2134
<i>Richard, Antoine; Aravecchia, Stephanie; Schillaci, Thomas; Geist, Matthieu; Pradalier, Cedric</i>	
Robust Underwater Visual SLAM Fusing Acoustic Sensing	2140
<i>Vargas, Elizabeth; Scona, Raluca; Scharff Willners, Jonatan; Łuczyński, Tomasz; Cao, Yu; Wang, Sen; Petillot, Yvan R.</i>	
Session TuT18 : Field Robotics III	
Place Recognition in Forests with Urquhart Tessellations	2147
<i>Vicentim Nardari, Guilherme; Cohen, Avraham; Chen, Steven W; Liu, Xu; Arcot, Vaibhav; Romero, Roseli Ap. Francelin; Kumar, Vijay</i>	
Detecting and Counting Oysters	2156
<i>Sadrfaridpour, Behzad; Aloimonos, Yiannis; Yu, Miao; Tao, Yang; Webster, Donald</i>	
Autonomous Distributed 3D Radiation Field Estimation for Nuclear Environment Characterization	2163
<i>Mascarich, Frank; De Petris, Paolo; Nguyen, Huan; Khedekar, Nikhil Vijay; Alexis, Kostas</i>	
Locomotion and Control of a Friction-Driven Tripedal Robot	2170
<i>Hermes, Mark; McLaughlin, Taylor; Luhar, Mitul; Nguyen, Quan</i>	
Session TuGT18 : Field Robotics IV	
Predicting the Time Until a Vehicle Changes the Lane Using LSTM-Based Recurrent Neural Networks	2177
<i>Wirthmueller, Florian; Klimke, Marvin; Schlechtriemen, Julian; Hipp, Jochen; Reichert, Manfred</i>	
Robot-Supervised Learning of Crop Row Segmentation	2185
<i>Bakken, Marianne; Ponnambalam, Vignesh Raja; Moore, Richard James Donald; Gjevestad, Jon Glenn; From, Pål Johan</i>	
Deep Regression versus Detection for Counting in Robotic Phenotyping	2192
<i>Salazar-Gomez, Adrian; Parsons, Simon; Aptoula, Erchan; Bosilj, Petra</i>	
Neural Network Controller for Autonomous Pile Loading Revised	2198
<i>Yang, Wenyan; Strokina, Nataliya; Serbenyuk, Nikolay; Pajarinen, Joni; Ghabcheloo, Reza; M. Aref, Mohammad; Vihonen, Juho; Kamarainen, Joni-Kristian</i>	
Session TuAT19 : Field Robotics V	
A Peg-In-Hole Task Strategy for Holes in Concrete	2205
<i>Yasutomi, André Yuji; Mori, Hiroki; Ogata, Tetsuya</i>	

Semantic Mapping of Construction Site from Multiple Daily Airborne LiDAR Data	2212
<i>Westfechtel, Thomas; Ohno, Kazunori; Akegawa, Tetsu; Yamada, Kento; Bezerra, Ranulfo; Kojima, Shotaro; Suzuki, Taro; Komatsu, Tomohiro; Shibata Yukinori, Shibata; Asano, Kimitaka; Nagatani, Keiji; Miyamoto, Naoto; Suzuki, Takahiro; Harada, Tatsuya; Tadokoro, Satoshi</i>	
TaskNet: A Neural Task Planner for Autonomous Excavator	2220
<i>Zhao, Jinxin; Zhang, Liangjun</i>	
Steering Induced Roll Quantification During Ship Turning Circle Manoeuvre	2227
<i>Esnault, Nathanael; Patel, Nitish; Tunncliffe, Jon</i>	
Session TuDT17 : Field Robotics VI	
Mobile Manipulator for Autonomous Localization, Grasping and Precise Placement of Construction Material in a Semi-Structured Environment	2233
<i>Stibinger, Petr; Broughton, George; Majer, Filip; Rozsypálek, Zdeněk; Wang, Anthony; Jindal, Kshitij; Zhou, Alex; Thakur, Dinesh; Loianno, Giuseppe; Krajník, Tomáš; Saska, Martin</i>	
Experimental Validation of Unsteady Wave Induced Loads on a Stationary Remotely Operated Vehicle	2242
<i>Walker, Kyle Liam; Gabl, Roman; Aracri, Simona; Cao, Yu; Stokes, Adam Andrew; Kiprakis, Aristides; Giorgio-Serchi, Francesco</i>	
ASV Lite: A High-Performance Simulator for Autonomous Surface Vehicles	2249
<i>Thomas, Toby; Bossens, David Mark; Tarapore, Danesh</i>	
Continuous Shortest Path Vector Field Navigation on 3D Triangular Meshes for Mobile Robots	2256
<i>Pütz, Sebastian; Wiemann, Thomas; Kleine Piening, Malte; Hertzberg, Joachim</i>	
Session TuDT16 : Field Robotics VII	
Predicting the Post-Impact Velocity of a Robotic Arm Via Rigid Multibody Models: An Experimental Study	2264
<i>Aouaj, Ilias; Padois, Vincent; Saccon, Alessandro</i>	
Compliant plant exploration for agricultural procedures with a collaborative robot	2272
<i>Polic, Marsela; Car, Marko; Petric, Frano; Orsag, Matko</i>	
Conv1D Energy-Aware Path Planner for Mobile Robots in Unstructured Environments	2279
<i>Visca, Marco; Bouton, Arthur; Powell, Roger; Gao, Yang; Fallah, Saber</i>	
Resilient Collision-Tolerant Navigation in Confined Environments	2286
<i>De Petris, Paolo; Nguyen, Huan; Kulkarni, Mihir; Mascari, Frank; Alexis, Kostas</i>	
Session TuBT19 : Field Robotics VIII	
A Coach-Based Bayesian Reinforcement Learning Method for Snake Robot Control	2293

Jia, Yuanyuan; Ma, Shugen

Estimation of Spatially-Correlated Ocean Currents from Ensemble Forecasts and Online Measurements 2301

To, Kwun Yiu Cadmus; Kong, Felix Honglim; Lee, Ki Myung Brian; Yoo, Chanyeol; Anstee, Stuart David; Fitch, Robert

Semi-Supervised Gated Recurrent Neural Networks for Robotic Terrain Classification 2308

Ahmadi, Ahmadreza; Nygaard, Tønnes F.; Kottege, Navinda; Howard, David; Hudson, Nicolas

Circus ANYmal: A Quadruped Learning Dexterous Manipulation with Its Limbs 2316

Shi, Fan; Homberger, Timon; Lee, Joonho; Miki, Takahiro; Zhao, Moju; Farshidian, Farbod; Okada, Kei; Inaba, Masayuki; Hutter, Marco

Session TuET16 : Field Robotics: Agricultural Applications

PATHoBot: A Robot for Glasshouse Crop Phenotyping and Intervention 2324

Smitt, Claus; Halstead, Michael Allan; Zaenker, Tobias; Bennewitz, Maren; McCool, Christopher Steven

Using depth information and colour space variations for improving outdoor robustness for instance segmentation of cabbage 2331

Lüling, Nils; Reiser, David; Stana, Alexander; Griepentrog, Hans

Joint Plant Instance Detection and Leaf Count Estimation for In-Field Plant Phenotyping 2337

Weyler, Jan; Milioto, Andres; Falck, Tillmann; Behley, Jens; Stachniss, Cyrill

MP-STSP: A Multi-Platform Steiner Traveling Salesman Problem Formulation for Precision Agriculture in Orchards 2345

Carpio, Renzo Fabrizio; Maiolini, Jacopo; Potena, Ciro; Garone, Emanuele; Ulivi, Giovanni; Gasparri, Andrea

Session TuHT16 : Field Robotics: Control

Environment Reconfiguration Planning for Autonomous Robotic Manipulation to Overcome Mobility Constraints 2352

Arora, Prateek; Papachristos, Christos

On Null Space-Based Inverse Kinematics Techniques for Fleet Management: Toward Time-Varying Task Activation 2359

Mannucci, Anna; Caporale, Danilo; Pallottino, Lucia

LaND: Learning to Navigate from Disengagements 2377

Kahn, Gregory; Abbeel, Pieter; Levine, Sergey

Adaptive Sampling Using POMDPs with Domain-Specific Considerations 2385

Salhotra, Gautam; Denniston, Christopher E.; Caron, David A.; Sukhatme, Gaurav

Session TuT16 : Field Robotics: Machine Learning

- [Meta Learning with Paired Forward and Inverse Models for Efficient Receding Horizon Control](#) 2392
McKinnon, Christopher; Schoellig, Angela P.
- [Reaching Pruning Locations in a Vine Using a Deep Reinforcement Learning Policy](#) 2400
Yandun, Francisco; Parhar, Tanvir; Silwal, Abhisesh; Clifford, David; Yuan, Zhiqiang; Levine, Gabriella; Yaroshenko, Sergey; Kantor, George
- [A Generative Model-Based Predictive Display for Robotic Teleoperation](#) 2407
Xie, Bowen; Han, Mingjie; Jin, Jun; Barczyk, Martin; Jagersand, Martin

Session TuET17 : Field Robotics: Mobile Robots

- [Behavior-Tree-Based Person Search for Symbiotic Autonomous Mobile Robot Tasks](#) 2414
Stuede, Marvin; Lerche, Timo; Petersen, Martin Alexander; Spindeldreier, Svenja
- [Online velocity fluctuation of off-road wheeled mobile robots: A reinforcement learning approach](#) 2421
Gauthier-Clerc, François; Hill, Ashley William David; Laneurit, Jean; Lenain, Roland; Lucet, Eric
- [Information-Driven Gas Source Localization Exploiting Gas and Wind Local Measurements for Autonomous Mobile Robots](#) 2428
Ojeda, Pepe; Monroy, Javier; Gonzalez-Jimenez, Javier
- [Integration of a Human-Aware Risk-Based Braking System into an Open-Field Mobile Robot](#) 2435
Mayoral Baños, José Carlos; Grimstad, Lars; From, Pål Johan; Cielniak, Grzegorz

Session TuJT18 : Field Robotics: Perception

- [Three-Dimensional Terrain Aware Autonomous Exploration for Subterranean and Confined Spaces](#) 2443
Azpúrua, Héctor Ignacio; Campos, Mario Montenegro; G. Macharet, Douglas
- [Semantically-Aware Strategies for Stereo-Visual Robotic Obstacle Avoidance](#) 2450
Hong, Jungseok; de Langis, Karin Johanna Denton; Wyeth, Cole; Walaszek, Chris; Sattar, Junaed
- [LiDARNet: A Boundary-Aware Domain Adaptation Model for Point Cloud Semantic Segmentation](#) 2457
Jiang, Peng; Saripalli, Srikanth
- [Real-Time Navigation Using Virtual Magnetic Fields](#) 2465
Moussa, Majda; Beltrame, Giovanni

Session WeBT7 : Field Robots I

- [Design and Experimental Validation of a Robotic System for Reactor Core Detector Removal](#) 2473

Han, Zhe; Tian, Huanyu; Fansheng, Meng; Hao, Wen; Rui, Ma; Duan, Xingguang; Yilin, Zhang; Chenghua, Liu

[Accurate and Robust Stereo Direct Visual Odometry for Agricultural Environment](#) 2480
Yu, Tao; Zhou, Junwei; Wang, Liangliang; Xiong, Shengwu

[A General Approach for the Automation of Hydraulic Excavator Arms Using Reinforcement Learning](#) 2487
Egli, Pascal Arturo; Hutter, Marco

[Parameter Estimation of an Industrial Car-Like Tractor](#) 2495
Zhao, Hongchao; Chen, Wen; Zhou, Shunbo; Liu, Yunhui

Session WeCT7 : Field Robots II

[Enhancement for Robustness of Koopman Operator-Based Data-Driven Mobile Robotic Systems](#) 2503
Shi, Lu; Karydis, Konstantinos

[Collision Risk Assessment and Obstacle Avoidance Control for Autonomous Sailing Robots](#) 2511
Qi, Weimin; Sun, Qinbo; Liu, Chongfeng; Ji, Xiaoqiang; Cao, Zhongzhong; Liang, Yiwen; Qian, Huihuan (Alex)

[MSTC*: Multi-Robot Coverage Path Planning under Physical Constraints](#) 2518
Tang, Jingtao; Chun, Sun; Zhang, Xinyu

[Impact Mitigation for Dynamic Legged Robots with Steel Wire Transmission Using Nonlinear Active Compliance Control](#) 2525
Yang, Junjie; Sun, Hao; An, Hao; Wang, Changhong

Session TuKT19 : Force Control

[Admittance Control with Unknown Location of Interaction](#) 2532
Yamane, Katsu

[Low-Level Force-Control of MR-Hydrostatic Actuators](#) 2540
Denis, Jeff; Plante, Jean-Sebastien; Girard, Alexandre

[Zero-Potential-Energy Motions Due to Stiffness in Impedance Control of Robotic Tasks: An Innovative Theory and Experimental Study](#) 2548
Saldarriaga, Carlos; Kao, Imin

Session TuCT18 : Grasping and Manipulation

[Adversarial Skill Learning for Robust Manipulation](#) 2555
Jian, Pingcheng; Yang, Chao; Guo, Di; Liu, Huaping; Sun, Fuchun

[Learning Visual Affordances with Target-Orientated Deep Q-Network to Grasp Objects by Harnessing Environmental Fixtures](#) 2562
Liang, Hengyue; Lou, Xibai; Yang, Yang; Choi, Changhyun

Enhancing Robot Perception in Grasping and Dexterous Manipulation through Crowdsourcing and Gamification 2569
Gorjup, Gal; Gerez, Lucas; Liarokapis, Minas

Teaching Robotic and Biomechatronic Concepts with a Gripper Design Project and a Grasping and Manipulation Competition 2576
Liarokapis, Minas; Kontoudis, George

Session TuFT17 : Grasping I

Contact Space Computation of Two-Finger Gravity Based Caging Grasps Security Measure 2583
Shirizly, Alon; Rimon, Elon; Wan, Weiwei

Analysis of Open-Loop Grasping from Piles 2591
Pall, Elod; Brock, Oliver

Human Initiated Grasp Space Exploration Algorithm for an Underactuated Robot Gripper Using Variational Autoencoder 2598
Rolinat, Clément; Grossard, Mathieu; Aloui, Saifeddine; Godin, Christelle

An Underactuated Gripper Based on Car Differentials for Self-Adaptive Grasping with Passive Disturbance Rejection 2605
Lu, Qiujie; Wang, Jinhong; Zhang, Zhuang; Chen, Genliang; Wang, Hao; Rojas, Nicolas

Session TuAT20 : Grasping II

Dig-Grasping Via Direct Quasistatic Interaction Using Asymmetric Fingers: An Approach to Effective Bin Picking 2612
Tong, Zhekai; Ng, Yu Hin; Kim, Chung Hee; He, Tierui; Seo, Jungwon

Uncertainty-Aware Self-Supervised Target-Mass Grasping of Granular Foods 2620
Takahashi, Kuniyuki; Ko, Wilson Kien Ho; Ummadisingu, Avinash; Maeda, Shin-ichi

SCT-CNN: A Spatio-Channel-Temporal Attention CNN for Grasp Stability Prediction 2627
Yan, Gang; Schmitz, Alexander; Funabashi, Satoshi; Somlor, Sophon; Tomo, Tito Pradhono; Sugano, Shigeki

Tactile Velocity Estimation for Controlled In-Grasp Sliding 2635
Chen, Yuan; Prepiscus, Colin; Lee, Daewon; Lee, Daniel

Session TuKT18 : Hierarchical Motion Planning

Q-Tree Search: An Information-Theoretic Approach Toward Hierarchical Abstractions for Agents with Computational Limitations 2643
Larsson, Daniel; Maity, Dipankar; Tsiotras, Panagiotis

A Safe Hierarchical Planning Framework for Complex Driving Scenarios Based on Reinforcement Learning 2660

Li, Jinning; Sun, Liting; Chen, Jianyu; Tomizuka, Masayoshi; Zhan, Wei

Behavior Planning at Urban Intersections through Hierarchical Reinforcement Learning 2667
Qiao, Zhiqian; Schneider, Jeff; Dolan, John M.

Collision Avoidance in Tightly-Constrained Environments without Coordination: A Hierarchical Control Approach 2674
Shen, Xu; Zhu, Edward; Stürz, Yvonne R.; Borrelli, Francesco

Session TuHT17 : Human-Centered Robotics I

Human Arm Stability in Relation to Damping-Defined Mechanical Environments in Physical Interaction with a Robotic Arm 2681
Zahedi, Fatemeh; Lee, Hyunglae

Conditioning Style on Substance: Plans for Narrative Observation 2687
Chaudhuri, Diptanil; Ike, Rhema; Rahmani, Hazhar; Shell, Dylan; Becker, Aaron; O'Kane, Jason

Negative Emotion Management Using a Smart Shirt and a Robot Assistant 2694
Sheng, Weihua; Pham, Minh; Do, Ha Manh; Su, Zhidong; Bishop, Alex J.

Corrective Shared Autonomy for Addressing Task Variability 2702
Hagenow, Michael; Senft, Emmanuel; Radwin, Robert; Gleicher, Michael; Mutlu, Bilge; Zinn, Michael

Session TuIT17 : Human-Centered Robotics II

A Robot Walks into a Bar: Automatic Robot Joke Success Assessment 2710
Srivastava, Ajitesh; Fitter, Naomi T.

Reverse Psychology in Trust-Aware Human-Robot Interaction 2717
Guo, Yaohui; Shi, Cong; Yang, X. Jessie

Hey Robot, Which Way Are You Going? Nonverbal Motion Legibility Cues for Human-Robot Interaction 2725
Hetherington, Nicholas J.; Croft, Elizabeth; Van der Loos, H.F. Machiel

Robots Asking for Favors: The Effects of Directness and Familiarity on Persuasive HRI 2731
Saunderson, Shane; Nejat, Goldie

Session TuJT17 : Human-Centered Robotics III

Smile Like You Mean It: Driving Animatronic Robotic Face with Learned Models 2739
Chen, Boyuan; Hu, Yuhang; Li, LianFeng; Cummings, Sara; Lipson, Hod

I Know What You Meant: Learning Human Objectives by (Under)estimating Their Choice Set 2747
Jonnavittula, Ananth; Losey, Dylan

Analyzing Human Models that Adapt Online	2754
<i>Bajcsy, Andrea; Siththaranjan, Anand; Tomlin, Claire; Dragan, Anca</i>	
When Shall I Be Empathetic? the Utility of Empathetic Parameter Estimation in Multi-Agent Interactions	2761
<i>Chen, Yi; Zhang, Lei; Merry, Tanner; Amatya, Sunny; Zhang, Wenlong; Ren, Yi</i>	
Session TuKT17 : Human-In-The-Loop Control	
End-To-End Grasping Policies for Human-In-The-Loop Robots Via Deep Reinforcement Learning	2768
<i>Sharif, Mohammadreza; Erdogmus, Deniz; Amato, Christopher; Padir, Taskin</i>	
An Investigation of a Balanced Hybrid Active-Passive Actuator for Physical Human-Robot Interaction	2775
<i>Dills, Patrick; Dawson-Elli, Alexander; Gruben, Kreg; Adamczyk, Peter G.; Zinn, Michael</i>	
Situational Confidence Assistance for Lifelong Shared Autonomy	2783
<i>Zurek, Matthew; Bobu, Andreea; Brown, Daniel; Dragan, Anca</i>	
Recognizing Orientation Slip in Human Demonstrations	2790
<i>Hagenow, Michael; Zhang, Bolun; Mutlu, Bilge; Zinn, Michael; Gleicher, Michael</i>	
Session TuKT13 : Humanoid and Bipedal Locomotion I	
Learning Bipedal Robot Locomotion from Human Movement	2797
<i>Taylor, Michael; Bashkirov, Sergey; Fernandez Rico, Javier; Toriyama, Ike; Yanagisawa, Hideki; Miyada, Naoyuki; Ishizuka, Kensaku</i>	
Preference-Based Learning for User-Guided HZD Gait Generation on Bipedal Walking Robots	2804
<i>Tucker, Maegan; Csomay-Shanklin, Noel; Ma, Wenlong; Ames, Aaron</i>	
Reinforcement Learning for Robust Parameterized Locomotion Control of Bipedal Robots	2811
<i>Li, Zhongyu; Cheng, Xuxin; Peng, Xue Bin; Abbeel, Pieter; Levine, Sergey; Berseth, Glen; Sreenath, Koushil</i>	
Session TuHT12 : Humanoid and Bipedal Locomotion II	
Motion Planning and Feedback Control for Bipedal Robots Riding a Snakeboard	2818
<i>Anglingdarma, Jonathan; Agrawal, Ayush; Morey, Joshua; Sreenath, Koushil</i>	
Global Position Control on Underactuated Bipedal Robots: Step-To-Step Dynamics Approximation for Step Planning	2825
<i>Xiong, Xiaobin; Reher, Jenna; Ames, Aaron</i>	
One-Step Ahead Prediction of Angular Momentum about the Contact Point for Control of Bipedal Locomotion: Validation in a LIP-Inspired Controller	2832
<i>Gong, Yukai; Grizzle, J.W</i>	

Hybrid Sampling/Optimization-Based Planning for Agile Jumping Robots on Challenging Terrains 2839
Ding, Yanran; Zhang, Mengchao; Li, Chuangzheng; Park, Hae-Won; Hauser, Kris

Session TuT12 : Humanoid Robots

A Comparison Between Joint Space and Task Space Mappings for Dynamic Teleoperation of an Anthropomorphic Robotic Arm in Reaction Tests 2846
Wang, Sunyu; Murphy, Kevin; Kenney, Dillan; Ramos, Joao

Real-Time Self-Collision Avoidance in Joint Space for Humanoid Robots 2853
Koptev, Mikhail; Figueroa, Nadia; Billard, Aude

Model Hierarchy Predictive Control of Robotic Systems 2861
Li, He; Frei, Robert; Wensing, Patrick M.

Impedance Optimization for Uncertain Contact Interactions through Risk Sensitive Optimal Control 2869
Hammoud, Bilal; Khadiv, Majid; Righetti, Ludovic

Session TuJT12 : Humanoids and Animaloids

Learning Human Objectives from Sequences of Physical Corrections 2877
Li, Mengxi; Canberk, Alper; Losey, Dylan; Sadigh, Dorsa

SimGAN: Hybrid Simulator Identification for Domain Adaptation Via Adversarial Reinforcement Learning 2884
Jiang, Yifeng; Zhang, Tingnan; Ho, Daniel; Bai, Yunfei; Liu, Karen; Levine, Sergey; Tan, Jie

Look at my new blue force-sensing shoes! 2891
Han, Yuanfeng; Li, Ruixin; Chirikjian, Gregory

Learning Spring Mass Locomotion: Guiding Policies with a Reduced-Order Model 2897
Green, Kevin; Godse, Yesh; Dao, Jeremy; Hatton, Ross; Fern, Alan; Hurst, Jonathan

Session TuET13 : Humanoids and Animaloids I

DILIGENT-KIO: A Proprioceptive Base Estimator for Humanoid Robots Using Extended Kalman Filtering on Matrix Lie Groups 2904
Ramadoss, Prashanth; Romualdi, Giulio; Dafarra, Stefano; Andrade Chavez, Francisco Javier; Traversaro, Silvio; Pucci, Daniele

Modeling of Visco-Elastic Environments for Humanoid Robot Motion Control 2911
Romualdi, Giulio; Dafarra, Stefano; Pucci, Daniele

Feasibility-Driven Step Timing Adaptation for Robust MPC-Based Gait Generation in Humanoids 2919
Smaldone, Filippo Maria; Scianca, Nicola; Lanari, Leonardo; Oriolo, Giuseppe

Humanoid Control under Interchangeable Fixed and Sliding Unilateral Contacts 2927

Samadi, Saeid; Roux, Julien; Tanguy, Arnaud; Caron, Stephane; Kheddar, Abderrahmane

Session TuBT17 : Humanoids and Animaloids III

- [Lywal: A Leg-Wheel Transformable Quadruped Robot with Picking up and Transport Functions](#) 2935
Xue, Yongjiang; Yuan, Xichen; Wang, Yuhai; Yang, Yang; Lu, Siyu; Zhang, Bo; Lai, Juezhu; Wang, Jianming; Xiao, Xuan
- [Design of a Compact Embedded Hydraulic Power Unit for Bipedal Robots](#) 2942
Cho, Buyoun; Kim, Min-Su; Kim, Sung Woo; Shin, Seunghoon; Jeong, Yeseong; Oh, Jun Ho; Park, Hae-Won
- [Stair Climbing Capability-Based Dimensional Synthesis for the Multi-Legged Robot](#) 2950
Li, Huayang; Qi, Chenkun; Chen, Xianbao; Mao, Liheng; Zhao, Yue; Gao, Feng
- [Versatile Locomotion by Integrating Ankle, Hip, Stepping, and Height Variation Strategies](#) 2957
Ding, Jiatao; Xin, Songyan; Lam, Tin Lun; Vijayakumar, Sethu

Session TuFT13 : Humanoids and Animaloids IV

- [Fast Footstep Planning with Aborting A*](#) 2964
Missura, Marcell; Bennewitz, Maren
- [Stiffness Modulation in a Humanoid Robotic Leg and Knee](#) 2971
Russell, Felix; Takeda, Yukio; Kormushev, Petar; Vaidyanathan, Ravi; Ellison, Peter
- [Exploiting Visual Servoing and Centroidal Momentum for Whole-Body Motion Control of Humanoid Robots in Absence of Contacts and Gravity](#) 2979
Mingo Hoffman, Enrico; Paolillo, Antonio
- [Variable Horizon MPC with Swing Foot Dynamics for Bipedal Walking Control](#) 2986
Daneshmand, Elham; Khadiv, Majid; Grimminger, Felix; Righetti, Ludovic

Session TuCT17 : Humanoids and Animaloids V

- [Robust Landing Stabilization of Humanoid Robot on Uneven Terrain Via Admittance Control and Heel Strike Motion](#) 2994
Jo, Joonhee; Park, Gyunghoon; Oh, Yonghwan
- [Toward Autonomous Driving by Musculoskeletal Humanoids: A Study of Developed Hardware and Learning-Based Software](#) 3001
Kawaharazuka, Kento; Tsuzuki, Kei; Koga, Yuya; Omura, Yusuke; Makabe, Tasuku; Shinjo, Koki; Onitsuka, Moritaka; Nagamatsu, Yuya; Asano, Yuki; Okada, Kei; Kawasaki, Koji; Inaba, Masayuki
- [Automatic Grouping of Redundant Sensors and Actuators Using Functional and Spatial Connections: Application to Muscle Grouping for Musculoskeletal Humanoids](#) 3011

Kawaharazuka, Kento; Nishiura, Manabu; Koga, Yuya; Omura, Yusuke; Toshimitsu, Yasunori; Asano, Yuki; Okada, Kei; Kawasaki, Koji; Inaba, Masayuki

[State Estimation for Hybrid Wheeled-Legged Robots Performing Mobile Manipulation Tasks](#) 3019

You, Yangwei; Cheong, Samuel; Chen, Lawrence Tai Pang; Chen, Yuda; Zhang, Kun; Acar, Cihan; Lai, Fon Lin; Adiwahono, Albertus Hendrawan; Tee, Keng Peng

Session TuGT13 : Humanoids and Animaloids VI

[Precise Jump Planning using Centroidal Dynamics based Bilevel Optimization](#) 3026

Vatavuk, Ivo; Kovacic, Zdenko

[DeepWalk: Omnidirectional Bipedal Gait by Deep Reinforcement Learning](#) 3033

Rodriguez, Diego; Behnke, Sven

[ULT-Model: Towards a One-Legged Unified Locomotion Template Model for Forward Hopping with an Upright Trunk](#) 3040

Ossadnik, Dennis; Jensen, Elisabeth; Haddadin, Sami

[Nonlinear Stiffness Allows Passive Dynamic Hopping for One-Legged Robots with an Upright Trunk](#) 3047

Ossadnik, Dennis; Jensen, Elisabeth; Haddadin, Sami

Session TuAT16 : Humanoids and Animaloids VII

[Reachability-Based Push Recovery for Humanoid Robots with Variable-Height Inverted Pendulum](#) 3054

Yang, Shunpeng; Chen, Hua; Zhang, Luyao; Cao, Zhefeng; Wensing, Patrick M.; Liu, Yizhang; Pang, Jianxin; Zhang, Wei

[Meaningful Centroidal Frame Orientation of Multi-body Floating Locomotion Systems](#) 3061

Du, Wenqian; Wang, Ze; Moullet, Etienne; Ben Amar, Faiz

[Online Object Searching by a Humanoid Robot in an Unknown Environment](#) 3068

Tsuru, Masato; Escande, Adrien; Tanguy, Arnaud; Chappellet, Kevin; Harada, Kensuke

[Origami-inspired New Material Feeding Mechanism for Soft Growing Robots to Keep the Camera Stay at the Tip by Securing Its Path](#) 3076

Kim, Ji-Hun; JaeHyung, Jang; Lee, Sang-min; Jeong, Sang-Goo; Kim, Yong-Jae; Ryu, Jee-Hwan

Session WeBT3 : Humanoids and Animaloids VIII

[Vision-Based Path Following of Snake-Like Robots](#) 3084

Liu, Lixing; Xi, Wei; Guo, Xian; Fang, Yongchun

[Configuration Transformation of the Wheel-Legged Robot Using Inverse Dynamics Control](#) 3091

Zhou, Haitao; Yu, Haoyang; Li, Xu; Feng, Haibo; Zhang, Songyuan; Fu, Yili

A Passive Hydraulic Auxiliary System Designed for Increasing Legged Robot Payload and Efficiency	3097
<i>Fan, Wu; Liu, Tao; Yi, Jingang; Huang, Xinyan; Zhang, Bin; Zhang, Xiufeng; Wang, Shuoyu</i>	
Legged Robot State Estimation in Slippery Environments Using Invariant Extended Kalman Filter with Velocity Update	3104
<i>Teng, Sangli; Mueller, Mark Wilfried; Sreenath, Koushil</i>	
Session TuDT0 : Human-Robot Interaction Award Session	
Collision Detection, Identification, and Localization on the DLR SARA Robot with Sensing Redundancy	3111
<i>Iskandar, Maged; Eiberger, Oliver; Albu-Schäffer, Alin; De Luca, Alessandro; Dietrich, Alexander</i>	
Reactive Human-To-Robot Handovers of Arbitrary Objects	3118
<i>Yang, Wei; Paxton, Chris; Mousavian, Arsalan; Chao, Yu-Wei; Cakmak, Maya; Fox, Dieter</i>	
Session TuJT16 : Human-Robot Interaction I	
Evaluating Guided Policy Search for Human-Robot Handovers	3125
<i>Kshirsagar, Alap; Hoffman, Guy; Biess, Armin</i>	
Communication Strategy for Efficient Guidance Providing	3133
<i>Lo, Shih-Yun; Thomaz, Andrea Lockerd</i>	
LBGP: Learning Based Goal Planning for Autonomous Following in Front	3140
<i>Nikdel, Payam; Vaughan, Richard; Chen, Mo</i>	
Session TuFT16 : Human-Robot Interaction II	
A Reversible Dynamic Movement Primitive Formulation	3147
<i>Sidiropoulos, Antonis; Doulgeri, Zoe</i>	
A Safety-Aware Kinodynamic Architecture for Human-Robot Collaboration	3154
<i>Pupa, Andrea; Arrfou, Mohammad; Andreoni, Gildo; Secchi, Cristian</i>	
A Human-Centered Dynamic Scheduling Architecture for Collaborative Application	3161
<i>Pupa, Andrea; van Dijk, Wietse; Secchi, Cristian</i>	
Towards Efficient Human-Robot Cooperation for Socially-Aware Robot Navigation in Human-Populated Environments: The SNAPE Framework	3169
<i>Vega, Araceli; Gondkar, Rishi; Manso, Luis J.; Núñez, Pedro</i>	
Session WeCT11 : Human-Robot Interaction III	
Relational Navigation Learning in Continuous Action Space among Crowds	3175

Zhang, Xueyou; Xi, Wei; Guo, Xian; Fang, Yongchun; Wang, Bin; Liu, Wulong; Hao, Jianye

Limits of Probabilistic Safety Guarantees When Considering Human Uncertainty 3182
Cheng, Richard; Murray, Richard; Burdick, Joel

Probabilistic Human Motion Prediction Via a Bayesian Neural Network 3190
Xu, Jie; Chen, Xingyu; Lan, Xuguang; Zheng, Nanning

Directed Acyclic Graph Neural Network for Human Motion Prediction 3197
Li, Qin; Chalvatzaki, Georgia; Peters, Jan; Wang, Yong

Session TuKT16 : Human-Robot Interaction in Exoskeletons

Crawling Support Using Wearable SuperLimbs: Human-Robot Synchronization and Metabolic Cost Assessment 3205
Daniel, Phillip; Asada, Harry

ROIAL: Region of Interest Active Learning for Characterizing Exoskeleton Gait Preference Landscapes 3212
Li, Kejun; Tucker, Maegan; Biyik, Erdem; Novoseller, Ellen; Burdick, Joel; Sui, Yanan; Sadigh, Dorsa; Yue, Yisong; Ames, Aaron

Control of a Transfemoral Prosthesis on Sloped Terrain using Continuous and Nonlinear Impedance Parameters 3219
Anil Kumar, Namita; Hong, Woolim; Hur, Pilwon

Model-Dependent Prosthesis Control with Interaction Force Estimation 3226
Gehlhar, Rachel; Ames, Aaron

Session TuAT18 : Human-Robot Interaction IV

Comparison of Three Feedback Modalities for \square Haptics Sensation in Remote Machine Manipulation 3233
Haruna, Masaki; Kawaguchi, Noboru; Ogino, Masaki; Koike-Akino, Toshiaki

Prediction-Error Negativity to Assess Singularity Avoidance Strategies in Physical Human-Robot Collaboration 3241
Aldini, Stefano; Singh, Avinash Kumar; Carmichael, Marc; Wang, Yu-Kai; Liu, Dikai; Lin, Chin-Teng

A Large Area Robotic Skin with Sparsely Embedded Microphones for Human-Robot Tactile Communication 3248
Yang, Min Jin; Park, Kyungseo; Kim, Jung

Star Topology Based Interaction for Robust Trajectory Forecasting in Dynamic Scene 3255
Zhu, Yanliang; Ren, Dongchun; Qian, Deheng; Li, Xin; Fan, Mingyu; Xia, Huaxia

Session TuIT15 : Human-Robot Interaction IX

Maximum Spectral Flatness Control of a Manipulandum for Human Motor System Identification <i>Qiu, Yingxin; Wu, Mengnan; Ting, Lena; Ueda, Jun</i>	3262
Learning from Demonstration for Real-Time User Goal Prediction and Assistive Shared Control <i>Qiao, Calvin Z.; Sakr, Maram; Muelling, Katharina; Admoni, Henny</i>	3270
Human-Aware Robot Task Planning Based on a Hierarchical Task Model <i>Cheng, Yujiao; Sun, Liting; Tomizuka, Masayoshi</i>	3276
Exploiting Natural Language for Efficient Risk-Aware Multi-Robot SaR Planning <i>Shree, Vikram; Arruda Asfora, Beatriz; Zheng, Rachel; Hong, Samantha; Banfi, Jacopo; Campbell, Mark</i>	3284
Session TuHT15 : Human-Robot Interaction V	
Force-Sensing Tensegrity for Investigating Physical Human-Robot Interaction in Compliant Robotic Systems <i>Barkan, Andrew R.; Padmanabha, Akhil; Tiemann, Sala; Lee, Albert; Kanter, Matthew; Agarwal, Yash; Agogino, Alice</i>	3292
Risk-Aware Decision Making for Service Robots to Minimize Risk of Patient Falls in Hospitals <i>Sabbagh Novin, Roya; Yazdani, Amir; Merryweather, Andrew; Hermans, Tucker</i>	3299
Haptic Feedback Improves Human-Robot Agreement and User Satisfaction in Shared-Autonomy Teleoperation <i>Zhang, Dawei; Tron, Roberto; Khurshid, Rebecca</i>	3306
Effect of Robot Assistance, Operator Cognitive Fatigue, and Sex on Task Efficiency, Workload, and Situation Awareness in Human-Robot Collaboration <i>Hopko, Sarah; Khurana, Riya; Mehta, Ranjana; Pagilla, Prabhakar Reddy</i>	3313
Session TuGT17 : Human-Robot Interaction VI	
Composing HARMONI: An Open-Source Tool for Human and Robot Modular Open Interaction <i>Spitale, Micol; Birmingham, Chris; Swan, Michael; Mataric, Maja</i>	3322
Robot Interaction Studio: A Platform for Unsupervised HRI <i>Mohan, Mayumi; Nunez, Cara M.; Kuchenbecker, Katherine J.</i>	3330
MorphFace: A Hybrid Morphable Face for a Robopatient <i>Lalitharatne, Thilina Dulantha; Tan, Yongxuan; He, Liang; Leong, Florence Ching Ying; Van Zalk, Nejra; de Lusignan, Simon; Iida, Fumiya; Nanayakkara, Thrishantha</i>	3337
Which Gesture Generator Performs Better? <i>Zabala Cristobal, Unai; Rodriguez, Igor; Martínez-Otzeta, José María; Irigoien, Itziar; Lazkano, Elena</i>	3345
Session WeCT3 : Human-Robot Interaction VII	

Two-Stream 2D/3D Residual Networks for Learning Robot Manipulations from Human Demonstration Videos	3353
<i>Xu, Xin; Qian, Kun; Zhou, Bo; Chen, Shenghao; Li, Yitong</i>	
Waypoints Updating Based on Adam and ILC for Path Learning in Physical Human-Robot Interaction	3359
<i>Xia, Jingkan; Song, Chenjian; Huang, Deqing; Xing, Xueyan; Ma, Lei; Li, Yanan</i>	
Virtual-Fixture Based Drilling Control for Robot-Assisted Craniotomy: Learning from Demonstration	3366
<i>Duan, Xingguang; Tian, Huanyu; Li, Changsheng; Cui, Tengfei; Han, Zhe; Shi, Qingxin; Hao, Wen; Wang, Jin</i>	
A Graph Attention Spatio-Temporal Convolutional Network for 3D Human Pose Estimation in Video	3374
<i>Liu, Junfa; Rojas, Juan; Li, Yihui; Liang, Zhijun; Guan, Yisheng; Xi, Ning; Zhu, Haifei</i>	
Session TuBT18 : Human-Robot Interaction VIII	
Human-In-The-Loop Auditory Cueing Strategy for Gait Modification	3381
<i>Wu, Tina LY; Murphy, Anna; Chen, Chao; Kulic, Dana</i>	
A Self-Training Approach-Based Traversability Analysis for Mobile Robots in Urban Environments	3389
<i>Lee, Hyunsuk; Chung, Woojin</i>	
Active and Interactive Mapping with Dynamic Gaussian Process Implicit Surfaces for Mobile Manipulators	3395
<i>Liu, Liyang; Vidal-Calleja, Teresa A.; Wu, Lan; Paul, Gavin; Vu, Thanh; Fryc, Simon</i>	
Proactive Interaction Framework for Intelligent Social Receptionist Robots	3403
<i>Xue, Yang; Wang, Fan; Tian, Hao; Zhao, Min; Li, Jiangyong; Pan, Haiqing; Dong, Yueqiang</i>	
Session TuGT16 : Human-Robot Interaction X	
Interpreting Contact Interactions to Overcome Failure in Robot Assembly Task	3410
<i>Zachares, Peter; Lee, Michelle; Lian, Wenzhao; Bohg, Jeannette</i>	
Decentralized Ability-Aware Adaptive Control for Multi-Robot Collaborative Manipulation	3418
<i>Yan, Lei; Stouraitis, Theodoros; Vijayakumar, Sethu</i>	
Learning Interaction-Aware Trajectory Predictions for Decentralized Multi-Robot Motion Planning in Dynamic Environments	3426
<i>Zhu, Hai; Martínez Claramunt, Francisco; Brito, Bruno; Alonso-Mora, Javier</i>	
Real-Time Surgical Environment Enhancement for Robot-Assisted Minimally Invasive Surgery Based on Super-Resolution	3434
<i>Wang, Ruoxi; Zhang, Dandan; Li, Qingbiao; Zhou, Xiao-Yun; Lo, Benny Ping Lai</i>	

Session TuAT17 : Human-Robot Interaction XI

Exploiting Inherent Human Motor Behaviour in the Online Personalisation of Human-Prosthetic Interfaces	3441
<i>Garcia-Rosas, Ricardo; Yu, Tianshi; Oetomo, Denny; Manzie, Chris; Tan, Ying; Choong, Peter</i>	
Design and Clinical Validation of a Robotic Ankle-Foot Simulator with Series Elastic Actuator for Ankle Clonus Assessment Training	3450
<i>Pei, Yinan; Han, Tianyi; Zallek, Christopher; Liu, Tao; Yang, Liangjing; Hsiao-Wecksler, Elizabeth</i>	
A Hybrid Impedance Controller for Series Elastic Actuators to Render a Wide Range of Stable Stiffness in Uncertain Environments	3458
<i>Lee, Yu-Shen; Chiao, Kuan-Wei; Lan, Chao-Chieh</i>	
Soft-Jig-Driven Assembly Operations	3466
<i>Kiyokawa, Takuya; Sakuma, Tatsuya; Takamatsu, Jun; Ogasawara, Tsukasa</i>	
Session TuT13 : Human-Robot Interaction: Learning to Predict	
Identifying Driver Interactions Via Conditional Behavior Prediction	3473
<i>Tolstaya, Ekaterina; Mahjourian, Reza; Downey, Carlton; Varadarajan, Balakrishnan; Sapp, Benjamin; Anguelov, Dragomir</i>	
Autonomous Robotic Escort Incorporating Motion Prediction and Human Intention	3480
<i>Conte, Dean; Furukawa, Tomonari</i>	
Two-Stage Clustering of Human Preferences for Action Prediction in Assembly Tasks	3487
<i>Nemlekar, Heramb; Modi, Jignesh; Gupta, Satyandra K.; Nikolaidis, Stefanos</i>	
Dynamically Switching Human Prediction Models for Efficient Planning	3495
<i>Sripathy, Arjun; Bobu, Andreea; Brown, Daniel; Dragan, Anca</i>	
Session TuJT15 : Human-Robot Interaction: Robot Navigation I	
Socially-Compatible Behavior Design of Autonomous Vehicles with Verification on Real Human Data	3502
<i>Wang, Letian; Sun, Liting; Tomizuka, Masayoshi; Zhan, Wei</i>	
Social Navigation for Mobile Robots in the Emergency Department	3510
<i>Taylor, Angelique; Matsumoto, Sachiko; Xiao, Wesley; Riek, Laurel D.</i>	
Decentralized Structural-RNN for Robot Crowd Navigation with Deep Reinforcement Learning	3517
<i>Liu, Shuijing; Chang, Peixin; Liang, Weihang; Chakraborty, Neeloy; Driggs-Campbell, Katherine</i>	
Range Limited Coverage Control Using Air-Ground Multi-Robot Teams	3525
<i>Rudolph, Max; Wilson, Sean; Egerstedt, Magnus</i>	

Session TuHT13 : Human-Robot Interaction: Robot Navigation II

- Investigation of Unmanned Aerial Vehicle Gesture Perceptibility and Impact of Viewpoint Variance 3531
Fletcher, Paul; Detweiler, Carrick; Duncan, Brittany
- Can a Robot Trust You? A DRL-Based Approach to Personality-Driven, Human-Guided Navigation 3538
Dorbala, Vishnu Sashank; Ambalam, Arjun; Bera, Aniket
- Mesh Based Analysis of Low Fractal Dimension Reinforcement Learning Policies 3546
Gillen, Sean; Byl, Katie
- Watch Where You're Going! Gaze and Head Orientation As Predictors for Social Robot Navigation 3553
Holman, Blake; Anwar, Abrar; Singh, Akash; Tec, Mauricio; Hart, Justin; Stone, Peter

Session TuDT15 : Human-Robot Interaction: Control

- Robust Classification of Grasped Objects in Intuitive Human-Robot Collaboration Using a Wearable Force-Myography Device 3560
Kahanowich, Nadav Dov; Sintov, Avishai
- Augmented Hierarchical Quadratic Programming for Adaptive Compliance Robot Control 3568
Tassi, Francesco; De Momi, Elena; Ajoudani, Arash
- An Optimization Approach for a Robust and Flexible Control in Collaborative Applications 3575
Benzi, Federico; Secchi, Cristian
- Probabilistic Adaptive Control for Robust Behavior Imitation 3582
Jankowski, Julius; Girgin, Hakan; Calinon, Sylvain

Session TuET15 : Human-Robot Interaction: Detection

- CSM: Contact Sensitivity Maps for Benchmarking Robot Collision Handling Systems 3590
Kirschner, Robin Jeanne; Jantalia, João Pedro; Mansfeld, Nico; Abdolshah, Saeed; Haddadin, Sami
- A Data-Driven Approach for Contact Detection, Classification and Reaction in Physical Human-Robot Collaboration 3597
Lippi, Martina; Gillini, Giuseppe; Marino, Alessandro; Arrichiello, Filippo
- Pointing at Moving Robots: Detecting Events from Wrist IMU Data 3604
Abbate, Gabriele; Gromov, Boris; Gambardella, Luca; Giusti, Alessandro

Session TuFT15 : Human-Robot Interaction: Haptics

- Learning Human-like Hand Reaching for Human-Robot Handshaking 3612
Prasad, Vignesh; Stock-Homburg, Ruth; Peters, Jan

Simultaneous Haptic Guidance and Learning of Task Parameters During Robotic Teleoperation - a Geometrical Approach 3619
Poignonec, Thibault; Nageotte, Florent; Zemiti, Nabil; Bayle, Bernard

Human-Like Artificial Skin Sensor for Physical Human-Robot Interaction 3626
Teyssier, Marc; Parilusyan, Brice; Roudaut, Anne; Steimle, Jürgen

A Unified Perception Benchmark for Capacitive Proximity Sensing towards Safe Human-Robot Collaboration (HRC) 3634
Ergun, Serkan; Ding, Yitao; Alagi, Hosam; Schöffmann, Christian; Ubezio, Barnaba; Soti, Gergely; Rathmair, Michael; Mühlbacher-Karrer, Stephan; Thomas, Ulrike; Hein, Björn; Hofbaur, Michael; Zangl, Hubert

Session TuGT15 : Human-Robot Interaction: Learning

Engagement Estimation During Child Robot Interaction Using Deep Convolutional Networks Focusing on ASD Children 3641
Anagnostopoulou, Dafni; Efthymiou, Niki; Papailiou, Christina; Maragos, Petros

Ergodic Imitation: Learning from What to Do and What Not to Do 3648
Kalinowska, Aleksandra; Prabhakar, Ahalya; Fitzsimons, Kathleen; Murphey, Todd

Imitation Learning with Inconsistent Demonstrations through Uncertainty-Based Data Manipulation 3655
Valletta, Peter; Pérez-Dattari, Rodrigo; Kober, Jens

Learning Motor Resonance in Human-Human and Human-Robot Interaction with Coupled Dynamical Systems 3662
Ferreira Duarte, Nuno; Rakovic, Mirko; Santos-Victor, José

Session TuKT15 : Human-Robot Interaction: Medical Robots and Systems I

Can Therapists Design Robot-Mediated Interventions and Teleoperate Robots Using VR to Deliver Interventions for ASD? 3669
Kulikovskiy, Roman; Sochanski, Megan; Hijaz, Alaaldin; Eaton, Matteson; Korneder, Jessica; Louie, Wing-Yue Geoffrey

A Low-Cost Intrinsically Safe Mechanism for Physical Distancing between Clinicians and Patients 3677
Soleymani, Abed; Torabi, Ali; Tavakoli, Mahdi

Collaborative Fall Detection Using a Wearable Device and a Companion Robot 3684
Liang, Fei; Hernandez, Ricardo; Lu, Jiaxing; Ong, Brandon T.; Moore, M. Jackson; Sheng, Weihua; Zhang, Senlin

Conversation-Based Medication Management System for Older Adults Using a Companion Robot and Cloud 3691
Su, Zhidong; Liang, Fei; Do, Ha Manh; Bishop, Alex J.; Carlson, Barbara; Sheng, Weihua

Session TuHT14 : Human-Robot Interaction: Medical Robots and Systems II

- Variable Impedance Control for pHRI: Impact on Stability, Agility, and Human Effort in Controlling a Wearable Ankle Robot 3699
Arnold, James; Lee, Hyunglae
- Design and Validation of a Novel Exoskeleton Hand Interface: The Eminence Grip 3707
Ghonasgi, Keya; Rose, Chad; De Oliveira, Ana Christine; Varghese, Rohit John; Deshpande, Ashish
- Entrainment During Human Locomotion Using a Soft Wearable Ankle Robot 3714
Thalman, Carly; Debeurre, Marielle Prescott; Lee, Hyunglae
- Active Telepresence Assistance for Supervisory Control: A User Study with a Multi-Camera Tele-Nursing Robot 3722
Valiton, Alexandra; Baez, Hannah; Harrison, Naomi; Roy, Justine; Li, Zhi

Session TuIT14 : Human-Robot Interaction: Motion Planning

- A Scalable Approach to Predict Multi-Agent Motion for Human-Robot Collaboration 3728
Yasar, Mohammad; Iqbal, Tariq
- Temporal Anticipation and Adaptation Methods for Fluent Human-Robot Teaming 3736
Iqbal, Tariq; Riek, Laurel D.
- Robust Planning with Emergent Human-Like Behavior for Agents Traveling in Groups 3744
Lo, Shih-Yun; Short, Elaine Schaertl; Thomaz, Andrea Lockerd
- Order Matters: Generating Progressive Explanations for Planning Tasks in Human-Robot Teaming 3751
Zakershahra, Mehrdad; Marpally, Shashank Rao; Sharma, Akshay; Gong, Ze; Zhang, Yu (Tony)

Session TuDT14 : Human-Robot Interaction: Motion Prediction

- Human-Robot Collaborative Object Transfer Using Human Motion Prediction Based on Cartesian Pose Dynamic Movement Primitives 3758
Sidiropoulos, Antonis; Karayiannidis, Yiannis; Doulgeri, Zoe
- Dynamic Projection of Human Motion for Safe and Efficient Human-Robot Collaboration 3765
Meng, Xuming; Weitschat, Roman
- Achieving Hard Real-Time Capability for 3D Human Pose Estimation Systems 3772
Schlosser, Patrick; Ledermann, Christoph
- Zoomorphic Gestures for Cobots 3779
Sauer, Vanessa; Sauer, Axel; Mertens, Alexander

Session TuJT14 : Human-Robot Interaction: Multimedia

ARROCH: Augmented Reality for Robots Collaborating with a Human 3787
Chandan, Kishan; Kudalkar, Vidisha Prashant; Li, Xiang; Zhang, Shiqi

ARC-LfD: Using Augmented Reality for Interactive Long-Term Robot Skill Maintenance Via Constrained Learning from Demonstration 3794
Luebbers, Matthew; Brooks, Connor; Mueller, Carl Louis; Szafir, Daniel J.; Hayes, Bradley

Bringing WALL-E Out of the Silver Screen: Understanding How Transformative Robot Sound Affects Human Perception 3801
Zhang, Brian John; Stargu, Nick; Brimhall, Samuel; Chan, Lilian C.; Fick, Jason; Fitter, Naomi T.

How People Use Active Telepresence Cameras in Tele-manipulation 3808
Lin, Tsung-Chi; Unni Krishnan, Achyuthan; Li, Zhi

Session TuET14 : Human-Robot Interaction: Safety

Improving Safety and Accuracy of Impedance Controlled Robot Manipulators with Proximity Perception and Proactive Impact Reactions 3816
Ding, Yitao; Thomas, Ulrike

Optimal Scaling of Dynamic Safety Zones for Collaborative Robotics 3822
Scalera, Lorenzo; Vidoni, Renato; Giusti, Andrea

3D Collision-Force-Map for Safe Human-Robot Collaboration 3829
Svarny, Petr; Rozlivek, Jakub; Rustler, Lukas; Hoffmann, Matej

Safe, Passive Control for Mechanical Systems with Application to Physical Human-Robot Interactions 3836
Shaw Cortez, Wenceslao; Verginis, Christos; Dimarogonas, Dimos V.

Session TuKT14 : Human-Robot Interaction: Scheduling and Teleoperation

Online Dynamic Time Warping Algorithm for Human-Robot Imitation 3843
Taghavi, Nazita; Berdichevsky, Jacob; Balakrishnan, Namrata; Welch, Karla Conn; Das, Sumit Kumar; Popa, Dan

Discrete Windowed-Energy Variable Structure Passivity Signature Control for Physical Human-(Tele)Robot Interaction 3850
Thudi, Smrithi; Atashzar, S. Farokh

Investigation of Multiple Resource Theory Design Principles on Robot Teleoperation and Workload Management 3858
Han, Zhao; Norton, Adam; McCann, Eric; Baraniecki, Lisa; Ober, Will; Shane, Dave; Skinner, Anna; Yanco, Holly

Time-Domain Passivity-Based Controller with an Optimal Two-Channel Lawrence Telerobotic Architecture 3865

Feizi, Navid; Thudi, Smrithi; Patel, Rajni; Atashzar, S. Farokh

Session TuFT14 : Human-Robot Interaction: Simulation and Experiment

[Virtual Adversarial Humans Finding Hazards in Robot Workplaces](#) 3872

Huck, Tom Philip; Ledermann, Christoph; Kroeger, Torsten

[Crowd against the Machine: A Simulation-Based Benchmark Tool to Evaluate and Compare Robot Capabilities to Navigate a Human Crowd](#) 3879

Grzeskowiak, Fabien; Gonon, David Julian; Dugas, Daniel; Paez-Granados, Diego; Chung, Jen Jen; Nieto, Juan; Siegart, Roland; Billard, Aude; Babel, Marie; Pettre, Julien

[DROID: Minimizing the Reality Gap Using Single-Shot Human Demonstration](#) 3886

Tsai, Ya-Yen; Xu, Hui; Ding, Zihan; Zhang, Chong; Johns, Edward; Huang, Bidan

[Roboticians and Reporters. a Rhetorical Experiment at the Cité Des Sciences Et De l'Industrie \(Paris, France\) \(I\)](#) 3894

Pieters, Céline; Danblon, Emmanuelle; Laumond, Jean-Paul

Session TuGT14 : Human-Robot Interaction: Task Planning

[Task Planning with a Weighted Functional Object-Oriented Network](#) 3904

Paulius, David Andres; Dong, Kelvin Sheng Pei; Sun, Yu

[Haptic-Guided Path Generation for Remote Car-Like Vehicles](#) 3911

Fennel, Michael; Zea, Antonio; Hanebeck, Uwe D.

[Task-Based Role Adaptation For Human-Robot Cooperative Object Handling](#) 3919

Jaberzadeh Ansari, Ramin; Karayiannidis, Yiannis

[Towards providing explanations for robot motion planning](#) 3927

Brandao, Martim; Canal, Gerard; Krivic, Senka; Magazzeni, Daniele

Session TuDT13 : Human-Robot Interaction: Teleoperation

[Stabilization of User-defined Feedback Controllers in Teleoperation with Passive Coupling Reference](#) 3934

Balachandran, Ribin; Panzirsch, Michael; De Stefano, Marco; Singh, Harsimran; Ott, Christian; Albu-Schäffer, Alin

[Rate Mode Bilateral Teleoperation Based on Passivity Tanks and Variable Admittance Control](#) 3942

Saudrais, Charlélie; Barbé, Laurent; Bayle, Bernard

[Task Autocorrection for Immersive Teleoperation](#) 3949

Wang, Chenyang; Huber, Simon; Coros, Stelian; Poranne, Roi

[Manipulability Optimization for Multi-Arm Teleoperation](#) 3956

Kennel-Maushart, Florian; Poranne, Roi; Coros, Stelian

Session TuJT13 : Human-Robots Interface System

- UAV Target-Selection: 3D Pointing Interface System for Large-Scale Environment 3963
Medeiros, Anna; Ratsamee, Photchara; Orlosky, Jason; Uranishi, Yuki; Higashida, Manabu; Takemura, Haruo
- A Framework for Customizable Multi-User Teleoperated Control 3970
Munawar, Adnan; Wu, Jie Ying; Taylor, Russell H.; Kazanzides, Peter; Fischer, Gregory Scott
- SQRP: Sensing Quality-Aware Robot Programming System for Non-Expert Programmers 3978
Hsieh, Yi-Hsuan; Huang, Pei-Chi; Mok, Aloysius
- Automated Environment Reduction for Debugging Robotic Systems 3985
Von Stein, Meriel; Elbaum, Sebastian

Session WeAT14 : IMU-Based Localization

- IMU Data Processing for Inertial Aided Navigation: A Recurrent Neural Network Based Approach 3992
Zhang, Ming; Li, Mingyang; Zhang, Mingming; Chen, Yiming
- Highly Efficient Line Segment Tracking with an IMU-KLT Prediction and a Convex Geometric Distance Minimization 3999
Wei, Hao; Tang, Fulin; Zhang, Chaofan; Wu, Yihong
- Robust Localization for Planar Moving Robot in Changing Environment: A Perspective on Density of Correspondence and Depth 4006
Jiao, Yanmei; Liu, Lili; Fu, Bo; Ding, Xiaqing; Wang, Minhang; Wang, Yue; Xiong, Rong
- IMU/Vehicle Calibration and Integrated Localization for Autonomous Driving 4013
Liu, Zhenbo; Wang, Leijie; Wen, Feng; Zhang, Hongbo

Session TuKT12 : Intelligence Design

- Optimizing Cellular Networks Via Continuously Moving Base Stations on Road Networks 4020
Girdhar, Yogesh; Rivkin, Dmitriy; Wu, Di; Jenkin, Michael; Liu, Xue; Dudek, Gregory
- The Resh Programming Language for Multirobot Orchestration 4026
Carroll, Martin; Namjoshi, Kedar; Segall, Itai
- Sensing Via Collisions: A Smart Cage for Quadrotors with Applications to Self-Localization 4033
Liu, Cheng; Tron, Roberto
- Generative Design of NU's Husky Carbon: A Morpho-Functional, Legged Robot 4040
Ramezani, Alireza; Dangol, Pravin; Sihite, Eric; Lessieur, Andrew; Kelly, Peter

Session TuBT16 : Learning and Control in Robotics and Automation

- [Hyperparameter Auto-Tuning in Self-Supervised Robotic Learning](#) 4047
Huang, Jiancong; Rojas, Juan; Zimmer, Matthieu; Wu, Hongmin; Guan, Yisheng; Weng, Paul
- [An Analytical Diabolo Model for Robotic Learning and Control](#) 4055
von Drigalski, Felix Wolf Hans Erich; Joshi, Devwrat Omkar; Murooka, Takayuki; Tanaka, Kazutoshi; Hamaya, Masashi; Ijiri, Yoshihisa
- [Peer-Assisted Robotic Learning: A Data-Driven Collaborative Learning Approach for Cloud Robotic Systems](#) 4062
Liu, Boyi; Wang, Lujia; Chen, Xinquan; Huang, Lexiong; Han, Dong; Xu, Cheng-Zhong
- [Imitation Learning of Hierarchical Driving Model: From Continuous Intention to Continuous Trajectory](#) 4071
Wang, Yunkai; Zhang, Dongkun; Wang, Jingke; Chen, Zexi; Li, Yuehua; Wang, Yue; Xiong, Rong

Session TuCT16 : Learning and Optimization

- [Evolvable Motion-Planning Method Using Deep Reinforcement Learning](#) 4079
Nishi, Kaichiro; Nakasu, Nobuaki
- [Learning Sequences of Manipulation Primitives for Robotic Assembly](#) 4086
Vuong, Nghia; Pham, Hung; Pham, Quang-Cuong
- [Data-Efficient Learning for Complex and Real-Time Physical Problem Solving Using Augmented Simulation](#) 4093
Ota, Kei; Jha, Devesh; Romeres, Diego; Vanbaar, Jeroen; Smith, Kevin; Semitsu, Takayuki; Oiki, Tomohiro; Sullivan, Alan; Nikovski, Daniel; Tenenbaum, Joshua
- [EGO-Swarm: A Fully Autonomous and Decentralized Quadrotor Swarm System in Cluttered Environments](#) 4101
Zhou, Xin; Zhu, Jiangchao; Zhou, Hongyu; Xu, Chao; Gao, Fei

Session TuAT15 : Learning for Motion Planning

- [Deep Imitation Learning for Autonomous Navigation in Dynamic Pedestrian Environments](#) 4108
Qin, Lei; Huang, Zefan; Zhang, Chen; Guo, Hongliang; Ang Jr, Marcelo H; Rus, Daniela
- [Learning from Demonstration without Demonstrations](#) 4116
Blau, Tom; Morere, Philippe; Francis, Gilad
- [Optimal Cooperative Maneuver Planning for Multiple Nonholonomic Robots in a Tiny Environment via Adaptive-scaling Constrained Optimization](#) 4123
Li, Bai; Zhang, Youmin; Acarman, Tankut; Ouyang, Yakun; Kong, Qi; Shao, Zhijiang

Optimization-Based Framework for Excavation Trajectory Generation 4131
Yang, Yajue; Long, Pinxin; Song, Xibin; Pan, Jia; Zhang, Liangjun

Session TuDT12 : Learning for Robotics I

Adversarial Training Is Not Ready for Robot Learning 4140
Lechner, Mathias; Hasani, Ramin; Grosu, Radu; Rus, Daniela; Henzinger, Thomas

Deep Learning on 3D Object Detection for Automatic Plug-In Charging Using a Mobile Manipulator 4148
Zhou, Zhengxue; Li, Leihui; Wang, Riwei; Zhang, Xuping

Decentralized Multi-Agent Pursuit Using Deep Reinforcement Learning 4155
De Souza Jr., Cristino; Newbury, Rhys; Cosgun, Akansel; Castillo, Pedro; Vidolov, Borislav; Kulic, Dana

Differentiable Physics Models for Real-World Offline Model-Based Reinforcement Learning 4163
Lutter, Michael; Silberbauer, Johannes; Watson, Joe; Peters, Jan

Session TuET12 : Learning for Robotics II

Sample-Efficient Reinforcement Learning in Robotic Table Tennis 4171
Tebbe, Jonas; Krauch, Lukas; Gao, Yapeng; Zell, Andreas

Super-Human Performance in Gran Turismo Sport Using Deep Reinforcement Learning 4179
Fuchs, Florian; Song, Yunlong; Kaufmann, Elia; Scaramuzza, Davide; Duerr, Peter

No Face-Touch: Exploiting Wearable Devices and Machine Learning for Gesture Detection 4187
Marullo, Sara; Lisini Baldi, Tommaso; Paolucci, Gianluca; D'Aurizio, Nicole; Prattichizzo, Domenico

Robot Learning with Crash Constraints 4194
Marco, Alonso; Baumann, Dominik; Khadiv, Majid; Hennig, Philipp; Righetti, Ludovic; Trimpe, Sebastian

Session TuAT14 : Learning in Control

Sample Efficient Reinforcement Learning via Model-Ensemble Exploration and Exploitation 4202
Yao, Yao; Xiao, Li; An, Zhicheng; Zhang, Wanpeng; Luo, Dijun

Dreaming: Model-Based Reinforcement Learning by Latent Imagination without Reconstruction 4209
Okada, Masashi; Taniguchi, Tadahiro

A Variational Infinite Mixture for Probabilistic Inverse Dynamics Learning 4216
Abdulsamad, Hany; Nickl, Peter; Klink, Pascal; Peters, Jan

Model-Based Domain Randomization of Dynamics System with Deep Bayesian Locally Linear Embedding 4223

Park, J. hyeon; Park, Sungyong; Kim, H. Jin

Session TuBT15 : Learning in Robotics and Automation I

- [Learning Spatial Context with Graph Neural Network for Multi-Person Pose Grouping](#) 4230
Lin, Jiahao; Lee, Gim Hee
- [Automatic Hanging Point Learning from Random Shape Generation and Physical Function Validation](#) 4237
Takeuchi, Kosuke; Yanokura, Iori; Kakiuchi, Yohei; Okada, Kei; Inaba, Masayuki
- [Gaze-based dual resolution deep imitation learning for high-precision dexterous robot manipulation](#) 4244
Kim, Heecheol; Ohmura, Yoshiyuki; Kuniyoshi, Yasuo
- [Graph Convolutional Network Based Configuration Detection for Freeform Modular Robot Using Magnetic Sensor Array](#) 4252
Tu, Yuxiao; Liang, Guanqi; Lam, Tin Lun

Session TuCT15 : Learning in Robotics and Automation II

- [PVStereo: Pyramid Voting Module for End-To-End Self-Supervised Stereo Matching](#) 4259
Wang, Hengli; Fan, Rui; Cai, Peide; Liu, Ming
- [Embedding Symbolic Temporal Knowledge into Deep Sequential Models](#) 4267
Xie, Yaqi; Zhou, Fan; Soh, Harold
- [Multi-Modal Mutual Information \(MuMMI\) Training for Robust Self-Supervised Deep Reinforcement Learning](#) 4274
Chen, Kaiqi; Lee, Yong; Soh, Harold
- [Linguistic Descriptions of Human Motion with Generative Adversarial Seq2Seq Learning](#) 4281
Goutsu, Yusuke; Inamura, Tetsunari

Session WeBT14 : Learning in Robotics and Automation III

- [MDANet: Multi-Modal Deep Aggregation Network for Depth Completion](#) 4288
Ke, Yanjie; Li, Kun; Yang, Wei; Xu, Zhenbo; Hao, Dayang; Huang, Liusheng; Wang, Gang
- [GPR: Grasp Pose Refinement Network for Cluttered Scenes](#) 4295
Wei, Wei; Luo, Yongkang; Li, Fuyu; Xu, Guagnyun; Zhong, Jun; Li, Wanyi; Wang, Peng
- [Diversity-Aware Label Distribution Learning for Microscopy Auto Focusing](#) 4303
Zhang, Chuyan; Gu, Yun; Yang, Jie; Yang, Guang-Zhong
- [Contour Primitive of Interest Extraction Network Based on One-Shot Learning for Object-Agnostic Vision Measurement](#) 4311

Qin, Fangbo; Qin, Jie; Huang, Siyu; Xu, De

Session WeCT14 : Learning in Robotics and Automation IV

UMLE: Unsupervised Multi-Discriminator Network for Low Light Enhancement 4318
Qu, Yangyang; Chen, Kai; Liu, Chao; Ou, Yongsheng

Unsupervised Learning of 3D Scene Flow from Monocular Camera 4325
Wang, Guangming; Tian, Xiaoyu; Ding, Ruiqi; Wang, Hesheng

Monocular 3D Detection with Geometric Constraints Embedding and Semi-Supervised Training 4332
Li, Peixuan; Huaici, Zhao

Deep3DRanker: A Novel Framework for Learning to Rank 3D Models with Self-Attention in Robotic Vision 4341
Lo, Po Wen; Guo, Yao; Sun, Yingnan; Qiu, Jianing; Lo, Benny Ping Lai

FGR: Frustum-Aware Geometric Reasoning for Weakly Supervised 3D Vehicle Detection 4348
Wei, Yi; Su, Shang; Lu, Jiwen; Zhou, Jie

Session TuFT12 : Learning to Predict

Combining Events and Frames Using Recurrent Asynchronous Multimodal Networks for Monocular Depth Prediction 4355
Gehrig, Daniel; Rüegg, Michelle; Hidalgo Carrio, Javier; Gehrig, Mathias; Scaramuzza, Davide

Predicting Disparity Distributions 4363
Häger, Gustav; Persson, Mikael; Felsberg, Michael

Scoring Graspability Based on Grasp Regression for Better Grasp Prediction 4370
Depierre, Amaury; Dellandrea, Emmanuel; Chen, Liming

MonoSOD: Monocular Salient Object Detection Based on Predicted Depth 4377
Dimas, George; Gatoula, Panagiota - Chrysovalantou; Iakovidis, Dimitris

Session TuHT11 : Learning-Based Control

Efficient Reachability Analysis of Closed-Loop Systems with Neural Network Controllers 4384
Everett, Michael; Habibi, Golnaz; How, Jonathan Patrick

Reachability-Based Trajectory Safeguard (RTS): A Safe and Fast Reinforcement Learning Safety Layer for Continuous Control 4391
Shao, Yifei; Chen, Chao; Kousik, Shreyas; Vasudevan, Ram

Neural Identification for Control 4399
Saha, Priyabrata; Egerstedt, Magnus; Mukhopadhyay, Saibal

Learning Variable Impedance Control Via Inverse Reinforcement Learning for Force-Related Tasks 4407
Zhang, Xiang; Sun, Liting; Kuang, Zhian; Tomizuka, Masayoshi

Session TuGT12 : Learning-Based Control I

Interactive Learning of Temporal Features for Control 4415
Pérez-Dattari, Rodrigo; Celemin, Carlos; Franzese, Giovanni; Ruiz-del-Solar, Javier; Kober, Jens

A Fully Spiking Neural Control System Based on Cerebellar Predictive Learning for Sensor-Guided Robots 4423
Zahra, Omar; Navarro-Alarcon, David; Tolu, Silvia

Learning to Steer a Locomotion Contact Planner 4430
Chemin, Jason; Fernbach, Pierre; Song, Daeun; Saurel, Guilhem; Mansard, Nicolas; Tonneau, Steve

Learning Shape Control of Elastoplastic Deformable Linear Objects 4438
Laezza, Rita; Karayiannidis, Yiannis

Session TuDT11 : Learning-Based Control II

Leveraging Forward Model Prediction Error for Learning Control 4445
Bechtle, Sarah; Hammoud, Bilal; Rai, Akshara; Meier, Franziska; Righetti, Ludovic

GoSafe: Globally Optimal Safe Robot Learning 4452
Baumann, Dominik; Marco, Alonso; Turchetta, Matteo; Trimpe, Sebastian

Distilling a Hierarchical Policy for Planning and Control Via Representation and Reinforcement Learning 4459
Ha, Jung-Su; Park, Young-Jin; Chae, Hyeok-Joo; Park, Soon-Seo; Choi, Han-Lim

Active Model Learning Using Informative Trajectories for Improved Closed-Loop Control on Real Robots 4467
Zhang, Weixuan; Tognon, Marco; Ott, Lionel; Siegwart, Roland; Nieto, Juan

Session TuET11 : Learning-Based Grasping

Robot Learning of 6 DoF Grasping Using Model-Based Adaptive Primitives 4474
Berscheid, Lars; Friedrich, Christian; Kroeger, Torsten

Conditional StyleGAN for Grasp Generation 4481
Patzelt, Florian; Haschke, Robert; Ritter, Helge Joachim

Go Fetch! - Dynamic Grasps Using Boston Dynamics Spot with External Robotic Arm 4488
Zimmermann, Simon; Poranne, Roi; Coros, Stelian

Multi-FinGAN: Generative Coarse-To-Fine Sampling of Multi-Finger Grasps 4495

Lundell, Jens; Corona, Enric; Nguyen Le, Tran; Verdoja, Francesco; Weinzaepfel, Philippe; Rogez, Gregory; Moreno-Noguer, Francesc; Kyrki, Ville

Session TuBT14 : Learning-Based Human-Robot Interaction

[Machine Learning-Based Human-Following System: Following the Predicted Position of a Walking Human](#) 4502

Wang, Ansheng; Makino, Yasutoshi; Shinoda, Hiroyuki

[Anytime Game-Theoretic Planning with Active Reasoning About Humans' Latent States for Human-Centered Robots](#) 4509

Tian, Ran; Sun, Liting; Tomizuka, Masayoshi; Isele, David

[Momentum Observer-Based Collision Detection Using LSTM for Model Uncertainty Learning](#) 4516

Lim, Daegyul; Kim, Donghyeon; Park, Jaeheung

[Deep Learning and Mixed Reality to Autocomplete Teleoperation](#) 4523

Kassem Zein, Mohammad; Al Aawar, Majd; Asmar, Daniel; Elhajj, Imad

Session WeAT10 : Learning-Based Manipulation I

[Mechanical Intelligence for Adaptive Precision Grasp](#) 4530

Lu, Qiuji; Baron, Nicholas; Bai, Guochao; Rojas, Nicolas

[Learning Multi-Object Dense Descriptor for Autonomous Goal-Conditioned Grasping](#) 4537

Yang, Shuo; Zhang, Wei; Song, Ran; Cheng, Jiyu; Li, Yibin

[Hierarchical Learning from Demonstrations for Long-Horizon Tasks](#) 4545

Li, Boyao; Li, Jiayi; Lu, Tao; Cai, Yinghao; Wang, Shuo

[How to Select and Use Tools? : Active Perception of Target Objects Using Multimodal Deep Learning](#) 4552

Saito, Namiko; Ogata, Tetsuya; Funabashi, Satoshi; Mori, Hiroki; Sugano, Shigeki

Session TuHT10 : Learning-Based Manipulation II

[Robots of the Lost Arc: Self-Supervised Learning to Dynamically Manipulate Fixed-Endpoint Cables](#) 4560

Zhang, Harry Haolun; Ichnowski, Jeffrey; Seita, Daniel; Wang, Jonathan; Huang, Huang; Goldberg, Ken

[Learning to Rearrange Deformable Cables, Fabrics, and Bags with Goal-Conditioned Transporter Networks](#) 4568

Seita, Daniel; Florence, Peter; Thompson, Jonathan; Coumans, Erwin; Sindhwani, Vikas; Goldberg, Ken; Zeng, Andy

[A Joint Network for Grasp Detection Conditioned on Natural Language Commands](#) 4576

Chen, Yiye; Xu, Ruinian; Lin, Yunzhi; Vela, Patricio

ReLMoGen: Integrating Motion Generation in Reinforcement Learning for Mobile Manipulation 4583
Xia, Fei; Li, Chengshu; Martín-Martín, Roberto; Litany, Or; Toshev, Alexander; Savarese, Silvio

Session TuFT11 : Learning-Based Manipulation III

Learning Behavior Trees with Genetic Programming in Unpredictable Environments 4591
Iovino, Matteo; Styrud, Jonathan; Falco, Pietro; Smith, Claes Christian

Active Learning of Bayesian Probabilistic Movement Primitives 4598
Kulak, Thibaut; Girgin, Hakan; Odobez, Jean-Marc; Calinon, Sylvain

Learning Efficient Constraint Graph Sampling for Robotic Sequential Manipulation 4606
Ortiz-Haro, Joaquim; Hartmann, Valentin Noah; Oguz, Ozgur S.; Toussaint, Marc

Coarse-to-Fine Imitation Learning: Robot Manipulation from a Single Demonstration 4613
Johns, Edward

Session TuCT14 : Learning-Based Manipulation IV

AdaGrasp: Learning a Gripper-Aware Grasping Policy 4620
Xu, Zhenjia; Qi, Beichun; Agrawal, Shubham; Song, Shuran

TRANS-AM: Transfer Learning by Aggregating Dynamics Models for Soft Robotic Assembly 4627
Tanaka, Kazutoshi; Yonetani, Ryo; Hamaya, Masashi; Lee, Robert; von Drigalski, Felix Wolf Hans Erich; Ijiri, Yoshihisa

Learning Deep Nets for Gravitational Dynamics with Unknown Disturbance through Physical Knowledge Distillation: Initial Feasibility Study 4634
Lin, Hongbin; Gao, Qian; Chu, Xiangyu; Dou, Qi; Deguet, Anton; Kazanzides, Peter; Au, K. W. Samuel

Learning to Place Objects Onto Flat Surfaces in Upright Orientations 4642
Newbury, Rhys; He, Kerry; Cosgun, Akansel; Drummond, Tom

Session TuGT11 : Learning-Based Manipulation IX

Efficient Self-Supervised Data Collection for Offline Robot Learning 4650
Endrawis, Shadi; Leibovich, Gal; Jacob, Guy; Novik, Gal; Tamar, Aviv

Total Singulation with Modular Reinforcement Learning 4657
Sarantopoulos, Iason; Kiatos, Marios; Doulgeri, Zoe; Malassiotis, Sotiris

Active Inference for Integrated State-Estimation, Control, and Learning 4665
Baioumy, Mohamed; Duckworth, Paul; Lacerda, Bruno; Hawes, Nick

Robot Program Parameter Inference Via Differentiable Shadow Program Inversion 4672
Alt, Benjamin; Katic, Darko; Jäkel, Rainer; Bozcuoglu, Asil Kaan; Beetz, Michael

Session TuT10 : Learning-Based Manipulation V

- [Learning Multimodal Contact-Rich Skills from Demonstrations without Reward Engineering](#) 4679
Balakuntala Srinivasa Murthy, Mythra Varun; Kaur, Upinder; Ma, Xin; Voyles, Richard; Wachs, Juan
- [Keep It Simple: Data-Efficient Learning for Controlling Complex Systems with Simple Models](#) 4686
Power, Thomas; Berenson, Dmitry
- [DIPN: Deep Interaction Prediction Network with Application to Clutter Removal](#) 4694
Huang, Baichuan; Han, Shuai D.; Boularias, Abdeslam; Yu, Jingjin
- [Toward Agile Maneuvers in Highly Constrained Spaces: Learning from Hallucination](#) 4702
Xiao, Xuesu; Liu, Bo; Warnell, Garrett; Stone, Peter

Session TuDT10 : Learning-Based Manipulation VI

- [Learning Conditional Postural Synergies for Dexterous Hands: A Generative Approach Based on Variational Auto-Encoders and Conditioned on Object Size and Category](#) 4710
Dimou, Dimitrios; Santos-Victor, José; Moreno, Plinio
- [ReForm: A Robot Learning Sandbox for Deformable Linear Object Manipulation](#) 4717
Laezza, Rita; Gieselmann, Robert; Pokorny, Florian T.; Karayiannidis, Yiannis
- [Adversarial Imitation Learning with Trajectorial Augmentation and Correction](#) 4724
Antotsiou, Dafni; Ciliberto, Carlo; Kim, Tae-Kyun
- [Learning Reachable Manifold and Inverse Mapping for a Redundant Robot Manipulator](#) 4731
Kim, Seungsu; Perez, Julien

Session TuAT13 : Learning-Based Manipulation VII

- [Living Object Grasping Using Two-Stage Graph Reinforcement Learning](#) 4738
Hu, Zhe; Zheng, Yu; Pan, Jia
- [Reinforcement Learning for Robotic Assembly Using Non-Diagonal Stiffness Matrix](#) 4746
Oikawa, Masahide; Kusakabe, Tsukasa; Kutsuzawa, Kyo; Sakaino, Sho; Tsuji, Toshiaki
- [Uncertainty-Aware Contact-Safe Model-Based Reinforcement Learning](#) 4754
Kuo, Cheng-Yu; Schaarschmidt, Andreas; Cui, Yunduan; Asfour, Tamim; Matsubara, Takamitsu
- [Reducing the Deployment-Time Inference Control Costs of Deep Reinforcement Learning Agents via an Asymmetric Architecture](#) 4762
Chang, Chin-Jui; Chu, Yu-Wei; Ting, Chao-Hsien; Liu, Hao Kang; Hong, Zhang-Wei; Lee, Chun-Yi

Session TuJT10 : Learning-Based Manipulation VIII

- ECNNs: Ensemble Learning Methods for Improving Planar Grasp Quality Estimation 4769
Alladkani, Fadi; Akl, James; Calli, Berk
- Causal Reasoning in Simulation for Structure and Transfer Learning of Robot Manipulation Policies 4776
Lee, Timothy Edward; Zhao, Jialiang; Sawhney, Amrita; Girdhar, Siddharth; Kroemer, Oliver
- SuPer Deep: A Surgical Perception Framework for Robotic Tissue Manipulation Using Deep Learning for Feature Extraction 4783
Lu, Jingpei; Sreekumaran Nair Jayakumari, Ambareesh; Richter, Florian; Li, Yang; Yip, Michael C.
- An Affordance Keypoint Detection Network for Robot Manipulation 4790
Xu, Ruinian; Chu, Fu-Jen; Tang, Chao; Liu, Weiyu; Vela, Patricio

Session TuET10 : Learning-Based Motion Planning

- Learning Robot Trajectories Subject to Kinematic Joint Constraints 4799
Kiemel, Jonas; Kroeger, Torsten
- Enhancing Lattice-Based Motion Planning with Introspective Learning and Reasoning 4806
Tiger, Mattias; Bergström, David; Norrstig, Andreas; Heintz, Fredrik
- Learning Functionally Decomposed Hierarchies for Continuous Control Tasks with Path Planning 4815
Christen, Sammy; Jendele, Lukas; Aksan, Emre; Hilliges, Otmar
- Self-Imitation Learning by Planning 4823
Luo, Sha; Kasaei, Hamidreza; Schomaker, Lambert R.B.

Session TuIT11 : Learning-Based Motion Planning I

- Learning and Planning for Temporally Extended Tasks in Unknown Environments 4830
Bradley, Christopher; Pacheck, Adam; Stein, Gregory; Castro, Sebastian; Kress-Gazit, Hadas; Roy, Nicholas
- Behavior Tree Learning for Robotic Task Planning through Monte Carlo DAG Search Over a Formal Grammar 4837
Scheide, Emily; Best, Graeme; Hollinger, Geoffrey
- Improving Off-Road Planning Techniques with Learned Costs from Physical Interactions 4844
Sivaprakasam, Matthew; Triest, Samuel; Wang, Wenshan; Yin, Peng; Scherer, Sebastian

Session TuJT11 : Learning-Based Motion Planning II

Planning with Learned Dynamics: Probabilistic Guarantees on Safety and Reachability via Lipschitz Constants	4851
<i>Knuth, Craig; Chou, Glen; Ozay, Necmiye; Berenson, Dmitry</i>	
Single-Query Path Planning Using Sample-Efficient Probability Informed Trees	4859
<i>Rakita, Daniel; Mutlu, Bilge; Gleicher, Michael</i>	
Learning from Imperfect Demonstrations from Agents with Varying Dynamics	4867
<i>Cao, Zhangjie; Sadigh, Dorsa</i>	
Perceive, Attend, and Drive: Learning Spatial Attention for Safe Self-Driving	4875
<i>Wei, Bob; Ren, Mengye; Zeng, Wenyan; Liang, Ming; Yang, Bin; Urtasun, Raquel</i>	
Session TuKT11 : Learning-Based Motion Planning III	
Robotic Information Gathering Using Semantic Language Instructions	4882
<i>Rankin, Ian; McCammon, Seth; Hollinger, Geoffrey</i>	
MPC-MPNet: Model-Predictive Motion Planning Networks for Fast, Near-Optimal Planning under Kinodynamic Constraints	4889
<i>Li, Linjun; Miao, Yinglong; Qureshi, Ahmed Hussain; Yip, Michael C.</i>	
Deep Structured Reactive Planning	4897
<i>Liu, Jerry; Zeng, Wenyan; Urtasun, Raquel; Yumer, Ersin</i>	
Learning a Centroidal Motion Planner for Legged Locomotion	4905
<i>Viereck, Julian; Righetti, Ludovic</i>	
Session TuHT9 : Legged Robots I	
Optimal Estimation of the Centroidal Dynamics of Legged Robots	4912
<i>Bailly, François; Carpentier, Justin; Soueres, Philippe</i>	
A Unified Optimization Framework and New Set of Performance Metrics for Robot Leg Design	4919
<i>Rezazadeh, Siavash; Semasinghe, Chathura Lakshan; Taylor, Drake</i>	
A Novel Model Predictive Control Framework Using Dynamic Model Decomposition Applied to Dynamic Legged Locomotion	4926
<i>Shen, Junjie; Hong, Dennis</i>	
Generating Continuous Motion and Force Plans in Real-Time for Legged Mobile Manipulation	4933
<i>Ewen, Parker; Sleiman, Jean-Pierre; Chen, Yuxin; Lu, Wei-Chun; Hutter, Marco; Vasudevan, Ram</i>	
Session TuIT9 : Legged Robots II	
Planning in Learned Latent Action Spaces for Generalizable Legged Locomotion	4940
<i>Li, Tianyu; Calandra, Roberto; Pathak, Deepak; Tian, Yuandong; Meier, Franziska; Rai, Akshara</i>	

The Fluid Field SLIP Model: Terrestrial-Aquatic Dynamic Legged Locomotion <i>Austin, Max; Clark, Jonathan</i>	4948
Dynamics Randomization Revisited: A Case Study for Quadrupedal Locomotion <i>Xie, Zhaoming; Da, Xingye; van de Panne, Michiel; Babich, Buck; Garg, Animesh</i>	4955
Coupled Control Lyapunov Functions for Interconnected Systems, with Application to Quadrupedal Locomotion <i>Ma, Wenlong; Csomay-Shanklin, Noel; Kolathaya, Shishir; Akbari Hamed, Kaveh; Ames, Aaron</i>	4962
Session TuFT10 : Legged Robots III	
Balancing on a Springy Leg <i>Gamba, Juan David; Featherstone, Roy</i>	4970
Gyrobot: Nonanthropomorphic Stabilization for a Biped <i>Mikhalkov, Nikita; Prutskiy, Alexey; Sechennev, Semyon; Kazakov, Dmitry; Simulin, Aleksei; Sokolov, Dmitry; Riadchikov, Igor</i>	4976
Feasible Region: An Actuation-Aware Extension of the Support Region <i>Orsolino, Romeo; Focchi, Michele; Caron, Stephane; Raiola, Gennaro; Barasuol, Victor; Caldwell, Darwin G.; Semini, Claudio</i>	4983
A Novel Method for Computing the 3D Friction Cone Using Complimentary Constraints <i>Pretorius, Dean; Fisher, Callen</i>	5000
Session TuGT10 : Legged Robots IV	
Implementation of a Reactive Walking Controller for the New Open-Hardware Quadruped Solo-12 <i>Léziart, Pierre-Alexandre; Flayols, Thomas; Grimminger, Felix; Mansard, Nicolas; Soueres, Philippe</i>	5007
Imitation Learning from MPC for Quadrupedal Multi-Gait Control <i>Reske, Alexander; Carius, Jan; Ma, Yuntao; Farshidian, Farbod; Hutter, Marco</i>	5014
Comparison of Predictive Controllers for Locomotion and Balance Recovery of Quadruped Robots <i>Corbères, Thomas; Flayols, Thomas; Léziart, Pierre-Alexandre; Budhiraja, Rohan; Soueres, Philippe; Saurel, Guilhem; Mansard, Nicolas</i>	5021
Locomotion Adaptation in Heavy Payload Transportation Tasks with the Quadruped Robot CENTAURO <i>Zhao, Xinyuan; You, Yangwei; Laurenzi, Arturo; Kashiri, Navvab; Tsagarakis, Nikos</i>	5028
Session WeCT10 : LiDAR-Based Localization I	
Elastic and Efficient LiDAR Reconstruction for Large-Scale Exploration Tasks	5035

Wang, Yiduo; Funk, Nils; Ramezani, Milad; Papatheodorou, Sotiris; Popovic, Marija; Camurri, Marco; Leutenegger, Stefan; Fallon, Maurice

[KFS-LIO: Key-Feature Selection for Lightweight Lidar Inertial Odometry](#) 5042
Li, Wei; Hu, Yu; Han, Yinhe; Li, Xiaowei

[CamVox: A Low-Cost and Accurate Lidar-Assisted Visual SLAM System](#) 5049
Zhu, Yuewen; Zheng, Chunran; Yuan, Chongjian; Huang, Xu; Hong, Xiaoping

[PSF-LO: Parameterized Semantic Features Based Lidar Odometry](#) 5056
Chen, Guibin; Wang, Bosheng; Wang, Xiaoliang; Deng, Huanjun; Wang, Bing; Zhang, Shuo

Session TuBT13 : LiDAR-Based Localization II

[LiDAR-Based Initial Global Localization Using Two-Dimensional \(2D\) Submap Projection Image \(SPI\)](#) 5063
Li, Yanhao; Li, Hao

[Automatic Hyper-Parameter Tuning for Black-Box LiDAR Odometry](#) 5069
Koide, Kenji; Yokozuka, Masashi; Oishi, Shuji; Banno, Atsuhiko

[Locus: LiDAR-based Place Recognition Using Spatiotemporal Higher-Order Pooling](#) 5075
Vidanapathirana, Kavisha; Moghadam, Peyman; Harwood, Ben; Zhao, Muming; Sridharan, Sridha; Fookes, Clinton

[Automated Extrinsic Calibration for 3D LiDARs with Range Offset Correction Using an Arbitrary Planar Board](#) 5082
Kim, Junha; Kim, Changhyeon; Han, Youngsoo; Kim, H. Jin

Session TuKT10 : Localization and Control

[Model Predictive Control for Cooperative Hunting in Obstacle Rich and Dynamic Environments](#) 5089
Liao, Jacky; Liu, Che; Liu, Hugh H.-T.

[Instance-Aware Predictive Navigation in Multi-Agent Environments](#) 5096
Cao, Jinkun; Wang, Xin; Darrell, Trevor; Yu, Fisher

[SLAAM: Simultaneous Localization and Additive Manufacturing](#) 5103
Li, Jinbo; Aubin-Fournier, Pierre-Lucas; Skonieczny, Krzysztof

[SimNet: Learning Reactive Self-Driving Simulations from Real-World Observations](#) 5119
Bergamini, Luca; Ye, Yawei; Scheel, Oliver; Chen, Long; Hu, Chih; Del Pero, Luca; Osin' ski, Błażej; Grimmett, Hugo; Ondruska, Peter

Session TuDT9 : Localization and Estimation

[MonStereo: When Monocular and Stereo Meet at the Tail of 3D Human Localization](#) 5126

Bertoni, Lorenzo; Kreiss, Sven; Mordan, Taylor; Alahi, Alexandre

[Enabling Spatio-Temporal Aggregation in Birds-Eye-View Vehicle Estimation](#) 5133

Saha, Avishkar; Mendez Maldonado, Oscar Alejandro; Russell, Chris; Bowden, Richard

[Multimodal Scale Consistency and Awareness for Monocular Self-Supervised Depth Estimation](#) 5140

Chawla, Hemang; Varma, Arnav; Arani, Elahe; Zonooz, Bahram

[There and Back Again: Self-Supervised Multispectral Correspondence Estimation](#) 5147

Walters, Celyn; Mendez Maldonado, Oscar Alejandro; Johnson, Mark; Bowden, Richard

Session TuET9 : Localization and Mapping I

[Deep Compression for Dense Point Cloud Maps](#) 5155

Wiesmann, Louis; Milioto, Andres; Chen, Xieyuanli; Stachniss, Cyrill; Behley, Jens

[Exploration of Large Outdoor Environments Using Multi-Criteria Decision Making](#) 5163

Lehner, Hannah; Schuster, Martin J.; Bodenmueller, Tim; Triebel, Rudolph

[SD-DefSLAM: Semi-Direct Monocular SLAM for Deformable and Intracorporeal Scenes](#) 5170

Gomez, Juanjo; Lamarca, Jose; Morlana, Javier; Tardos, Juan D.; Montiel, J.M.M

[Hough2Map – Iterative Event-Based Hough Transform for High-Speed Railway Mapping](#) 5178

Tschopp, Florian; von Einem, Cornelius; Cramariuc, Andrei; Hug, David; Palmer, Andrew William; Siegwart, Roland; Chli, Margarita; Nieto, Juan

Session TuJT9 : Localization and Mapping II

[3D Motion Capture of an Unmodified Drone with Single-Chip Millimeter Wave Radar](#) 5186

Zhao, Peijun; Lu, Chris Xiaoxuan; Wang, Bing; Trigoni, Niki; Markham, Andrew

[Zero-Shot Reinforcement Learning on Graphs for Autonomous Exploration Under Uncertainty](#) 5193

Chen, Fanfei; Szenher, Paul; Huang, Yewei; Wang, Jinkun; Shan, Tixiao; Bai, Shi; Englot, Brendan

[Fast Uncertainty Quantification for Deep Object Pose Estimation](#) 5200

Shi, Guanya; Zhu, Yifeng; Tremblay, Jonathan; Birchfield, Stan; Ramos, Fabio; Anandkumar, Anima; Zhu, Yuke

[Mesh Reconstruction from Aerial Images for Outdoor Terrain Mapping Using Joint 2D-3D Learning](#) 5208

Feng, Qiaojun; Atanasov, Nikolay

Session WeAT2 : Localization and Mapping III

[Tightly-Coupled Multi-Sensor Fusion for Localization with LiDAR Feature Maps](#) 5215

Pan, Liangliang; Ji, Kaijin; Zhao, Ji

Greedy-Based Feature Selection for Efficient LiDAR SLAM	5222
<i>Jiao, Jianhao; Zhu, Yilong; Ye, Haoyang; Huang, Huaiyang; Yun, Peng; Jiang, Lingxin; Wang, Lujia; Liu, Ming</i>	
Road Mapping and Localization Using Sparse Semantic Visual Features	5229
<i>Cheng, Wentao; Yang, Sheng; Zhou, Maomin; Liu, Ziyuan; Chen, Yiming; Li, Mingyang</i>	
Retrieval and Localization with Observation Constraints	5237
<i>Zhou, Yuhao; Fan, Huanhuan; Gao, Shuang; Yang, Yuchen; Zhang, Xudong; Li, Jijunnan; Guo, Yandong</i>	
Session TuCT13 : Localization and Mapping IV	
MSTSL: Multi-Sensor Based Two-Step Localization in Geometrically Symmetric Environments	5245
<i>Wu, Zhenyu; Yue, Yufeng; Wen, Mingxing; Zhang, Jun; Peng, Guohao; Wang, Danwei</i>	
Range-Focused Fusion of Camera-IMU-UWB for Accurate and Drift-Reduced Localization	5252
<i>Nguyen, Thien Hoang; Nguyen, Thien-Minh; Xie, Lihua</i>	
Interactive Planning for Autonomous Urban Driving in Adversarial Scenarios	5261
<i>Luo, Yuanfu; Meghiani, Malika; Ho, Qi Heng; Hsu, David; Rus, Daniela</i>	
Kernel-Based 3-D Dynamic Occupancy Mapping with Particle Tracking	5268
<i>Min, Youngjae; Kim, Do-Un; Choi, Han-Lim</i>	
Session WeAT16 : Localization and Mapping IX	
Robust Dual Quadric Initialization for Forward-Translating Camera Movements	5275
<i>Chen, Shujia; Song, Shuangfu; Zhao, Junqiao; Feng, Tiantian; Ye, Chen; Xiong, Lu; Li, Deyi</i>	
Robust Motion Averaging under Maximum Correntropy Criterion	5283
<i>Zhu, Jihua; Hu, Jie; Lu, Huimin; Chen, Badong; Li, Zhongyu; Li, Yaochen</i>	
Robust Semantic Map Matching Algorithm Based on Probabilistic Registration Model	5289
<i>Zhang, Qingxiang; Wang, Meiling; Yue, Yufeng</i>	
Accurate and Robust Scale Recovery for Monocular Visual Odometry Based on Plane Geometry	5296
<i>Tian, Rui; Zhang, Yunzhou; Zhu, Delong; Shiwen, Liang; Coleman, Sonya; Kerr, Dermot</i>	
Session TuKT9 : Localization and Mapping V	
Polarimetric Monocular Dense Mapping Using Relative Deep Depth Prior	5303
<i>Shakeri, Moein; Loo, Shing Yan; Zhang, Hong; Hu, Kangkang</i>	

Learned Uncertainty Calibration for Visual Inertial Localization	5311
<i>Tsuei, Stephanie; Soatto, Stefano; Tabuada, Paulo; Milam, Mark B.</i>	
CLEAR: A Consistent Lifting, Embedding, and Alignment Rectification Algorithm for Multiview Data Association	5318
<i>Fathian, Kaveh; Khosoussi, Kasra; Tian, Yulun; Lusk, Parker C.; How, Jonathan Patrick</i>	
Distributed Client-Server Optimization for SLAM with Limited On-Device Resources	5336
<i>Zhang, Yetong; Hsiao, Ming; Zhao, Yipu; Dong, Jing; Engel, Jakob</i>	
Session WeAT12 : Localization and Mapping VI	
Multi-Parameter Optimization for a Robust RGB-D SLAM System	5343
<i>Wang, Yizhao; Zhu, Xiaoxiao; Guohan, He; Cao, Qixin</i>	
Invariant EKF Based 2D Active SLAM with Exploration Task	5350
<i>Xu, Mengya; Song, Yang; Chen, Yongbo; Huang, Shoudong; Hao, Qi</i>	
2D Laser SLAM with Closed Shape Features: Fourier Series Parameterization and Submap Joining	5357
<i>Zhao, Jiaheng; Li, Tiancheng; Yang, Tong; Zhao, Liang; Huang, Shoudong</i>	
A Switching-Coupled Backend for Simultaneous Localization and Dynamic Object Tracking	5365
<i>Liu, Yuzhen; Liu, Jiacheng; Hao, Yun; Deng, Bowen; Meng, Ziyang</i>	
Session TuAT12 : Localization and Mapping VII	
B-Splines for Purely Vision-Based Localization and Mapping on Non-Holonomic Ground Vehicles	5374
<i>Huang, Kun; Wang, Yifu; Kneip, Laurent</i>	
Robust SRIF-Based LiDAR-IMU Localization for Autonomous Vehicles	5381
<i>Ouyang, Zhanpeng; Li, Kun; Hu, Lan; Hao, Dayang; Kneip, Laurent</i>	
Structure Reconstruction Using Ray-Point-Ray Features: Representation and Camera Pose Estimation	5388
<i>He, Yijia; Liu, Xiangyue; Liu, Xiao; Zhao, Ji</i>	
Lightweight 3-D Localization and Mapping for Solid-State LiDAR	5395
<i>Wang, Han; Wang, Chen; Xie, Lihua</i>	
Session TuHT8 : Localization and Mapping VIII	
Simultaneous Estimation and Modeling of Robotic Systems with Non-Gaussian State Belief	5403
<i>Steckenrider, J. Josiah</i>	
Efficient Online Calibration for Autonomous Vehicle's Longitudinal Dynamical System: A Gaussian Model Approach	5410
<i>Wang, Shihao; Canqiang, Deng; Qi, Qingjie</i>	

Fuzzing Mobile Robot Environments for Fast Automated Crash Detection 5417
Woodlief, Trey; Elbaum, Sebastian; Sulluvan, Kevin

Multimodal Safety-Critical Scenarios Generation for Decision-Making Algorithms Evaluation 5424
Ding, Wenhao; Chen, Baiming; Li, Bo; Kim, Ji Eun; Zhao, Ding

Session TuBT12 : Localization and Mapping X

Intelligent Reference Curation for Visual Place Recognition Via Bayesian Selective Fusion 5432
Molloy, Timothy L.; Fischer, Tobias; Milford, Michael J; Nair, Girish

Accelerating Probabilistic Volumetric Mapping Using Ray-Tracing Graphics Hardware 5440
Min, Heajung; Han, Kyung Min; Kim, Young J.

ERASOR: Egocentric Ratio of Pseudo Occupancy-Based Dynamic Object Removal for Static 3D Point Cloud Map Building 5446
Lim, Hyungtae; Hwang, Sungwon; Myung, Hyun

UVIP: Robust UWB Aided Visual-Inertial Positioning System for Complex Indoor Environments 5454
Yang, Bo; Li, Jun; Zhang, Hong

Session TuIT8 : Localization and Mapping XI

Do We Need to Compensate for Motion Distortion and Doppler Effects in Spinning Radar Navigation? 5461
Burnett, Keenan; Schoellig, Angela P.; Barfoot, Timothy

Robust Place Recognition Using an Imaging Lidar 5469
Shan, Tixiao; Englot, Brendan; Duarte, Fábio; Ratti, Carlo; Rus, Daniela

High-Speed Robot Navigation Using Predicted Occupancy Maps 5476
Katyal, Kapil; Polevoy, Adam; Moore, Joseph; Knuth, Craig; Popek, Katie

Session TuCT12 : Localization and Mapping XII

Signal Temporal Logic Synthesis As Probabilistic Inference 5483
Lee, Ki Myung Brian; Yoo, Chanyeol; Fitch, Robert

Bias Compensated UWB Anchor Initialization Using Information-Theoretic Supported Triangulation Points 5490
Blüml, Julian; Fornasier, Alessandro; Weiss, Stephan

Multiresolution Representations for Large-Scale Terrain with Local Gaussian Process Regression 5497
Liu, Xu; Li, Decai; He, Yuqing

DiSCO: Differentiable Scan Context with Orientation 5504
Xu, Xuecheng; Yin, Huan; Chen, Zexi; Li, Yuehua; Wang, Yue; Xiong, Rong

Session TuCT11 : Localization and Mapping XIII

FAST-LIO: A Fast, Robust LiDAR-Inertial Odometry Package by Tightly-Coupled Iterated Kalman Filter <i>Xu, Wei; Zhang, Fu</i>	5512
BALM: Bundle Adjustment for Lidar Mapping <i>Liu, Zheng; Zhang, Fu</i>	5520
Extrinsic Calibration of Multiple LiDARs of Small FoV in Targetless Environments <i>Liu, Xiyuan; Zhang, Fu</i>	5528
MOLTR: Multiple Object Localisation, Tracking and Reconstruction from Monocular RGB Videos <i>Li, Kejie; Rezatofighi, Hamid; Reid, Ian</i>	5536
Efficient Modification of the Upper Triangular Square Root Matrix on Variable Reordering <i>Elimelech, Khen; Indelman, Vadim</i>	5544

Session WeBT2 : Localization and Mapping: Dataset

VIODE: A Simulated Dataset to Address the Challenges of Visual-Inertial Odometry in Dynamic Environments <i>Minoda, Koji; Schilling, Fabian; Wüest, Valentin; Floreano, Dario; Yairi, Takehisa</i>	5552
A Multi-spectral Dataset for Evaluating Motion Estimation Systems <i>Dai, Weichen; Zhang, Yu; Chen, Shenzhou; Sun, Donglei; Kong, Da</i>	5560
PicoVO: A Lightweight RGB-D Visual Odometry Targeting Resource-Constrained IoT Devices <i>He, Yuquan; Wang, Ying; Liu, Cheng; Zhang, Lei</i>	5567
3D Surfel Map-Aided Visual Relocalization with Learned Descriptors <i>Ye, Haoyang; Huang, Huaiyang; Hutter, Marco; Sandy, Timothy; Liu, Ming</i>	5574

Session TuJT8 : Localization and Mapping: Distributed Systems

Invariant Extended Kalman Filtering Using Two Position Receivers for Extended Pose Estimation <i>Pavlassek, Natalia; Walsh, Alex; Forbes, James Richard</i>	5582
Compartmentalized Covariance Intersection: A Novel Filter Architecture for Distributed Localization <i>Wiktor, Adam; Rock, Stephen</i>	5589
Optimizing Non-Markovian Information Gain under Physics-Based Communication Constraints <i>Schack, Matthew; Rogers III, John G.; Han, Qi; Dantam, Neil</i>	5596
Towards Robust State Estimation by Boosting the Maximum Correntropy Criterion Kalman Filter with Adaptive Behaviors <i>Fakoorian, Seyed Abolfazl; Santamaria-Navarro, Angel; Lopez, Brett; Simon, Dan; Agha-mohammadi, Ali-akbar</i>	5603

Session TuFT9 : Localization and Mapping: LiDAR

- [Robust LiDAR Feature Localization for Autonomous Vehicles Using Geometric Fingerprinting on Open Datasets](#) 5610
Steinke, Nicolai; Ritter, Claas-Norman; Goehring, Daniel; Rojas, Raul
- [RADIATE: A Radar Dataset for Automotive Perception in Bad Weather](#) 5617
Sheeny, Marcel; De Pellegrin, Emanuele; Mukherjee, Saptarshi; Ahrabian, Alireza; Wang, Sen; Wallace, Andrew M.
- [Poisson Surface Reconstruction for LiDAR Odometry and Mapping](#) 5624
Vizzo, Ignacio; Chen, Xieyuanli; Chebrolu, Nived; Behley, Jens; Stachniss, Cyrill
- [Lidar-Monocular Surface Reconstruction Using Line Segments](#) 5631
Amblard, Victor; Osedach, Timothy; Croux, Arnaud; Speck, Andrew; Leonard, John

Session TuGT9 : Localization and Mapping: Point Cloud

- [SKD: Keypoint Detection for Point Clouds Using Saliency Estimation](#) 5638
Tinchev, Georgi; Penate-Sanchez, Adrian; Fallon, Maurice
- [Panoster: End-To-End Panoptic Segmentation of LiDAR Point Clouds](#) 5646
Gasperini, Stefano; Nikouei Mahani, Mohammad-Ali; Marcos-Ramiro, Alvaro; Navab, Nassir; Tombari, Federico
- [NDT-Transformer: Large-Scale 3D Point Cloud Localisation Using the Normal Distribution Transform Representation](#) 5654
Zhou, Zhicheng; Zhao, Cheng; Adolfsson, Daniel; Su, Song-Zhi; Gao, Yang; Duckett, Tom; Sun, Li
- [PHASER: A Robust and Correspondence-Free Global Pointcloud Registration](#) 5661
Bernreiter, Lukas; Ott, Lionel; Nieto, Juan; Siegwart, Roland; Cadena Lerma, Cesar

Session TuKT8 : Localization and Mapping: Sensor Fusion I

- [Asynchronous Multi-View SLAM](#) 5669
Yang, Anqi Joyce; Cui, Can; Bârsan, Ioan Andrei; Urtasun, Raquel; Wang, Shenlong
- [Fusion-DHL: WiFi, IMU, and Floorplan Fusion for Dense History of Locations in Indoor Environments](#) 5677
Herath, Sachini; Irandoust, Saghar; Chen, Bowen; Qian, Yiming; Kim, Pyojin; Furukawa, Yasutaka
- [Relative Position Estimation between Two UWB Devices with IMUs](#) 5684
Cossette, Charles Champagne; Shalaby, Mohammed; Saussié, David; Forbes, James Richard; Le Ny, Jerome
- [LVI-SAM: Tightly-Coupled Lidar-Visual-Inertial Odometry Via Smoothing and Mapping](#) 5692

Shan, Tixiao; Englot, Brendan; Ratti, Carlo; Rus, Daniela

Session TuHT7 : Localization and Mapping: Sensor Fusion II

[Visual-Laser-Inertial SLAM Using a Compact 3D Scanner for Confined Space](#) 5699

Cheng, Daqian; Shi, Haowen; Xu, Albert; Schwerin, Michael; Crivella, Michelle; Li, Lu; Choset, Howie

[Efficient Multi-Sensor Aided Inertial Navigation with Online Calibration](#) 5706

Lee, Woosik; Yang, Yulin; Huang, Guoquan (Paul)

[Robust Monocular Visual-Inertial Depth Completion for Embedded Systems](#) 5713

Merrill, Nathaniel; Geneva, Patrick; Huang, Guoquan (Paul)

[Range-Visual-Inertial Odometry: Scale Observability without Excitation](#) 5720

Delaune, Jeff; Bayard, David; Brockers, Roland

Session TuIT7 : Localization and Mapping: Sensor Fusion III

[Reconfigurable Curved Beams for Selectable Swimming Gaits in an Underwater Robot](#) 5728

Sharifzadeh, Mohammad; Jiang, Yuhao; Aukes, Daniel

[Airflow-Inertial Odometry for Resilient State Estimation on Multirotors](#) 5736

Tagliabue, Andrea; How, Jonathan Patrick

[Cirrus: A Long-Range Bi-Pattern LiDAR Dataset](#) 5744

Wang, Ze; Ding, Sihao; Li, Ying; Fenn, Jonas; Roychowdhury, Sohini; Wallin, Andreas; Martin, Lane; Ryvola, Scott; Qiu, Qiang; Sapiro, Guillermo

[\$\pi\$ -LSAM: LiDAR Smoothing and Mapping with Planes](#) 5751

Zhou, Lipu; Wang, Shengze; Kaess, Michael

Session TuJT7 : Localization for Robotics

[Improving Ranging-Based Location Estimation with Rigidity-Constrained CRLB-Based Motion Planning](#) 5758

Cano, Justin; Le Ny, Jerome

[Relative Position Estimation in Multi-Agent Systems Using Attitude-Coupled Range Measurements](#) 5765

Shalaby, Mohammed; Cossette, Charles Champagne; Forbes, James Richard; Le Ny, Jerome

[Vehicle-To-Vehicle Collaborative Graph-Based Proprioceptive Localization](#) 5772

Cheng, Hsin-Min; Chou, Chieh; Song, Dezhen

[Rover Relocalization for Mars Sample Return by Virtual Template Synthesis and Matching](#) 5780

Pham, Tu-Hoa; Seto, William; Daftry, Shreyansh; Ridge, Barry; Hansen, Johanna; Thrush, Tristan; Van der Merwe, Mark; Maggiolino, Gerard; Brinkman, Alexander; Mayo, John; Cheng, Yang; Padgett, Curtis; Kulczycki, Eric; Detry, Renaud

Session TuDT8 : Localization I

- | | |
|---|------|
| Global Aerial Localisation Using Image and Map Embeddings | 5788 |
| <i>Samano, Noe; Zhou, Mengjie; Calway, Andrew</i> | |
| UWB Indoor Global Localisation for Nonholonomic Robots with Unknown Offset Compensation | 5795 |
| <i>Fontanelli, Daniele; Shamsfakhr, Farhad; Bevilacqua, Paolo; Palopoli, Luigi</i> | |
| Range Image-Based LiDAR Localization for Autonomous Vehicles | 5802 |
| <i>Chen, Xieyuanli; Vizzo, Ignacio; Läbe, Thomas; Behley, Jens; Stachniss, Cyrill</i> | |
| RadarLoc: Learning to Relocalize in FMCW Radar | 5809 |
| <i>Wang, Wei; Porto Buarque de Gusmão, Pedro; Yang, Bo; Markham, Andrew; Trigoni, Niki</i> | |

Session TuET8 : Localization II

- | | |
|--|------|
| Freetures: Localization in Signed Distance Function Maps | 5816 |
| <i>Millane, Alexander James; Oleynikova, Helen; Lanegger, Christian; Delmerico, Jeffrey; Nieto, Juan; Siegwart, Roland; Pollefeys, Marc; Cadena Lerma, Cesar</i> | |
| End-To-End Semi-Supervised Learning for Differentiable Particle Filters | 5825 |
| <i>Wen, Hao; Chen, Xiongjie; Papagiannis, Georgios; Hu, Conghui; Li, Yunpeng</i> | |
| Self-Supervised Learning of Domain-Invariant Local Features for Robust Visual Localization under Challenging Conditions | 5832 |
| <i>Venator, Moritz; El Himer, Yassine; Aklanoglu, Selcuk; Bruns, Erich; Maier, Andreas</i> | |
| Learning to Localize in New Environments from Synthetic Training Data | 5840 |
| <i>Winkelbauer, Dominik; Denninger, Maximilian; Triebel, Rudolph</i> | |

Session TuFT8 : Localization III

- | | |
|--|------|
| SoftMP: Attentive feature pooling for joint local feature detection and description for place recognition in changing environments | 5847 |
| <i>Yuan, Fangming; Neubert, Peer; Schubert, Stefan; Protzel, Peter</i> | |
| Resolving Place Recognition Inconsistencies Using Intra-Set Similarities | 5854 |
| <i>Neubert, Peer; Schubert, Stefan; Protzel, Peter</i> | |
| Beyond ANN: Exploiting Structural Knowledge for Efficient Place Recognition | 5861 |
| <i>Schubert, Stefan; Neubert, Peer; Protzel, Peter</i> | |
| Simultaneous Multi-Level Descriptor Learning and Semantic Segmentation for Domain-Specific Relocalization | 5868 |

Wu, Xiaolong; Chen, Yiye; Pradalier, Cedric; Vela, Patricio

Session TuBT11 : Localization IV

- [GCC-PHAT with Speech-Oriented Attention for Robotic Sound Source Localization](#) 5876
Wang, Jiadong; Qian, Xinyuan; Pan, Zihan; Zhang, Malu; Li, Haizhou
- [Towards Robust GNSS Positioning and Real-Time Kinematic Using Factor Graph Optimization](#) 5884
Wen, Weisong; Hsu, Li-ta
- [Camera Relocalization Using Deep Point Cloud Generation and Hand-Crafted Feature Refinement](#) 5891
Wang, Junyi; Qi, Yue
- [Semantic Histogram Based Graph Matching for Real-Time Multi-Robot Global Localization in Large Scale Environment](#) 5898
Guo, Xiyue; Hu, Junjie; Chen, Junfeng; Deng, Fuqin; Lam, Tin Lun

Session TuKT7 : Machine Learning for Control

- [Reinforced iLQR: A Sample-Efficient Robot Locomotion Learning](#) 5906
Zong, Tongyu; Sun, Liyang; Liu, Yong
- [Scalable Learning of Safety Guarantees for Autonomous Systems Using Hamilton-Jacobi Reachability](#) 5914
Herbert, Sylvia; Choi, Jason J.; Sanjeev, Suvansh; Gibson, Marsalis; Sreenath, Koushil; Tomlin, Claire
- [OmniHang: Learning to Hang Arbitrary Objects Using Contact Point Correspondences and Neural Collision Estimation](#) 5921
You, Yifan; Shao, Lin; Migimatsu, Toki; Bohg, Jeannette

Session TuAT11 : Machine Learning for Pose Estimation

- [HueCode: A Meta-Marker Exposing Relative Pose and Additional Information in Different Colored Layers](#) 5928
Okada, Yoshito; Fujikura, Daiki; Ozawa, Yu; Tadakuma, Kenjiro; Ohno, Kazunori; Tadokoro, Satoshi
- [REDE: End-To-End Object 6D Pose Robust Estimation Using Differentiable Outliers Elimination](#) 5935
Hua, Weitong; Zhou, Zhongxiang; Wu, Jun; Huang, Huang; Wang, Yue; Xiong, Rong
- [PREGAN: Pose Randomization and Estimation for Weakly Paired Image Style Translation](#) 5943
Chen, Zexi; Guo, Jiaxin; Xu, Xuecheng; Wang, Yunkai; Huang, Huang; Wang, Yue; Xiong, Rong
- [Deep Samplable Observation Model for Global Localization and Kidnapping](#) 5951
Chen, Runjian; Yin, Huan; Jiao, Yanmei; Dissanayake, Gamini; Wang, Yue; Xiong, Rong

Session TuGT8 : Machine Learning for Robotic Applications

- Robot in a China Shop: Using Reinforcement Learning for Location-Specific Navigation Behaviour 5959
Bian, Xihan; Mendez Maldonado, Oscar Alejandro; Hadfield, Simon
- Model Identification of a Small Fully-Actuated Aquatic Surface Vehicle Using a Long Short-Term Memory Neural Network 5966
Dimitrov, Marin; Groves, Keir; Howard, David; Lennox, Barry
- Real-Time Trajectory Adaptation for Quadrupedal Locomotion Using Deep Reinforcement Learning 5973
Gangapurwala, Siddhant; Geisert, Mathieu; Orsolino, Romeo; Fallon, Maurice; Havoutis, Ioannis
- Robust Iterative Learning Control for Pneumatic Muscle with State Constraint and Model Uncertainty 5980
Qian, Kun; Li, Zhenhong; Asker, Ahmed; Zhang, Zhiqiang; Xie, Sheng Quan

Session TuHT6 : Machine Learning I

- MCMC Occupancy Grid Mapping with a Data-Driven Patch Prior 5988
Merali, Rehman; Barfoot, Timothy
- Shape-Based Transfer of Generic Skills 5996
Thompson, Skye; Kaelbling, Leslie; Lozano-Perez, Tomas
- Safety Uncertainty in Control Barrier Functions Using Gaussian Processes 6003
Khan, Mouhyemen; Ibuki, Tatsuya; Chatterjee, Abhijit
- Object Rearrangement Using Learned Implicit Collision Functions 6010
Danielczuk, Michael; Mousavian, Arsalan; Eppner, Clemens; Fox, Dieter

Session TuIT6 : Machine Learning II

- Continual Learning of Knowledge Graph Embeddings 6018
Daruna, Angel; Gupta, Mehul; Sridharan, Mohan; Chernova, Sonia
- Learning Topology from Synthetic Data for Unsupervised Depth Completion 6026
Wong, Alex; Cicek, Safa; Soatto, Stefano
- PTP: Parallelized Tracking and Prediction with Graph Neural Networks and Diversity Sampling 6034
Weng, Xinshuo; Yuan, Ye; Kitani, Kris
- Feedback Linearization for Quadrotors with a Learned Acceleration Error Model 6042
Spitzer, Alexander; Michael, Nathan

Session TuJT6 : Machine Learning Method for Navigation

- Bi-Directional Domain Adaptation for Sim2Real Transfer of Embodied Navigation Agents 6049

Truong, Joanne; Chernova, Sonia; Batra, Dhruv

DWA-RL: Dynamically Feasible Deep Reinforcement Learning Policy for Robot Navigation among Mobile Obstacles 6057
Patel, Utsav; Sanjeev Kumar, Nithish Kumar; Sathyamoorthy, Adarsh Jagan; Manocha, Dinesh

Reinforcement Learning for Autonomous Driving with Latent State Inference and Spatial-Temporal Relationships 6064
Ma, Xiaobai; Li, Jiachen; Kochenderfer, Mykel; Isele, David; Fujimura, Kikuo

A Lifelong Learning Approach to Mobile Robot Navigation 6072
Liu, Bo; Xiao, Xuesu; Stone, Peter

Session TuKT6 : Machine Learning: Adaptive Systems

APPLI: Adaptive Planner Parameter Learning from Interventions 6079
Wang, Zizhao; Xiao, Xuesu; Liu, Bo; Warnell, Garrett; Stone, Peter

APPLR: Adaptive Planner Parameter Learning from Reinforcement 6086
Xu, Zifan; Dhamankar, Gauraang; Nair, Anirudh; Xiao, Xuesu; Warnell, Garrett; Liu, Bo; Wang, Zizhao; Stone, Peter

An Adaptive Framework For Learning Unsupervised Depth Completion 6093
Wong, Alex; Fei, Xiaohan; Hong, Byung-Woo; Soatto, Stefano

PennSyn2Real: Training Object Recognition Models without Human Labeling 6101
Nguyen, Ty; Miller, Ian; Cohen, Avi; Thakur, Dinesh; Guru, Arjun; Prasad, Shashank; Taylor, Camillo Jose; Chaudhari, Pratik; Kumar, Vijay

Session TuAT10 : Machine Learning: Applications

Robotic Indoor Scene Captioning from Streaming Video 6109
Li, Xinghang; Guo, Di; Liu, Huaping; Sun, Fuchun

Geometry-Aware Unsupervised Domain Adaptation for Stereo Matching 6116
Sakuma, Hiroki; Konishi, Yoshinori

Reasoning Operational Decisions for Robots Via Time Series Causal Inference 6124
Cao, Yu; Li, Boyang; Li, Qian; Stokes, Adam Andrew; Ingram, David; Kiprakis, Aristides

Embodying Pre-Trained Word Embeddings through Robot Actions 6132
Toyoda, Minori; Suzuki, Kanata; Mori, Hiroki; Hayashi, Yoshihiko; Ogata, Tetsuya

Session TuHT5 : Manipulation and Grasping I

Grasp Analysis and Manipulation Kinematics for Isoperimetric Truss Robots 6140

Hammond, Zachary; Usevitch, Nathan; Follmer, Sean

[Improving Grasp Classification through Spatial Metrics Available from Sensors](#) 6147
Swenson, Nigel; Scott, Garrett; Bloch, Peter; Soni, Paresh Laxman; Nishat, Nuha; Asar, Anjali Harish; Grimm, Cindy; Fern, Xiaoli; Balasubramanian, Ravi

[Assistive Supernumerary Grasping with the Back of the Hand](#) 6154
Lee, Jungpyo; Yu, Licheng; Derbier, Lucie; Stuart, Hannah

[Robotic Pick-and-Place With Uncertain Object Instance Segmentation and Shape Completion](#) 6161
Gualtieri, Marcus; Platt, Robert

Session TuIT5 : Manipulation and Grasping II

[Learning Dexterous Grasping with Object-Centric Visual Affordances](#) 6169
Mandikal, Priyanka; Grauman, Kristen

[Learning Collaborative Pushing and Grasping Policies in Dense Clutter](#) 6177
Tang, Bingjie; Corsaro, Matt; Konidaris, George; Nikolaidis, Stefanos; Tellex, Stefanie

[Grasping with Chopsticks: Combating Covariate Shift in Model-Free Imitation Learning for Fine Manipulation](#) 6185
Ke, Liyiming; Wang, Jingqiang; Bhattacharjee, Tapomayukh; Boots, Byron; Srinivasa, Siddhartha

[Learning Task-Oriented Dexterous Grasping from Human Knowledge](#) 6192
Li, Hui; Zhang, Yinlong; Li, Yanan; He, Hongsheng

Session TuJT5 : Manipulation and Grasping III

[Decision Making in Joint Push-Grasp Action Space for Large-Scale Object Sorting](#) 6199
Pan, Zherong; Hauser, Kris

[Deep Affordance Foresight: Planning through What Can Be Done in the Future](#) 6206
Xu, Danfei; Mandlekar, Ajay Uday; Martín-Martín, Roberto; Zhu, Yuke; Savarese, Silvio; Fei-Fei, Li

[Learning Dense Rewards for Contact-Rich Manipulation Tasks](#) 6214
Wu, Zheng; Lian, Wenzhao; Unhelkar, Vaibhav V.; Tomizuka, Masayoshi; Schaal, Stefan

[ACRONYM: A Large-Scale Grasp Dataset Based on Simulation](#) 6222
Eppner, Clemens; Mousavian, Arsalan; Fox, Dieter

Session TuAT2 : Manipulation Award Session

[KPAM 2.0: Feedback Control for Category-Level Robotic Manipulation](#) 6228

Gao, Wei; Tedrake, Russ

- Policy Blending and Recombination for Multimodal Contact-Rich Tasks 6236
Narita, Tetsuya; Kroemer, Oliver

Session TuBT10 : Manipulation Control I

- Position and Orientation Control of Polygonal Objects by Sensorless In-Hand Caging Manipulation 6244
Komiyama, Shun; Maeda, Yusuke

- Non-Fixed Contact Manipulation Control Framework for Deformable Objects with Active Contact Adjustment 6250
Huang, Jing; Cai, Yuanpei; Chu, Xiangyu; Taylor, Russell H.; Au, K. W. Samuel

- 3D Biped Locomotion Control Including Seamless Transition between Walking and Running Via 3D ZMP Manipulation 6258
Sugihara, Tomomichi; Imanishi, Kenta; Yamamoto, Takanobu; Caron, Stephane

- Modeling and Balance Control of SuperArm for Overhead Tasks 6264
Luo, Jianwen; Su, Yao; Gong, Zelin; Ruan, Lecheng; Zhao, Ye; Asada, Harry; Fu, Chenglong

Session TuCT10 : Manipulation Control II

- Generation of Efficient Rectilinear Gait Based on Dynamic Morphological Computation and Its Theoretical Analysis 6272
Li, Longchuan; Ma, Shugen; Tokuda, Isao; Asano, Fumihiko; Nokata, Makoto; Tian, Yang; Du, Liang

- Simultaneous Precision Assembly of Multiple Objects through Coordinated Micro-Robot Manipulation 6280
Liu, Song; Jia, Yuyu; Li, Y.F.; Guo, Yao; Lu, Haojian

- Dynamic Compensation in Throwing Motion with High-Speed Robot Hand-Arm 6287
Takahashi, Akira; Sato, Masaki; Namiki, Akio

Session TuAT9 : Manipulation Control III

- Introspective Visuomotor Control: Exploiting Uncertainty in Deep Visuomotor Control for Failure Recovery 6293
Hung, Chia-Man; Sun, Li; Wu, Yizhe; Havoutis, Ioannis; Posner, Ingmar

- Sim-To-Real Visual Grasping Via State Representation Learning Based on Combining Pixel-Level and Feature-Level Domain Adaptation 6300
Suh, Il Hong; Park, Young-Bin; Lee, Sang Hyoung

- Dexterous Manoeuvre through Touch in a Cluttered Scene 6308
Liang, Wenyu; Ren, Qinyuan; Chen, Xiaoqiao; Gao, Junli; Wu, Yan

Mapless-Planner: A Robust and Fast Planning Framework for Aggressive Autonomous Flight without Map Fusion 6315
Ji, Jialin; Wang, Zhepei; Wang, Yingjian; Xu, Chao; Gao, Fei

Session TuIT4 : Manipulation I

Contact Localization for Robot Arms in Motion without Torque Sensing 6322
Liang, Jacky; Kroemer, Oliver

Semi-Infinite Programming with Complementarity Constraints for Pose Optimization with Pervasive Contact 6329
Zhang, Mengchao; Hauser, Kris

Finite Horizon Synthesis for Probabilistic Manipulation Domains 6336
Wells, Andrew; Kingston, Zachary; Lahijanian, Morteza; Kavraki, Lydia; Moshe, Vardi

IKEA Furniture Assembly Environment for Long-Horizon Complex Manipulation Tasks 6343
Lee, Youngwoon; Hu, Edward; Lim, Joseph

Session TuJT4 : Manipulation II

Robotic Grasping through Combined Image-Based Grasp Proposal and 3D Reconstruction 6350
Yang, Daniel; Tosun, Tarik; Eisner, Benjamin; Isler, Volkan; Lee, Daniel

Attribute-Based Robotic Grasping with One-Grasp Adaptation 6357
Yang, Yang; Liu, Yuanhao; Liang, Hengyue; Lou, Xibai; Choi, Changhyun

Collision-Aware Target-Driven Object Grasping in Constrained Environments 6364
Lou, Xibai; Yang, Yang; Choi, Changhyun

6-DoF Contrastive Grasp Proposal Network 6371
Zhu, Xinghao; Sun, Lingfeng; Fan, Yongxiang; Tomizuka, Masayoshi

Session TuKT4 : Manipulation III

RASCAL: Robotic Arm for Shards and Ceramics Automated Locomotion 6378
Wang, Deborah; Lutz, Brandon; Cobb, Peter; Dames, Philip

Reactive Planning for Mobile Manipulation Tasks in Unexplored Semantic Environments 6385
Vasilopoulos, Vasileios; Kantaros, Yiannis; Pappas, George J.; Koditschek, Daniel

Dynamic Grasping for Object Picking Using Passive Zero-DOF End Effectors 6393
Mucchiani, Caio; Yim, Mark

Arm-Hand Systems As Hybrid Parallel-Serial Systems: A Novel Inverse Kinematics Solution 6401
Qiu, Shuwei; Kermani, Mehrdad R.

Session WeAT3 : Manipulation IV

- An Integrated Approach for Determining Objects to Be Relocated and Their Goal Positions Inside Clutter for Object Retrieval 6408
Ahn, Jeeho; Lee, Jaeho; Cheong, Sang Hun; Kim, ChangHwan; Nam, Changjoo
- A Hybrid Position/Force Controller for Joint Robots 6415
Xie, Shengwen; Ren, Juan
- DIMSAN: Fast Exploration with the Synergy between Density-Based Intrinsic Motivation and Self-Adaptive Action Noise 6422
Li, Jiayi; Li, Boyao; Lu, Tao; Lu, Ning; Cai, Yinghao; Wang, Shuo
- A Unified Approach for Hybrid Motion Control of MOCA Based on Weighted Whole-Body Cartesian Impedance Formulation 6429
Wu, Yuqiang; Lamon, Edoardo; Zhao, Fei; Kim, Wansoo; Ajoudani, Arash

Session TuKT5 : Manipulation: Haptics

- Tactile-RL for Insertion: Generalization to Objects of Unknown Geometry 6437
Dong, Siyuan; Jha, Devesh; Romeres, Diego; Kim, Sangwoon; Nikovski, Daniel; Rodriguez, Alberto
- Sim-To-Real for Robotic Tactile Sensing Via Physics-Based Simulation and Learned Latent Projections 6444
Narang, Yashraj; Sundaralingam, Balakumar; Macklin, Miles; Mousavian, Arsalan; Fox, Dieter
- Fingers See Things Differently (FIST-D): An Object Aware Visualization and Manipulation Framework Based on Tactile Observations 6452
Xiao, Chenxi; Madapana, Naveen; Wachs, Juan

Session TuIT2 : Manipulation: Measurement

- Mass Estimation of a Moving Object through Minimal Manipulation Interaction 6461
Aguilera, Sergio; Murtaza, Muhammad Ali; Zhao, Ye; Hutchinson, Seth
- GelSight Wedge: Measuring High-Resolution 3D Contact Geometry with a Compact Robot Finger 6468
Wang, Shaoxiong; She, Yu; Romero, Branden; Adelson, Edward
- Identifying External Contacts from Joint Torque Measurements on Serial Robotic Arms and Its Limitations 6476
Pang, Tao; Umenberger, Jack; Tedrake, Russ
- Cable-Driven Parallel Robot Pose Estimation Using Extended Kalman Filtering with Inertial Payload Measurements 6483
Nguyen, Vinh; Caverly, Ryan James

Session TuDT7 : Manipulation: Perception

Vision Based Adaptation to Kernelized Synergies for Human Inspired Robotic Manipulation <i>Katyara, Sunny; Ficuciello, Fanny; Chen, Fei; Siciliano, Bruno; Caldwell, Darwin G.</i>	6491
Vision-Based Robotic Pushing and Grasping for Stone Sample Collection under Computing Resource Constraints <i>Grimm, Raphael; Grotz, Markus; Ottenhaus, Simon; Asfour, Tamim</i>	6498
Friction Estimation for Tendon-Driven Robotic Hands <i>Lange, Friedrich; Pfanne, Martin; Steinmetz, Franz; Wolf, Sebastian; Stulp, Freek</i>	6505
Representation Matters: Improving Perception and Exploration for Robotics <i>Wulfmeier, Markus; Byravan, Arunkumar; Hertweck, Tim; Higgins, Irina; Gupta, Ankush; Kulkarni, Tejas; Reynolds, Malcolm; Teplyashin, Denis; Hafner, Roland; Lampe, Thomas; Riedmiller, Martin</i>	6512
Session TuIT3 : Manipulation: Planning I	
Contact Mode Guided Sampling-Based Planning for Quasistatic Dexterous Manipulation in 2D <i>Cheng, Xianyi; Huang, Eric; Hou, Yifan; Mason, Matthew T.</i>	6520
KPAM-SC: Generalizable Manipulation Planning Using KeyPoint Affordance and Shape Completion <i>Gao, Wei; Tedrake, Russ</i>	6527
Alternative Paths Planner (APP) for Provably Fixed-Time Manipulation Planning in Semi-Structured Environments <i>Islam, Fahad; Paxton, Chris; Eppner, Clemens; Peele, Bryan; Likhachev, Maxim; Fox, Dieter</i>	6534
Hierarchical Planning for Long-Horizon Manipulation with Geometric and Symbolic Scene Graphs <i>Zhu, Yifeng; Tremblay, Jonathan; Birchfield, Stan; Zhu, Yuke</i>	6541
Session TuJT3 : Manipulation: Planning II	
Region-Based Planning for 3D Within-Hand-Manipulation via Variable Friction Robot Fingers and Extrinsic Contacts <i>Sahin, Alp; Spiers, Adam; Calli, Berk</i>	6549
Planning for Multi-Stage Forceful Manipulation <i>Holladay, Rachel; Lozano-Perez, Tomas; Rodriguez, Alberto</i>	6556
Towards Robust Planar Translations Using Delta-Manipulator Arrays <i>Thompson, Skye; Mannam, Pragna; Temel, Zeynep; Kroemer, Oliver</i>	6563
Manipulation Planning among Movable Obstacles Using Physics-Based Adaptive Motion Primitives <i>Saxena, Dhruv Mauria; Saleem, Muhammad Suhail; Likhachev, Maxim</i>	6570

Session TuET7 : Manipulation: Planning III

Reactive Cooperative Manipulation Based on Set Primitives and Circular Fields 6577
Laha, Riddhiman; Figueredo, Luis Felipe Cruz; Vrabel, Juraj; Swikir, Abdalla; Haddadin, Sami

Efficient Multi-Scale POMDPs for Robotic Object Search and Delivery 6585
Holzherr, Luc; Förster, Julian; Breyer, Michel; Nieto, Juan; Siegwart, Roland; Chung, Jen Jen

Path Planning for Manipulation Using Experience-Driven Random Trees 6592
Païret, Èric; Chamzas, Constantinos; Petillot, Yvan R.; Kavraki, Lydia

Co-Optimizing Robot, Environment, and Tool Design Via Joint Manipulation Planning 6600
Toussaint, Marc; Ha, Jung-Su; Oguz, Ozgur S.

Session TuKT3 : Manipulation: Real World Applications

Robotic Slicing of Fruits and Vegetables: Modeling the Effects of Fracture Toughness and Knife Geometry 6607
Jamdagni, Prajjwal; Jia, Yan-Bin

A Convex Quasistatic Time-Stepping Scheme for Rigid Multibody Systems with Contact and Friction 6614
Pang, Tao; Tedrake, Russ

Uniform Object Rearrangement: From Complete Monotone Primitives to Efficient Non-Monotone Informed Search 6621
Wang, Rui; Gao, Kai; Nakhimovich, Daniel; Yu, Jingjin; Bekris, Kostas E.

Session TuJT2 : Manipulation: Reinforcement Learning I

Shaping Rewards for Reinforcement Learning with Imperfect Demonstrations Using Generative Models 6628
Wu, Yuchen; Mozifian, Melissa; Shkurti, Florian

DisCo RL: Distribution-Conditioned Reinforcement Learning for General-Purpose Policies 6635
Nasiriany, Soroush; Pong, Vitchyr; Nair, Ashvin; Khazatsky, Alexander; Berseth, Glen; Levine, Sergey

Recovery RL: Safe Reinforcement Learning with Learned Recovery Zones 6642
Balakrishna, Ashwin; Thananjeyan, Brijen; Nair, Suraj; Luo, Michael; Srinivasan, Krishnan; Hwang, Minh; Gonzalez, Joseph E.; Ibarz, Julian; Finn, Chelsea; Goldberg, Ken

LASER: Learning a Latent Action Space for Efficient Reinforcement Learning 6650
Martín-Martín, Roberto; Allshire, Arthur; Lin, Charles; Manuel, Shawn; Savarese, Silvio; Garg, Animesh

Session TuKT2 : Manipulation: Reinforcement Learning II

Multi-Step Recurrent Q-Learning for Robotic Velcro Peeling 6657
Yuan, Jiacheng; Häni, Nicolai; Isler, Volkan

Reset-Free Reinforcement Learning Via Multi-Task Learning: Learning Dexterous Manipulation Behaviors without Human Intervention 6664
Gupta, Abhishek; Yu, Justin; Zhao, Zihao; Kumar, Vikash; Aaron, Rovinsky; Xu, Kelvin; Devlin, Thomas; Levine, Sergey

Model Predictive Actor-Critic: Accelerating Robot Skill Acquisition with Deep Reinforcement Learning 6672
Morgan, Andrew; Nandha, Daljeet; Chalvatzaki, Georgia; D'Eramo, Carlo; Dollar, Aaron; Peters, Jan

Batch Exploration with Examples for Scalable Robotic Reinforcement Learning 6679
Chen, Annie; Nam, HyunJi; Nair, Suraj; Finn, Chelsea

Session TuFT7 : Mapping I

ManhattanSLAM: Robust Planar Tracking and Mapping Leveraging Mixture of Manhattan Frames 6687
Yunus, Raza; Li, Yanyan; Tombari, Federico

Multi-Resolution 3D Mapping with Explicit Free Space Representation for Fast and Accurate Mobile Robot Motion Planning 6694
Funk, Nils; Tarrio, Juan Jose; Papatheodorou, Sotiris; Popovic, Marija; Fernández Alcantarilla, Pablo; Leutenegger, Stefan

Weighted Node Mapping and Localisation on a Pixel Processor Array 6702
Castillo Elizalde, Hector; Liu, Yanan; Bose, Laurie; Mayol, Walterio

Direct Sparse Mapping 6709
Zubizarreta, Jon; Aguinaga, Iker; Montiel, J.M.M

Session TuGT7 : Mapping II

Dynamic Occupancy Grid Mapping with Recurrent Neural Networks 6717
Schreiber, Marcel; Belagiannis, Vasileios; Glaeser, Claudius; Dietmayer, Klaus

Automatic Mapping of Tailored Landmark Representations for Automated Driving and Map Learning 6725
Pauls, Jan-Hendrik; Schmidt, Benjamin; Stiller, Christoph

Lightweight Semantic Mesh Mapping for Autonomous Vehicles 6732
Herb, Markus; Weiherer, Tobias; Navab, Nassir; Tombari, Federico

LatentSLAM: Unsupervised Multi-Sensor Representation Learning for Localization and Mapping 6739
Catal, Ozan; Jansen, Wouter; Verbelen, Tim; Dhoedt, Bart; Steckel, Jan

Session TuIT0 : Marine Robotics

Autonomous Data Collection with Timed Communication Constraints for Unmanned Underwater Vehicles 6746
McMahon, James; Plaku, Erion

Docking and Undocking a Modular Underactuated Oscillating Swimming Robot 6754
Knizhnik, Gedaliah; Yim, Mark

Predictive 3D Sonar Mapping of Underwater Environments via Object-Specific Bayesian Inference 6761
McConnell, John; Englot, Brendan

Session WeAT7 : Mechanism and Control I

Reciprocally Rotating Magnetic Actuation and Automatic Trajectory Following for Wireless Capsule Endoscopy 6768
Xu, Yangxin; Li, Keyu; Zhao, Ziqi; Meng, Fei; Liu, Li; Meng, Max Q.-H.

Reduced Dynamics and Control for an Autonomous Bicycle 6775
Xiong, Jiaming; Li, Bo; 余, 瑞汉; Ma, Daolin; Wang, Wei; Liu, Caishan

Balance Control of a Novel Wheel-Legged Robot: Design and Experiments 6782
Wang, Shuai; Cui, Leilei; Zhang, Jingfan; Lai, Jie; Dongsheng, Zhang; Chen, Ke; Zheng, Yu; Zhang, Zhengyou; Jiang, Zhong-Ping

Blending of Series-Parallel Compliant Actuation with Field-Weakening Control for Explosive Motion Generation 6789
Amara, Vishnu Dev; Malzahn, Jörn; Roozing, Wesley; Tsagarakis, Nikos

Session TuCT8 : Mechanism and Control II

Pneumatic Actuation-Based Bidirectional Modules with Variable Stiffness and Closed-Loop Position Control 6797
Chen, Yaohui; Chung, Hoam; Chen, Bernard; Ping, Ho Yi; Sun, Yonghang

A Capturability-Based Control Framework for the Underactuated Bipedal Walking 6804
Yuan, Haihui; Song, Sumian; Du, Ruilong; Zhu, Shiqiang; Gu, Jason; Zhao, Mingguo; Pang, Jianxin

Appearance-based Loop Closure Detection via Bidirectional Manifold Representation Consensus 6811
Zhang, Kaining; Li, Zizhuo; Ma, Jiayi

Synergetic Effect between Limbs and Spine Dynamics in Quadruped Walking Robots 6818
Li, Longchuan; Ma, Shugen; Tokuda, Isao; Asano, Fumihiko; Nokata, Makoto; Tian, Yang; Du, Liang

Session TuJT0 : Mechanism and Verification

Assumption Monitoring Using Runtime Verification for UAV Temporal Task Plan Executions 6824

Zudaire, Sebastian; Gorostiaga, Felipe; Sánchez, César; Schneider, Gerardo; Uchitel, Sebastian

Scalable POMDP Decision-Making Using Circulant Controllers 6831
Wray, Kyle; Csuprynski, Kenneth

Granular Resistive Force Theory Implementation for Three-Dimensional Trajectories 6838
Treers, Laura; Cao, Cyndia; Stuart, Hannah

Implicit Integration for Articulated Bodies with Contact Via the Nonconvex Maximal Dissipation Principle 6846
Pan, Zherong; Hauser, Kris

Session TuDT6 : Mechanism Design and Control I

Efficient and Goal-Directed Oscillations in Articulated Soft Robots: the Point-to-Point Case 6853
Bonacchi, Luigi Bono; Roa, Maximo A.; Sesselmann, Anna; Loeffl, Florian; Albu-Schäffer, Alin; Della Santina, Cosimo

Visual Servoing of Cable-Driven Parallel Robots with Tension Management 6861
Zake, Zane; Chaumette, Francois; Pedemonte, Nicolo; Caro, Stéphane

Automated design of underactuated monolithic soft robotics structures with multiple predefined end poses 6868
Schiele, Simon; Phalen, Henry; Kulozik, Julian; Krieger, Yannick S.; Lueth, Tim C.

Design and Control of a Highly Redundant Rigid–Flexible Coupling Robot to Assist the COVID-19 Oropharyngeal-Swab Sampling 6875
Hu, Yingbai; Li, Jian; Chen, Yongquan; Wang, Qiwen; Chi, Chuliang; Zhang, Heng; Gao, Qing; Lan, Yuanmin; Li, Zheng; Mu, Zonggao; Sun, Zhenglong; Knoll, Alois

Session TuET6 : Mechanism Design and Control II

Multifunctional Arm for Telerobotic Wind Turbine Blade Repair 6883
Sadeghian, Rasoul; Sareh, Sina

Modeling, Gait Sequence Design, and Control Architecture of BADGER Underground Robot 6890
Vartholomeos, Panagiotis; Marantos, Panos; Karras, George; Salvador, Elisabeth Menendez; Marin Rodriguez, Marcos; Martínez, Santiago; Balaguer, Carlos

Automated Behavior Tree Error Recovery Framework for Robotic Systems 6898
Wu, Ruichao; Kortik, Sitar; Hellmann Santos, Christoph

Design of a Magnetic Actuation System for a Microbiota-Collection Ingestible Capsule 6905
Finocchiaro, Martina; Giosuè, Cristina; Drago, Gaspare; Cibella, Fabio; Mencias, Arianna; Sprovieri, Mario; Ciuti, Gastone

Session TuBT9 : Mechanism Design I

Development of a Humanoid Shoulder Based on 3-Motor 3 Degrees-Of-Freedom Coupled Tendon-Driven Joint Module	6912
<i>Li, Wenyang; Wang, Yiwei; Togo, Shunta; Yokoi, Hiroshi; Jiang, Yinlai</i>	
Mecanum Crank: A Novel Omni-Directional Vehicle Using Crank Leg	6919
<i>Noda, Satsuya; Kunii, Haruki; Yaginuma, Mutsuki; Yamanobe, Kazushi</i>	
Internally-Balanced Displacement-Force Converter for Stepless Control of Spring Deformation Compensated by Cam with Variable Pressure Angle	6925
<i>Shimizu, Tori; Tadakuma, Kenjiro; Watanabe, Masahiro; Takane, Eri; Konyo, Masashi; Tadokoro, Satoshi</i>	
2-DOF Spherical Parallel Mechanism Capable of Biaxial Swing Motion with Active Arc Sliders	6933
<i>Saiki, Naoto; Tadakuma, Kenjiro; Watanabe, Masahiro; Takane, Eri; Nobutoki, Masashi; Suzuki, Shintaro; Konyo, Masashi; Tadokoro, Satoshi</i>	
Session TuCT9 : Mechanism Design II	
A Locally-Adaptive, Parallel-Jaw Gripper with Clamping and Rolling Capable, Soft Fingertips for Fine Manipulation of Flexible Flat Cables	6941
<i>Chapman, Jayden; Gorjup, Gal; Dwivedi, Anany; Matsunaga, Saori; Mariyama, Toshisada; MacDonald, Bruce; Liarokapis, Minas</i>	
Stable, Sensor-Less and Compliance-Less Module Connection for Automated Construction System of a Modularized Rail Structure	6948
<i>Yasuda, Mari; Warisawa, Shin'ichi; Fukui, Rui</i>	
Numerical Simulations of A Novel Force Controller Serially Combining The Admittance and Impedance Controllers	6955
<i>Fujiki, Takuto; Tahara, Kenji</i>	
Kinematic Stability Based AFG-RRT* Path Planning for Cable-Driven Parallel Robots	6963
<i>Mishra, Utkarsh Aashu; Métillon, Marceau; Caro, Stéphane</i>	
Session WeAT4 : Mechanism Design III	
Implementing Rat-Like Motion for a Small-Sized Biomimetic Robot Based on Extraction of Key Movement Joints	6970
<i>Shi, Qing; Gao, Zihang; Jia, Guanglu; Li, Chang; Huang, Qiang; Ishii, Hiroyuki; Takanishi, Atsuo; Fukuda, Toshio</i>	
Design and Testing of a Damped Piezo-Driven Decoupled XYZ Stage	6986
<i>Chen, Zhong; Shi, Junjie; Zhu, Songwei; Zhong, Xineng; Zhang, Xianmin</i>	
Innovative Design and Simulation of a Transformable Robot with Flexibility and Versatility, RHex-T3	6992
<i>Lin, Yue; Tian, Yujia; Xue, Yongjiang; Han, Shujun; Zhang, Huaiyu; Lai, Wenxin; Xiao, Xuan</i>	
A Variable Stiffness Actuator Based on Second-order Lever Mechanism and Its Manipulator Integration	6999

Liu, Zhangxing; Jin, HongZhe; Zhang, Hui; Liu, Yubin; Long, Yilin; Liu, Xiufang; Zhao, Jie

Session TuAT8 : Mechanism Design IV

- Temperature Compensated 3D Printed Strain Sensor for Advanced Manufacturing Applications 7006
Munasinghe, Nuwan; Masangkay, John; Paul, Gavin
- Design of a Deployable Underwater Robot for the Recovery of Autonomous Underwater Vehicles Based on Origami Technique 7013
Li, Jisen; Yang, Yuliang; Zhang, Yvmei; Zhu, Hua; Li, Yongqi; Huang, Qiujun; Lu, Haibo; He, Shan; Li, Shengquan; Zhang, Wei; Mei, Tao; Wu, Feng; Zhang, Aidong
- Modelling and Optimisation of a Mechanism-Based Metamaterial for a Wrist Flexion-Extension Assistive Device 7020
Raghavendra Kulkarni, Suhas; Alexandre Pinto Sales de Noronha, Bernardo; Campolo, Domenico; Accoto, Dino
- Mechatronic Design of a Low-Noise Active Knee Prosthesis with High Backdrivability 7027
Fu, Guoxiang; Zhu, Jinying; Wang, Zilu; Mai, Jingeng; Wang, Qining

Session TuBT8 : Mechanism Design V

- Restoring Force Design of Active Self-Healing Tension Transmission System and Application to Tendon-Driven Legged Robot 7033
Nakashima, Shinsuke; Kawaharazuka, Kento; Nishiura, Manabu; Asano, Yuki; Kakiuchi, Yohei; Okada, Kei; Kawasaki, Koji; Inaba, Masayuki
- A Translational Parallel Continuum Robot Reinforced by Origami and Cross-Routing Tendons 7039
Troeung, Charles; Chen, Chao
- Design of a 3-DOF Coupled Tendon-Driven Waist Joint 7046
Wang, Yiwei; Li, Wenyang; Togo, Shunta; Yokoi, Hiroshi; Jiang, Yinlai
- Design and Modeling of a Variable-Stiffness Spring Mechanism for Impedance Modulation in Physical Human–Robot Interaction 7052
Chaichaowarat, Ronnapree; Nishimura, Satoshi; Krebs, Hermano Igo

Session TuKT0 : Mechanism Design VII

- Exploratory Hand: Leveraging Safe Contact to Facilitate Manipulation in Cluttered Spaces 7058
Lin, Michael A.; Thomasson, Rachel; Uribe, Gabriela; Choi, Hojung; Cutkosky, Mark
- An Autonomous Vault-Building Robot System for Creating Spanning Structures 7066
Melenbrink, Nathan; Wang, Ariel; Werfel, Justin
- Towards the Unification of System Design and Motion Synthesis for High-Performance Hopping Robots 7073
Ambrose, Eric; Ma, Wenlong; Ames, Aaron

Session ThJT7 : Mechanism Design VI

- Neural Fidelity Warping for Efficient Robot Morphology Design 7079
Hu, Sha; Yang, Zeshi; Mori, Greg
- Computational Design and Fabrication of Corrugated Mechanisms from Behavioral Specifications 7087
Liu, Chang; Yan, Wenzhong; Mehta, Ankur
- Human Driven Compliant Transmission Mechanism 7094
Zhang, Tiange; Braun, David
- Design Paradigms Based on Spring Agonists for Underactuated Robot Hands: Concepts and Application 7100
Chen, Tianjian; Zhang, Tianyi; Ciocarlie, Matei

Session TuDT3 : Mechatronics and Design Award Session

- Soft Hybrid Aerial Vehicle Via Bistable Mechanism 7107
Li, Xuan; McWilliams, Jessica; Li, Minchen; Sung, Cynthia; Jiang, Chenfanfu
- A Versatile Inverse Kinematics Formulation for Retargeting Motions Onto Robots with Kinematic Loops 7114
Schumacher, Christian; Knoop, Espen; Bächer, Moritz

Session TuAT7 : Medical Imaging and Sensing I

- Robust Three-Dimensional Shape Sensing for Flexible Endoscopic Surgery Using Multi-Core FBG Sensors 7122
Lu, Yiang; Lu, Bo; Li, Bin; Guo, Huanhuan; Liu, Yunhui
- Robot-To-Image Registration with Geometric Marker for CT-Guided Robotic Needle Insertion 7130
Ikedo, Iori; Sekine, Kai; Tsumura, Ryosuke; Iwata, Hiroyasu
- Shape Sensor Using Magnetic Induction with Frequency Sweeping for Medical Catheters 7137
Jeon, Jiyun; Kim, Chunwoo
- Robotically Surgical Vessel Localization Using Robust Hybrid Video Motion Magnification 7144
Fan, Wenkang; Zheng, Zhuohui; Zeng, Wankang; Chen, Yinran; Zeng, Hui-Qing; Shi, Hong; Luo, Xiongbiao

Session WeAT6 : Medical Imaging and Sensing II

- Generalized Point Set Registration with the Kent Distribution 7151
Min, Zhe; Zhu, Delong; Meng, Max Q.-H.
- Self-Supervised Learning for Monocular Depth Estimation on Minimally Invasive Surgery Scenes 7159
Shao, Shuwei; Pei, Zhongcai; Chen, Weihai; Zhang, Baochang; Wu, Xingming; Sun, Dianmin; Doermann, David

Intermittent Visual Servoing: Efficiently Learning Policies Robust to Instrument Changes for High-Precision Surgical Manipulation 7166
Paradis, Samuel; Hwang, Minh; Thananjeyan, Brijen; Ichnowski, Jeffrey; Seita, Daniel; Fer, Danyal; Low, Thomas; Gonzalez, Joseph E.; Goldberg, Ken

Towards Fully Autonomous Ultrasound Scanning Robot with Imitation Learning Based on Clinical Protocols 7174
Huang, Yanwei; Xiao, Wei; Wang, Chuyang; Liu, Hengli; Huang, Rui; Sun, Zhenglong

Session ThKT6 : Micro/Nano Robotics I

Tailored Magnetic Torsion Springs for Miniature Magnetic Robots 7182
Forbrigger, Cameron; Schonewille, Adam; Diller, Eric D.

Real-Time Teleoperation of Magnetic Force-Driven Microrobots with 3D Haptic Force Feedback for Micro-Navigation and Micro-Transportation 7189
Lee, Jaeyeon; Zhang, Xiao; Park, Chung Hyuk; Kim, MinJun

Yaw Control of a Hovering Flapping-Wing Aerial Vehicle with a Passive Wing Hinge 7197
Chukewad, Yogesh M; Fuller, Sawyer

Automated End-Effector Alignment for Robotic Cell Manipulation 7205
Dai, Changsheng; Zhuang, Songlin; Zhang, Zhuoran; Shan, Guanqiao; Sun, Yu

A High-Voltage Power Electronics Unit for Flying Insect Robots That Can Modulate Wing Thrust 7212
James, Johannes; Fuller, Sawyer

Session ThKT7 : Micro/Nano Robotics III

Residual Model Learning for Microrobot Control 7219
Gruenstein, Joshua; Chen, Tao; Doshi, Neel; Agrawal, Pulkit

Small Autonomous Robot Actuator (SARA): A Solar-Powered Wireless MEMS Gripper 7227
Moreno, Alex; Patel, Austin; Teal, Daniel; Gomez, Hani; Fearing, Andrew; Rentmeister, Jan; Stauth, Jason; Pister, Kristofer S. J.

Path Planning and Tracking for an Underactuated Two-Microrobot System 7234
Salehizadeh, Mohammad; Diller, Eric D.

Tiny Robot Learning (tinyRL) for Source Seeking on a Nano Quadcopter 7242
Duisterhof, Bardienus Pieter; Krishnan, Srivatsan; Cruz, Jonathan Jesus; Banbury, Colby Richard; Fu, William; Faust, Aleksandra; de Croon, Guido; Janapa Reddi, Vijay

Session WeCT4 : Micro/Nano Robotics IV

Micro Robotic Manipulation System for the Force Stimulation of Muscle Fiber-Like Cell Structure 7249
Chen, Xie; Shi, Qing; Shimoda, Shingo; Sun, Tao; Wang, Huaping; Huang, Qiang; Fukuda, Toshio

Automated Fabrication of the High-Fidelity Cellular Micro-Scaffold through Proportion-Corrective Control of the Photocuring Process 7255
Li, Xin; Wang, Huaping; Shi, Qing; Liu, JiaXin; Xin, Zhanhua; Dong, Xinyi; Huang, Qiang; Fukuda, Toshio

A Versatile Vision-Pheromone-Communication Platform for Swarm Robotics 7261
Liu, Tian; Sun, Xuelong; Hu, Cheng; Fu, Qinbing; Yue, Shigang

3D Periodic Magnetic Servoing System for Microrobot Actuation Using Decoupled Asynchronous Repetitive Control Approach 7267
Sun, Zhiyong; Cheng, Yu; Zhou, Chao; Cheng, Erkang; Chen, Liangliang; Dong, Lixin; Song, Bo

Session WeBT6 : Micro/Nano Robotis II

Modeling and Control of an Untethered Magnetic Gripper 7274
Mao, Yunxuan; Yuan, Sishen; Wang, Jiaole; Zhang, Jinmin; Song, Shuang

A Flexible Magnetic Field Mapping Model for Calibration of Magnetic Manipulation System 7281
Xing, Yi; Jia, Yanchao; Zhan, Zhen; Li, Jianjie; Hu, Chengzhi

Dynamic Tracking of Microrobot with Active Magnetic Sensor Array 7288
Wang, Min; Leung, Kwan Yi; Rui, Liu; Song, Shuang; Yin, Jianqin; Yuan, Yixuan; Meng, Max Q.-H.; Liu, Jun

Dynamic Modeling of Magnetic Helical Microrobots 7295
Wang, Xiaopu; Hu, Chengzhi; Pané, Salvador; Nelson, Bradley J.

Session ThJT6 : Model Learning for Control

Batteries, Camera, Action! Learning a Semantic Control Space for Expressive Robot Cinematography 7302
Bonatti, Rogerio; Bucker, Arthur Fender Coelho; Scherer, Sebastian; Mukadam, Mustafa; Hodgins, Jessica

Sim-To-Real Learning of All Common Bipedal Gaits Via Periodic Reward Composition 7309
Siekman, Jonah; Godse, Yesh; Fern, Alan; Hurst, Jonathan

Agile Robot Navigation through Hallucinated Learning and Sober Deployment 7316
Xiao, Xuesu; Liu, Bo; Stone, Peter

Nonholonomic Yaw Control of an Underactuated Flying Robot with Model-Based Reinforcement Learning 7323
Lambert, Nathan; Schindler, Craig; Drew, Daniel S.; Pister, Kristofer S. J.

Session ThHT19 : Model Predictive Control I

High-Frequency Nonlinear Model Predictive Control of a Manipulator 7330

Kleff, Sebastien; Meduri, Avadesh; Budhiraja, Rohan; Mansard, Nicolas; Righetti, Ludovic

[Adaptive Nonlinear Model Predictive Control for Autonomous Surface Vessels with Largely Varying Payload](#) 7337

Wang, Wei; Hagemann, Niklas; Ratti, Carlo; Rus, Daniela

[Time-Varying Model Predictive Control for Highly Dynamic Motions of Quadrupedal Robots](#) 7344

Garcia Chavez, Gabriel Enrique; Griffin, Robert J.; Pratt, Jerry

[Koopman NMPC: Koopman-Based Learning and Nonlinear Model Predictive Control of Control-Affine Systems](#) 7350

Folkestad, Carl; Burdick, Joel

Session ThHT6 : Model Predictive Control II

[ALTRO-C: A Fast Solver for Conic Model-Predictive Control](#) 7357

Jackson, Brian E.; Punnoose, Tarun; Neamati, Daniel; Jitosho, Rianna; Tracy, Kevin; Manchester, Zachary

[Model Predictive Control of Nonlinear Latent Force Models: A Scenario-Based Approach](#) 7365

Woodruff, Thomas; Askari, Iman; Wang, Guanghui; Fang, Huazhen

[The Value of Planning for Infinite-Horizon Model Predictive Control](#) 7372

Hatch, Nathan; Boots, Byron

[Automatic Tuning for Data-Driven Model Predictive Control](#) 7379

Edwards, William; Tang, Gao; Mamakoukas, Giorgos; Murphey, Todd; Hauser, Kris

Session WeCT5 : Motion and Path Planning I

[Efficient Heuristic Generation for Robot Path Planning with Recurrent Generative Model](#) 7386

Li, Zhaoting; Wang, Jiansun; Meng, Max Q.-H.

[Scalable Coverage Path Planning of Multi-Robot Teams for Monitoring Non-Convex Areas](#) 7393

Collins, Leighton; Ghassemi, Payam; Esfahani, Ehsan; Doermann, David; Dantu, Karthik; Chowdhury, Souma

[Time and Energy Optimized Trajectory Generation for Multi-Agent Constellation Changes](#) 7400

Ladinig, Paul; Weiss, Stephan; Rinner, Bernhard

[Towards an Online RRT-Based Path Planning Algorithm for Ackermann-Steering Vehicles](#) 7407

Peng, Jie; Chen, Yu'an; Duan, Yifan; Ji, Jianmin; Zhang, Yu; Zhang, Yanyong

Session TuBT7 : Motion and Path Planning II

[A Global-Local Coupling Two-Stage Path Planning Method for Mobile Robots](#) 7414

Jian, Zhiqiang; Zhang, Songyi; Chen, Shitao; Nan, Zhixiong; Zheng, Nanning

Learn to Navigate Maplessly with Varied LiDAR Configurations: A Support Point-Based Approach 7422
Zhang, Wei; Liu, Ning; Zhang, Yunfeng

Fast Replanning Multi-Heuristic A* 7430
Ha, Junhyoung; Kim, Soonkyum

Generating Large-Scale Trajectories Efficiently Using Double Descriptions of Polynomials 7436
Wang, Zhepei; Ye, Hongkai; Xu, Chao; Gao, Fei

Session ThIT6 : Motion and Path Planning III

AXLE: Computationally-Efficient Trajectory Smoothing Using Factor Graph Chains 7443
Olson, Edwin

Computationally-Efficient Roadmap-based Inspection Planning via Incremental Lazy Search 7449
Fu, Mengyu; Salzman, Oren; Alterovitz, Ron

Multi-Query Serverless Motion Planning for Fog Robotics 7457
Anand, Raghav; Ichnowski, Jeffrey; Wu, Chenggang; Hellerstein, Joe; Gonzalez, Joseph E.; Goldberg, Ken

Composable Geometric Motion Policies using Multi-Task Pullback Bundle Dynamical Systems 7464
Bylard, Andrew; Bonalli, Riccardo; Pavone, Marco

Session ThKT5 : Motion and Path Planning IV

A Gravity-Referenced Moving Frame for Vehicle Path Following Applications in 3D 7471
Hernandez Ramirez, Juan Carlos; Nahon, Meyer

Safe, Optimal, Real-Time Trajectory Planning with a Parallel Constrained Bernstein Algorithm 7479
Kousik, Shreyas; Zhang, Bohao; Zhao, Pengcheng; Vasudevan, Ram

A Spatial Searching Method for Planning under Time Dependent Constraints for Eco-Driving in Signalized Traffic Intersection 7495
Li, Tianqi; Gopalswamy, Swaminathan

A Generalized A* Algorithm for Finding Globally Optimal Paths in Weighted Colored Graphs 7503
Lim, Jaein; Tsiotras, Panagiotis

Session ThHT22 : Motion and Path Planning V

Chance Constrained Simultaneous Path Planning and Task Assignment with Bottleneck Objective 7510
Yang, Fan; Chakraborty, Nilanjan

Planning with Attitude 7517
Jackson, Brian E.; Tracy, Kevin; Manchester, Zachary

Constrained Path Planning and Guidance in General Wind Fields 7526
Paiva, Ely; Morillo, Mariana Costa Perazzo; Cordeiro, Rafael

LTO: Lazy Trajectory Optimization with Graph-Search Planning for High DOF Robots in Cluttered Environments 7533
Shirai, Yuki; Lin, Xuan; Mehta, Ankur; Hong, Dennis

Session ThIT22 : Motion Control for Manipulators I

Emergent Hand Morphology and Control from Optimizing Robust Grasps of Diverse Objects 7540
Pan, Xinlei; Garg, Animesh; Anandkumar, Anima; Zhu, Yuke

Generalizing Object-Centric Task-Axes Controllers Using Keypoints 7548
Sharma, Mohit; Kroemer, Oliver

Dynamic Primitives and Optimal Feedback Control for the Manipulation of Complex Objects 7555
Sharif Razavian, Reza; Bazzi, Salah; Nayeem, Rashida; Sadeghi, Mohsen; Sternad, Dagmar

Learning Reactive and Predictive Differentiable Controllers for Switching Linear Dynamical Models 7563
Saxena, Saumya; LaGrassa, Alex; Kroemer, Oliver

Session TuFT6 : Motion Control for Manipulators II

Globally Optimal Online Redundancy Resolution for Serial 7-DOF Kinematics Along SE(3) Trajectories 7570
Huber, Gerold; Wollherr, Dirk

A Real-Time-Capable Closed-Form Multi-Objective Redundancy Resolution Scheme for Seven-DoF Serial Manipulators 7577
Wiedmeyer, Wolfgang; Altoé, Philipp; Auberle, Jonathan; Ledermann, Christoph; Kroeger, Torsten

Robot Arm Motion Planning Based on Geodesics 7585
Laux, Mario; Zell, Andreas

FlexDMP - Extending Dynamic Movement Primitives towards Flexible Joint Robots 7592
Wahrburg, Arne; Guida, Simone; Enayati, Nima; Zanchettin, Andrea Maria; Rocco, Paolo

Session TuGT6 : Motion Estimation

Unsupervised 3D Motion Estimation of Vehicles Using ICP 7599
Roussel, Tom; Tuytelaars, Tinne; Van Eycken, Luc

CNN-Based Ego-Motion Estimation for Fast MAV Maneuvers 7606
Xu, Yingfu; de Croon, Guido

Mid-Air Range-Visual-Inertial Estimator Initialization for Micro Air Vehicles 7613
Scheiber, Martin; Delaune, Jeff; Weiss, Stephan; Brockers, Roland

Pose Estimation for Vehicle-Mounted Cameras Via Horizontal and Vertical Planes 7620
Gál, István Gergő; Barath, Daniel; Hajder, Levente

Session TuCT7 : Motion Planning and Control I

SA-LOAM: Semantic-Aided LiDAR SLAM with Loop Closure 7627
Li, Lin; Kong, Xin; Zhao, Xiangrui; Li, Wanlong; Wen, Feng; Zhang, Hongbo; Liu, Yong

Reinforcement Learning-Based Visual Navigation with Information-Theoretic Regularization 7635
Wu, Qiaoyun; Xu, Kai; Wang, Jun; Xu, Mingliang; Gong, Xiaoxi; Manocha, Dinesh

An On-Line POMDP Solver for Continuous Observation Spaces 7643
Hoerger, Marcus; Kurniawati, Hanna

Session TuAT6 : Motion Planning and Control II

NEO: A Novel Expeditious Optimisation Algorithm for Reactive Motion Control of Manipulators 7650
Haviland, Jesse; Corke, Peter

Optimized Method for Planning and Controlling the Somersault Motion of Quadruped Robot 7658
Chen, Teng; Rong, Xuewen; Li, Yibin

Motion Coupling Analysis for the Decoupled Design of a Two-Segment Notched Continuum Robot 7665
Zeng, Wenhui; Yan, Junyan; Huang, Xu; Cheng, Shing Shin

VINS-Motion: Tightly-Coupled Fusion of VINS and Motion Constraint 7672
Yu, Zhelin; Zhu, Lidong; Lu, Guoyu

Session ThIT23 : Motion Planning for Aerial Robotics

The Reachable Set of a Drone: Exploring the Position Isochrones for a Quadcopter 7679
Sultan, Mohammad; Biediger, Dan; Li, Bernard; Becker, Aaron

Two-Stage Trajectory Optimization for Flapping Flight with Data-Driven Models 7686
Hoff, Jonathan; Kim, Joohyung

Online Trajectory Optimization for Dynamic Aerial Motions of a Quadruped Robot 7693
Chignoli, Matthew; Kim, Sangbae

SwarmCCO: Probabilistic Reactive Collision Avoidance for Quadrotor Swarms under Uncertainty 7700
Arul, Senthil Hariharan; Manocha, Dinesh

Session ThHT23 : Motion Planning for Autonomous Vehicle

Path Optimization for Ground Vehicles in Off-Road Terrain 7708
Overbye, Timothy; Saripalli, Srikanth

Robust & Asymptotically Locally Optimal UAV-Trajectory Generation Based on Spline Subdivision 7715
Ni, Ruiqi; Schneider, Teseo; Panozzo, Daniele; Pan, Zherong; Gao, Xifeng

Vehicle Trajectory Prediction Using Generative Adversarial Network with Temporal Logic Syntax Tree Features 7722
Li, Xiao; Rosman, Guy; Gilitschenski, Igor; Vasile, Cristian Ioan; DeCastro, Jonathan; Karaman, Sertac; Rus, Daniela

Autonomous Vehicle Motion Planning Via Recurrent Spline Optimization 7730
Xu, Wenda; Wang, Qian; Dolan, John M.

Session ThHT21 : Motion Planning for Surgical Robots

Bimanual Regrasping for Suture Needles Using Reinforcement Learning for Rapid Motion Planning 7737
Chiu, Zih-Yun; Richter, Florian; Funk, Emily; Orosco, Ryan; Yip, Michael C.

Dual-Arm Needle Manipulation with the Da Vinci® Surgical Robot under Uncertainty 7744
Lu, Su; Shkurti, Tom; Cavusoglu, M. Cenk

Learning Surgical Motion Pattern from Small Data in Endoscopic Sinus and Skull Base Surgeries 7751
Li, Yangming; Bly, Randall; Akkina, Sarah; Qin, Fangbo; Saxena, Rajeev; Humphreys, Ian; Mark, Whipple; Moe, Kris; Hannaford, Blake

Backward Planning for a Multi-Stage Steerable Needle Lung Robot 7758
Hoelscher, Janine; Fu, Mengyu; Fried, Inbar; Emerson, Maxwell; Ertop, Tayfun Efe; Rox, Margaret; Kuntz, Alan; Akulian, Jason; Webster III, Robert James; Alterovitz, Ron

Session ThIT21 : Motion Planning for Task-Specific Robots I

A Primitive-Based Approach to Good Seamanship Path Planning for Autonomous Surface Vessels 7767
Stankiewicz, Paul; Kobilarov, Marin

A Scavenger Hunt for Service Robots 7774
Yedidsion, Harel; Suriadinata, Jennifer; Xu, Zifan; deBruyn, Stefan; Stone, Peter

Exploring Large and Complex Environments Fast and Efficiently 7781
Cao, Chao; Zhu, Hongbiao; Choset, Howie; Zhang, Ji

Planning Laser-Forming Folding Motion with Thermal Simulation 7788
Hao, Yue; Guan, Weilin; Peraza Hernandez, Edwin; Lien, Jyh-Ming

Session ThJT21 : Motion Planning for Task-Specific Robots II

Robot Development and Path Planning for Indoor Ultraviolet Light Disinfection <i>Conroy, Jonathan; Thierauf, Christopher; Rule, Parker; Krause, Evan; Akitaya, Hugo; Gonczi, Andrei; Korman, Matias; Scheutz, Matthias</i>	7795
Piecewise-Linear Motion Planning Amidst Static, Moving, or Morphing Obstacles <i>El Khadir, Bachir; Jb, Lasserre; Sindhwani, Vikas</i>	7802
Smooth Path Planning for Continuum Arms <i>Meng, Brandon; Kanj, Iyad; Godage, Isuru S.</i>	7809
Anticipatory Path Planning for Continuum Arms in Dynamic Environments <i>Meng, Brandon; Arachchige, Dimuthu; Deng, Jiahao; Godage, Isuru S.; Kanj, Iyad</i>	7815
Session TuDT5 : Motion Planning I	
Reactive Navigation in Crowds for Non-holonomic Robots with Convex Bounding Shape <i>Gonon, David Julian; Paez-Granados, Diego; Billard, Aude</i>	7821
NavRep: Unsupervised Representations for Reinforcement Learning of Robot Navigation in Dynamic Human Environments <i>Dugas, Daniel; Nieto, Juan; Siegwart, Roland; Chung, Jen Jen</i>	7829
Scenario-Based Trajectory Optimization in Uncertain Dynamic Environments <i>de Groot, Oscar; Brito, Bruno; Ferranti, Laura; Gavrila, Darius; Alonso-Mora, Javier</i>	7836
High Speed Planning in Unknown Environments for Multirotors Considering Drag <i>Toumieh, Charbel; Lambert, Alain</i>	7844
Session TuET5 : Motion Planning II	
Sparse Multilevel Roadmaps for High-Dimensional Robotic Motion Planning <i>Orthey, Andreas; Toussaint, Marc</i>	7851
Saliency Features for 3D CAD-Data in the Context of Sampling-Based Motion Planning <i>Hegewald, Robert; Wolpert, Nicola; Schömer, Elmar</i>	7858
Search-Based Planning of Dynamic MAV Trajectories Using Local Multiresolution State Lattices <i>Schleich, Daniel; Behnke, Sven</i>	7865
Bench-MR: A Motion Planning Benchmark for Wheeled Mobile Robots <i>Heiden, Eric; Palmieri, Luigi; Bruns, Leonard; Arras, Kai Oliver; Sukhatme, Gaurav; Koenig, Sven</i>	7872
Session TuFT5 : Motion Planning III	
Expansive Voronoi Tree: A Motion Planner for Assembly Sequence Planning <i>Dorn, Sebastian; Wolpert, Nicola; Schömer, Elmar</i>	7880

MS2MP: A Min-Sum Message Passing Algorithm for Motion Planning <i>Bari, Salman; Gabler, Volker; Wollherr, Dirk</i>	7887
Cubic Bézier Local Path Planner for Non-Holonomic Feasible and Comfortable Path Generation <i>Vailland, Guillaume; Gouranton, Valérie; Babel, Marie</i>	7894
Voxplan: A 3D Global Planner Using Signed Distance Function Submaps <i>Gasser, Laura Maria; Millane, Alexander James; Reijgwart, Victor; Bähnemann, Rik; Siegwart, Roland</i>	7901
Session WeBT13 : Motion Planning in Automation	
Prediction-Based Reachability for Collision Avoidance in Autonomous Driving <i>Li, Anjian; Sun, Liting; Zhan, Wei; Tomizuka, Masayoshi; Chen, Mo</i>	7908
Lane-free Autonomous Intersection Management: A Batch-processing Framework Integrating Reservation-based and Planning-based Methods <i>Li, Bai; Zhang, Youmin; Acarman, Tankut; Ouyang, Yakun; Yaman, Cagdas; Wang, Yaonan</i>	7915
Pheromone-Diffusion-Based Conscientious Reactive Path Planning for Road Network Persistent Surveillance <i>Wang, Tong; Dong, Gangqi; Huang, Panfeng</i>	7922
Session ThKT21 : Motion Planning in Multi-Agents System I	
Towards Safe Motion Planning in Human Workspaces: A Robust Multi-Agent Approach <i>Lo, Shih-Yun; Fernandez, Benito R.; Stone, Peter; Thomaz, Andrea Lockerd</i>	7929
Anytime Fault-Tolerant Adaptive Routing for Multi-Robot Teams <i>Fiorilo dos Santos, Ronaldo; Nascimento, Erickson; G. Macharet, Douglas</i>	7936
Exploiting Collisions for Sampling-Based Multicopter Motion Planning <i>Zha, Jiaming; Mueller, Mark Wilfried</i>	7943
Multi-Robot Motion Planning with Unlabeled Goals for Mobile Robots with Differential Constraints <i>Le, Thai Duong; Plaku, Erion</i>	7950
Session ThHT20 : Motion Planning in Multi-Agents System II	
A Visibility Roadmap Sampling Approach for a Multi-Robot Visibility-Based Pursuit-Evasion Problem <i>Olsen, Trevor; Tumlin, Anne; Stiffler, Nicholas; O'Kane, Jason</i>	7957
Time-Optimal Multi-Quadrotor Trajectory Planning for Pesticide Spraying <i>Lal, Ratan; Prabhakar, Pavithra</i>	7965
Do You See What I See? Coordinating Multiple Aerial Cameras for Robot Cinematography <i>Bucker, Arthur Fender Coelho; Bonatti, Rogerio; Scherer, Sebastian</i>	7972

MIDAS: Multi-Agent Interaction-Aware Decision-Making with Adaptive Strategies for Urban Autonomous Navigation 7980
Chen, Xiaoyi; Chaudhari, Pratik

Session ThIT20 : Motion Planning in Multi-Agents System III

Scalable Active Information Acquisition for Multi-Robot Systems 7987
Kantaros, Yiannis; Pappas, George J.

MAPS-X: Explainable Multi-Robot Motion Planning Via Segmentation 7994
Kottinger, Justin; Almagor, Shaull; Lahijanian, Morteza

Representation-Optimal Multi-Robot Motion Planning Using Conflict-Based Search 8001
Solis Vidana, Juan Irving; Motes, James; Sandstrom, Read; Amato, Nancy

Spatial and Temporal Splitting Heuristics for Multi-Robot Motion Planning 8009
Guo, Teng; Han, Shuai D.; Yu, Jingjin

Session ThJT20 : Motion Planning IV

Multi-Hypothesis Interactions in Game-Theoretic Motion Planning 8016
Laine, Forrest; Fridovich-Keil, David; Chiu, Chih-Yuan; Tomlin, Claire

An Approximation Algorithm for an Assisted Shortest Path Problem 8024
Montez, Christopher; Rathinam, Sivakumar; Casbeer, David; Darbha, Swaroop; Manyam, Satyanarayana Gupta

TAMPC: A Controller for Escaping Traps in Novel Environments 8031
Zhong, Sheng; Zhang, Zhenyuan; Fazeli, Nima; Berenson, Dmitry

Projector-Guided Non-Holonomic Mobile 3D Printing 8039
Xu, Xuchu; Wang, Ziteng; Feng, Chen

Session TuGT5 : Motion Planning V

Learning from Simulation, Racing in Reality 8046
Chisari, Eugenio; Liniger, Alexander; Rupenyan, Alisa; Van Gool, Luc; Lygeros, John

Equality Constrained Differential Dynamic Programming 8053
El Kazdadi, Sarah; Carpentier, Justin; Ponce, Jean

Learning Constrained Distributions of Robot Configurations with Generative Adversarial Network 8060
Lembono, Teguh Santoso; Pignat, Emmanuel; Jankowski, Julius; Calinon, Sylvain

Shape-Preserving and Reactive Adaptation of Robot End-Effector Trajectories 8068
Vochten, Maxim; Decré, Wilm; Aertbelien, Erwin; De Schutter, Joris

Session TuET4 : Motion Planning VI

- Image Representation of a City and Its Taxi Fleet for End-To-End Learning of Rebalancing Policies 8076
Gächter, Joel; Zanardi, Alessandro; Ruch, Claudio; Frazzoli, Emilio
- COLREGs-Informed RRT* for Collision Avoidance of Marine Crafts 8083
Enevoldsen, Thomas Thuesen; Reinartz, Christopher Clarc; Galeazzi, Roberto
- Learning to Robustly Negotiate Bi-Directional Lane Usage in High-Conflict Driving Scenarios 8090
Killing, Christoph; Villaflor, Adam; Dolan, John M.
- Self-Supervised Motion Retargeting with Safety Guarantee 8097
Choi, Sungjoon; Song, Min Jae; Ahn, Hyemin; Kim, Joohyung

Session ThKT20 : Motion Planning with Partial Information

- Data-Based Control of Partially-Observed Robotic Systems 8104
Wang, Ran; Goyal, Raman; Chakravorty, Suman; Skelton, Robert
- Partial Information Target Defense Game 8111
Shishika, Daigo; Maity, Dipankar; Dorothy, Michael
- Stochastic Motion Planning under Partial Observability for Mobile Robots with Continuous Range Measurements 8118
Sun, Ke; Schlotfeldt, Brent; Pappas, George J.; Kumar, Vijay
- Long-Horizon Motion Planning for Autonomous Vehicle Parking Incorporating Incomplete Map Information 8135
Dai, Siyu; Wang, Yebin

Session TuBT6 : Motion Planning: Autonomous Driving

- ICurb: Imitation Learning-Based Detection of Road Curbs Using Aerial Images for Autonomous Driving 8143
Xu, Zhenhua; Sun, Yuxiang; Liu, Ming
- Search-Based Online Trajectory Planning for Car-Like Robots in Highly Dynamic Environments 8151
Lin, Jiahui; Zhou, Tong; Zhu, DeLong; Liu, Jianbang; Meng, Max Q.-H.
- Task-Space Decomposed Motion Planning Framework for Multi-Robot Loco-Manipulation 8158
Zhang, Xiaoyu; Yan, Lei; Lam, Tin Lun; Vijayakumar, Sethu
- SMT-Based Optimal Deployment of Mobile Robot Rechargers 8165
Kundu, Tanmoy; Saha, Indranil

Session TuCT6 : Motion Planning: Collision Avoidance

- VR-ORCA: Variable Responsibility Optimal Reciprocal Collision Avoidance 8172

Guo, Ke; Wang, Dawei; Fan, Tingxiang; Pan, Jia

Dynamic Window Approach with Human Imitating Collision Avoidance 8180
Matsuzaki, Sango; Aonuma, Shinta; Hasegawa, Yuji

Disruption-Resistant Deformable Object Manipulation on Basis of Online Shape Estimation and Prediction-Driven Trajectory Correction 8187
Tanaka, Daisuke; Arnold, Solvi; Yamazaki, Kimitoshi

Dynamic Movement Primitive Based Motion Retargeting for Dual-Arm Sign Language Motions 8195
Liang, Yuwei; Li, Weijie; Wang, Yue; Xiong, Rong; Mao, Yichao; Zhang, Jiafan

Session TuFT4 : Motion Planning: Control

Whole Body Model Predictive Control with Memory of Motion: Experiments on a Torque-Controlled TALOS 8202
Dantec, Ewen; Budhiraja, Rohan; Roig, Adria; Lembono, Teguh Santoso; Saurel, Guilhem; Stasse, Olivier; Fernbach, Pierre; Tonneau, Steve; Calinon, Sylvain; Vijayakumar, Sethu; Taïx, Michel; Mansard, Nicolas

Constraint Handling in Continuous-Time DDP-Based Model Predictive Control 8209
Sleiman, Jean-Pierre; Farshidian, Farbod; Hutter, Marco

Sparsity-Inducing Optimal Control Via Differential Dynamic Programming 8216
Dinev, Traiko; Merkt, Wolfgang Xaver; Ivan, Vladimir; Havoutis, Ioannis; Vijayakumar, Sethu

A Passive Navigation Planning Algorithm for Collision-Free Control of Mobile Robots 8223
Tiseo, Carlo; Ivan, Vladimir; Merkt, Wolfgang Xaver; Havoutis, Ioannis; Mistry, Michael; Vijayakumar, Sethu

Session WeAT13 : Motion Planning: Decision

TIE: Time-Informed Exploration for Robot Motion Planning 8230
Joshi, Sagar; Hutchinson, Seth; Tsiotras, Panagiotis

MRPB 1.0: A Unified Benchmark for the Evaluation of Mobile Robot Local Planning Approaches 8238
Wen, Jian; Zhang, Xuebo; Bi, Qingchen; Pan, Zhangchao; Feng, Yanghe; Yuan, Jing; Fang, Yongchun

Belief Space Partitioning for Symbolic Motion Planning 8245
Hou, Mengxue; Lin, Tony X.; Zhou, Haomin; Zhang, Wei; Edwards, Catherine; Zhang, Fumin

Anticipatory Planning and Dynamic Lost Person Models for Human-Robot Search and Rescue 8252
Heintzman, Larkin; Hashimoto, Amanda; Abaid, Nicole; Williams, Ryan

Session TuGT4 : Motion Planning: Kinematics and Dynamics

The Virtual Wheel Concept for the Singularity-Free Kinematic and Dynamic Modeling of Pseudo-Omnidirectional Vehicles	8259
<i>Stöger, Christoph; Gattringer, Hubert; Mueller, Andreas</i>	
Collision-Free MPC for Legged Robots in Static and Dynamic Scenes	8266
<i>Gaertner, Magnus; Bjelonic, Marko; Farshidian, Farbod; Hutter, Marco</i>	
Temporal Coupling of Dynamical Movement Primitives for Constrained Velocities and Accelerations	8273
<i>Dahlin, Albin; Karayiannidis, Yiannis</i>	
Obstacle Avoidance with Kinetic Energy Buffer	8280
<i>Pitkänen, Ville; Pennanen, Tuulia; Tikanmäki, Antti; Röning, Juha Jaakko</i>	
Session WeBT5 : Motion Planning: Learning	
Tra2Tra: Trajectory-To-Trajectory Prediction with a Global Social Spatial-Temporal Attentive Neural Network	8287
<i>Xu, Yi; Ren, Dongchun; Li, Mingxia; Chen, Yuehai; Fan, Mingyu; Xia, Huaxia</i>	
Remote-Center-Of-Motion Recommendation Toward Brain Needle Intervention Using Deep Reinforcement Learning	8295
<i>Gao, Huxin; Xiao, Xiao; Qiu, Liang; Meng, Max Q.-H.; King, Nicolas, Kon Kam; Ren, Hongliang</i>	
Autonomous Navigation of an Ultrasound Probe towards Standard Scan Planes with Deep Reinforcement Learning	8302
<i>Li, Keyu; Wang, Jian; Xu, Yangxin; Qin, Hao; Liu, Dongsheng; Liu, Li; Meng, Max Q.-H.</i>	
A Knowledge-Based Fast Motion Planning Method through Online Environmental Feature Learning	8309
<i>Yuan, Yuan; Liu, Jie; Wang, Jiankun; Chi, Wenzheng; Chen, Guodong; Sun, Lining</i>	
Session TuAT5 : Motion Planning: Learning-Based Prediction	
Uncertainty-aware Non-linear Model Predictive Control for Human-following Companion Robot	8316
<i>Sekiguchi, Shunichi; Yorozu, Ayanori; Kuno, Kazuhiro; Okada, Masaki; Watanabe, Yutaka; Takahashi, Masaki</i>	
Path Planning in Uncertain Ocean Currents Using Ensemble Forecasts	8323
<i>Yoo, Chanyeol; Lee, James Ju Heon; Anstee, Stuart David; Fitch, Robert</i>	
Distributed Motion Coordination Using Convex Feasible Set Based Model Predictive Control	8330
<i>Zhou, Hongyu; Liu, Changliu</i>	
Risk Conditioned Distributional Soft Actor-Critic for Risk-Sensitive Navigation	8337
<i>Choi, Jinyoung; Dance, Christopher; Kim, Jung-eun; Hwang, SeulBin; Park, Kyung-sik</i>	

Session TuET3 : Motion Planning: Legged Robots

- Optimization-Inspired Controller Design for Transient Legged Locomotion 8345
Fisher, Callen; van Zyl, Joshua; Govender, Reuben; Patel, Amir
- Multi-Layered Safety for Legged Robots Via Control Barrier Functions and Model Predictive Control 8352
Grandia, Ruben; Taylor, Andrew; Ames, Aaron; Hutter, Marco
- Agile Actions with a Centaur-Type Humanoid: A Decoupled Approach 8359
Parigi Polverini, Matteo; Mingo Hoffman, Enrico; Laurenzi, Arturo; Tsagarakis, Nikos
- Combined Sampling and Optimization Based Planning for Legged-Wheeled Robots 8366
Jelavic, Edo; Farshidian, Farbod; Hutter, Marco

Session WeAT5 : Motion Planning: Manipulator

- Robot Motion Planning with Human-Like Motion Patterns based on Human Arm Movement Primitive Chains 8373
Gong, Shiqiu; Zhao, Jing; Xie, Biyun
- A Model-Free Synchronous Control of Humanoid Robot Finger 8380
Liu, Ziqi; Jiang, Li; Yang, Bin; Li, Chongyang; Cheng, Ming; Fan, Shaowei; Yang, Dapeng
- An Overall Configuration Planning Method of Continuum Hyper-Redundant Manipulators Based on Improved Artificial Potential Field Method 8386
Tian, Yu; Zhu, Xiaojun; Meng, Deshan; Wang, Xueqian; Liang, Bin
- Autonomous UAV Exploration of Dynamic Environments Via Incremental Sampling and Probabilistic Roadmap 8394
Xu, Zhefan; Deng, Di; Shimada, Kenji

Session TuBT5 : Motion Planning: Optimization

- Smooth-RRT*: Asymptotically Optimal Motion Planning for Mobile Robots under Kinodynamic Constraints 8402
Kang, Yiting; Yang, Zhi; Zeng, Riya; Wu, Qi
- Continuous Optimization-Based Task and Motion Planning with Signal Temporal Logic Specifications for Sequential Manipulation 8409
Takano, Rin; Oyama, Hiroyuki; Yamakita, Masaki
- Proximal Policy Optimization with Relative Pearson Divergence 8416
Kobayashi, Taisuke
- Optimal Object Placement for Minimum Discontinuity Non-Revisiting Coverage Task 8422
Yang, Tong; Valls Miro, Jaime; Wang, Yue; Xiong, Rong

Session TuCT5 : Motion Planning: Robot Perception

Active Information Acquisition under Arbitrary Unknown Disturbances 8429
Wakulicz, Jennifer; Kong, He; Sukkarieh, Salah

Real-Time Obstacle Avoidance with a Virtual Torque Approach for a Robotic Tool in the End Effector 8436
Song, Kai-Tai; Lee, Yi-Hung

A Robotic Platform to Navigate MRI-Guided Focused Ultrasound System 8443
Dai, Jing; He, Zhuoliang; Fang, Ge; Wang, Xiaomei; Li, Yingqi; Cheung, Chim Lee; Liang, Liyuan; Iordachita, Ioan Iulian; Chang, Hing-Chiu; Kwok, Ka-Wai

Approximating Constraint Manifolds Using Generative Models for Sampling-Based Constrained Motion Planning 8451
Acar, Cihan; Tee, Keng Peng

Session TuBT4 : Motion Planning: Semantic Scene

Anticipatory Navigation in Crowds by Probabilistic Prediction of Pedestrian Future Movements 8458
Zhi, Weiming; Lai, Tin; Ott, Lionel; Ramos, Fabio

Real-Time Human Lower Limbs Motion Estimation and Feedback for Potential Applications in Robotic Gait Aid and Training 8465
Wang, Lei; Li, Qingguo; Yi, Jingang; Zhang, Jinyuan; Liu, Tao

Virtual Surfaces and Attitude Aware Planning and Behaviours for Negative Obstacle Navigation 8472
Hines, Thomas; Stepanas, Kazys; Talbot, Fletcher; Sa, Inkyu; Lewis, Jake; Hernandez, Emily; Kottege, Navinda; Hudson, Nicolas

Cost-To-Go Function Generating Networks for High Dimensional Motion Planning 8480
Huh, Jinwook; Isler, Volkan; Lee, Daniel

Session TuCT4 : Motion Planning: Task-Based Planning

Integrated Task Assignment and Path Planning for Capacitated Multi-Agent Pickup and Delivery 8487
Chen, Zhe; Alonso-Mora, Javier; Bai, Xiaoshan; Harabor, Daniel Damir; Stuckey, Peter James

Social Trajectory Planning for Urban Autonomous Surface Vessels 8495
Park, Shinkyu; Cap, Michal; Alonso-Mora, Javier; Ratti, Carlo; Rus, Daniela

A Geometric Folding Pattern for Robot Coverage Path Planning 8509
Zhu, Lifeng; Yao, Shuai; Li, Boyang; Jia, Yiyang; Mitani, Jun; Song, Aiguo

Tree Search-Based Task and Motion Planning with Prehensile and Non-Prehensile Manipulation for Obstacle Rearrangement in Clutter 8516
Lee, Jinhwi; Nam, Changjoo; Park, Jong Hyeon; Kim, ChangHwan

Session TuFT3 : Motion Prediction

Design, Development and Validation of a Dynamic Fall Prediction System for Excavators <i>Argiolas, Alfredo; Casini, Simona; Fujio, Kazuhiro; Hiramatsu, Toshifumi; Morita, Satoshi; Ragaglia, Matteo; Sugiura, Hisashi; Niccolini, Marta</i>	8523
Feasible and Adaptive Multimodal Trajectory Prediction with Semantic Maneuver Fusion <i>Berkemeyer, Hendrik; Franceschini, Riccardo; Tran, Anh Tuan; Che, Lin; Pipa, Gordon</i>	8530
Exploiting Latent Representation of Sparse Semantic Layers for Improved Short-Term Motion Prediction with Capsule Networks <i>Dulian, Albert; Murray, John Christopher</i>	8537
Movement Recognition and Prediction Using DMPs <i>Kordia, Ali H.; Melo, Francisco S.</i>	8544
Session ThJT22 : Motion Prediction in Navigation	
Occupancy Map Inpainting for Online Robot Navigation <i>Wei, Minghan; Lee, Daewon; Isler, Volkan; Lee, Daniel</i>	8551
Ellipse Loss for Scene-Compliant Motion Prediction <i>Cui, Henggang; Shajari, Hoda; Yalamanchi, Sai Bhargav; Djuric, Nemanja</i>	8558
Predictive Runtime Monitoring for Mobile Robots Using Logic-Based Bayesian Intent Inference <i>Yoon, Hansol; Sankaranarayanan, Sriram</i>	8565
BiTraP: Bi-Directional Pedestrian Trajectory Prediction with Multi-Modal Goal Estimation <i>Yao, Yu; Atkins, Ella; Johnson-Roberson, Matthew; Vasudevan, Ram; Du, Xiaoxiao</i>	8572
Graph-SIM: A Graph-Based Spatiotemporal Interaction Modelling for Pedestrian Action Prediction <i>Yau, Tiffany Yee Kay; Malekmohammadi, Saber; Rasouli, Amir; Lakner, Peter; Rohani, Mohsen; Luo, Jun</i>	8580
Session ThJT19 : Multiple and Distributed Intelligence	
Multi-Robot Distributed Semantic Mapping in Unfamiliar Environments through Online Matching of Learned Representations <i>Jamieson, Stewart; Fathian, Kaveh; Khosoussi, Kasra; How, Jonathan Patrick; Girdhar, Yogesh</i>	8587
Learning to Herd Agents Amongst Obstacles: Training Robust Shepherding Behaviors Using Deep Reinforcement Learning <i>Zhi, Jixuan; Lien, Jyh-Ming</i>	8594
Sensor Placement for Globally Optimal Coverage of 3D-Embedded Surfaces <i>Feng, Si Wei; Gao, Kai; Gong, Jie; Yu, Jingjin</i>	8600
Reachability Analysis for FollowerStopper: Safety Analysis and Experimental Results	8607

Chou, Fang-Chieh; Gibson, Marsalis; Bhadani, Rahul; Bayen, Alexandre; Sprinkle, Jonathan

Session TuBT2 : Multiple and Distributed Systems I

[PRIMAL2: Pathfinding Via Reinforcement and Imitation Multi-Agent Learning - Lifelong](#) 8614
Damani, Mehul; Luo, Zhiyao; Wenzel, Emerson; Sartoretti, Guillaume Adrien

[Consensus-Based Control Barrier Function for Swarm](#) 8623
Machida, Manao; Ichien, Masumi

[Bayesian Disturbance Injection: Robust Imitation Learning of Flexible Policies](#) 8629
Oh, Hanbit; Sasaki, Hikaru; Michael, Brendan; Matsubara, Takamitsu

[Active Modular Environment for Robot Navigation](#) 8636
Kameyama, Shota; Okumura, Keisuke; Tamura, Yasumasa; Defago, Xavier

Session TuCT2 : Multiple and Distributed Systems II

[Command Filtered Tracking Control for High-Order Systems with Limited Transmission Bandwidth](#) 8643
Bao, Jiale; Liu, Peter X.; Wang, Huanqing; Zheng, Minhua; Zhao, Ying

[Online Trajectory Planning for Multiple Quadrotors in Dynamic Environments Using Relative Safe Flight Corridor](#) 8649
Park, Jungwon; Kim, H. Jin

[Multi-Scale Cost Volumes Cascade Network for Stereo Matching](#) 8657
Jia, Xiaogang; Chen, Wei; Li, Chen; Liang, Zhengfa; Wu, Mingfei; Tan, Yusong; Huang, Libo

[Hierarchical MCTS for Scalable Multi-Vessel Multi-Float Systems](#) 8664
D'urso, Giovanni Salvatore; Lee, James Ju Heon; Pizarro, Oscar; Yoo, Chanyeol; Fitch, Robert

Session TuBT3 : Multiple and Distributed Systems III

[Deep Reinforcement Learning of Event-Triggered Communication and Control for Multi-Agent Cooperative Transport](#) 8671
Shibata, Kazuki; Jimbo, Tomohiko; Matsubara, Takamitsu

[Multi-Robot Task Allocation Games in Dynamically Changing Environments](#) 8678
Park, Shinkyu; Zhong, Yaofeng Desmond; Leonard, Naomi

[An Upper Confidence Bound for Simultaneous Exploration and Exploitation in Heterogeneous Multi-Robot Systems](#) 8685
Lee, Ki Myung Brian; Kong, Felix Honglim; Cannizzaro, Ricardo; Palmer, Jennifer L.; Johnson, David; Yoo, Chanyeol; Fitch, Robert

Priority Patrolling Using Multiple Agents	8692
<i>Mallya, Deepak; Kandala, Sumanth; Vachhani, Leena; Sinha, Arpita</i>	
Session TuCT3 : Multiple and Distributed Systems IV	
Distributed Heuristic Multi-Agent Path Finding with Communication	8699
<i>Ma, Ziyuan; Luo, Yudong; Ma, Hang</i>	
Distributed PDOP Coverage Control: Providing Large-Scale Positioning Service Using a Multi-Robot System	8706
<i>Zhang, Liang; Zhang, Zexu; Siegwart, Roland; Chung, Jen Jen</i>	
Autonomous Distributed System for Gait Generation for Single-Legged Modular Robots Connected in Various Configurations	8714
<i>Hayakawa, Tomohiro; Kamimura, Tomoya; Kaji, Shizuo; Matsuno, Fumitoshi</i>	
A Distributed Two-Layer Framework for Teleoperated Platooning of Fixed-Wing UAVs Via Decomposition and Backstepping	8734
<i>Lee, Minhyeong; Lee, Dongjun</i>	
Session ThIT18 : Multiple and Distributed Systems IX	
PuzzleBots: Physical Coupling of Robot Swarms	8742
<i>Yi, Sha; Temel, Zeynep; Sycara, Katia</i>	
Spatial Intention Maps for Multi-Agent Mobile Manipulation	8749
<i>Wu, Jimmy; Sun, Xingyuan; Zeng, Andy; Song, Shuran; Rusinkiewicz, Szymon; Funkhouser, Thomas A.</i>	
Flocking-Segregative Swarming Behaviors Using Gibbs Random Fields	8757
<i>Frota Rezeck, Paulo Alfredo; Assuncao, Renato; Chaimowicz, Luiz</i>	
Multi-Agent Ergodic Coverage in Urban Environments	8764
<i>Patel, Shivang; Arul, Senthil Hariharan; Dhulipala, Pranav; Lin, Ming C.; Manocha, Dinesh; Xu, Huan; Otte, Michael W.</i>	
Session WeBT4 : Multiple and Distributed Systems V	
Multi-Target Coverage with Connectivity Maintenance Using Knowledge-Incorporated Policy Framework	8772
<i>Wu, Shiguang; Pu, Zhiqiang; Liu, Zhen; Qiu, Tenghai; Yi, Jianqiang; Zhang, Tianle</i>	
SMMR-Explore: SubMap-Based Multi-Robot Exploration System with Multi-Robot Multi-Target Potential Field Exploration Method	8779
<i>Jincheng, Yu; Tong, Jianming; Xu, Yuanfan; Xu, Zhilin; Dong, Haolin; Yang, Tianxiang; Wang, Yu</i>	
Multi-Objective Conflict-Based Search for Multi-Agent Path Finding	8786
<i>Ren, Zhongqiang; Rathinam, Sivakumar; Choset, Howie</i>	

Simultaneous Calibration of Multi-Coordinates for a Dual-Robot System by Solving the $AXB=YCZ$ Problem 8792

Wang, Gang; Wen-long, Li; Jiang, Cheng; Zhu, Dahu; Xie, He; Liu, Xingjian; Ding, Han

Session WeAT11 : Multiple and Distributed Systems VI

Pylot: A Modular Platform for Exploring Latency-Accuracy Tradeoffs in Autonomous Vehicles 8806

Gog, Ionel; Kalra, Sukrit; Schafhalter, Peter; Wright, Matthew A.; Gonzalez, Joseph E.; Stoica, Ion

Decentralized Circle Formation Control for Fish-Like Robots in Real-World Via Reinforcement Learning 8814

Zhang, Tianhao; Li, Yueheng; Li, Shuai; Ye, Qiwei; Wang, Chen; Xie, Guangming

Graph Connectivity Control of a Mobile Robot Network with Mixed Dynamic Multi-Tasks 8821

Boldrer, Manuel; Bevilacqua, Paolo; Palopoli, Luigi; Fontanelli, Daniele

Distributed Rendezvous Control of Networked Uncertain Robotic Systems with Bearing Measurements 8829

Zhao, Jianing; Hu, Hanjiang; Zhu, Keyi; Yu, Xiao; Wang, Hesheng

Session ThJT18 : Multiple and Distributed Systems VII

Flow-FL: Data-Driven Federated Learning for Spatio-Temporal Predictions in Multi-Robot Systems 8836

Majcherczyk, Nathalie; Srishankar, Nishan; Pincirolì, Carlo

CHORD: Distributed Data-Sharing Via Hybrid ROS 1 and 2 for Multi-Robot Exploration of Large-Scale Complex Environments 8843

Ginting, Muhammad Fadhil; Otsu, Kyohei; Edlund, Jeffrey; Gao, Jay; Aghamohammadi, Ali-akbar

ROS-NetSim: A Framework for the Integration of Robotic and Network Simulators 8851

Calvo-Fullana, Miguel; Mox, Daniel; Pyattaev, Alexander; Fink, Jonathan; Kumar, Vijay; Ribeiro, Alejandro

Non-Monotone Energy-Aware Information Gathering for Heterogeneous Robot Teams 8859

Cai, Xiaoyi; Schlotfeldt, Brent; Khosoussi, Kasra; Atanasov, Nikolay; Pappas, George J.; How, Jonathan Patrick

Session ThKT19 : Multiple and Distributed Systems VIII

Probabilistic Resilience of Dynamic Multi-Robot Systems 8866

Wehbe, Remy; Williams, Ryan

Distributed Topology Correction for Flexible Connectivity Maintenance in Multi-Robot Systems 8874

Yi, Sha; Luo, Wenhao; Sycara, Katia

Decentralized Nested Gaussian Processes for Multi-Robot Systems <i>Kontoudis, George; Stilwell, Daniel</i>	8881
Cascaded Filtering Using the Sigma Point Transformation <i>Shalaby, Mohammed; Cossette, Charles Champagne; Le Ny, Jerome; Forbes, James Richard</i>	8888
Session ThHT18 : Multiple and Distributed Systems X	
The Robotarium: Automation of a Remotely Accessible, Multi-Robot Testbed <i>Wilson, Sean; Glotfelter, Paul; Mayya, Siddharth; Notomista, Gennaro; Emam, Yousef; Cai, Xiaoyi; Egerstedt, Magnus</i>	8896
Multiplexing Robot Experiments: Theoretical Underpinnings, Conditions for Existence, and Demonstrations <i>Moan, Rachel; Shell, Dylan; O'Kane, Jason</i>	8904
SMAC: Symbiotic Multi-Agent Construction <i>Wagner, Caleb; Dhanaraj, Neel; Rizzo, Trevor; Contreras, Josue; Liang, Hannan; Lewin, Gregory; Pincirolì, Carlo</i>	8911
Efficient Multi-Robot Inspection of Row Crops Via Kernel Estimation and Region-Based Task Allocation <i>Edmonds, Merrill; Yi, Jingang</i>	8919
Session ThKT18 : Multiple and Distributed Systems XI	
An Adaptive Fuzzy Reinforcement Learning Cooperative Approach for the Autonomous Control of Flock Systems <i>Qu, Shuzheng; Abouheaf, Mohammed; Gueaieb, Wail; Spinello, Davide</i>	8927
Optimal Sequential Stochastic Deployment of Multiple Passenger Robots <i>Lee, Chris (Yu Hsuan); Best, Graeme; Hollinger, Geoffrey</i>	8934
Online Connectivity-Aware Dynamic Deployment for Multi-Robot System <i>Lin, Chendi; Luo, Wenhao; Sycara, Katia</i>	8941
Achieving Multitasking Robots in Multi-Robot Tasks <i>Smith, Winston; Zhang, Yu (Tony)</i>	8948
Session ThHT17 : Multiple and Distributed Systems: Control	
Communication-Aware Multi-Robot Coordination with Submodular Maximization <i>Shi, Guangyao; Ishat-E-Rabban, Md.; Zhou, Lifeng; Tokekar, Pratap</i>	8955
Controllability and Stabilization for Herding a Robotic Swarm Using a Leader: A Mean-Field Approach <i>Elamvazhuthi, Karthik; Kakish, Zahi; Shirsat, Aniket; Berman, Spring</i>	8962

Online Flocking Control of UAVs with Mean-Field Approximation <i>Fernando, Malintha</i>	8977
Proportional and Reachable Cluster Teleoperation of a Distributed Multi-Robot System <i>Yang, Yuan; Constantinescu, Daniela; Shi, Yang</i>	8984
Session ThIT17 : Multiple and Distributed Systems: Monitoring and Planning I	
Planning of Heterogeneous Multi-Agent Systems under Signal Temporal Logic Specifications with Integral Predicates <i>Buyukkocak, Ali Tevfik; Aksaray, Derya; Yazicioglu, Yasin</i>	8991
Multi-Agent Aerial Monitoring of Moving Convoys using Elliptical Orbits <i>Borkar, Aseem; Chowdhary, Girish</i>	8999
LUCIDGames: Online Unscented Inverse Dynamic Games for Adaptive Trajectory Prediction and Planning <i>Le Cleac'h, Simon; Schwager, Mac; Manchester, Zachary</i>	9006
Event-Based Signal Temporal Logic Synthesis for Single and Multi-Robot Tasks <i>Gundana, David; Kress-Gazit, Hadas</i>	9014
Session ThJT17 : Multiple and Distributed Systems: Monitoring and Planning II	
Affordable Autonomy through Cooperative Sensing and Planning <i>Kelkar, Paritosh; Chopra, Parth; Pereira, Savio; DeLano, Dan; Miller, Aaron; Rim, Kyungzun; Rajab, Samer; Butzke, Jonathan; Likhachev, Maxim</i>	9022
Reachable Polyhedral Marching (RPM): A Safety Verification Algorithm for Robotic Systems with Deep Neural Network Components <i>Vincent, Joseph; Schwager, Mac</i>	9029
Multi-Robot Dynamical Source Seeking in Unknown Environments <i>Du, Bin; Qian, Kun; Iqbal, Hassan; Claudel, Christian; Sun, Dengfeng</i>	9036
Volumetric Objectives for Multi-Robot Exploration of Three-Dimensional Environments <i>Corah, Micah; Michael, Nathan</i>	9043
Session ThKT17 : Multiple and Distributed Systems: Perception	
Adaptation to Team Composition Changes for Heterogeneous Multi-Robot Sensor Coverage <i>Reily, Brian; Mott, Terran; Zhang, Hao</i>	9051
Distributed Multi-Target Tracking for Heterogeneous Mobile Sensing Networks with Limited Field of Views <i>Chen, Jun; Dames, Philip</i>	9058
Safety with Limited Range Sensing Constraints for Fixed Wing Aircraft <i>Squires, Eric G; Konda, Rohit; Pierpaoli, Pietro; Coogan, Samuel; Egerstedt, Magnus</i>	9065

A Queue-Stabilizing Framework for Networked Multi-Robot Exploration 9072
Clark, Lillian; Galante, Joseph; Krishnamachari, Bhaskar; Psounis, Konstantinos

Session ThHT16 : Multiple and Distributed Systems: Search Algorithm

Multi-Robot Gaussian Process Estimation and Coverage: A Deterministic Sequencing Algorithm and Regret Analysis 9080
Wei, Lai; McDonald, Andrew; Srivastava, Vaibhav

Multi-agent Receding Horizon Search with Terminal Cost 9086
Biggs, Benjamin; McMahon, James; Baldoni, Phillip; Stilwell, Daniel

Shaped Policy Search for Evolutionary Strategies Using Waypoints 9093
Lekkala, Kiran; Itti, Laurent

Multi-Agent Active Search Using Realistic Depth-Aware Noise Model 9101
Ghods, Ramina; Durkin, William; Schneider, Jeff

Session ThIT16 : Multiple and Distributed Systems: Task Allocation

Fair Robust Assignment Using Redundancy 9109
Malencia, Matthew; Kumar, Vijay; Pappas, George J.; Prorok, Amanda

Fast Near-Optimal Heterogeneous Task Allocation Via Flow Decomposition 9117
Solovey, Kiril; Bandyopadhyay, Saptarshi; Rossi, Federico; Wolf, Michael; Pavone, Marco

Data-Driven Adaptive Task Allocation for Heterogeneous Multi-Robot Teams Using Robust Control Barrier Functions 9124
Emam, Yousef; Notomista, Gennaro; Glotfelter, Paul; Egerstedt, Magnus

Resilient Task Allocation in Heterogeneous Multi-Robot Systems 9131
Mayya, Siddharth; S. Dantonio, Diego; Saldaña, David; Kumar, Vijay

Session TuET2 : Multi-Robot Systems I

Self-Organised Saliency Detection and Representation in Robot Swarms 9139
Alhafnawi, Merihan; Hauert, Sabine; O'Dowd, Paul Jason

A Practical Method to Cover Evenly a Dynamic Region with a Swarm 9147
Teruel, Enrique; Aragues, Rosario; Lopez-Nicolas, Gonzalo

Robust Distributed Estimation of the Algebraic Connectivity for Networked Multi-Robot Systems 9155
Malli, Ioanna; Bechlioulis, Charalampos; Kyriakopoulos, Kostas

ModGNN: Expert Policy Approximation in Multi-Agent Systems with a Modular Graph Neural Network Architecture 9161
Kortvelesy, Ryan; Prorok, Amanda

Session TuGT3 : Multi-Robot Systems II

- [WRAPP-Up: A Dual-Arm Robot for Intralogistics](#) 9168
Garabini, Manolo; Caporale, Danilo; Tincani, Vinicio; Palleschi, Alessandro; Gabellieri, Chiara; Gugliotta, Marco; Settimi, Alessandro; Catalano, Manuel Giuseppe; Grioli, Giorgio; Pallottino, Lucia
- [A Laser-Based Dual-Arm System for Precise Control of Collaborative Robots](#) 9183
Silvério, João; Clivaz, Guillaume; Calinon, Sylvain
- [Near-Optimal Multi-Robot Motion Planning with Finite Sampling](#) 9190
Dayan, Dror; Solovey, Kiril; Pavone, Marco; Halperin, Dan
- [Whole-Body Real-Time Motion Planning for Multicopters](#) 9197
Yang, Shaohui; He, Botao; Wang, Zhepei; Xu, Chao; Gao, Fei

Session TuHT3 : Multi-Robotic Systems Award Session

- [Self-Organized Evasive Fountain Maneuvers with a Bioinspired Underwater Robot Collective](#) 9204
Berlinger, Florian; Wulkop, Paula; Nagpal, Radhika
- [Learning Multi-Arm Manipulation through Collaborative Teleoperation](#) 9212
Tung, Albert; Wong, Josiah; Mandlekar, Ajay Uday; Martín-Martín, Roberto; Zhu, Yuke; Fei-Fei, Li; Savarese, Silvio

Session ThIT19 : Multi-View Perception

- [Probabilistic Multi-View Fusion of Active Stereo Depth Maps for Robotic Bin-Picking](#) 9220
Yang, Jun; Li, Dong; Waslander, Steven Lake
- [Multi-View Sensor Fusion by Integrating Model-Based Estimation and Graph Learning for Collaborative Object Localization](#) 9228
Gao, Peng; Guo, Rui; Lu, Hongsheng; Zhang, Hao
- [Deep Multi-View Depth Estimation with Predicted Uncertainty](#) 9235
Ke, Tong; Do, Tien; Vuong, Khiem; Sartipi, Kourosh; Roumeliotis, Stergios
- [MultiViewStereoNet: Fast Multi-View Stereo Depth Estimation Using Incremental Viewpoint-Compensated Feature Extraction](#) 9242
Greene, William Nicholas; Roy, Nicholas

Session TuBT0 : Navigation and Mapping

- [Differential Information Aided 3-D Registration for Accurate Navigation and Scene Reconstruction](#) 9249
Jin, Wu; Zhang, Shuyang; Zhu, Yilong; Geng, Ruoyu; Fu, Zhongtao; Ma, Fulong; Liu, Ming

Autonomous Navigation in Dynamic Environments with Multi-Modal Perception Uncertainties <i>Guo, Hongliang; Huang, Zefan; Ho, Qi Heng; Ang Jr, Marcelo H; Rus, Daniela</i>	9255
Learning World Transition Model for Socially Aware Robot Navigation <i>Cui, Yuxiang; Zhang, Haodong; Wang, Yue; Xiong, Rong</i>	9262
Probabilistic Dynamic Crowd Prediction for Social Navigation <i>Kiss, Stefan; Katuwandeniya, Kavindie; Alempijevic, Alen; Vidal-Calleja, Teresa A.</i>	9269
Session TuCT0 : Navigation in Humanoids and Animaloids	
Autonomous Decentralized Shape-Based Navigation for Snake Robots in Dense Environments <i>Sartoretti, Guillaume Adrien; Wang, Tianyu; Chuang, Gabriel; Li, Qingyang; Choset, Howie</i>	9276
Real-Time Optimal Navigation Planning Using Learned Motion Costs <i>Yang, Bowen; Wellhausen, Lorenz; Miki, Takahiro; Liu, Ming; Hutter, Marco</i>	9283
Humanoid Loco-Manipulation Planning Based on Graph Search and Reachability Maps <i>Murooka, Masaki; Kumagai, Iori; Morisawa, Mitsuharu; Kanehiro, Fumio; Kheddar, Abderrahmane</i>	9290
Autonomous Navigation for Adaptive Unmanned Underwater Vehicles Using Fiducial Markers <i>Chen, Juan; Sun, Caiming; Zhang, Aidong</i>	9298
Session ThDT4 : Novel Applications I	
OpenBot: Turning Smartphones into Robots <i>Mueller, Matthias; Koltun, Vladlen</i>	9305
Quasi-LPV Unknown Input Observer with Nonlinear Outputs: Application to Motorcycles <i>Nehaoua, Lamri; Fouka, Majda; Arioui, Hichem</i>	9312
A Novel Torsional Actuator Augmenting Twisting Skeleton and Artificial Muscle for Robots in Extreme Environments <i>Jiang, Zhujin; Zhang, Ketao</i>	9318
Compact Digital Microrobot Based on Multistable Modules <i>Mohand Ousaid, Abdenbi; Bouhadda, Ismail; Bourbon, Gilles; Le moal, Patrice; Haddab, Yassine; Lutz, Philippe</i>	9325
Session WeCT2 : Novel Applications II	
A General Elimination Strategy for Camera Motion Estimation <i>Ding, Yaqing; Su, Yingna; Xu, Cheng-Zhong; Yang, Jian; Kong, Hui</i>	9333
Group Feature Learning and Domain Adversarial Neural Network for aMCI Diagnosis System Based on EEG	9340

Fan, Chen-Chen; Xie, Haiqun; Peng, Liang; Yang, Hongjun; Ni, ZhenLiang; Wang, Guan'an; Zhou, Yan-Jie; Chen, Sheng; Fang, Zhijie; Huang, Shuyun; Hou, Zeng-Guang

Line-Based Automatic Extrinsic Calibration of LiDAR and Camera 9347
Zhang, Xinyu; Zhu, Shifan; Guo, Shichun; Li, Jun; Liu, Huaping

RIL: Riemannian Incremental Learning of the Inertial Properties of the Robot Body Schema 9354
Diaz Ledezma, Fernando; Haddadin, Sami

Session ThET4 : Novel Applications III

ChoiRbot: A ROS 2 Toolbox for Cooperative Robotics 9361
Testa, Andrea; Camisa, Andrea; Notarstefano, Giuseppe

Formal Verification of ROS Based Systems Using a Linear Logic Theorem Prover 9368
Kortik, Sitar; Shastha, Tejas

Fuzz Testing in Behavior-Based Robotics 9375
Delgado Vega, Rodrigo Alexis; Campusano, Miguel; Bergel, Alex

The Robot Household Marathon Experiment 9382
Kazhoyan, Gayane; Stelter, Simon; Kenghagho Kenfack, Franklin; Koralewski, Sebastian; Beetz, Michael

Session WeCT9 : Novel Applications IV

Sliding Mode Control of the Semi-Active Hover Backpack Based on the Bioinspired Skyhook Damper Model 9389
Zhang, Bin; Liu, Tao; Fan, Wu; Zhang, Jinyuan

Fast Light Show Design Platform for K-12 Children 9396
Mao, Pengda; Gao, Yan; Wang, Bo; Yan, An; Chi, Xiaoyu; Quan, Quan

Autonomous Overtaking in Gran Turismo Sport Using Curriculum Reinforcement Learning 9403
Song, Yunlong; Lin, HaoChih; Kaufmann, Elia; Duerr, Peter; Scaramuzza, Davide

An MR Safe Rotary Encoder Based on Eccentric Sheave and FBG Sensors 9410
Huang, Shaoping; Gao, Anzhu; Wu, Zicong; Lou, Chuqian; Wang, Yanjun; Yang, Guang-Zhong

Session ThFT5 : Novel Applications V

A Relative Dynamics Formulation for Hardware-In-The-Loop Simulation of On-Orbit Robotic Missions 9417
De Stefano, Marco; Mishra, Hrishik; Giordano, Alessandro Massimo; Lampariello, Roberto; Ott, Christian

Structured Prediction for CRISP Inverse Kinematics Learning with Misspecified Robot Models 9425

Marconi, Gian Maria; Camoriano, Raffaello; Rosasco, Lorenzo; Ciliberto, Carlo

[Rapid Solution of Cosserat Rod Equations Via a Nonlinear Partial Observer](#) 9433
Thamo, Balint; Dhaliwal, Kev; Khadem, Mohsen

[The Effects of Robot Cognitive Reliability and Social Positioning on Child-Robot Team Dynamics](#) 9439
Charisi, Vicky; Merino, Luis; Escobar Planas, Marina; Caballero, Fernando; Gomez, Randy; Gomez, Emilia

Session ThET5 : Novel Applications: Manipulation

[ProbRobScene: A Probabilistic Specification Language for 3D Robotic Manipulation Environments](#) 9446
Innes, Craig; Ramamoorthy, Subramanian

[Towards Real-Time Interaction with Industrial Robots in the Creative Industries](#) 9453
Braumann, Johannes; Singline, Karl

[Automated Acquisition of Structured, Semantic Models of Manipulation Activities from Human VR Demonstration](#) 9460
Haidu, Andrei; Beetz, Michael

[A Shared Control Framework for Robotic Telemanipulation Combining Electromyography Based Motion Estimation and Compliance Control](#) 9467
Dwivedi, Anany; Turner, Amber; Shieff, Dasha; Gorjup, Gal; Kwon, Yongje; Liarokapis, Minas

Session WeBT10 : Novel Design Technologies

[NeuralSim: Augmenting Differentiable Simulators with Neural Networks](#) 9474
Heiden, Eric; Millard, David; Coumans, Erwin; Sheng, Yizhou; Sukhatme, Gaurav

[V-Stability Based Control for Energy-Saving towards Long Range Sailing*](#) 9482
Sun, Qinbo; Qi, Weimin; Ji, Xiaoqiang; Qian, Huihuan (Alex)

[Continuous Transition: Improving Sample Efficiency for Continuous Control Problems Via MixUp](#) 9490
Lin, Junfan; Huang, Zhongzhan; Wang, Keze; Liang, Xiaodan; Chen, Weiwei; Lin, Liang

[Effective Crash Recovery of Robot Software Programs in ROS](#) 9498
Zou, Yong-Hao; Bai, Jia-Ju

Session ThFT4 : Object Detection and Segmentation I

[Self-Supervised Visual Terrain Classification from Unsupervised Acoustic Feature Learning](#) 9505
Zürn, Jannik; Burgard, Wolfram; Valada, Abhinav

[Fast Few-Shot Classification by Few-Iteration Meta-Learning](#) 9522
Tripathi, Ardhendu Shekhar; Danelljan, Martin; Van Gool, Luc; Timofte, Radu

Deep Hierarchical Rotation Invariance Learning with Exact Geometry Feature Representation for Point Cloud Classification 9529
Lin, Jianjie; Rickert, Markus; Knoll, Alois

Fool Me Once: Robust Selective Segmentation Via Out-Of-Distribution Detection with Contrastive Learning 9536
Williams, David; Gadd, Matthew; De Martini, Daniele; Newman, Paul

Session ThJT16 : Object Recognition and Segmentation II

TORNADO-Net: MulTiview tOtal vaRiation semAntic Segmentation with Diamond inceptiOn Module 9543
Gerdzhev, Martin; Razani, Ryan; Taghavi, Ehsan; Liu, Bingbing

Lite-HDSeg: LiDAR Semantic Segmentation Using Lite Harmonic Dense Convolutions 9550
Razani, Ryan; Cheng, Ran; Taghavi, Ehsan; Liu, Bingbing

Real-Time Semantic Segmentation with Fast Attention 9557
Hu, Ping; Perazzi, Federico; Heilbron, Fabian David; Wang, Oliver; Lin, Zhe; Saenko, Kate; Sclaroff, Stanley

A Graph-Based Method for Joint Instance Segmentation of Point Clouds and Image Sequences 9565
Abello, Montiel; Mangelson, Joshua; Kaess, Michael

Session ThKT16 : Object Recognition and Segmentation III

Fusing RGBD Tracking and Segmentation Tree Sampling for Multi-Hypothesis Volumetric Segmentation 9572
Price, Andrew; Huang, Kun; Berenson, Dmitry

YolactEdge: Real-Time Instance Segmentation on the Edge 9579
Liu, Haotian; Rivera Soto, Rafael; Xiao, Fanyi; Lee, Yong Jae

Learning Panoptic Segmentation from Instance Contours 9586
Chennupati, Sumanth; Narayanan, Venkatraman; Sistu, Ganesh; Yogamani, Senthil; Rawashdeh, Samir

0-MMS: Zero-Shot Multi-Motion Segmentation with a Monocular Event Camera 9594
Parameshwara, Chethan; J Sanket, Nitin; Singh, Chahat; Fermuller, Cornelia; Aloimonos, Yiannis

Session ThFT3 : Odometry I

Self-Supervised Learning of LiDAR Odometry for Robotic Applications 9601
Nubert, Julian; Khattak, Shehryar; Hutter, Marco

Tight Integration of Feature-based Relocalization in Monocular Direct Visual Odometry 9608
Gladkova, Mariia; Wang, Rui; Zeller, Niclas; Cremers, Daniel

Continuous Scale-Space Direct Image Alignment for Visual Odometry from RGB-D Images 9615
Ahmine, Yassine; Caron, Guillaume; Chouireb, Fatima; Mouaddib, El Mustapha

Unified Multi-Modal Landmark Tracking for Tightly Coupled Lidar-Visual-Inertial Odometry 9623
Wisth, David; Camurri, Marco; Das, Sandipan; Fallon, Maurice

Session ThDT5 : Odometry II

Simple but Effective Redundant Odometry for Autonomous Vehicles 9631
Reinke, Andrzej; Chen, Xieyuanli; Stachniss, Cyrill

Markov Localisation Using Heatmap Regression and Deep Convolutional Odometry 9638
Mendez Maldonado, Oscar Alejandro; Hadfield, Simon; Bowden, Richard

R-LOAM: Improving LiDAR Odometry and Mapping with Point-To-Mesh Features of a Known 3D Reference Object 9645
Oelsch, Martin; Karimi, Mojtaba; Steinbach, Eckehard

Autonomous Cooperative Visual Navigation for Planetary Exploration Robots 9653
Sotoodeh Bahraini, Masoud; Zenati, Abdelhafid; Aouf, Nabil

Session ThET6 : Optimal Control for Motion Planning

Optimal TCP and Robot Base Placement for a Set of Complex Continuous Paths 9659
Weingartshofer, Thomas; Hartl-Nesic, Christian; Kugi, Andreas

Control-Tree Optimization: An Approach to MPC under Discrete Partial Observability 9666
Phiquepal, Camille; Toussaint, Marc

Leveraging Neural Network Gradients within Trajectory Optimization for Proactive Human-Robot Interactions 9673
Schaefer, Simon; Leung, Karen; Ivanovic, Boris; Pavone, Marco

Gramian-based optimal active sensing control under intermittent measurements 9680
Napolitano, Olga; Fontanelli, Daniele; Pallottino, Lucia; Salaris, Paolo

Session TuHT22 : Optimization

A Complete, Accurate and Efficient Solution for the Perspective-N-Line Problem 9687
Zhou, Lipu; Koppel, Daniel; Kaess, Michael

Accelerating Robot Dynamics Gradients on a CPU, GPU, and FPGA 9695
Plancher, Brian; Neuman, Sabrina; Bourgeat, Thomas; Kuindersma, Scott; Devadas, Srinj; Janapa Reddi, Vijay

Accelerating Combinatorial Filter Reduction through Constraints 9703
Zhang, Yulin; Rahmani, Hazhar; Shell, Dylan; O'Kane, Jason

Persistent Covering with Latency and Energy Constraints 9710
Lien, Jyh-Ming; Rodriguez, Samuel; Morales, Marco

Session ThHT15 : Optimization and Control I

Equality Constrained Linear Optimal Control with Factor Graphs 9717
Yang, Shuo; Chen, Gerry; Zhang, Yetong; Choset, Howie; Dellaert, Frank

Robust Optimization-based Motion Planning for high-DOF Robots under Sensing Uncertainty 9724
Quintero-Peña, Carlos; Kyrillidis, Anastasios; Kavraki, Lydia

Optimized Coverage Planning for UV Surface Disinfection 9731
Correia Marques, Joao Marcos; Ramalingam, Ramya; Pan, Zherong; Hauser, Kris

Constrained Differential Dynamic Programming Revisited 9738
Aoyama, Yuichiro; Patel, Akash; Boutselis, George; Theodorou, Evangelos

Session ThIT15 : Optimization and Control II

Computing All Solutions to a Discretization-Invariant Formulation for Optimal Mechanism Design 9745
Baskar, Aravind; Plecnik, Mark

Optimal Multi-Manipulator Arm Placement for Maximal Dexterity During Robotics Surgery 9752
Di, James; Xu, Mingwei; Das, Nikhil; Yip, Michael C.

Balancing Stability and Stiffness through Optimization of Parallel Compliance 9759
Kim, Mincheol; Deshpande, Ashish

Direct Policy Optimization Using Deterministic Sampling and Collocation 9767
Howell, Taylor; Fu, Chunjiang; Manchester, Zachary

Session ThFT6 : Optimization and Control III

Linear-Quadratic Optimal Control in Maximal Coordinates 9775
Bruedigam, Jan; Manchester, Zachary

Safe and Efficient Model-Free Adaptive Control Via Bayesian Optimization 9782
König, Christopher; Turchetta, Matteo; Lygeros, John; Rupenyan, Alisa; Krause, Andreas

Data-efficient Domain Randomization with Bayesian Optimization 9789
Muratore, Fabio; Eilers, Christian; Gienger, Michael; Peters, Jan

Adaptive Robust Kernels for Non-Linear Least Squares Problems 9797
Chebrolu, Nived; Läbe, Thomas; Vysotska, Olga; Behley, Jens; Stachniss, Cyrill

Session ThET7 : Optimization for Legged Robots

Receding-Horizon Perceptive Trajectory Optimization for Dynamic Legged Locomotion with Learned Initialization 9805
Melon, Oliwier Aleksander; Orsolino, Romeo; Surovik, David; Geisert, Mathieu; Havoutis, Ioannis; Fallon, Maurice

Trajectory Optimization of Contact-Rich Motions Using Implicit Differential Dynamic Programming 9812
Chatzinikolaidis, Iordanis; Li, Zhibin

Friction-Driven Three-Foot Robot Inspired by Snail Movement 9820
Yue, Tianqi; Gadelha, Hermes; Rossiter, Jonathan

Modeling and Optimal Control for Rope-Assisted Rappelling Maneuvers 9826
Mingo Hoffman, Enrico; Parigi Polverini, Matteo; Laurenzi, Arturo; Tsagarakis, Nikos

Session ThDT7 : Optimization for Multi-Robot Systems

General-Sum Multi-Agent Continuous Inverse Optimal Control 9833
Neumeyer, Christian; Oliehoek, Frans; Gavrilu, Dariu

Shared Control of Robot-Robot Collaborative Lifting with Agent Postural and Force Ergonomic Optimization 9840
Rapetti, Lorenzo; Tirupachuri, Yeshasvi; Ranavolo, Alberto; Kawakami, Tomohiro; Yoshiike, Takahide; Pucci, Daniele

Rapidly Adapting Robot Swarms with Swarm Map-Based Bayesian Optimisation 9848
Bossens, David Mark; Tarapore, Danesh

GPU Accelerated Convex Approximations for Fast Multi-Agent Trajectory Optimization 9855
Rastgar, Fatemeh; Masnavi, Houman; Shrestha, Jatan; Kruusamäe, Karl; Aabloo, Alvo; Singh, Arun Kumar

Session ThIT14 : Optimization in Robotic Design I

Multi-Objective Graph Heuristic Search for Terrestrial Robot Design 9863
Xu, Jie; Spielberg, Andrew; Zhao, Allan; Rus, Daniela; Matusik, Wojciech

Factor Graph-Based Trajectory Optimization for a Pneumatically-Actuated Jumping Robot 9870
Tiziani, Lucas; Zhang, Yetong; Dellaert, Frank; Hammond III, Frank L.

MO-BBO: Multi-Objective Bilevel Bayesian Optimization for Robot and Behavior Co-Design 9877
Kim, Yeonju; Hauser, Kris; Pan, Zherong

Manipulator Task Space Trajectory Tracking with Kinematics and Dynamics Uncertainties 9884
Tarokh, Mahmoud

Session ThDT6 : Optimization in Robotic Design II

Minimum-Effort Task-Based Design Optimization of Modular Reconfigurable Robots <i>Romiti, Edoardo; Kashiri, Navvab; Malzahn, Jörn; Tsagarakis, Nikos</i>	9891
Computational Design of Energy-Efficient Legged Robots: Optimizing for Size and Actuators <i>Fadini, Gabriele; Flayols, Thomas; Del Prete, Andrea; Mansard, Nicolas; Soueres, Philippe</i>	9898
On the Effect of Robotic Leg Design on Energy Efficiency <i>Koutsoukis, Konstantinos; Papadopoulos, Evangelos</i>	9905
Elastic Structure Preserving Control for Compliant Robots Driven by Agonistic-Antagonistic Actuators (ESPaa) <i>Mengacci, Riccardo; Keppler, Manuel; Pfanne, Martin; Bicchi, Antonio; Ott, Christian</i>	9912

Session ThJT15 : Optimization-Based Motion Planning I

Contact-Implicit Trajectory Optimization with Learned Deformable Contacts Using Bilevel Optimization <i>Zhu, Yifan; Pan, Zherong; Hauser, Kris</i>	9921
Energy-Optimal Path Planning with Active Flow Perception for Autonomous Underwater Vehicles <i>Yang, Niankai; Chang, Dongsik; Johnson-Roberson, Matthew; Sun, Jing</i>	9928
Double Meta-Learning for Data Efficient Policy Optimization in Non-Stationary Environments <i>Aghapour, Elahe; Ayanian, Nora</i>	9935
Adversarial Attacks on Optimization Based Planners <i>Vemprala, Sai; Kapoor, Ashish</i>	9943

Session ThKT15 : Optimization-Based Motion Planning II

Strobe: An Acceleration Meta-Algorithm for Optimizing Robot Paths Using Concurrent Interleaved Sub-Epoch Pods <i>Rakita, Daniel; Mutlu, Bilge; Gleicher, Michael</i>	9950
Designing Multi-Stage Coupled Convex Programming with Data-Driven McCormick Envelope Relaxations for Motion Planning <i>Lin, Xuan; Ahn, Min Sung; Hong, Dennis</i>	9957
Robust Model Predictive Path Integral Control: Analysis and Performance Guarantees <i>Gandhi, Manan; Vlahov, Bogdan; Gibson, Jason; Williams, Grady; Theodorou, Evangelos</i>	9964
Belief Space Planning for Mobile Robots with Range Sensors Using ILQG <i>Sun, Ke; Kumar, Vijay</i>	9973

Session ThHT14 : Optimization-Based Motion Planning III

Multi-Modal Motion Planning Using Composite Pose Graph Optimization <i>Lao Beyer, Lukas; Balabanska, Nadya; Tal, Ezra; Karaman, Sertac</i>	9981
Asymptotically Optimal Kinodynamic Planning Using Bundles of Edges <i>Shome, Rahul; Kavraki, Lydia</i>	9988
CollisionIK: A Per-Instant Pose Optimization Method for Generating Robot Motions with Environment Collision Avoidance <i>Rakita, Daniel; Shi, Haochen; Mutlu, Bilge; Gleicher, Michael</i>	9995
Trajectory Optimization for Manipulation of Deformable Objects: Assembly of Belt Drive Units <i>Jin, Shiyu; Romeres, Diego; Raghunathan, Arvind; Jha, Devesh; Tomizuka, Masayoshi</i>	10002
Session ThFT7 : Path Planning for Multiple Mobile Robots	
Hierarchical and Flexible Traffic Management of Multi-AGV Systems Applied to Industrial Environments <i>Pratissoli, Federico; Battilani, Nicola; Fantuzzi, Cesare; Sabattini, Lorenzo</i>	10009
Combining Multi-Robot Motion Planning and Goal Allocation Using Roadmaps <i>Salvado, João; Mansouri, Masoumeh; Pecora, Federico</i>	10016
Asynchronous Reliability-Aware Multi-UAV Coverage Path Planning <i>Li, Mickey; Richards, Arthur; Sooriyabandara, Mahesh</i>	10023
Distributed Coordinated Path Following Using Guiding Vector Fields <i>Yao, Weijia; Garcia de Marina, Hector; Sun, Zhiyong; Cao, Ming</i>	10030
Session WeBT16 : Path Planning for Multiple Robots	
An Efficient Parallel Self-Assembly Planning Algorithm for Modular Robots in Environments with Obstacles <i>Zhang, Lianxin; Fu, Zhang-Hua; Liu, Hengli; Liu, Qingquan; Ji, Xiaoqiang; Qian, Huihuan (Alex)</i>	10038
Multi-Robot Informative Path Planning Using a Leader-Follower Architecture <i>Di Caro, Gianni; Ziaullah Yousaf, Abdul Wahab</i>	10045
Tightly-Coupled Perception and Navigation of Heterogeneous Land-Air Robots in Complex Scenarios <i>Yue, Yufeng; Wen, Mingxing; Putra, Yosmar; Wang, Meiling; Wang, Danwei</i>	10052
Fully Distributed Cooperation for Networked Uncertain Mobile Manipulators <i>Ren, Yi; Sosnowski, Stefan; Hirche, Sandra</i>	10059
Session ThET8 : Path Planning I	
FT-BSP: Focused Topological Belief Space Planning	10079

Shienman, Moshe; Kitanov, Andrej; Indelman, Vadim

[Path Planning for a Reconfigurable Robot in Extreme Environments](#) 10087
Cheah, Wei; Garcia-Nathan, Tomas Bartolome; Groves, Keir; Watson, Simon; Lennox, Barry

[AM-RRT*: Informed Sampling-Based Planning with Assisting Metric](#) 10093
Armstrong, Daniel; Jonasson, André

[Complete Path Planning That Simultaneously Optimizes Length and Clearance](#) 10100
Sakcak, Basak; LaValle, Steven M

Session ThFT8 : Path Planning II

[On Smooth Time-Optimal Trajectory Planning in Twisted String Actuators](#) 10107
Nedelchev, Simeon; Kirsanov, Daniil; Gaponov, Igor; Seong, Hyeonseok; Ryu, Jee-Hwan

[Fast Swing-Up Trajectory Optimization for a Spherical Pendulum on a 7-DoF Collaborative Robot](#) 10114
Vu, Minh Nhat; Hartl-Nesic, Christian; Kugi, Andreas

[Surface-Based Path Following Control: Application of Curved Tapes on 3D Objects](#) 10121
Hartl-Nesic, Christian; Glück, Tobias; Kugi, Andreas

[Human-Robot Collaborative Multi-Agent Path Planning Using Monte Carlo Tree Search and Social Reward Sources](#) 10133
Dalmasso, Marc; Garrell, Anais; Dominguez-Vidal, Jose Enrique; Jiménez, Pablo; Sanfeliu, Alberto

Session TuET0 : Perception for Manipulation I

[Embodied Reasoning for Discovering Object Properties Via Manipulation](#) 10139
Behrens, Jan Kristof; Nazarczuk, Michal; Stepanova, Karla; Hoffmann, Matej; Demir, Yiannis; Mikolajczyk, Krystian

[Robust High-Transparency Haptic Exploration for Dexterous Telemanipulation](#) 10146
Kouhkiloui Babarahmati, Keyhan; Tiseo, Carlo; Rouxel, Quentin; Li, Zhibin; Mistry, Michael

[Unsupervised Feature Learning for Manipulation with Contrastive Domain Randomization](#) 10153
Rabinovitz, Carmel; Gruben, Niko; Tamar, Aviv

["What's This?" - Learning to Segment Unknown Objects from Manipulation Sequences](#) 10160
Boerdijk, Wout; Sundermeyer, Martin; Durner, Maximilian; Triebel, Rudolph

Session TuGT0 : Perception for Manipulation II

[Polyhedral Friction Cone Estimator for Object Manipulation](#) 10168

Azad, Morteza; Cruciani, Silvia; Jacob Mathew, Michael; Deacon, Graham; de Chambrier, Guillaume

[Interpretability in Contact-Rich Manipulation via Kinodynamic Images](#) 10175
Mitsioni, Ioanna; Mänttari, Joonatan; Karayiannidis, Yiannis; Folkesson, John; Kragic, Danica

[Differentiable Simulation for Physical System Identification](#) 10182
Le Lidec, Quentin; Kalevatykh, Igor; Laptev, Ivan; Schmid, Cordelia; Carpentier, Justin

[Few-Shot Model-Based Adaptation in Noisy Conditions](#) 10190
Arndt, Karol; Ghadirzadeh, Ali; Hazara, Murtaza; Kyrki, Ville

Session ThJT14 : Planning Algorithms for Robotics

[Minimal Exposure Dubins Orienteering Problem](#) 10198
G. Macharet, Douglas; Alves Neto, Armando; Shishika, Daigo

[Generalized Nonlinear and Finsler Geometry for Robotics](#) 10206
Ratliff, Nathan; Van Wyk, Karl; Xie, Man; Li, Anqi; Rana, Muhammad Asif

[A Fast and Approximate Medial Axis Sampling Technique](#) 10213
Denny, Jory; Qin, David; Zhou, Hanglin

[An Adaptive Method for the Stochastic Orienteering Problem](#) 10220
Thayer, Thomas C.; Carpin, Stefano

Session ThDT8 : Pose Estimation

[Probabilistic Scan Matching: Bayesian Pose Estimation from Point Clouds](#) 10228
Mendrzik, Rico; Meyer, Florian

[Learning a State Representation and Navigation in Cluttered and Dynamic Environments](#) 10235
Hoeller, David; Wellhausen, Lorenz; Farshidian, Farbod; Hutter, Marco

[Reinforcement Learning for Orientation Estimation Using Inertial Sensors with Performance Guarantee](#) 10243
Hu, Liang; Tang, Yujie; Zhou, Zhipeng; Pan, Wei

[Consistent State Estimation on Manifolds for Autonomous Metal Structure Inspection](#) 10250
Starbuck, Bryan; Fornasier, Alessandro; Weiss, Stephan; Pradalier, Cedric

Session ThKT14 : Probabilistic Method in Motion Planning

[Planning on a \(Risk\) Budget: Safe Non-Conservative Planning in Probabilistic Dynamic Environments](#) 10257

Huang, Hung-Jui; Huang, Kai-Chi; Čáp, Michal; Zhao, Yibiao; Wu, Ying Nian; Baker, Chris

[Avoidance Critical Probabilistic Roadmaps for Motion Planning in Dynamic Environments](#) 10264
Arias, Felipe Felix; Ichter, Brian; Faust, Aleksandra; Amato, Nancy

[Robust Trajectory Optimization Over Uncertain Terrain with Stochastic Complementarity](#) 10271
Drnach, Luke; Zhao, Ye

[Planning under Non-Rational Perception of Uncertain Spatial Costs](#) 10279
Suresh, Aamodh; Martinez, Sonia

Session ThAT7 : Reconstruction and Perception

[Rapid Pose Label Generation through Sparse Representation of Unknown Objects](#) 10287
Singh, Rohan Pratap; Benallegue, Mehdi; Yoshiyasu, Yusuke; Kanehiro, Fumio

[Learning to Predict Repeatability of Interest Points](#) 10294
Doan, Anh-Dzung; Turmukhambetov, Daniyar; Latif, Yasir; Chin, Tat-Jun; Bae, Soohyun

[DRACO: Weakly Supervised Dense Reconstruction and Canonicalization of Objects](#) 10302
Sajnani, Rahul; Sanchawala, Aadil Mehdi; Jatavallabhula, Krishna; Sridhar, Srinath; Krishna, Madhava

[FastFlowNet: A Lightweight Network for Fast Optical Flow Estimation](#) 10310
Kong, Lingtong; Shen, Chunhua; Yang, Jie

Session ThHT13 : Rehabilitation and Assistive Robotics I

[Drumming Arm: An Upper-Limb Prosthetic System to Restore Grip Control for a Transradial Amputee Drummer](#) 10317
Yang, Ning; Sha, Ruizhi; Sankaranarayanan, Raghavasimhan; Sun, Qianyi; Weinberg, Gil

[Analysis of the Effect of Common Disturbances on the Safety of a Wearable Tremor Suppression Device](#) 10324
Zhou, Yue; Ibrahim, Anas; Naish, Michael D.; Jenkins, Mary; Trejos, Ana Luisa

[FLEXotendon Glove-III: Soft Robotic Hand Rehabilitation Exoskeleton for Spinal Cord Injury](#) 10332
Tran, Phillip; Jeong, Seokhwan; Herrin, Kinsey; Bhatia, Shovan; Kozin, Scott; Desai, Jaydev P.

[Development of a Series Elastic Elbow Neurological Exam Training Simulator for Lead-Pipe Rigidity](#) 10340
Gim, Kevin; He, Maxine; Mansouri, Mahshid; Pei, Yinan; Ripperger, Evan; Zallek, Christopher; Hsiao-Weckslar, Elizabeth

Session TuFT0 : Rehabilitation and Assistive Robotics II

A Variable Soft Finger Exoskeleton for Quantifying Fatigue-Induced Mechanical Impedance 10347
Xiong, Xiaofeng; Manoonpong, Poramate

A Constant-Force End-Effector with Online Force Adjustment for Robotic Ultrasonography 10353
Bao, Xianqiang; Wang, Shuangyi; Housden, Richard James; Hajnal, Joseph; Rhode, Kawal

Affordance-Aware Handovers with Human Arm Mobility Constraints 10361
Ardón, Paola; Cabrera, Maria Eugenia; Pairet, Èric; Petrick, Ron; Ramamoorthy, Subramanian; Lohan, Katrin Solveig; Cakmak, Maya

Wearable Integrated Soft Haptics in a Prosthetic Socket 10369
Barontini, Federica; Catalano, Manuel Giuseppe; Grioli, Giorgio; Bianchi, Matteo; Bicchi, Antonio

Session ThAT6 : Rehabilitation and Assistive Robotics III

Verbal Focus-Of-Attention System for Learning-From-Observation 10377
Wake, Naoki; Yanokura, Iori; Sasabuchi, Kazuhiro; Ikeuchi, Katsushi

Hybrid Model Control of WalkON Suit for Precise and Robust Gait Assistance of Paraplegics 10385
Park, Kyeong-Won; Choi, Jungsu; Kong, Kyoungchul

A Novel Gait Phase Detection Algorithm for Foot Drop Correction through Optimal Hybrid FES-Orthosis Assistance 10391
Jung, Pyeong-gook; Huo, Weiguang; Moon, Huiseok; Amirat, Yacine; Mohammed, Samer

A Phase-Shifting Based Human Gait Phase Estimation for the Powered Transfemoral Prosthesis 10398
Hong, Woolim; Hur, Pilwon; Anil Kumar, Namita

Session ThIT13 : Rehabilitation and Assistive Robotics IV

Customized Handling of Unintended Interface Operation in Assistive Robots 10406
Edakkattil Gopinath, Deepak; Nejati Javaremi, Mahdieh; Argall, Brenna

Integrated Voluntary-Reactive Control of a Human-SuperLimb Hybrid System for Hemiplegic Patient Support 10413
Song, Hanjun; Asada, Harry

Inverse Optimal Robust Adaptive Controller for Upper Limb Rehabilitation Exoskeletons with Inertia and Load Uncertainties 10421
Wang, Jiamin; Barry, Oumar

Perceived Usefulness of a Social Robot Augmented Telehealth Platform by Therapists in the United States 10430
Sobrepera, Michael J.; Lee, Vera G.; Garg, Suveer; Mendonca, Rochelle; Johnson, Michelle J.

Session TuFT2 : Rehabilitation and Assistive Robotics V

- [Toward Seamless Transitions between Shared Control and Supervised Autonomy in Robotic Assistance](#) 10438
Bustamante, Samuel; Quere, Gabriel; Hagmann, Katharina; Wu, Xuwei; Schmaus, Peter; Vogel, Jörn; Stulp, Freek; Leidner, Daniel
- [Computing the Positioning Error of an Upper-Arm Robotic Prosthesis from the Observation of Its Wearer's Posture](#) 10446
Poignant, Alexis; Legrand, Mathilde; Jarrassé, Nathanael; Morel, Guillaume
- [Intent-Aware Control in Kinematically Redundant Systems: Towards Collaborative Wearable Robots](#) 10453
Khoramshahi, Mahdi; Morel, Guillaume; Jarrassé, Nathanael
- [Foot Placement Prediction for Assistive Walking by Fusing Sequential 3D Gaze and Environmental Context](#) 10461
Zhang, Kuangen; Liu, Haiyuan; Fan, Zixuan; Chen, Xinxing; Leng, Yuquan; de Silva, Clarence; Fu, Chenglong

Session ThBT6 : Rehabilitation and Assistive Robotics VI

- [Nonlinear Disturbance Observer-Based Robust Position Control for Series Elastic Actuator-Driven Robots](#) 10469
Han, Shuaishuai; Wang, Haoping; Yu, Haoyong
- [Composing an Assistive Control Strategy Based on Linear Bellman Combination from Estimated User's Motor Goal](#) 10476
Furukawa, Jun-ichiro; Morimoto, Jun
- [Biomimetic Control of Myoelectric Prosthetic Hand Based on a Lambda-Type Muscle Model](#) 10484
Furui, Akira; Nakagaki, Kosuke; Tsuji, Toshio
- [Control and Evaluation of Body Weight Support Walker for Overground Gait Training](#) 10491
Dong, Zonghao; Salazar Luces, Jose Victorio; Hirata, Yasuhisa

Session WeAT15 : Rehabilitation and Assistive Robotics VII

- [Developing of a Rigid-Compliant Finger Joint Exoskeleton Using Topology Optimization Method](#) 10499
Liang, Renghao; Xu, Guanghua; Bo, He; Li, Min; Teng, Zhicheng; Zhang, Sicong
- [Wheel-Legged Robotic Limb to Assist Human with Load Carriage: An Application for Environmental Disinfection During COVID-19](#) 10505
Leng, Yuquan; Lin, Xin; Huang, Guan; Wu, Jing; Hao, Ming; Xiang, Yanzhen; Fu, Chenglong
- [SpringExo, a Spring-Based Exoskeleton for Providing Knee Assistance: Design, Characterization and Feasibility Study](#) 10513
Sui, Dongbao; Chang, Biing-Chwen; Hidayah, Rand; Zhu, Yanhe; Agrawal, Sunil

High-Force Fabric-Based Pneumatic Actuators with Asymmetric Chambers and Interference-Reinforced Structure for Soft Wearable Assistive Gloves	10520
<i>Feng, Miao; Yang, Dezhi; Gu, Guoying</i>	

Session ThJT13 : Rehabilitation and Assistive Robotics: Machine Learning

Leveraging Post Hoc Context for Faster Learning in Bandit Settings with Applications in Robot-Assisted Feeding	10528
<i>Gordon, Ethan Kroll; Roychowdhury, Sumegh; Bhattacharjee, Tapomayukh; Jamieson, Kevin; Srinivasa, Siddhartha</i>	

Task-Invariant Learning of Continuous Joint Kinematics During Steady-State and Transient Ambulation Using Ultrasound Sensing	10536
<i>Jahanandish, M. Hassan; Rabe, Kaitlin; Srinivas, Abhishek; Fey, Nicholas; Hoyt, Kenneth</i>	

Toward Deep Generalization of Peripheral EMG-Based Human-Robot Interfacing: A Hybrid Explainable Solution for NeuroRobotic Systems	10543
<i>Gulati, Paras; Hu, Qin; Atashzar, S. Farokh</i>	

Kinesthetic feedback improves grasp performance in cable-driven prostheses	10551
<i>Abbott, Michael; Fajardo, Joshua; Lim, Hou Woei; Stuart, Hannah</i>	

Session ThKT13 : Rehabilitation and Assistive Robotics: Prosthetics and Exoskeletons

Real-Time User-Independent Slope Prediction Using Deep Learning for Modulation of Robotic Knee Exoskeleton Assistance	10558
<i>Lee, Dawit; Kang, Inseung; Molinaro, Dean; Yu, Alexander; Young, Aaron</i>	

Real-Time Gait Phase Estimation for Robotic Hip Exoskeleton Control During Multimodal Locomotion	10565
<i>Kang, Inseung; Molinaro, Dean; Duggal, Srijan; Chen, Yanrong; Kunapuli, Pratik; Young, Aaron</i>	

Evaluation of Continuous Walking Speed Determination Algorithms and Embedded Sensors for a Powered Knee & Ankle Prosthesis	10572
<i>Bhakta, Krishan; Camargo, Jonathan; Compton, William; Herrin, Kinsey; Young, Aaron</i>	

Validation of a Novel Parallel-Actuated Shoulder Exoskeleton Robot for the Characterization of Human Shoulder Impedance	10580
<i>Chang, Dongjune; Hunt, Justin; Atkins, John; Lee, Hyunglae</i>	

Session ThHT12 : Rehabilitation and Assistive Robotics: Reinforcement Learning

Human-Guided Robot Behavior Learning: A GAN-Assisted Preference-Based Reinforcement Learning Approach	10587
<i>Zhan, Huixin; Tao, Feng; Cao, Yongcan</i>	

Protective Policy Transfer	10595
----------------------------	-------

Yu, Wenhao; Liu, Karen; Turk, Greg

Natural Walking with Musculoskeletal Models Using Deep Reinforcement Learning 10603
Weng, Jiacheng; Hashemi, Ehsan; Arami, Arash

A Data-Driven Reinforcement Learning Solution Framework for Optimal and Adaptive Personalization of a Hip Exoskeleton 10610
Tu, Xikai; Li, Minhan; Liu, Ming; Si, Jennie; Huang, He (Helen)

Session ThIT12 : Reinforcement Learning for Robotics I

FISAR: Forward Invariant Safe Reinforcement Learning with a Deep Neural Network-Based Optimizer 10617
Sun, Chuangchuang; Kim, Dong Ki; How, Jonathan Patrick

Coding for Distributed Multi-Agent Reinforcement Learning 10625
Wang, Baoqian; Xie, Junfei; Atanasov, Nikolay

Model-Based Meta-Reinforcement Learning for Flight with Suspended Payloads 10632
Belkhale, Suneel; Kahn, Gregory; McAllister, Rowan; Calandra, Roberto; Levine, Sergey

Transfer Reinforcement Learning across Homotopy Classes 10640
Cao, Zhangjie; Kwon, Minae; Sadigh, Dorsa

Session TuGT2 : Reinforcement Learning for Robotics II

Model-Free Reinforcement Learning for Stochastic Games with Linear Temporal Logic Objectives 10649
Bozkurt, Alper Kamil; Wang, Yu; Zavlanos, Michael M.; Pajic, Miroslav

Secure Planning against Stealthy Attacks Via Model-Free Reinforcement Learning 10656
Bozkurt, Alper Kamil; Wang, Yu; Pajic, Miroslav

Harmonic-Based Optimal Motion Planning in Constrained Workspaces Using Reinforcement Learning 10663
Rousseas, Panagiotis; Bechlioulis, Charalampos; Kyriakopoulos, Kostas

Reward Learning from Very Few Demonstrations 10670
Eteke, Cem; Kebude, Dogancan; Akgun, Baris

Hierarchies of Planning and Reinforcement Learning for Robot Navigation 10682
Wöhlke, Jan; Schmitt, Felix; van Hoof, Herke

Session ThBT7 : Reinforcement Learning for Robotics III

Context-Aware Safe Reinforcement Learning for Non-Stationary Environments 10689
Chen, Baiming; Liu, Zuxin; Zhu, Jiacheng; Xu, Mengdi; Ding, Wenhao; Li, Liang; Zhao, Ding

Deep Learning Assisted Robotic Magnetic Anchored and Guided Endoscope for Real-Time Instrument Tracking 10696
Cheng, Truman; Li, Weibing; Ng, Wing Yin; Huang, Yisen; Li, Jixiu; Ng, Sze Hang; Chiu, Philip, Wai-yan; Li, Zheng

Incorporating Multi-Context into the Traversability Map for Urban Autonomous Driving Using Deep Inverse Reinforcement Learning 10704
Jung, Chanyoung; Shim, David Hyunchul

Quantification of Joint Redundancy Considering Dynamic Feasibility Using Deep Reinforcement Learning 10712
Chai, Jiazheng; Hayashibe, Mitsuhiro

Session ThDT14 : Reinforcement Learning in Navigation

A Novel Hybrid Approach for Fault-Tolerant Control of UAVs based on Robust Reinforcement Learning 10719
Sohege, Yves; Quinones-Grueiro, Marcos; Provan, Gregory

Deep Probabilistic Feature-Metric Tracking 10726
Xu, Binbin; Davison, Andrew J; Leutenegger, Stefan

Using Reinforcement Learning to Create Control Barrier Functions for Explicit Risk Mitigation in Adversarial Environments 10734
Scukins, Edvards; Ogren, Petter

Edge Computing in 5G for Drone Navigation: What to Offload? 10741
Hayat, Samira; Jung, Roland; Hellwagner, Hermann; Bettstetter, Christian; Emini, Driton; Schnieders, Dominik

Session ThJT12 : Robot Safety

Encoding Defensive Driving As a Dynamic Nash Game 10749
Chiu, Chih-Yuan; Fridovich-Keil, David; Tomlin, Claire

Enhancing Safety of Students with Mobile Air Filtration During School Reopening from COVID-19 10757
Yang, Haoguang; Balakuntala Srinivasa Murthy, Mythra Varun; Moser, Abigayle; Quinones Cortes, Jhon Jairo; Doosttalab, Ali; Esquivel-Puentes, Helber Antonio; Purwar, Tanya; Castillo, Luciano; Mahmoudian, Nina; Voyles, Richard

Probabilistic Safety Assured Adaptive Merging Control for Autonomous Vehicles 10764
Lyu, Yiwei; Luo, Wenhao; Dolan, John M.

Negotiating Visibility for Safe Autonomous Navigation in Occluding and Uncertain Environments 10771
Higgins, Jacob; Bezzo, Nicola

Session ThKT12 : Robotic Learning with Visual Signal

Visionary: Vision Architecture Discovery for Robot Learning 10779

Akinola, Ireteayo; Angelova, Anelia; Lu, Yao; Chebotar, Yevgen; Kalashnikov, Dmitry; Varley, Jacob; Ibarz, Julian; Ryoo, Michael S.

[Zero-Shot Policy Learning with Spatial Temporal Reward Decomposition on Contingency-Aware Observation](#) 10786

Xu, Huazhe; Chen, Boyuan; Gao, Yang; Darrell, Trevor

[Approximate Inverse Reinforcement Learning from Vision-Based Imitation Learning](#) 10793

Lee, Keuntaek; Vlahov, Bogdan; Gibson, Jason; Rehg, James; Theodorou, Evangelos

[Efficient Robotic Object Search via HIEM: Hierarchical Policy Learning with Intrinsic-Extrinsic Modeling](#) 10800

Ye, Xin; Yang, Yezhou

Session ThET17 : Robotic Manipulation

[Reward Conditioned Neural Movement Primitives for Population-Based Variational Policy Optimization](#) 10808

Akbulut, Mete Tuluhan; Bozdogan, Utku; Tekden, Ahmet; Ugur, Emre

[Contextual Latent-Movements Off-Policy Optimization for Robotic Manipulation Skills](#) 10815

Tosatto, Samuele; Chalvatzaki, Georgia; Peters, Jan

[Optimal Deep Learning for Robot Touch](#) 10822

Lepora, Nathan; Lloyd, John

[Learning Optimal Impedance Control During Complex 3D Arm Movements](#) 10832

Naceri, Abdeldjalil; Schumacher, Tobias; Li, Qiang; Calinon, Sylvain; Ritter, Helge Joachim

Session ThBT15 : Robotic Mechanisms and Design I

[Air-Hydraulic Servo Booster Toward Submersible Water-Driven Robots](#) 10840

Hyon, Sang-Ho; Akama, Kazuto

[Joint Mechanical Design and Flight Control Optimization of a Nature-Inspired Unmanned Aerial Vehicle via Collaborative Co-Evolution](#) 10847

Sufiyan, Danial; Win, Luke Soe Thura; Win, Shane Kyi Hla; Soh, Gim Song; Foong, Shaohui

[Development of Cable-Driven Anthropomorphic Robot Hand](#) 10855

Min, Sungjae; Yi, Sooyeong

[Origami-Inspired Snap-Through Bistability in Parallel and Curved Mechanisms through the Inflection of Degree Four Vertexes](#) 10863

Yeow, Bok Seng; Cai, Catherine; Sivaperuman Kalairaj, Manivannan; Hoo, Feng Wen; Lee, Zu Xuan; Tan, Chui Shien Janice; Ho, Jian Rong; Ma, Minhui Vienna; Huang, Hui; Ren, Hongliang

Session ThBT21 : Robotic Mechanisms and Design II

- Applications: Twisted String Actuation-Based Compact Automatic Transmission 10870
Jeong, Seokhwan; Lee, Yeongseok; Kim, Kyung-Soo
- Power Transmission Design of Fast and Energy-Efficient Stiffness Modulation for Human Power Assistance 10877
Shin, Wonseok; Park, Gunhee; Lee, JooYoung; Chang, Handdeut; Kim, Jung
- A Novel Variable Resolution Torque Sensor Based on Variable Stiffness Principle 10884
Sun, Xiantao; Chen, Wenjie; Zhang, Jianbin; Wang, Jianhua; Jiang, Jun; Chen, Weihai
- A Motion Estimation Filter for Inertial Measurement Unit with On-board Ferromagnetic Materials 10890
Tafrishi, Seyed Amir; Svinin, Mikhail; Yamamoto, Motoji
- Energy Saving of Schooling Robotic Fish in Three Dimensional Formations 10898
Li, Liang; Zheng, Xingwen; Mao, Rui; Xie, Guangming

Session ThHT11 : Robotic Perception I

- Self-Guided Instance-Aware Network for Depth Completion and Enhancement 10905
Luo, Zhongzhen; Zhang, Fengjia; Fu, Guoyi; Xu, Jiajie
- World-in-the-Loop Simulation for Autonomous Systems Validation 10912
Hildebrandt, Carl; Elbaum, Sebastian
- RetinaGAN: An Object-Aware Approach to Sim-To-Real Transfer 10920
Ho, Daniel; Rao, Kanishka; Xu, Zhuo; Jang, Eric; Khansari, Mohi; Bai, Yunfei
- A Framework for Multisensory Foresight for Embodied Agents 10927
Chen, Xiaohui; Hosseini, Ramtin; Karen, Panetta; Sinapov, Jivko

Session ThFT17 : Robotic Perception II

- HDROmni: Optical Extension of Dynamic Range for Panoramic Robot Vision 10934
Ducrocq, Julien Jean; Caron, Guillaume; Mouaddib, El Mustapha
- The GRIFFIN Perception Dataset: Bridging the Gap between Flapping-Wing Flight and Robotic Perception 10942
Rodriguez-Gomez, Juan Pablo; Tapia, Raul; Paneque, Julio L.; Grau, Pedro; Gómez Eguíluz, Augusto; Martinez-de-Dios, Jose Ramiro; Ollero, Anibal
- OmniDet: Surround View Cameras Based Multi-Task Visual Perception Network for Autonomous Driving 10950
Ravi Kumar, Varun; Yogamani, Senthil; Rashed, Hazem; Sistu, Ganesh; Witt, Christian; Leang, Isabelle; Milz, Stefan; Mäder, Patrick

Offline Dynamic Grid Generation for Automotive Environment Perception Using Temporal Inference Methods	10958
<i>Ye, Egon; Würsching, Gerald; Steyer, Sascha; Althoff, Matthias</i>	

Session ThIT11 : Robotic Perception III

6D Object Pose Estimation with Pairwise Compatible Geometric Features	10966
<i>Lin, Muyuan; Murali, Varun; Karaman, Sertac</i>	

Robust Skin-Feature Tracking in Free-Hand Video from Smartphone or Robot-Held Camera, to Enable Clinical-Tool Localization and Guidance	10974
<i>Huang, Chun-Yin; Galeotti, John</i>	

In-Hand Object-Dynamics Inference Using Tactile Fingertips	10981
<i>Sundaralingam, Balakumar; Hermans, Tucker</i>	

From Multi-Target Sensory Coverage to Complete Sensory Coverage: An Optimization-Based Robotic Sensory Coverage Approach	10994
<i>Burdick, Joel; Bouman, Amanda; Rimon, Elon</i>	

Session ThDT16 : Robotic Percetpion IV

A Minimally Supervised Approach Based on Variational Autoencoders for Anomaly Detection in Autonomous Robots	11001
<i>Azzalini, Davide; Bonali, Luca; Amigoni, Francesco</i>	

Faster R-CNN-Based Decision Making in a Novel Adaptive Dual-Mode Robotic Anchoring System	11010
<i>Shahin, Shahrooz; Sadeghian, Rasoul; Sareh, Sina</i>	

Hearing What You Cannot See: Acoustic Vehicle Detection Around Corners	11017
<i>Schulz, Yannick; Mattar, Avinash Kini; Hehn, Thomas; Kooij, Julian</i>	

Robot Action Diagnosis and Experience Correction by Falsifying Parameterised Execution Models	11025
<i>Mitrevski, Alex; Plöger, Paul G.; Lakemeyer, Gerhard</i>	

Session ThAT21 : Robotic Vision I

Robust 360-8PA: Redesigning the Normalized 8-Point Algorithm for 360-FoV Images	11032
<i>Solarte, Bolivar; Wu, Chin-Hsuan; Lu, Kuan-Wei; Tsai, Yi-Hsuan; Chiu, Wei-Chen; Sun, Min</i>	

STA-VPR: Spatio-Temporal Alignment for Visual Place Recognition	11039
<i>Lu, Feng; Chen, Baifan; Zhou, Xiang-Dong; Song, Dezhen</i>	

Initialisation of Autonomous Aircraft Visual Inspection Systems Via CNN-Based Camera Pose Estimation	11047
<i>Oh, Xueyan; Loh, Leonard; Foong, Shaohui; Koh, Zhong Bao Andy; Ng, Kow Leong; Tan, Poh Kang; Toh, Pei Lin Pearlin; Tan, U-Xuan</i>	

Voxelized GICP for Fast and Accurate 3D Point Cloud Registration <i>Koide, Kenji; Yokozuka, Masashi; Oishi, Shuji; Banno, Atsuhiko</i>	11054
Session ThET16 : Robotic Vision II	
Generic Hand-Eye Calibration of Uncertain Robots <i>Ulrich, Markus; Hillemann, Markus</i>	11060
In-Situ Translational Hand-Eye Calibration of Laser Profile Sensors Using Arbitrary Objects <i>Murali, Prajval Kumar; Sorrentino, Ines; Rendiniello, Angelo; Fantacci, Claudio; Villagrossi, Enrico; Polo, Andrea; Ardesi, Alessandro; Maggiali, Marco; Natale, Lorenzo; Pucci, Daniele; Traversaro, Silvio</i>	11067
Autonomous UAV Safety by Visual Human Crowd Detection Using Multi-Task Deep Neural Networks <i>Papaioannidis, Christos; Mademlis, Ioannis; Pitas, Ioannis</i>	11074
CloudAAE: Learning 6D Object Pose Regression with On-Line Data Synthesis on Point Clouds <i>Gao, Ge; Lauri, Mikko; Hu, Xiaolin; Zhang, Jianwei; Frintrop, Simone</i>	11081
Session ThFT16 : Robust Control	
No Need for Interactions: Robust Model-Based Imitation Learning Using Neural ODE <i>Lin, HaoChih; Li, Baopu; Zhou, Xin; Wang, Jiankun; Meng, Max Q.-H.</i>	11088
Robust Trajectory Planning with Parametric Uncertainties <i>Brault, Pascal; Delamare, Quentin; Robuffo Giordano, Paolo</i>	11095
Robust Policy Search for Robot Navigation <i>Garcia-Barcos, Javier; Martinez-Cantin, Ruben</i>	11102
Robust Footstep Planning and LQR Control for Dynamic Quadrupedal Locomotion <i>Xin, Guiyang; Xin, Songyan; Cebe, Oguzhan; Pollayil, Mathew Jose; Angelini, Franco; Garabini, Manolo; Vijayakumar, Sethu; Mistry, Michael</i>	11110
Session ThJT11 : Robust/Optimal Control	
Towards Robust One-Shot Task Execution Using Knowledge Graph Embeddings <i>Daruna, Angel; Nair, Lakshmi Velayudhan; Liu, Weiyu; Chernova, Sonia</i>	11118
An Efficient Closed-Form Method for Optimal Hybrid Force-Velocity Control <i>Hou, Yifan; Mason, Matthew T.</i>	11125
RAT iLQR: A Risk Auto-Tuning Controller to Optimally Account for Stochastic Model Mismatch <i>Nishimura, Haruki; Mehr, Negar; Gaidon, Adrien; Schwager, Mac</i>	11132
Sliding on Manifolds: Geometric Attitude Control with Quaternions <i>Lopez, Brett; Slotine, Jean-Jacques E.</i>	11140

Session ThBT8 : Segmentation and Recognition

- Deep Balanced Learning for Long-Tailed Facial Expressions Recognition 11147
Hongxiang, Gao; An, Shan; Liu, Chengyu; Li, Jianqing
- AU-Expression Knowledge Constrained Representation Learning for Facial Expression Recognition 11154
Pu, Tao; Chen, Tianshui; Xie, Yuan; Wu, Hefeng; Lin, Liang
- Covariance Self-Attention Dual Path UNet for Rectal Tumor Segmentation 11162
Gao, Haijun; Zeng, Xiangyin; Zheng, Bochuan
- Fabric Defect Detection Using Tactile Information 11169
Long, Xingming; Fang, Bin; Zhang, Yifan; Luo, GuoYi; Sun, Fuchun

Session ThAT20 : Semantic Planning

- Towards Real-time Semantic RGB-D SLAM in Dynamic Environments 11175
Ji, Tete; Wang, Chen; Xie, Lihua
- Real-Time Robot Path Planning Using Rapid Visible Tree 11182
Xing, Wen; Song, Aiguo; Zhu, Lifeng
- Semantically Guided Multi-View Stereo for Dense 3D Road Mapping 11189
Lv, Mingzhe; Tu, Diantao; Tang, Xincheng; Liu, Yuqian; Shen, Shuhan
- Spatial Reasoning from Natural Language Instructions for Robot Manipulation 11196
Gubbi Venkatesh, Sagar; Biswas, Anirban; Upadrashta, Raviteja; Srinivasan, Vikram; Talukdar, Partha; Amrutur, Bharadwaj

Session ThKT11 : Semantic Scene Understanding

- Semantic SLAM with Autonomous Object-Level Data Association 11203
Qian, Zhentian; Patath, Kartik; Fu, Jie; Xiao, Jing
- Kimera-Multi: A System for Distributed Multi-Robot Metric-Semantic Simultaneous Localization and Mapping 11210
Chang, Yun; Tian, Yulun; How, Jonathan Patrick; Carlone, Luca
- Any Way You Look at It: Semantic Crossview Localization and Mapping with LiDAR 11219
Miller, Ian; Cowley, Anthony; Konkimalla, Ravi; Skandan, Shreyas; Nguyen, Ty; Smith, Trey; Taylor, Camillo Jose; Kumar, Vijay
- Semantic and Geometric Modeling with Neural Message Passing in 3D Scene Graphs for Hierarchical Mechanical Search 11227
Kurenkov, Andrey; Martín-Martín, Roberto; Ichnowski, Jeffrey; Goldberg, Ken; Savarese, Silvio

Session WeBT11 : Semantics Localization

- Point Set Registration with Semantic Region Association Using Cascaded Expectation Maximization 11234
Hu, Lan; Wei, Jiaxin; Ouyang, Zhanpeng; Kneip, Laurent
- A Flexible and Efficient Loop Closure Detection Based on Motion Knowledge 11241
Liu, Bingxi; Tang, Fulin; Fu, Yujie; Yang, Yanqun; Wu, Yihong
- RoadMap: A Light-Weight Semantic Map for Visual Localization towards Autonomous Driving 11248
Qin, Tong; Zheng, Yuxin; Chen, Tongqing; Chen, Yilun; Su, Qing
- Visual Semantic Localization Based on HD Map for Autonomous Vehicles in Urban Scenarios 11255
Wang, Huayou; Xue, Changliang; Zhou, Yanxing; Wen, Feng; Zhang, Hongbo

Session ThBT20 : Sensing in Manipulation

- Extrinsic Contact Sensing with Relative-Motion Tracking from Distributed Tactile Measurements 11262
Ma, Daolin; Dong, Siyuan; Rodriguez, Alberto
- Needle Tip Tracking in 2D Ultrasound Based on Improved Compressive Tracking and Adaptive Kalman Filter 11269
Yan, Wanquan; Ding, Qingpeng; Chen, Jianghua; Cheng, Shing Shin
- Robotic Imitation of Human Assembly Skills Using Hybrid Trajectory and Force Learning 11278
Wang, Yan; Beltran-Hernandez, Cristian Camilo; Wan, Weiwei; Harada, Kensuke
- Contact Feature Recognition Based on MFCC of Force Signals 11285
Tsuji, Toshiaki; Sato, Koyo; Sakaino, Sho

Session ThDT15 : Sensor Fusion

- DSEC: A Stereo Event Camera Dataset for Driving Scenarios 11291
Gehrig, Mathias; Aarents, Willem; Gehrig, Daniel; Scaramuzza, Davide
- Interval-Based Visual-LiDAR Sensor Fusion 11299
Voges, Raphael; Wagner, Bernardo
- Optimizing RGB-D Fusion for Accurate 6DoF Pose Estimation 11307
Saadi, Lounès; Besbes, Bassem; Kramm, Sébastien; Bensrhair, Abdelaziz
- EagerMOT: 3D Multi-Object Tracking Via Sensor Fusion 11315
Kim, Aleksandr; Osep, Aljosa; Leal-Taixe, Laura

Session TuDT2 : Service Robotics Award Session

- Tactile SLAM: Real-time inference of shape and pose from planar pushing 11322

Suresh, Sudharshan; Bauza Villalonga, Maria; Yu, Kuan-Ting; Mangelson, Joshua; Rodriguez, Alberto; Kaess, Michael

[BADGR: An Autonomous Self-Supervised Learning-Based Navigation System](#) 11329
Kahn, Gregory; Abbeel, Pieter; Levine, Sergey

Session ThBT17 : Service Robotics I

[Multiple-Place Swarm Foraging with Dynamic Robot Chains](#) 11337
Lee, Dohee; Lu, Qi; Au, Tsz-Chiu

[Collaborative Learning of Multiple-Discontinuous-Image Saliency Prediction for Drone Exploration](#) 11343
Chu, Ting-tsan; Chen, Po-Heng; Huang, Pin-Jie; Chen, Kuan-Wen

[Positioning Control for Underactuated Unmanned Surface Vehicles to Resist Environmental Disturbances](#) 11350
Qu, Yang; Cai, Lilong

[Not Your Grandmother's Toolbox – the Robotics Toolbox Reinvented for Python](#) 11357
Corke, Peter; Haviland, Jesse

Session ThAT17 : Service Robotics II

[A Robotic Defect Inspection System for Free-Form Specular Surfaces](#) 11364
Huo, Shengzeng; Navarro-Alarcon, David; Chik, David TW

[Keeping Social Distance During the Pandemic: Contactless Meal Order and Takeout Service Via AI-Assisted Smart Robots](#) 11371
Lin, Ting-Yu; Wu, Kunru; Chen, You-Shuo; Huang, Wei-Hau; Chen, Yi-Tuo

[Serverless Architecture for Service Robot Management System](#) 11379
Nishimiya, Kenji; Imai, Yuta

[Can Non-Humanoid Social Robots Reduce Workload of Special Educators : An Online and In-Premises Field Study](#) 11386
Paul, Nabanita; Ramesh, Siddharth; Bhattacharya, Chiranjib; Ramesh, Jayashree; Vijayan, Priya

Session ThAT18 : Service Robotics III

[Heart Position Estimation Based on Bone Distribution Toward Autonomous Robotic Fetal Ultrasonography](#) 11393
Shida, Yuuki; Tsumura, Ryosuke; Watanabe, Takabumi; Iwata, Hiroyasu

[Chip-Less Wireless Sensing of Origami Structural Morphing under Various Mechanical Stimuli Using Home-Based Ink-Jet Printable Materials](#) 11400
Ponraj, Godwin; Yeo, Wei Le; Senthil Kumar, Kirthika; Sivaperuman Kalairaj, Manivannan; Cai, Catherine; Ren, Hongliang

A 2-Dimensional Branch-And-Bound Algorithm for Hand-Eye Self-Calibration of SCARA Robots <i>Tao, Chengyu; Lv, Na; Chen, Shan-Ben</i>	11408
Long-Term Multiple Time-Constant Model of a Spring Roll Dielectric Elastomer Actuator under Dynamic Loading <i>Jeong, Seung Mo; Kyung, Ki-Uk</i>	11415
Session ThBT18 : Service Robotics IV	
S2P2: Self-Supervised Goal-Directed Path Planning Using RGB-D Data for Robotic Wheelchairs <i>Wang, Hengli; Sun, Yuxiang; Fan, Rui; Liu, Ming</i>	11422
HanGrawler: Large-Payload and High-Speed Ceiling Mobile Robot Using Crawler <i>Fukui, Rui; Yamada, Yudai; Mitsudome, Keisuke; Sano, Katsuya; Warisawa, Shin'ichi</i>	11429
Multimodal Anomaly Detection Based on Deep Auto-Encoder for Object Slip Perception of Mobile Manipulation Robots <i>Yoo, Youngjae; Lee, Chung-Yeon; Zhang, Byoung-Tak</i>	11443
Route Coverage Testing for Autonomous Vehicles Via Map Modeling <i>Tang, Yun; Zhou, Yuan; Wu, Fenghua; Liu, Yang; Sun, Jun; Huang, Wuling; Wang, Gang</i>	11450
Session ThAT19 : Service Robotics V	
A Wheeled V-Shaped In-Pipe Robot with Clutched Underactuated Joints <i>Oka, Yoshimichi; Kakogawa, Atsushi; Ma, Shugen</i>	11457
Walking Trajectory Design of Hydraulic Legged Robot with Limited Powered Pump <i>Tani, Kosuke; Nabae, Hiroyuki; Hirota, Yoshiharu; Endo, Gen; Suzumori, Koichi</i>	11463
Robotic Guide Dog: Leading a Human with Leash-Guided Hybrid Physical Interaction <i>Xiao, Anxing; Tong, Wenzhe; Yang, Lizhi; Zeng, Jun; Li, Zhongyu; Sreenath, Koushil</i>	11470
An Overconstrained Robotic Leg with Coaxial Quasi-Direct Drives for Omni-Directional Ground Mobility <i>Feng, Shihao; Gu, Yuping; Guo, Weijie; Guo, Yuqin; Wan, Fang; Pan, Jia; Song, Chaoyang</i>	11477
Session ThBT19 : Service Robotics VI	
A Data-Set and a Method for Pointing Direction Estimation from Depth Images for Human-Robot Interaction and VR Applications <i>Das, Shome S</i>	11485
Learning-Based Optoelectronically Innervated Tactile Finger for Rigid-Soft Interactive Grasping <i>Yang, Linhan; Han, Xudong; Guo, Weijie; Zhang, Zixin; Wan, Fang; Pan, Jia; Song, Chaoyang</i>	11492

SeqNet: Learning Descriptors for Sequence-based Hierarchical Place Recognition 11500
Garg, Sourav; Milford, Michael J

Extendable Navigation Network Based Reinforcement Learning for Indoor Robot Exploration 11508
Lee, Woo-Cheol; Lim, Ming Chong; Choi, Han-Lim

Session ThJT9 : Simulation and Control

Learning Dense Visual Correspondences in Simulation to Smooth and Fold Real Fabrics 11515
Ganapathi, Aditya; Sundaresan, Priya; Thananjeyan, Brijen; Balakrishna, Ashwin; Seita, Daniel; Grannen, Jennifer; Hwang, Minho; Hoque, Ryan; Gonzalez, Joseph E.; Jamali, Nawid; Yamane, Katsu; Iba, Soshi; Goldberg, Ken

Can I Pour into It? Robot Imagining Open Containability Affordance of Previously Unseen Objects Via Physical Simulations 11523
Wu, Hongtao; Chirikjian, Gregory

Visualization of Stable Heteroclinic Channel-Based Movement Primitives 11531
Rouse, Natasha A.; Daltorio, Kathryn A

Stable Learning-Based Tracking Control of Underactuated Balance Robots 11538
Han, Feng; Yi, Jingang

Session WeBT12 : SLAM I

Hybrid Bird's-Eye Edge Based Semantic Visual SLAM for Automated Valet Parking 11546
Xiang, Zhenzhen; Bao, Anbo; Su, Jianbo

Collaborative Visual Inertial SLAM for Multiple Smart Phones 11553
Liu, Jialing; Liu, Ruyu; Chen, Kaiqi; Zhang, Jianhua; Guo, Dongyan

MS*: A New Exact Algorithm for Multi-agent Simultaneous Multi-goal Sequencing and Path Finding 11560
Ren, Zhongqiang; Rathinam, Sivakumar; Choset, Howie

Inertial Aided 3D LiDAR SLAM with Hybrid Geometric Primitives in Large-Scale Environments 11566
Chen, Wen; Zhao, Hongchao; Shen, Qi; Xiong, Chao; Zhou, Shunbo; Liu, Yunhui

Session ThET15 : SLAM II

Online Range-Based SLAM Using B-Spline Surfaces 11573
T. Rodrigues, Rômulo; Tsiogkas, Nikolaos; Pascoal, Antonio; Aguiar, A. Pedro

RGB-D SLAM with Structural Regularities 11581
Li, Yanyan; Yunus, Raza; Brasch, Nikolas; Navab, Nassir; Tombari, Federico

Revisiting Visual-Inertial Structure-From-Motion for Odometry and SLAM Initialization 11588
Evangelidis, Georgios; Micusik, Branislav

RigidFusion: Robot Localisation and Mapping in Environments with Large Dynamic Rigid Objects 11596
Long, Ran; Rauch, Christian; Zhang, Tianwei; Ivan, Vladimir; Vijayakumar, Sethu

Session ThAT16 : SLAM III

Bidirectional Trajectory Computation for Odometer-Aided Visual-Inertial SLAM 11604
Liu, Jinxu; Gao, Wei; Hu, Zhanyi

Optimization-Based Visual-Inertial SLAM Tightly Coupled with Raw GNSS Measurements 11612
Liu, Jinxu; Gao, Wei; Hu, Zhanyi

LITAMIN2: Ultra Light LiDAR-Based SLAM Using Geometric Approximation Applied with KL-Divergence 11619
Yokozuka, Masashi; Koide, Kenji; Oishi, Shuji; Banno, Atsuhiko

Compositional and Scalable Object SLAM 11626
Sharma, Akash; Dong, Wei; Kaess, Michael

Session ThFT15 : SLAM IV

MULLS: Versatile LiDAR SLAM Via Multi-Metric Linear Least Square 11633
Pan, Yue; Xiao, Pengchuan; He, Yujie; Shao, Zhenlei; Li, Zesong

Dynamic Object Aware LiDAR SLAM Based on Automatic Generation of Training Data 11641
Pfrendschuh, Patrick; Hendriks, Hubertus Franciscus Cornelis; Reijgwart, Victor; Dubé, Renaud; Siegwart, Roland; Cramariuc, Andrei

A FastSLAM Approach Integrating Beamforming Maps for Ultrasound-Based Robotic Inspection of Metal Structures 11648
Ouabi, Othmane-Latif; Pomaredé, Pascal; Geist, Matthieu; Declercq, Nico F.; Pradalier, Cedric

Connecting Semantic Building Information Models and Robotics: An Application to 2D LiDAR-Based Localization 11654
Hendriks, Bob; Pauwels, Pieter; Torta, Elena; Bruyninckx, Herman; Molengraaf van de, René

Session ThBT16 : SLAM V

Markov Parallel Tracking and Mapping for Probabilistic SLAM 11661
Huai, Zheng; Huang, Guoquan (Paul)

Multi-Session Underwater Pose-Graph SLAM Using Inter-Session Opti-Acoustic Two-View Factor 11668
Jang, Hyesu; Yoon, SungHo; Kim, Ayoung

Avoiding Degeneracy for Monocular Visual SLAM with Point and Line Features 11675
Lim, Hyunjun; Kim, Yeeun; Jung, Kwangyik; Hu, Sumin; Myung, Hyun

Intensity-SLAM: Intensity Assisted Localization and Mapping for Large Scale Environment 11682
Wang, Han; Wang, Chen; Xie, Lihua

Session ThDT17 : SLAM VI

TT-SLAM: Dense Monocular SLAM for Planar Environments 11690
Wang, Xi; Christie, Marc; Marchand, Eric

OV2SLAM : A Fully Online and Versatile Visual SLAM for Real-Time Applications 11697
Ferrera, Maxime; Eudes, Alexandre; Moras, Julien; Sanfourche, Martial; Lebesnerais, Guy

DOT: Dynamic Object Tracking for Visual SLAM 11705
Ballester, Irene; Fontan, Alejandro; Civera, Javier; Strobl, Klaus H.; Triebel, Rudolph

DefSLAM: Tracking and Mapping of Deforming Scenes from Monocular Sequences 11712
Lamarca, Jose; Parashar, Shaifali; Bartoli, Adrien; Montiel, J.M.M

Session ThHT10 : SLAM with Monocular Camera

CAROM - Vehicle Localization and Traffic Scene Reconstruction from Monocular Cameras on Road Infrastructures 11725
Lu, Duo; Jammula, Varun Chandra; Como, Steve; Jeffrey, Wishart; Chen, Yan; Yang, Yezhou

A Front-End for Dense Monocular SLAM using a Learned Outlier Mask Prior 11732
Zhang, Yihao; Leonard, John

HyperMap: Compressed 3D Map for Monocular Camera Registration 11739
Chang, Ming-Fang; Mangelson, Joshua; Kaess, Michael; Lucey, Simon

Bidirectional Attention Network for Monocular Depth Estimation 11746
Aich, Shubhra; Vianney, Jean Marie Uwabeza; Islam, Md; Kaur, Mannat; Liu, Bingbing

Session ThIT10 : Soft Robotics I

Vision-Based Shape Reconstruction of Soft Continuum Arms Using a Geometric Strain Parametrization 11753
AlBeladi, Ali; Krishnan, Girish; Belabbas, Mohamed Ali; Hutchinson, Seth

Reconstruction of Backbone Curves for Snake Robots 11760
Wang, Tianyu; Lin, Bo; Zhong, Baxi; Whitman, Julian; Travers, Matthew; Goldman, Daniel; Blekherman, Grigoriy; Choset, Howie

Hybrid Vine Robot with Internal Steering-Reeling Mechanism Enhances System-Level Capabilities 11767
Haggerty, David Arthur; Naclerio, Nicholas; Hawkes, Elliot Wright

A Dynamics Simulator for Soft Growing Robots 11775
Jitosho, Rianna; Agharese, Nathaniel; Okamura, Allison M.; Manchester, Zachary

Session ThJT10 : Soft Robotics II

StRETch: A Soft to Resistive Elastic Tactile Hand 11782
Matl, Carolyn; Koe, Josephine; Bajcsy, Ruzena

An Active Palm Enhances Dexterity of Soft Robotic In-Hand Manipulation 11790
Teeple, Clark; Kim, Grace; Graule, Moritz A.; Wood, Robert

Elastica: A compliant mechanics environment for soft robotic control 11797
Naughton, Noel; Sun, Jiarui; Tekinalp, Arman; Parthasarathy, Tejaswin; Chowdhary, Girish; Gazzola, Mattia

Compensating for Unmodeled Forces Using Neural Networks in Soft Manipulator Planning 11805
Chow, Scott; Olson, Gina; Hollinger, Geoffrey

Session ThKT10 : Soft Robotics III

A Legged Soft Robot Platform for Dynamic Locomotion 11812
Xia, Boxi; Fu, Jiaming; Zhu, Hongbo; Song, Zhicheng; Yibo, Jiang; Lipson, Hod

States and Contact Forces Estimation for a Fabric-Reinforced Inflatable Soft Robot 11820
Bui, Phuc; Schultz, Joshua

Acoustic Communication and Sensing for Inflatable Modular Soft Robots 11827
Drew, Daniel S.; Devlin, Matthew; Hawkes, Elliot Wright; Follmer, Sean

Cooperative Collision Avoidance Control of Servo/IPMC Driven Robotic Fish with Back-Relaxation Effect 11834
Yi, Xiongfen; Chakravarthy, Animesh; Chen, Zheng

Session WeAT9 : Soft Robotics IV

Elevation Control of a Soft Jumping Robot 11843
Chen, Huimin; Liang, Jiaming; Miao, Zicong; Zhou, Guo; Liu, Ying; Zhang, Min

A Soft-Rigid Air-Propelled Pipe-Climbing Robot 11850
Zhao, Qing xiang; Jiang, Zhiyi; Chu, Henry

A Versatile Pneumatic Actuator Based on Scissor Mechanisms: Design, Modeling, and Experiments 11856
Yu, Binghuan; Yang, Jiawei; Du, Ruxu; Zhong, Yong

A Lightweight Soft Gripper Driven by Self-Sensing Super-Coiled Polymer Actuator 11864
Wang, Sen; Huang, Hongxin; Huang, Hailin; Li, Bing; Huang, Ke

Session WeBT9 : Soft Robotics V

- Design and Analysis of a Novel Lightweight, Versatile Soft-Rigid Robot 11871
Li, Yongyao; Cong, Ming; Liu, Dong; Du, Yu
- Kinetostatics for Variable Cross-Section Continuum Manipulators 11878
Yuan, Han; Li, Zuan; Xu, Wenfu
- Numerical Simulation of an Untethered Omni-Directional Star-Shaped Swimming Robot 11884
Huang, Xiaonan; Huang, Weicheng; Patterson, Zach J.; Ren, Zhijian; Khalid Jawed, Mohammad; Majidi, Carmel
- Body Stiffness Variation of a Tensegrity Robotic Fish Using Antagonistic Stiffness in a Kinetostatically Singular Configuration 11891
Chen, Bingxing; Jiang, Hong-zhou

Session ThAT15 : Soft Robotics: Actuation

- Amplifying Laminar Jamming for Soft Robots by Geometry-Induced Rigidity 11907
Li, Wen-Bo; Guo, Xin-Yu; Fang, Fu-Yi; Zhang, Wen-Ming
- Long Short Term Memory Model Based Position-Stiffness Control of Antagonistically Driven Twisted-Coiled Polymer Actuators Using Model Predictive Control 11913
Luong, Anh Tuan; Moon, Hyungpil; Choi, Hyouk Ryeol; Koo, Ja Choon; Seo, Sungwon; Kim, Kihyeon; Jeon, Jeongmin
- Expanding Pouch Motor Patterns for Programmable Soft Bending Actuation 11921
Lee, Haneol; Oh, Namsoo; Rodrigue, Hugo
- Towards a Multi-Imager Compatible Continuum Robot with Improved Dynamics Driven by Modular SMA 11930
Ding, Qingpeng; Lu, Yongkang; Kyme, Andre; Cheng, Shing Shin

Session ThET14 : Soft Robotics: Analysis and Modeling

- Screw Theory-Based Stiffness Analysis for a Fluidic-Driven Soft Robotic Manipulator 11938
Shi, Jiale; Frantz, Julio C.; Shariati, Azadeh; Shiva, Ali; Dai, Jian; Martins, Daniel; Wurdemann, Helge Arne
- Liquid Metal Logic for Soft Robotics 11945
Garrad, Martin; Chen, Hsing-Yu; Conn, Andrew; Hauser, Helmut; Rossiter, Jonathan
- Minimum Directed Information: A Design Principle for Compliant Robots 11953
Haninger, Kevin
- Model and Validation of a Highly Extensible and Tough Actuator Based on a Ballooning Membrane 11961
Herzig, Nicolas; Jones, Joanna; Perez Guagnelli, Eduardo R.; Damian, Dana

Session ThBT5 : Soft Robotics: Bionic Robots

- [SomBot: A Bio-Inspired Dynamic Somersaulting Soft Robot](#) 11968
Li, Wen-Bo; Guo, Xin-Yu; Zhang, Wen-Ming
- [A Bioinspired Composite Finger with Self-Locking Joints](#) 11976
Hu, Qiqiang; Huang, Hanjin; Dong, Erbao; Sun, Dong
- [A Multimodal, Enveloping Soft Gripper: Shape Conformation, Bioinspired Adhesion, and Expansion-Driven Suction](#) 11984
Hao, Yufei; Biswas, Shantonu; Hawkes, Elliot Wright; Wang, Tianmiao; Zhu, Mengjia; Wen, Li; Visell, Yon
- [Design and Modeling of a Biomimetic Gastropod-Like Soft Robot with Wet Adhesive Locomotion](#) 11997
Xin, Wenci; Pan, Tianle Flippy; Li, Yehui; Chiu, Philip, Wai-yan; Li, Zheng

Session ThFT14 : Soft Robotics: Control I

- [Planning for a Tight Squeeze: Navigation of Morphing Soft Robots in Congested Environments](#) 12004
Gough, Edward; Conn, Andrew; Rossiter, Jonathan
- [Soft Robot Optimal Control Via Reduced Order Finite Element Models](#) 12010
Tonkens, Sander; Lorenzetti, Joseph; Pavone, Marco
- [Multi-Point Orientation Control of Discretely-Magnetized Continuum Manipulators](#) 12017
Richter, Michiel; Kalpathy Venkiteswaran, Venkatasubramanian; Misra, Sarthak
- [Design and Optimization of a Dextrous Robotic Finger: Incorporating a Sliding, Rotating, and Soft-Bending Mechanism While Maximizing Dexterity and Minimizing Dimensions](#) 12025
Pagoli, Amir; Chapelle, Frédéric; Corrales Ramon, Juan Antonio; Mezouar, Youcef; Lapusta, Yuri

Session ThAT14 : Soft Robotics: Control II

- [Deep Reinforcement Learning Framework for Underwater Locomotion of Soft Robot](#) 12033
Li, Guanda; Shintake, Jun; Hayashibe, Mitsuhiro
- [A Parallelized Iterative Algorithm for Real-Time Simulation of Long Flexible Cable Manipulation](#) 12040
Lee, Jeongmin; Lee, Minji; Yoon, Jaemin; Lee, Dongjun
- [Compact Flat Fabric Pneumatic Artificial Muscle \(ffPAM\) for Soft Wearable Robotic Devices](#) 12047
Kim, Woojong; Park, Hyunkyu; Kim, Jung
- [An Autonomous Robotic Flexible Endoscope System with a DNA-Inspired Continuum Mechanism](#) 12055
Zhang, Xue; Li, Weibing; Ng, Wing Yin; Huang, Yisen; Chiu, Philip, Wai-yan; Li, Zheng

Session ThBT14 : Soft Robotics: Crawling Robots

- Design and Experiment of a Pneumatic Soft Climbing Robot 12061
Xu, Fengyu; Lu, Yuxuan; Jiang, Zhenjiang; Jiang, Guoping
- Starfish Inspired Milli Soft Robot with Omnidirectional Adaptive Locomotion Ability 12068
Yang, Xiong; Tan, Rong; Lu, Haojian; Shen, Yajing
- Surface Robots based on S-Isothermic Surfaces 12076
Iwamoto, Noriyasu; Nishikawa, Atsushi; Arai, Hiroaki
- Ascidian-Inspired Soft Robots That Can Crawl, Tumble, and Pick-And-Place Objects 12082
Zheng, Shirong; Park, Tongil; Hoang, Manh Cuong; Go, Gwangjun; Kim, Chang-Sei; Park, Jong-oh; Choi, Eunpyo; Hong, Ayoung

Session ThDT13 : Soft Robotics: Design

- Highly Maneuverable Eversion Robot Based on Fusion of Function with Structure 12089
Abrar, Taqi; Putzu, Fabrizio; Ataka, Ahmad; Godaba, Hareesh; Althoefer, Kaspar
- Automated Routing of Muscle Fibers for Soft Robots 12097
Maloisel, Guirec; Knoop, Espen; Schumacher, Christian; Bächer, Moritz
- A Fluidic Soft Robot for Needle Guidance and Motion Compensation in Intratympanic Steroid Injections 12110
Lindenroth, Lukas; Bano, Sophia; Stilli, Agostino; Manjaly, Joseph G.; Stoyanov, Danail
- B: Ionic Glove: A Soft Smart Wearable Sensory Feedback Device for Upper Limb Robotic Prostheses 12118
Simons, Melanie Florine; Digumarti, Krishna Manaswi; Le, Nguyen Hao; Chen, Hsing-Yu; Correia Carreira, Sara; Zaghoul, Nouf; Diteesawat, Richard Suphapol; Garrad, Martin; Conn, Andrew; Kent, Christopher; Rossiter, Jonathan

Session ThAT13 : Soft Robotics: Mechanism Design

- Soft Twisting Pneumatic Actuators Enabled by Freeform Surface Design 12124
Chen, Feifei; Miao, Yunpeng; Gu, Guoying; Zhu, Xiangyang
- A Dual-Mode Actuator for Soft Robotic Hand 12132
Li, Yunquan; Chen, Yonghua; Ren, Tao; Hu, Yong; Liu, Hao; Lin, Senyuan; Yang, Yang; Li, Yingtian; Zhou, Jianshu
- Soft Gripper Design Based on the Integration of Flat Dry Adhesive, Soft Actuator, and Microspine 12140
Hu, Qiqiang; Dong, Erbao; Sun, Dong
- Snap Pump: A Snap-Through Mechanism for a Pulsatile Pump 12156
Arakawa, Kazuki; Giorgio-Serchi, Francesco; Mochiyama, Hiromi

Session ThKT8 : Soft Sensors and Materials

- A Soft Robotic Gripper with Anti-Freezing Ionic Hydrogel-Based Sensors for Learning-Based Object Recognition 12164
Zuo, Runze; Zhou, Zhanfeng; Ying, Binbin; Liu, Xinyu
- Adaptive Tracking Control of Soft Robots Using Integrated Sensing Skins and Recurrent Neural Networks 12170
Weerakoon, Lasitha; Ye, Zepeng; Bama, Rahul; Smela, Elisabeth; Yu, Miao; Chopra, Nikhil
- WhiskSight: A reconfigurable, vision-based, optical whisker sensing array for simultaneous contact, airflow, and inertia stimulus detection 12177
Kent, Teresa; Kim, Suhan; Kornilowicz, Gabriel; Yuan, Wenzhen; Hartmann, Mitra; Bergbreiter, Sarah
- Embedded Neuromorphic Architecture for Form + Function 4-D Printing of Robotic Materials: Emulation of Optimized Neurons 12185
Eom, Sangjun; Abbaraju, Praveen; Xu, Yuqing; Rajiv Nair, Bharath; Voyles, Richard

Session ThKT9 : Stereo Vision Applications

- Toward Robust and Efficient Online Adaptation for Deep Stereo Depth Estimation 12192
Knowles, Milo; Peretroukhin, Valentin; Greene, William Nicholas; Roy, Nicholas
- Reconstructing Interactive 3D Scenes by Panoptic Mapping and CAD Model Alignments 12199
Han, Muzhi; Zhang, Zeyu; Jiao, Ziyuan; Xie, Xu; Zhu, Yixin; Zhu, Song-Chun; Liu, Hangxin
- Learning the Next Best View for 3D Point Clouds Via Topological Features 12207
Collander, Christopher; Beksi, William; Huber, Manfred
- A New Framework for Registration of Semantic Point Clouds from Stereo and RGB-D Cameras 12214
Zhang, Ray; Lin, Tzu-Yuan; Lin, Chien Erh; Parkison, Steven; Clark, William; Grizzle, J.W.; Eustice, Ryan; Ghaffari, Maani

Session WeCT15 : Surgical Continuum Robots

- Towards Collision Detection, Localization and Force Estimation for a Soft Cable-Driven Manipulator 12222
Wang, Yuxin; Wang, Hesheng; Xu, Fan; Yu, Junzhi; Chen, Weidong; Liu, Yunhui
- Kinematic Analysis of a Flexible Surgical Instrument for Robot-Assisted Minimally Invasive Surgery 12229
Feng, Mei; Ni, Zhixue; Fu, Yili; Jin, Xingze; Liu, Wei; Lu, Xiuquan
- Hybrid Adaptive Control Strategy for Continuum Surgical Robot under External Load 12236
Wang, Ziwen; Wang, Teng; Zhao, Baoliang; He, Yucheng; Zhang, Peng; Hu, Ying; Li, Bing; Meng, Max Q.-H.

[A Multi-Contact-Aided Continuum Manipulator with Anisotropic Shapes](#) 12244
Ai, Xiaojie; Gao, Anzhu; Lin, Zecai; He, Chong; Chen, Weidong

Session ThHT8 : Surgical Robotics I

[Parallelism in Autonomous Robotic Surgery](#) 12252
Abdelaal, Alaa Eldin; Liu, Jordan Z.R.; Hong, Nancy; Hager, Gregory; Salcudean, Septimiu E.

[A Confidence-Based Supervised-Autonomous Control Strategy for Robotic Vaginal Cuff Closure](#) 12261
Kam, Michael; Saeidi, Hamed; Hsieh, Michael; Kang, Jin; Krieger, Axel

[Design and Control of 5-DoF Robotically Steerable Catheter for the Delivery of the Mitral Valve Implant](#) 12268
Nayar, Namrata Unnikrishnan; Jeong, Seokhwan; Desai, Jaydev P.

[A Robotic System for Implant Modification in Single-Stage Cranioplasty](#) 12275
Liu, Shuya; Huang, Wei-Lun; Gordon, Chad; Armand, Mehran

Session ThBT13 : Surgical Robotics II

[Design and Implementation of a Novel, Intrinsically Safe Rigid-Flexible Coupling Manipulator for COVID-19 Oropharyngeal Swab Sampling](#) 12282
Zhang, Heng; Wang, Qiwen; Chi, Chuliang; Chen, Yongquan; Mu, Zonggao; Li, Zheng; Lan, Yuanmin; Zhang, Aidong

[Design and Control of Fully Handheld Microsurgical Robot for Active Tremor Cancellation](#) 12289
Kim, Eunchan; Choi, Ingu; Yang, Sungwook

[Towards a Wristed Percutaneous Robot with Variable Stiffness for Pericardiocentesis](#) 12296
Yan, Kim; Yan, Wanquan; Zeng, Wenhui; Ding, Qingpeng; Chen, Jianghua; Yan, Junyan; Lam, Chun Ping; Wan, Song; Cheng, Shing Shin

[Corneal Suturing Robot Capable of Producing Sutures with Desired Shape for Corneal Transplantation Surgery](#) 12305
Shin, Hyung Gon; Park, Ikjong; Kim, Keehoon; Kim, Hong-Kyun; Chung, Wan Kyun

Session ThIT8 : Surgical Robotics III

[Recovering Stress Distribution on Deformable Tissue for a Magnetic Actuated Insertable Laparoscopic Surgical Camera](#) 12314
Li, Ning; Mancini, Gregory; Chandler, Amy; Tan, Jindong

[A Novel Robotic System for Ultrasound-Guided Peripheral Vascular Localization](#) 12321
Ma, Guangshen; Oca, Siobhan; Zhu, Yifan; Codd, Patrick; Buckland, Daniel

[Real-To-Sim Registration of Deformable Soft Tissue with Position-Based Dynamics for Surgical Robot Autonomy](#) 12328

Liu, Fei; Li, Zihan; Han, Yunhai; Lu, Jingpei; Richter, Florian; Yip, Michael C.

- [Toward Force Estimation in Robot-Assisted Surgery Using Deep Learning with Vision and Robot State](#) 12335
Chua, Zonghe; Jarc, Tony; Okamura, Allison M.

Session ThAT12 : Surgical Robotics IV

- [A Variable Curvature Model for Multi-Backbone Continuum Robots to Account for Inter-Segment Coupling and External Disturbance](#) 12342
Chen, Yuyang; Wu, Baibo; Jin, Jiabin; Xu, Kai

- [Learning Domain Adaptation with Model Calibration for Surgical Report Generation in Robotic Surgery](#) 12350
Xu, Mengya; Islam, Mobarakol; Lim, Chwee Ming; Ren, Hongliang

- [Tele-Operative Low-Cost Robotic Lung Ultrasound Scanning Platform for Triage of COVID-19 Patients](#) 12357
Tsumura, Ryosuke; Hardin, John; Bimbraw, Keshav; GrosseStreuer, Anne; Odusanya, Olushola Segun; Zheng, Yihao; Hill, Jeffrey C.; Hoffmann, Beatrice; Soboyejo, Winston; Zhang, Haichong

- [Data-Driven Holistic Framework for Automated Laparoscope Optimal View Control with Learning-Based Depth Perception](#) 12366
Li, Bin; Lu, Bo; Lu, Yiang; Dou, Qi; Liu, Yunhui

Session ThJT8 : Surgical Robotics V

- [Multibranch Learning for Angiodysplasia Segmentation with Attention-Guided Networks and Domain Adaptation](#) 12373
Jia, Xiao; Mai, Xiaochun; Xing, Xiaohan; Shen, Yutian; Wang, Jiankun; Meng, Max Q.-H.

- [Model-Predictive Control of Blood Suction for Surgical Hemostasis Using Differentiable Fluid Simulations](#) 12380
Huang, Jingbin; Liu, Fei; Richter, Florian; Yip, Michael C.

- [Autonomous Robotic Suction to Clear the Surgical Field for Hemostasis Using Image-Based Blood Flow Detection](#) 12387
Richter, Florian; Shen, Shihao; Liu, Fei; Huang, Jingbin; Funk, Emily; Orosco, Ryan; Yip, Michael C.

- [Learning Invariant Representation of Tasks for Robust Surgical State Estimation](#) 12395
Qin, Yidan; Allan, Max; Yue, Yisong; Burdick, Joel; Azizian, Mahdi

Session ThET13 : Surgical Robotics VI

- [Bayesian Neural Network Modeling and Hierarchical MPC for a Tendon-Driven Surgical Robot with Uncertainty Minimization](#) 12403
Cursi, Francesco; Modugno, Valerio; Lanari, Leonardo; Oriolo, Giuseppe; Kormushev, Petar

MAMMOBOT: A Miniature Steerable Soft Growing Robot for Early Breast Cancer Detection <i>Berthet-Rayne, Pierre; Sadati, Seyedmohammadhadi; Petrou, Georgios; Patel, Neel; Giannarou, Stamatia; Leff, Daniel Richard; Bergeles, Christos</i>	12411
Data-Driven Intra-Operative Estimation of Anatomical Attachments for Autonomous Tissue Dissection <i>Tagliabue, Eleonora; Dall'Alba, Diego; Pfeiffer, Micha; Piccinelli, Marco; Marin, Riccardo; Castellani, Umberto; Speidel, Stefanie; Fiorini, Paolo</i>	12420
Design and Development of a Robotic Bioreactor for in Vitro Tissue Engineering <i>Smith, Abigail Florence; Thanarak, Jeerawan; Pontin, Marco; Green, Nicola; Damian, Dana</i>	12428
Session ThFT13 : Surgical Robotics VII	
Model-Based Design and Digital Implementation to Improve Control of the Da Vinci Research Kit Telerobotic Surgical System <i>Kohlgrueber, Stefan; Kim, Yeongmi; Kazanzides, Peter</i>	12435
Shared Control Strategy for Needle Insertion into Deformable Tissue Using Inverse Finite Element Simulation <i>Baksic, Paul; Courtecuisse, Hadrien; Bayle, Bernard</i>	12442
An Optimized Two-Layer Approach for Efficient and Robustly Stable Bilateral Teleoperation <i>Loschi, Filippo; Piccinelli, Nicola; Dall'Alba, Diego; Muradore, Riccardo; Fiorini, Paolo; Secchi, Cristian</i>	12449
Design and Evaluation of a Foot-Controlled Robotic System for Endoscopic Surgery <i>Huang, Yanpei; Lai, Wenjie; Cao, Lin; Burdet, Etienne; Phee, Louis</i>	12456
Session WeCT13 : Surgical Robots IX	
Cutting Depth Compensation Based on Milling Acoustic Signal for Robotic-Assisted Laminectomy <i>Xia, Guangming; Yao, Bin; Dai, Yu; Zhang, Jianxun</i>	12464
Non-Linear Hysteresis Compensation of a Tendon-Sheath-Driven Robotic Manipulator Using Motor Current <i>Lee, Dong-Ho; Kim, Young-Ho; Collins, Jarrod; Kapoor, Ankur; Kwon, Dong-Soo; Mansi, Tommaso</i>	12470
Fast Localization and Segmentation of Tissue Abnormalities by Autonomous Robotic Palpation <i>Yan, Youcan; Pan, Jia</i>	12478
Hysteresis Modeling of Robotic Catheters Based on Long Short-Term Memory Network for Improved Environment Reconstruction <i>Wu, Di; Zhang, Yao; Ourak, Mouloud; Niu, Kenan; Dankelman, Jenny; Vander Poorten, Emmanuel B</i>	12486

Session ThDT12 : Surgical Robots VIII

- [Motion-Aware Robotic 3D Ultrasound](#) 12494
Jiang, Zhongliang; Wang, Hanyu; Li, Zhenyu; Grimm, Matthias; Zhou, Mingchuan; Eck, Ulrich Eck; Brecht, Sandra V.; Lueth, Tim C.; Wendler, Thomas; Navab, Nassir
- [A 3D Printed Mechanical Model of the Knee to Detect and Avoid Total Knee Replacement Surgery Errors](#) 12501
Mercader, Alexandra Léna Victoria; Roettinger, Timon; Bigdeli, Amir; Roettinger, Heinz; Lueth, Tim C.
- [Detecting Blindspots in Colonoscopy by Modelling Curvature](#) 12508
Abrahams, George; Hervé, Anthony; Bernth, Julius Esmann; Yvon, Marc; Hayee, Bu; Liu, Hongbin
- [Out-Of-Plane Corrections for Autonomous Robotic Breast Ultrasound Acquisitions](#) 12515
Welleweerd, Marcel Klaas; De Groot, Antonius Gerardus; Groenhuis, Vincent; Siepel, Françoise J; Stramigioli, Stefano

Session ThET12 : Tactile Sensing for Manipulation

- [Improved Learning of Robot Manipulation Tasks Via Tactile Intrinsic Motivation](#) 12522
Vulin, Nikola; Christen, Sammy; Stevsic, Stefan; Hilliges, Otmar
- [Exploiting Distributed Tactile Sensors to Drive a Robot Arm through Obstacles](#) 12530
Albini, Alessandro; Grella, Francesco; Maiolino, Perla; Cannata, Giorgio
- [Slip Detection for Grasp Stabilisation with a Multi-Fingered Tactile Robot Hand](#) 12538
James, Jasper Wollaston; Lepora, Nathan
- [Grasp Detection for Robot to Human Handovers Using Capacitive Sensors](#) 12552
Mamaev, Ilshat; Kretsch, David; Alagi, Hosam; Hein, Björn

Session ThFT12 : Tactile Sensing in Surgical Applications

- [Foot Control of a Surgical Laparoscopic Gripper Via 5DoF Haptic Robotic Platform: Design, Dynamics and Haptic Shared Control](#) 12559
Hernandez Sanchez, Jacob; Amanhoud, Walid; Billard, Aude; Bouri, Mohamed
- [Providing Automatic Feedback to Trainees after Automatic Evaluation](#) 12567
Millan, Megane; Achard, Catherine
- [An Abdominal Phantom with Tunable Stiffness Nodules and Force Sensing Capability for Palpation Training](#) 12574
He, Liang; Herzig, Nicolas; de Lusignan, Simon; Scimeca, Luca; Maiolino, Perla; Iida, Fumiya; Nanayakkara, Thrishantha
- [A Haptic Mouse Design with Stiffening Muscle Layer for Simulating Guarding in Abdominal Palpation Training](#) 12588

He, Liang; Leong, Florence Ching Ying; Lalitharatne, Thilina Dulantha; de Lusignan, Simon; Nanayakkara, Thrishantha

Session ThIT9 : Task Planning I

- [Deep Learning for Robotic Mass Transport Cloaking](#) 12595
Khodayi-mehr, Reza; Zavlanos, Michael M.
- [Collective Transport of Unconstrained Objects Via Implicit Coordination and Adaptive Compliance](#) 12603
Carey, Nicole Erin; Werfel, Justin
- [Approximate Solutions to a Class of Reachability Games](#) 12610
Fridovich-Keil, David; Tomlin, Claire
- [Reactive Task and Motion Planning under Temporal Logic Specifications](#) 12618
Li, Shen; Park, Daehyung; Sung, Yoonchang; Shah, Julie A.; Roy, Nicholas

Session ThHT9 : Task Planning II

- [Dispersion-Minimizing Motion Primitives for Search-Based Motion Planning](#) 12625
Jarin-Lipschitz, Laura; Paulos, James; Bjorkman, Raymond; Kumar, Vijay
- [Meta-Adversarial Inverse Reinforcement Learning for Decision-Making Tasks](#) 12632
Wang, Pin; Li, Hanhan; Chan, Ching-Yao
- [Min-Max Entropy Inverse RL of Multiple Tasks](#) 12639
Arora, Saurabh; Doshi, Prashant; Banerjee, Bikramjit
- [Task Planning on Stochastic Aisle Graphs for Precision Agriculture](#) 12646
Kan, Xinyue; Thayer, Thomas C.; Carpin, Stefano; Karydis, Konstantinos

Session ThDT11 : Task Planning III

- [Productive Multitasking for Industrial Robots](#) 12654
Wuthier, David; Rovidia, Francesco; Fumagalli, Matteo; Krueger, Volker
- [Automated Planning of Workcell Layouts Considering Task Sequences](#) 12662
Bachmann, Timo; Nottensteiner, Korbinian; Roa, Maximo A.
- [Multi-Robot Task Sequencing & Automatic Path Planning for Cycle Time Optimization: Application for Car Production Line](#) 12669
Touzani, Hicham; Hadj-Abdelkader, Hicham; Séguy, Nicolas; Bouchafa, Samia
- [Multi-Goal Path Planning Using Multiple Random Trees](#) 12677
Janoš, Jaroslav; Vonasek, Vojtech; Penicka, Robert

Session ThHT7 : Time Delay Systems

Delay-Robust Nonlinear Control of Bounded-Input Telerobotic Systems with Synchronization Enhancement	12685
<i>Zakerimanesh, Amir; Sharifi, Mojtaba; Hashemzadeh, Farzad; Tavakoli, Mahdi</i>	
DESERTS: Delay-Tolerant Semi-Autonomous Robot Teleoperation for Surgery	12693
<i>Gonzalez, Glebys; Agarwal, Mridul; Balakuntala Srinivasa Murthy, Mythra Varun; Rahman, Md Masudur; Kaur, Upinder; Voyles, Richard; Aggarwal, Vaneet; Xue, Yexiang; Wachs, Juan</i>	
Discrete Time Delay Feedback Control of Stewart Platform with Intelligent Optimizer Weight Tuner	12701
<i>Tajdari, Farzam; Tajdari, Mahsa; Rezaei, Amin</i>	
The Effect of Input Signals Time-Delay on Stabilizing Traffic with Autonomous Vehicles	12708
<i>Al-Darabsah, Isam; Al Janaideh, Mohammad; Campbell, Sue Ann</i>	
Session ThIT7 : Topology-Based Motion Planning	
Homotopy-Driven Exploration of Human-Made Spaces Using Signs	12715
<i>Liang, Claire Yilan; Kress-Gazit, Hadas</i>	
A Topologically Inspired Path-Following Method with Intermittent State Feedback	12722
<i>Edwards, Sage; Le, Duc; Guralnik, Dan; Dixon, Warren</i>	
Graph-Based Topological Exploration Planning in Large-Scale 3D Environments	12730
<i>Yang, Fan; Lee, Dung-Han; Keller, John; Scherer, Sebastian</i>	
Roadmap Learning for Probabilistic Occupancy Maps with Topology-Informed Growing Neural Gas	12737
<i>Saroya, Manish; Best, Graeme; Hollinger, Geoffrey</i>	
Session ThET11 : Trajectory Optimization	
Trajectory Optimisation in Learned Multimodal Dynamical Systems Via Latent-ODE Collocation	12745
<i>Scannell, Aidan; Ek, Carl Henrik; Richards, Arthur</i>	
Inverse Dynamics vs. Forward Dynamics in Direct Transcription Formulations for Trajectory Optimization	12752
<i>Ferrolho, Henrique; Ivan, Vladimir; Merkt, Wolfgang Xaver; Havoutis, Ioannis; Vijayakumar, Sethu</i>	
Coupled Mobile Manipulation Via Trajectory Optimization with Free Space Decomposition	12759
<i>Spahn, Max; Brito, Bruno; Alonso-Mora, Javier</i>	
Designing Fast and Smooth Trajectories in Collaborative Workstations	12766
<i>Rojas, Rafael A.; Vidoni, Renato</i>	

Session ThFT11 : Trajectory Planning

Online Dynamic Trajectory Optimization and Control for a Quadruped Robot 12773
Cebe, Oguzhan; Tiseo, Carlo; Xin, Guiyang; Lin, Hsiu-Chin; Smith, Joshua; Mistry, Michael

Online DCM Trajectory Adaptation for Push and Stumble Recovery during Humanoid Locomotion 12780
Mesanan, George; Engelsberger, Johannes; Ott, Christian

Circular Fields and Predictive Multi-Agents for Online Global Trajectory Planning 12787
Becker, Marvin; Lilge, Torsten; Müller, Matthias A.; Haddadin, Sami

Exploring Dynamic Context for Multi-Path Trajectory Prediction 12795
Cheng, Hao; Liao, Wentong; Tang, Xuejiao; Yang, Michael Ying; Sester, Monika; Rosenhahn, Bodo

Session ThDT10 : Transfer Learning

Benchmarking Domain Randomisation for Visual Sim-To-Real Transfer 12802
Alghonaim, Raghad; Johns, Edward

There and Back Again: Learning to Simulate Radar Data for Real-World Applications 12809
Weston, Robert James; Parker Jones, Oiwi; Posner, Ingmar

Generation of GelSight Tactile Images for Sim2Real Learning 12817
Fernandes Gomes, Daniel; Paoletti, Paolo; Luo, Shan

Virtual Radar: Real-Time Millimeter-Wave Radar Sensor Simulation for Perception-Driven Robotics 12825
Schöffmann, Christian; Ubezio, Barnaba; Boehm, Christoph; Mühlbacher-Karrer, Stephan; Zangl, Hubert

Session ThBT12 : Underactuated and Stable Control

A Stable Control Strategy for Industrial Robots with External Feedback Loop 12833
Khan, Gulam; Nguyen, Huu-Thiet; Cheah, C. C.

Distance-Based Formation Control with Goal Assignment for Global Asymptotic Stability of Multi-Robot Systems 12839
Choi, Yun Ho; Kim, Doik

Operational Space Control Under Actuator Bandwidth Limitation 12847
Lee, Hosang; Park, Jaeheung

Operational Space Control for Planar PA^{N-1} Underactuated Manipulators Using Orthogonal Projection and Quadratic Programming 12853
Chu, Xiangyu; Tang, Yunxi; Giordano, Alessandro Massimo; Chen, Tan; Au, K. W. Samuel

Session TuHT4 : Unmanned Aerial Vehicle Award Session

Dynamically Feasible Task Space Planning for Underactuated Aerial Manipulators 12860
Welde, Jake; Paulos, James; Kumar, Vijay

Session ThAT11 : Vision and Perception I

PLG-IN: Pluggable Geometric Consistency Loss with Wasserstein Distance in Monocular Depth Estimation 12868
Hirose, Noriaki; Koide, Satoshi; Kawano, Keisuke; Kondo, Ruho

Real-Time Mesh Extraction from Implicit Functions via Direct Reconstruction of Decision Boundary 12875
Kawai, Wataru; Mukuta, Yusuke; Harada, Tatsuya

Uncertainty-Aware Fast Curb Detection Using Convolutional Networks in Point Clouds 12882
Jung, Younghwa; Jeon, Mingyu; Kim, Chan; Seo, Seung-Woo; Kim, Seong-Woo

OCR-Based Inventory Management Algorithms Robust to Damaged Images 12889
Seo, MinSeok; Kim, Daehan; Kang, Hyeyoon; Cho, Donghyeon; Choi, Dong-Geol

Session ThBT11 : Vision and Perception II

FG-Conv: Large-Scale LiDAR Point Clouds Understanding Leveraging Feature Correlation Mining and Geometric-Aware Modeling 12896
Liu, Kangcheng; Gao, Zhi; Lin, Feng; Chen, Ben M.

Exploiting Local Geometry for Feature and Graph Construction for Better 3D Point Cloud Processing with Graph Neural Networks 12903
Srivastava, Siddharth; Sharma, Gaurav

Elevation Angle Estimation in 2D Acoustic Images Using Pseudo Front View 12910
Wang, Yusheng; Ji, Yonghoon; Liu, Dingyu; Tsuchiya, Hiroshi; Yamashita, Atsushi; Asama, Hajime

Stereo Object Matching Network 12918
Choe, Jaesung; Joo, Kyungdon; Rameau, Francois; Kweon, In So

Session ThAT10 : Vision and Perception III

Robot Motion Control with Compressive Feedback 12925
Li, Congjian; Wang, Song; Wang, Siyu; Bi, Sheng; Guan, Yisheng; Xi, Ning

Action Sequencing Using Visual Permutations 12931
Burke, Michael; Subr, Kartic; Ramamoorthy, Subramanian

MFPN-6D : Real-time One-stage Pose Estimation of Objects on RGB Images 12939
Liu, Penglei; Zhang, Qieshi; Zhang, Jin; Fei, Wang; Cheng, Jun

A Novel Tactile Feedback System with On-Line Texture Decoding and Direct-Texture-Feedback 12946
Sakurada, Kuniharu; Ganesh, Gowrishankar; Yu, Wenwei

Session ThBT10 : Vision and Perception IV

- [Visual Place Recognition Via Local Affine Preserving Matching](#) 12954
Ye, Xinyu; Ma, Jiayi
- [View-Expansive Microscope System with Real-Time High-Resolution Imaging for Simplified Microinjection Experiments](#) 12961
Aoyama, Tadayoshi; Takeno, Sarau; Hano, Kazuki; Takasu, Masaki; Takeuchi, Masaru; Hasegawa, Yasuhisa
- [Leveraging Enhanced Virtual Reality Methods and Environments for Efficient, Intuitive, and Immersive Teleoperation of Robots](#) 12967
De Pace, Francesco; Gorjup, Gal; Bai, Huidong; Sanna, Andrea; Liarokapis, Minas; Billinghamurst, Mark
- [End-To-End Multi-Instance Robotic Reaching from Monocular Vision](#) 12974
Zhuang, Zheyu; Yu, Xin; Mahony, Robert

Session ThAT9 : Vision and Perception V

- [Toward a Unified Framework for Point Set Registration](#) 12981
Li, Feiran; Fujiwara, Kent; Matsushita, Yasuyuki
- [A Heteroscedastic Likelihood Model for Two-Frame Optical Flow](#) 12988
Farnworth, Timothy; Renton, Christopher; Strydom, Reuben; Wills, Adrian; Perez, Tristan
- [Microinjection System to Enable Real-Time 3D Image Presentation through Focal Position Adjustment](#) 12996
Fujishiro, Toshiki; Aoyama, Tadayoshi; Hano, Kazuki; Takasu, Masaki; Takeuchi, Masaru; Hasegawa, Yasuhisa
- [Volumetric Propagation Network: Stereo-LiDAR Fusion for Long-Range Depth Estimation](#) 13003
Choe, Jaesung; Joo, Kyungdon; Imtiaz, Tooba; Kweon, In So

Session WeCT8 : Vision and Perception: 3D Estimation

- [Robust Improvement in 3D Object Landmark Inference for Semantic Mapping](#) 13011
Lin, Xubin; Yang, Yirui; He, Li; Chen, Weinan; Guan, Yisheng; Zhang, Hong
- [YOLOStereo3D: A Step Back to 2D for Efficient Stereo 3D Detection](#) 13018
Liu, Yuxuan; Wang, Lujia; Liu, Ming
- [UniFuse: Unidirectional Fusion for 360 Panorama Depth Estimation](#) 13025
Jiang, Hualie; Sheng, Zhe; Zhu, Siyu; Dong, Zilong; Huang, Rui
- [Depth Estimation under Motion with Single Pair Rolling Shutter Stereo Images](#) 13033
Wang, Ke; Liu, Chuhao; Wang, Kaixuan; Shen, Shaojie

Session ThFT10 : Vision and Perception: Action Recognition I

- Pose Refinement Graph Convolutional Network for Skeleton-Based Action Recognition 13041
Li, ShiJie; Yi, Jinhui; Abu Farha, Yazan; Gall, Juergen
- Attentional Learn-Able Pooling for Human Activity Recognition 13049
Debnath, Bappaditya; O'Brien, Mary; Swagat, Kumar; Behera, Ardhendu
- Real-Time Instance Detection with Fast Incremental Learning 13056
Bormann, Richard; Wang, Xinjie; Völk, Markus; Kleeberger, Kilian; Lindermayr, Jochen
- 3D3L: Deep Learned 3D Keypoint Detection and Description for LiDARs 13064
Streiff, Dominic; Bernreiter, Lukas; Tschopp, Florian; Fehr, Marius; Siegwart, Roland

Session WeCT1 : Vision and Perception: Action Recognition II

- Maintaining a Reliable World Model Using Action-Aware Perceptual Anchoring 13071
Liang, Ying Siu; Choi, Dongkyu; Kwok, Kenneth
- Modeling Affect-Based Intrinsic Rewards for Exploration and Learning 13078
Zadok, Dean; McDuff, Daniel; Kapoor, Ashish
- A Multi-Level Network for Human Pose Estimation 13085
Shao, Zhanpeng; Liu, Peng; Li, Y.F.; Yang, Jianyu; Zhou, Xiaolong
- Open-Set Intersection Intention Prediction for Autonomous Driving 13092
Li, Fei; Li, Xiangxu; Luo, Jun; Shiwei, Fan; Zhang, Yihan; Zhang, Hongbo

Session ThHT1 : Vision and Perception: Applications I

- LiDAR Few-Shot Domain Adaptation Via Integrated CycleGAN and 3D Object Detector with Joint Learning Delay 13099
Corral-Soto, Eduardo R.; Nabatchian, Amir; Gerdzhev, Martin; Liu, Bingbing
- Three-Filters-To-Normal: An Accurate and Ultrafast Surface Normal Estimator 13106
Fan, Rui; Wang, Hengli; Xue, Bohuan; Huang, Huaiyang; Wang, Yuan; Liu, Ming; Pitas, Ioannis
- Device Design and System Integration of a Two-Axis Water-Immersible Micro Scanning Mirror (WIMSM) to Enable Dual-Modal Optical and Acoustic Communication and Ranging for Underwater Vehicles 13114
Duan, Xiaoyu; Zou, Jun; Wang, Di; Song, Dezhen
- Vanishing Point Aided LiDAR-Visual-Inertial Estimator 13120
Wang, Peng; Fang, Zheng; Zhao, Shibo; Chen, Yongnan; Zhou, Ming; An, Shan

Session ThIT1 : Vision and Perception: Applications II

Fine-Grained Activity Recognition for Assembly Videos 13127
Jones, Jonathan; Cortesa, Cathryn; Shelton, Amy; Landau, Barbara; Khudanpur, Sanjeev; Hager, Gregory

Cooperative Visual-Inertial Odometry 13135
Zhu, Pengxiang; Yang, Yulin; Ren, Wei; Huang, Guoquan (Paul)

Vision-Based Self-Assembly for Modular Multirotor Structures 13142
Litman, Yehonathan; Gandhi, Neeraj; Phan, Linh Thi Xuan; Saldaña, David

Evaluation of a Drone-Based Camera Calibration Approach for Hard-To-Reach Cameras 13149
Commun, Domitille; Pradalier, Cedric; Balchanos, Michael; Fischer, Olivia; Mavris, Dimitri N

Session ThJT1 : Vision and Perception: Auto-Calibration

Online Photometric Calibration of Automatic Gain Thermal Infrared Cameras 13156
Das, Manash Pratim; Matthies, Larry; Daftry, Shreyansh

A Continuous-Time Approach for 3D Radar to Camera Extrinsic Calibration 13164
Wise, Emmett; Peršić, Juraj; Grebe, Christopher; Petrovic, Ivan; Kelly, Jonathan

Learned Camera Gain and Exposure Control for Improved Visual Feature Detection and Matching 13171
Tomasi, Justin; Wagstaff, Brandon; Waslander, Steven Lake; Kelly, Jonathan

Auto-Calibration Method Using Stop Signs for Urban Autonomous Driving Applications 13179
Han, Yunhai; Liu, Yuhan; Paz, David; Christensen, Henrik Iskov

Session ThHT2 : Vision and Perception: Autonomous Vehicle Navigation I

Learning Robust Driving Policies without Online Exploration 13186
Graves, Daniel; Nguyen, Nhat; Hassanzadeh, Kimia; Jin, Jun; Luo, Jun

SSCNav: Confidence-Aware Semantic Scene Completion for Visual Semantic Navigation 13194
Liang, Yiqing; Chen, Boyuan; Song, Shuran

Ego-Centric Stereo Navigation Using Stixel World 13201
Feng, Shiyu; Lyu, Fanzhe; Hwang, Jin Ha; Vela, Patricio

PyTouch: A Machine Learning Library for Touch Processing 13208
Lambeta, Mike Maroje; Xu, Huazhe; Xu, Jingwei; Chou, Po-Wei; Wang, Shaoxiong; Darrell, Trevor; Calandra, Roberto

Session ThIT2 : Vision and Perception: Autonomous Vehicle Navigation II

ViNG: Learning Open-World Navigation with Visual Goals 13215

Shah, Dhruv; Eysenbach, Benjamin; Kahn, Gregory; Rhinehart, Nicholas; Levine, Sergey

[MaAST: Map Attention with Semantic Transformers for Efficient Visual Navigation](#) 13223
Seymour, Zachary; Thopalli, Kowshik; Mithun, Niluthpol Chowdhury; Chiu, Han-Pang; Samarasekera, Supun; Kumar, Rakesh

[A Few Shot Adaptation of Visual Navigation Skills to New Observations Using Meta-Learning](#) 13231
Luo, Qian; Sorokin, Maks; Ha, Sehoon

[Hierarchical Cross-Modal Agent for Robotics Vision-And-Language Navigation](#) 13238
Irshad, Muhammad Zubair; Ma, Chih-Yao; Kira, Zsolt

Session ThKT1 : Vision and Perception: Autonomous Vehicle Navigation III

[Efficient and Robust LiDAR-Based End-To-End Navigation](#) 13247
Liu, Zhijian; Amini, Alexander; Zhu, Sibor; Karaman, Sertac; Han, Song; Rus, Daniela

[Visual Navigation among Humans with Optimal Control As a Supervisor](#) 13255
Tolani, Varun; Bansal, Somil; Faust, Aleksandra; Tomlin, Claire

[Environmental Hotspot Identification in Limited Time with a UAV Equipped with a Downward-Facing Camera](#) 13264
Sung, Yoonchang; Dixit, Deeksha; Tokekar, Pratap

[Learning Composable Behavior Embeddings for Long-Horizon Visual Navigation](#) 13271
Meng, Xiangyun; Xiang, Yu; Fox, Dieter

Session ThET10 : Vision and Perception: Detection and Recognition I

[VelocityNet: Motion-Driven Feature Aggregation for 3D Object Detection in Point Cloud Sequences](#) 13279
Emmerichs, David; Pinggera, Peter; Ommer, Bjorn

[Don't Blindly Trust Your CNN: Towards Competency-Aware Object Detection by Evaluating Novelty in Open-Ended Environments](#) 13286
Howard, Rhys Peter Matthew; Barrett, Samuel; Kunze, Lars

[What My Motion Tells Me about Your Pose: A Self-Supervised Monocular 3D Vehicle Detector](#) 13293
Picron, Cédric; Chakravarty, Punarjay; Roussel, Tom; Tuytelaars, Tinne

[Self-Supervised Person Detection in 2D Range Data Using a Calibrated Camera](#) 13301
Jia, Dan; Steinweg, Mats; Hermans, Alexander; Leibe, Bastian

Session WeBT8 : Vision and Perception: Detection and Recognition II

[A Cascaded LiDAR-Camera Fusion Network for Road Detection](#) 13308
Gu, Shuo; Yang, Jian; Kong, Hui

GPR-RCNN: An Algorithm of Subsurface Defect Detection for Airport Runway based on GPR	13315
<i>Li, Haifeng; Li, Nansha; Wu, Renbiao; Wang, Huaichao; Gui, Zhongcheng; Song, Dezhen</i>	
On the Challenges of Open World Recognition under Shifting Visual Domains	13323
<i>Fontanel, Dario; Cermelli, Fabio; Mancini, Massimiliano; Caputo, Barbara</i>	
CentroidReg: A Global-To-Local Framework for Partial Point Cloud Registration	13331
<i>Zhao, Hengwang; Liang, Zhidong; Wang, Chunxiang; Yang, Ming</i>	
Session ThBT9 : Vision and Perception: Detection and Recognition III	
Real-Time 3D-Lidar, MMW Radar and GPS/IMU Fusion Based Vehicle Detection and Tracking in Unstructured Environment	13339
<i>Li, Ning; Lu, Caixia; Yu, XueWei; Liu, XueYan; Su, Bo</i>	
Relational Graph Learning on Visual and Kinematics Embeddings for Accurate Gesture Recognition in Robotic Surgery	13346
<i>Long, Yonghao; Wu, Jie Ying; Lu, Bo; Jin, Yueming; Unberath, Mathias; Liu, Yunhui; Heng, Pheng Ann; Dou, Qi</i>	
In Defense of Knowledge Distillation for Task Incremental Learning and Its Application in 3D Object Detection	13354
<i>Yun, Peng; Wang, Lujia; Liu, Yuxuan; Liu, Ming</i>	
City-Scale Scene Change Detection Using Point Clouds	13362
<i>Yew, Zi Jian; Lee, Gim Hee</i>	
Session ThAT8 : Vision and Perception: Detection and Recognition IV	
Joint Representation of Temporal Image Sequences and Object Motion for Video Object Detection	13370
<i>Koh, Junho; Kim, Jaekyum; Shin, Youniji; Lee, Byeongwon; Yang, Seungji; Choi, Jun Won</i>	
Targetless Multiple Camera-LiDAR Extrinsic Calibration Using Object Pose Estimation	13377
<i>Yoon, Byung-Hyun; Jeong, Hyeonwoo; Choi, Kang-Sun</i>	
Recognition and Prediction of Surgical Actions Based on Online Robotic Tool Detection	13384
<i>Park, Juyoun; Park, Chung Hyuk</i>	
Target-style-aware Unsupervised Domain Adaptation for Object Detection	13392
<i>Yun, Woo-han; Han, ByungOk; Lee, Jaeyeon; Kim, Jaehong; Kim, Junmo</i>	
Session ThAT1 : Vision and Perception: Detection and Recognition V	
Adversarially Trained Hierarchical Feature Extractor for Vehicle Re-Identification	13400
<i>Shyam, Pranjay; Yoon, Kuk-Jin; Kim, Kyung-Soo</i>	

VIC-Net: Voxelization Information Compensation Network for Point Cloud 3D Object Detection <i>Jiang, Tianyuan; Song, Nan; Liu, Huanyu; Yin, Ruihao; Gong, Ye; Yao, Jian</i>	13408
Semantic Reinforced Attention Learning for Visual Place Recognition <i>Peng, Guohao; Yue, Yufeng; Zhang, Jun; Wu, Zhenyu; Tang, Xiaoyu; Wang, Danwei</i>	13415
Towards Efficient Multiview Object Detection with Adaptive Action Prediction <i>Xu, Qianli; Fang, Fen; Gauthier, Nicolas; Liang, Wenyu; Wu, Yan; Li, Liyuan; Lim, Joo Hwee</i>	13423
Session ThDT9 : Vision and Perception: Grasping I	
Binary-LoRAX: Low-Latency Runtime Adaptable XNOR Classifier for Semi-Autonomous Grasping with Prosthetic Hands <i>Fasfous, Nael; Vemparala, Manoj Rohit; Frickenstein, Alexander; Badawy, Mohamed; Hundhausen, Felix; Hoefer, Julian; Nagaraja, Naveen Shankar; Unger, Christian; Voegel, Hans-Joerg; Becker, Juergen; Asfour, Tamim; Stechele, Walter</i>	13430
Contact-GraspNet: Efficient 6-DoF Grasp Generation in Cluttered Scenes <i>Sundermeyer, Martin; Mousavian, Arsalan; Triebel, Rudolph; Fox, Dieter</i>	13438
Residual Squeeze-And-Excitation Network with Multi-Scale Spatial Pyramid Module for Fast Robotic Grasping Detection <i>Cao, Hu; Chen, Guang; Li, Zhijun; Lin, Jianjie; Knoll, Alois</i>	13445
End-To-End Trainable Deep Neural Network for Robotic Grasp Detection and Semantic Segmentation from RGB <i>Ainetter, Stefan; Fraundorfer, Friedrich</i>	13452
Session WeAT8 : Vision and Perception: Grasping II	
RGB Matters: Learning 7-DoF Grasp Poses on Monocular RGBD Images <i>Gou, Minghao; Fang, Hao-Shu; Zhu, Zhanda; Xu, Sheng; Wang, Chenxi; Lu, Cewu</i>	13459
Hybrid Vision/Force Control for Interaction with the Bottle-Like Object <i>Han, Lijun; Wang, Hesheng; Chen, Weidong; Wang, Jingchuan; Yuan, Jianjun</i>	13467
REGNet: REgion-Based Grasp Network for End-To-End Grasp Detection in Point Clouds <i>Zhao, Binglei; Zhang, Hanbo; Lan, Xuguang; Wang, Haoyu; Tian, Zhiqiang; Zheng, Nanning</i>	13474
Visual Servoing of a Cable-Driven Soft Robot Manipulator with Shape Feature <i>Xu, Fan; Wang, Hesheng; Chen, Weidong; Miao, Yanzi</i>	13481
Session ThJT2 : Vision and Perception: Identification and Prediction	
Efficient Real-Time Inference in Temporal Convolution Networks <i>Khandelwal, Piyush; MacGlashan, James; Wurman, Peter; Stone, Peter</i>	13489

F-SIOL-310: A Robotic Dataset and Benchmark for Few-Shot Incremental Object Learning <i>Ayub, Ali; Wagner, Alan Richard</i>	13496
Deformable Linear Object Prediction Using Locally Linear Latent Dynamics <i>Zhang, Wenbo; Schmeckpeper, Karl; Chaudhari, Pratik; Daniilidis, Kostas</i>	13503
Visual-Inertial Filtering for Human Walking Quantification <i>Mitjans, Marc; Theofanidis, Michail; Collimore, Ashley Nicole; Disney, Madelaine Lee; Levine, David Michael; Awad, Louis; Tron, Roberto</i>	13510
Session ThET9 : Vision and Perception: Image Segmentation I	
CABiNet: Efficient Context Aggregation Network for Low-Latency Semantic Segmentation <i>Kumaar, Saumya; Lyu, Ye; Nex, Francesco; Yang, Michael Ying</i>	13517
Efficient RGB-D Semantic Segmentation for Indoor Scene Analysis <i>Seichter, Daniel; Köhler, Mona; Lewandowski, Benjamin; Wengefeld, Tim; Gross, Horst-Michael</i>	13525
Plane Segmentation in Organized Point Clouds Using Flood Fill <i>Roychoudhury, Arindam; Missura, Marcell; Bennewitz, Maren</i>	13532
Semantic Feature Mining for 3D Object Classification and Segmentation <i>Lu, Weihao; Zhao, Dezong; Premebida, Cristiano; Chen, Wen-Hua; Tian, Daxin</i>	13539
Session WeAT1 : Vision and Perception: Image Segmentation II	
Discriminative Asymmetric Learning for Efficient Surgical Instrument Parsing <i>Liu, Jiaqi; Qiao, Yu; Yang, Jie; Yang, Guang-Zhong; Gu, Yun</i>	13546
One to Many: Adaptive Instrument Segmentation Via Meta Learning and Dynamic Online Adaptation in Robotic Surgical Video <i>Zhao, Zixu; Jin, Yueming; Lu, Bo; Ng, Chi-Fai; Dou, Qi; Liu, Yunhui; Heng, Pheng Ann</i>	13553
Target-Targeted Domain Adaptation for Unsupervised Semantic Segmentation <i>Zhang, Xiaohong; Zhang, Haofeng; Lu, Jianfeng; Shao, Ling; Yang, Jingyu</i>	13560
Point Cloud Segmentation Via Edge-Fused Local Graph Learning <i>Han, Mengtao; Li, Yaochen; Zuo, Liangyu; Li, Qiao; Zhang, Chi; Su, Yuanqi; Li, Ping</i>	13567
Session ThFT9 : Vision and Perception: Image Segmentation III	
PlaneSegNet: Fast and Robust Plane Estimation Using a Single-Stage Instance Segmentation CNN <i>Yaxu, Xie; Rambach, Jason; Shu, Fangwen; Stricker, Didier</i>	13574
Fast Object Segmentation Learning with Kernel-Based Methods for Robotics	13581

Ceola, Federico; Maiettini, Elisa; Pasquale, Giulia; Rosasco, Lorenzo; Natale, Lorenzo

[Diffuser: Multi-View 2D-to-3D Label Diffusion for Semantic Scene Segmentation](#) 13589
Mascaro Palliser, Ruben; Teixeira, Lucas; Chli, Margarita

[A Benchmark for LiDAR-Based Panoptic Segmentation Based on KITTI](#) 13596
Behley, Jens; Milioto, Andres; Stachniss, Cyrill

Session ThKT2 : Vision and Perception: Learning

[Object-Centric Video Prediction without Annotation](#) 13604
Schmeckpeper, Karl; Georgakis, Georgios; Daniilidis, Kostas

[Generalization in Reinforcement Learning by Soft Data Augmentation](#) 13611
Hansen, Nicklas; Wang, Xiaolong

[Test-Time Training for Deformable Multi-Scale Image Registration](#) 13618
Zhu, Wentao; Huang, Yufang; Xu, Daguang; Qian, Zhen; Fan, Wei; Xie, Xiaohui

[Multi-GAT: A Graphical Attention-Based Hierarchical Multimodal Representation Learning Approach for Human Activity Recognition](#) 13626
Islam, Md Mofijul; Iqbal, Tariq

Session ThAT2 : Vision and Perception: Measurement

[Learning a Geometric Representation for Data-Efficient Depth Estimation Via Gradient Field and Contrastive Loss](#) 13634
Shim, Dongseok; Kim, H. Jin

[Stereo-Augmented Depth Completion from a Single RGB-LiDAR Image](#) 13641
Choi, Keunhoon; Jeong, Somi; Kim, Youngjung; Sohn, Kwanghoon

[Identifying Reflected Images from Object Detector in Indoor Environment Utilizing Depth Information](#) 13648
Park, Daehee; Park, Yong-Hwa

[PENet: Towards Precise and Efficient Image Guided Depth Completion](#) 13656
Hu, Mu; Wang, Shuling; Li, BiN; Fan, Li; Ning, Shiyu; Gong, Xiaojin

Session ThHT3 : Vision and Perception: Modeling

[Contingencies from Observations: Tractable Contingency Planning with Learned Behavior Models](#) 13663
Rhinehart, Nicholas; He, Jeff; Packer, Charles; Wright, Matthew A.; McAllister, Rowan; Gonzalez, Joseph E.; Levine, Sergey

[ScrewNet: Category-Independent Articulation Model Estimation from Depth Images Using Screw Theory](#) 13670
Jain, Ajinkya; Lioutikov, Rudolf; Chuck, Caleb; Niekum, Scott

Visual Perspective Taking for Opponent Behavior Modeling 13678
Chen, Boyuan; Hu, Yuhang; Kwiatkowski, Robert; Song, Shuran; Lipson, Hod

Learning Tactile Models for Factor Graph-Based Estimation 13686
Sodhi, Paloma; Kaess, Michael; Mukadam, Mustafa; Anderson, Stuart

Session ThIT3 : Vision and Perception: Multi-Agents

Congestion-Aware Multi-Agent Trajectory Prediction for Collision Avoidance 13693
Xie, Xu; Zhang, Chi; Zhu, Yixin; Wu, Ying Nian; Zhu, Song-Chun

3D Multi-Object Tracking Using Random Finite Set-Based Multiple Measurement Models Filtering (RFS-M³) for Autonomous Vehicles 13701
Pang, Su; Morris, Daniel; Radha, Hayder

Joint Object Detection and Multi-Object Tracking with Graph Neural Networks 13708
Wang, Yongxin; Kitani, Kris; Weng, Xinshuo

Droidlet: Modular, Heterogenous, Multi-Modal Agents 13716
Pratik, Anurag; Chintala, Soumith; Srinet, Kavya; Gandhi, Dhiraj; Qian, Rebecca; Sun, Yuxuan; Drew, Ryan; Elkafrawy, Sara; Tiwari, Anoushka; Hart, Tucker; Williamson, Mary; Gupta, Abhinav; Szlam, Arthur

Session ThBT1 : Vision and Perception: Navigation and Autonomous Driving

Robust Navigation for Racing Drones based on Imitation Learning and Modularization 13724
Wang, Tianqi; Chang, Dong Eui

Learning Interpretable End-to-End Vision-Based Motion Planning for Autonomous Driving with Optical Flow Distillation 13731
Wang, Hengli; Cai, Peide; Sun, Yuxiang; Wang, Lujia; Liu, Ming

Cross-Modal Contrastive Learning of Representations for Navigation Using Lightweight, Low-Cost Millimeter Wave Radar for Adverse Environmental Conditions 13738
Huang, Jui-Te; Lu, Chen-Lung; Chang, Po-Kai; Huang, Ching-I; Hsu, Chao-Chun; Ewe, Zu Lin; Huang, Po-Jui; Wang, Hsueh-Cheng

Task-Driven Deep Image Enhancement Network for Autonomous Driving in Bad Weather 13746
Lee, Younkwon; Jeon, Jihyo; Ko, Yeongmin; Jeon, Byung-Gwan; Jeon, Moongu

Session ThDT1 : Vision and Perception: Navigation I

VINSEval: Evaluation Framework for Unified Testing of Consistency and Robustness of Visual-Inertial Navigation System Algorithms 13754
Fornasier, Alessandro; Scheiber, Martin; Hardt-Stremayr, Alexander; Jung, Roland; Weiss, Stephan

Embodied Visual Navigation with Automatic Curriculum Learning in Real Environments 13761

Morad, Steven; Mecca, Roberto; Poudel, Rudra; Liwicki, Stephan; Cipolla, Roberto

[An Event-based Vision Dataset for Visual Navigation Tasks in Agricultural Environments](#) 13769
Zujevs, Andrejs; Pudzs, Mihails; Osadcuks, Vitalijs; Ardavs, Arturs; Galauskis, Maris; Grundspenkis, Janis

[Visual Navigation in Real-World Indoor Environments Using End-To-End Deep Reinforcement Learning](#) 13776
Kulhanek, Jonas; Derner, Erik; Babuska, Robert

Session WeBT1 : Vision and Perception: Navigation II

[A Real-Time Multi-Task Framework for Guidewire Segmentation and Endpoint Localization in Endovascular Interventions](#) 13784
Zhou, Yan-Jie; Liu, Shiqi; Xie, Xiaoliang; Zhou, Xiao-Hu; Wang, Guan'an; Hou, Zeng-Guang; Li, Rui-Qi; Ni, ZhenLiang; Fan, Chen-Chen

[Towards Adjoint Sensing and Acting Schemes and Interleaving Task Planning for Robust Robot Plan](#) 13791
Yang, Shuo; Mao, Xinjun; Wang, Shuo; Xiao, Huaiyu; Xue, Yuanzhou

[Autonomous Multi-View Navigation Via Deep Reinforcement Learning](#) 13798
Huang, Xueqin; Chen, Wei; Zhang, Wei; Song, Ran; Cheng, Jiyu; Li, Yibin

[Towards Multi-Modal Perception-Based Navigation: A Deep Reinforcement Learning Method](#) 13805
Huang, Xueqin; Deng, Han; Zhang, Wei; Song, Ran; Li, Yibin

Session ThJT3 : Vision and Perception: Optimization I

[VOLDOR-SLAM: For the Times When Feature-Based or Direct Methods Are Not Good Enough](#) 13813
Min, Zhixiang; Dunn, Enrique

[ROBIN: A Graph-Theoretic Approach to Reject Outliers in Robust Estimation Using Invariants](#) 13820
Shi, Jingnan; Yang, Heng; Carlone, Luca

[CLIPPER: A Graph-Theoretic Framework for Robust Data Association](#) 13828
Lusk, Parker C.; Fathian, Kaveh; How, Jonathan Patrick

[Monitoring Fatigue-Induced Changes in Performance During Robot-Mediated Dynamic Movement](#) 13835
Madden, Kaci; Djurdjanovic, Dragan; Deshpande, Ashish

Session ThET1 : Vision and Perception: Optimization II

[Optimizing Keypoint-Based Single-Shot Camera-To-Robot Pose Estimation through Shape Segmentation](#) 13843
Lambrech, Jens; Grosenick, Philipp; Meusel, Marvin

[Handling Object Symmetries in CNN-Based Pose Estimation](#) 13850
Richter-Klug, Jesse; Frese, Udo

Efficient and Robust Orientation Estimation of Strawberries for Fruit Picking Applications 13857
Wagner, Nikolaus; Kirk, Raymond; Hanheide, Marc; Cielniak, Grzegorz

Probabilistic Terrain Estimation for Autonomous Off-Road Driving 13864
Forkel, Bianca; Kallwies, Jan; Wuensche, Hans Joachim Joe

Session ThKT3 : Vision and Perception: Point Cloud

Evaluating Initialization Methods for Discriminative and Fast-Converging HGMM Point Clouds 13871
Lin, Haohan; Chen, Xuzhan; Tucsok, Matthew; Ji, Li; Najjaran, Homayoun

Navigable Space Construction from Sparse Noisy Point Clouds 13877
Chen, Zheng; Liu, Lantao

Point Set Voting for Partial Point Cloud Analysis 13885
Zhang, Junming; Chen, Weijia; Wang, Yuping; Vasudevan, Ram; Johnson-Roberson, Matthew

LRGNet: Learnable Region Growing for Class-Agnostic Point Cloud Segmentation 13893
Chen, Jingdao; Kira, Zsolt; Cho, Yong Kwon

Session ThFT1 : Vision and Perception: Pose Estimation

AcinoSet: A 3D Pose Estimation Dataset and Baseline Models for Cheetahs in the Wild 13901
Joska, Daniel; Clark, Liam; Muramatsu, Naoya; Jericevich, Ricky; Nicolls, Fred; Mathis, Alexander; Mathis, Mackenzie; Patel, Amir

PyraPose: Feature Pyramids for Fast and Accurate Object Pose Estimation under Domain Shift 13909
Thalhammer, Stefan; Leitner, Markus; Patten, Timothy; Vincze, Markus

Investigations on Output Parameterizations of Neural Networks for Single Shot 6D Object Pose Estimation 13916
Kleeberger, Kilian; Völk, Markus; Bormann, Richard; Huber, Marco F.

L6DNet: Light 6 DoF Network for Robust and Precise Object Pose Estimation with Small Datasets 13923
Gonzalez, Mathieu; Kacete, Amine; Murienne, Albert; Marchand, Eric

Session ThHT4 : Vision and Perception: Prediction

Double-Prong ConvLSTM for Spatiotemporal Occupancy Prediction in Dynamic Environments 13931
Toyungyernsub, Maneekwan; Itkina, Masha; Senanayake, Ransalu; Kochenderfer, Mykel

Social-STAGE: Spatio-Temporal Multi-Modal Future Trajectory Forecast 13938
Malla, Srikanth; Choi, Chiho; Dariush, Behzad

[LaserFlow: Efficient and Probabilistic Object Detection and Motion Forecasting](#) 13945
Meyer, Gregory P.; Charland, Jake; Pandey, Shreyash; Laddha, Ankit; Gautam, Shivam; Vallespi-Gonzalez, Carlos; Wellington, Carl

[Efficient Map Prediction Via Low-Rank Matrix Completion](#) 13953
Chen, Zheng; Bai, Shi; Liu, Lantao

Session ThDT2 : Vision and Perception: Rendering

[Towards In-Field Phenotyping Exploiting Differentiable Rendering with Self-Consistency Loss](#) 13960
Magistri, Federico; Chebrolu, Nived; Behley, Jens; Stachniss, Cyril

[Multi-View Object Pose Refinement with Differentiable Renderer](#) 13967
Shugurov, Ivan; Pavlov, Ivan; Zakharov, Sergey; Ilic, Slobodan

[Efficient Haptic Rendering of Regolith](#) 13975
Pereira, Aaron; Schmidt, Annika

[Parameterizable and Jerk-Limited Trajectories with Blending for Robot Motion Planning and Spherical Cartesian Waypoints](#) 13982
Lin, Jianjie; Rickert, Markus; Knoll, Alois

Session ThBT2 : Vision and Perception: Segmentation I

[PointMoSeg: Sparse Tensor-Based End-To-End Moving-Obstacle Segmentation in 3-D Lidar Point Clouds for Autonomous Driving](#) 13989
Sun, Yuxiang; Zuo, Weixun; Huang, Huaiyang; Cai, Peide; Liu, Ming

[Referring Image Segmentation Via Language-Driven Attention](#) 13997
Chen, Ding-Jie; Hsieh, He-Yen; Liu, Tyng-Luh

[GPU-Efficient Dense Convolutional Network for Real-Time Semantic Segmentation](#) 14004
Yang, Xinneng; Wu, Yan; Zhao, Junqiao; Liu, Feilin

[Feature Enhanced Projection Network for Zero-Shot Semantic Segmentation](#) 14011
Lu, Hongchao; Fang, Longwei; Lin, Matthieu; Deng, Zhidong

Session ThAT4 : Vision and Perception: Segmentation II

[A Large-Scale Dataset for Benchmarking Elevator Button Segmentation and Character Recognition](#) 14018
Liu, Jianbang; Fang, Yuqi; Zhu, Delong; Ma, Nachuan; Pan, Jin; Meng, Max Q.-H.

[Neighborhood Spatial Aggregation Based Efficient Uncertainty Estimation for Point Cloud Semantic Segmentation](#) 14025
Qi, Chao; Yin, Jianqin; Liu, Huaping; Liu, Jun

[A Two-Stage Unsupervised Approach for Low Light Image Enhancement](#) 14032
Hu, Junjie; Guo, Xiyue; Chen, Junfeng; Liang, Guanqi; Deng, Fuqin; Lam, Tin Lun

S3Net: 3D LiDAR Sparse Semantic Segmentation Network 14040
Cheng, Ran; Razani, Ryan; Ren, Yuan; Liu, Bingbing

Session ThIT4 : Vision and Perception: Self-Supervised Learning

Self-Supervised Learning of Lidar Segmentation for Autonomous Indoor Navigation 14047
Thomas, Hugues; Agro, Ben; Gridseth, Mona; Zhang, Jian; Barfoot, Timothy

A Self-Supervised Near-To-Far Approach for Terrain-Adaptive Off-Road Autonomous Driving 14054
Mayuku, Orighomisan; Surgenor, Brian; Marshall, Joshua A.

A Self-Supervised Learning System for Object Detection in Videos Using Random Walks on Graphs 14061
Tan, Juntao; Song, Changkyu; Boularias, Abdeslam

Adversarial Differentiable Data Augmentation for Autonomous Systems 14069
Shu, Manli; Shen, Yu; Lin, Ming C.; Goldstein, Tom

Session ThBT4 : Vision and Perception: Sensing

A Tactile Sensing Foot for Single Robot Leg Stabilization 14076
Zhang, Guanlan; Du, Yipai; Zhang, Yazhan; Wang, Michael Yu

High-Resolution 3-Dimensional Contact Deformation Tracking for FingerVision Sensor with Dense Random Color Pattern 14083
Du, Yipai; Zhang, Guanlan; Zhang, Yazhan; Wang, Michael Yu

Looking Farther in Parametric Scene Parsing with Ground and Aerial Imagery 14091
Modhugu, Raghava; Sethuram, Harish Rithish; Chandraker, Manmohan; Jawahar, C.V.

Fast Motion Understanding with Spatiotemporal Neural Networks and Dynamic Vision Sensors 14098
Bisulco, Anthony; Cladera Ojeda, Fernando; Isler, Volkan; Lee, Daniel

Session ThJT4 : Vision and Perception: Sensor Fusion

Fingertip Pulse-Echo Ultrasound and Optoacoustic Dual-Modal and Dual Sensing Mechanisms Near-Distance Sensor for Ranging and Material Sensing in Robotic Grasping 14105
Fang, Cheng; Wang, Di; Song, Dezhen; Zou, Jun

Development of a Perception System for an Autonomous Surface Vehicle Using Monocular Camera, LIDAR, and Marine RADAR 14112
Clunie, Thomas; DeFilippo, Michael; Sacarny, Michael; Robinette, Paul

Detecting and Mapping Trees in Unstructured Environments with a Stereo Camera and Pseudo-Lidar 14120
Wang, Brian; Diaz-Ruiz, Carlos; Banfi, Jacopo; Campbell, Mark

Linear Inverse Problem for Depth Completion with RGB Image and Sparse LIDAR Fusion 14127
Fu, Chen; Mertz, Christoph; Dolan, John M.

Session ThKT4 : Vision and Perception: Statistical Method

Out-Of-Distribution Robustness with Deep Recursive Filters 14134
Katyal, Kapil; Wang, I-Jeng; Hager, Gregory

ZePhyR: Zero-Shot Pose Hypothesis Rating 14141
Okorn, Brian; Gu, Qiao; Hebert, Martial; Held, David

CARPAL: Confidence-Aware Intent Recognition for Parallel Autonomy 14149
Huang, Xin; McGill, Stephen; DeCastro, Jonathan; Fletcher, Luke; Leonard, John; Williams, Brian; Rosman, Guy

A Successive-Elimination Approach to Adaptive Robotic Source Seeking 14157
Rolf, Esther; Fridovich-Keil, David; Simchowicz, Max; Recht, Benjamin; Tomlin, Claire

Session ThET2 : Vision and Perception: Tracking I

Tracking 6-DoF Object Motion from Events and Frames 14171
Li, Haolong; Stueckler, Joerg

Visual Tracking of Deforming Objects Using Physics-Based Models 14178
Sengupta, Agniva; Krupa, Alexandre; Marchand, Eric

Deep 6-DoF Tracking of Unknown Objects for Reactive Grasping 14185
Tuscher, Marc; Hörz, Julian; Driess, Danny; Toussaint, Marc

TSDF++: A Multi-Object Formulation for Dynamic Object Tracking and Reconstruction 14192
Grinvald, Margarita; Tombari, Federico; Siegwart, Roland; Nieto, Juan

Session WeCT12 : Vision and Perception: Tracking II

Tracking Partially-Occluded Deformable Objects While Enforcing Geometric Constraints 14199
Wang, Yixuan; McConachie, Dale Steven; Berenson, Dmitry

Online Recommendation-Based Convolutional Features for Scale-Aware Visual Tracking 14206
Duan, Ran; Fu, Changhong; Alexis, Kostas; Kayacan, Erdal

Exploiting Probabilistic Siamese Visual Tracking with a Conditional Variational Autoencoder 14213
Huang, Wenhui; Gu, Jason; Duan, Peiyong; Hou, Sujuan; Zheng, Yuanjie

Toward Intraoperative Endomicroscopy with a GPU-Accelerated Deformable Video Mosaicking Algorithm 14220
Gong, Lun; Zuo, Siyang

Session ThAT3 : Vision and Perception: Trajectory Prediction and Tracking

Probabilistic 3D Multi-Modal, Multi-Object Tracking for Autonomous Driving <i>Chiu, Hsu-kuang; Li, Jie; Ambrus, Rares; Bohg, Jeannette</i>	14227
AVGCN: Trajectory Prediction Using Graph Convolutional Networks Guided by Human Attention <i>Liu, Congcong; Chen, Yuying; Liu, Ming; Shi, Bertram Emil</i>	14234
Attentional-GCNN: Adaptive Pedestrian Trajectory Prediction towards Generic Autonomous Vehicle Use Cases <i>Li, Kunming; Eiffert, Stuart; Shan, Mao; Gomez-Donoso, Francisco; Worrall, Stewart; Nebot, Eduardo</i>	14241
Spatial Graph Regularized Multi-Kernel Subtask Cross-Correlation Tracker <i>Fan, Baojie</i>	14248

Session ThHT5 : Vision-Based Control

Constrained Image-Based Visual Servoing Using Barrier Functions <i>Salehi, Iman; Rotithor, Ghananeel; Saltus, Ryan; Dani, Ashwin</i>	14254
Deep Learning-Based Photoacoustic Visual Servoing: Using Outputs from Raw Sensor Data As Inputs to a Robot Controller <i>Gubbi, Mardava; Bell, Muyinatu A. Lediju</i>	14261
Uncertainty Constrained Differential Dynamic Programming in Belief Space for Vision Based Robots <i>Rahman, Shatil; Waslander, Steven Lake</i>	14268
Analyzing Neural Jacobian Methods in Applications of Visual Servoing and Kinematic Control <i>Przystupa, Michael; Dehghan, Masood; Jagersand, Martin; Mahmood, Rupam</i>	14276

Session ThIT5 : Vision-Based Manipulation

Reward Machines for Vision-Based Robotic Manipulation <i>Camacho, Alberto; Varley, Jacob; Zeng, Andy; Jain, Deepali; Iscen, Atil; Kalashnikov, Dmitry</i>	14284
What Can I Do Here? Learning New Skills by Imagining Visual Affordances <i>Khazatsky, Alexander; Nair, Ashvin; Jing, Daniel; Levine, Sergey</i>	14291
Learning Geometric Reasoning and Control for Long-Horizon Tasks from Visual Input <i>Driess, Danny; Ha, Jung-Su; Tedrake, Russ; Toussaint, Marc</i>	14298
Simulation of Vision-Based Tactile Sensors Using Physics Based Rendering <i>Agarwal, Arpit; Man, Tim; Yuan, Wenzhen</i>	14306

Session ThFT2 : Visual and Haptic Perception

Multi-Sensory Guidance and Feedback for Simulation-Based Training in Robot Assisted Surgery: A Preliminary Comparison of Visual, Haptic, and Visuo-Haptic <i>Caccianiga, Guido; Mariani, Andrea; Galli de Paratesi, Chiara; Menciassi, Arianna; De Momi, Elena</i>	14313
Haptic Teleoperation of Flexible Needles Combining 3D Ultrasound Guidance and Needle Tip Force Feedback <i>Aggravi, Marco; Estima, Daniel A. L.; Krupa, Alexandre; Misra, Sarthak; Pacchierotti, Claudio</i>	14322
A General Visual-Impedance Framework for Effectively Combining Vision and Force Sensing in Feature Space <i>Oliva, Alexander Antonio; Robuffo Giordano, Paolo; Chaumette, Francois</i>	14330
Probabilistic Surface Friction Estimation Based on Visual and Haptic Measurements <i>Nguyen Le, Tran; Verdoja, Francesco; Abu-Dakka, Fares; Kyrki, Ville</i>	14338
Session ThDT3 : Visual Learning	
Learning Camera Performance Models for Active Multi-Camera Visual Teach and Repeat <i>Mattamala, Matías; Ramezani, Milad; Camurri, Marco; Fallon, Maurice</i>	14346
MS-RANAS: Multi-Scale Resource-Aware Neural Architecture Search <i>Cioflan, Cristian; Timofte, Radu</i>	14353
Vision-Based Mobile Robotics Obstacle Avoidance with Deep Reinforcement Learning <i>Wenzel, Patrick; Schön, Torsten; Leal-Taixe, Laura; Cremers, Daniel</i>	14360
A Probabilistic Next Best View Planner for Depth Cameras Based on Deep Learning <i>Monica, Riccardo; Aleotti, Jacopo</i>	14367
Session WeCT16 : Visual Odometry	
ENCODE: A dEep poiNt Cloud ODometry NETwork <i>Zhang, Yihuan; Wang, Liang; Fu, Chen; Dai, Yifan; Dolan, John M.</i>	14375
CodeVIO: Visual-Inertial Odometry with Learned Optimizable Dense Depth <i>Zuo, Xingxing; Merrill, Nathaniel; Li, Wei; Liu, Yong; Pollefeys, Marc; Huang, Guoquan (Paul)</i>	14382
Lifelong Localization in Semi-Dynamic Environment <i>Zhu, Shifan; Zhang, Xinyu; Guo, Shichun; Li, Jun; Liu, Huaping</i>	14389
Deep Online Correction for Monocular Visual Odometry <i>Zhang, Jiaxin; Sui, Wei; Wang, Xinggang; Meng, Wenming; Zhu, Hongmei; Zhang, Qian</i>	14396
Direct Sparse Stereo Visual-Inertial Global Odometry <i>Wang, Ziqiang; Li, Mei; Dingkun, Zhou; Zheng, Ziqiang</i>	14403

Session ThBT3 : Visual Odometry for Localization

- Learning Optical Flow with R-CNN for Visual Odometry 14410
Huang, Yingping; Zhao, Baigan; Gao, Chong; Hu, Xing
- A Normal Distribution Transform-Based Radar Odometry Designed for Scanning and Automotive Radars 14417
Kung, Pou-Chun; Wang, Chieh-Chih; Lin, Wen-Chieh
- Are We Ready for Unmanned Surface Vehicles in Inland Waterways? The USVInland Multisensor Dataset and Benchmark 14424
Cheng, Yuwei; Jiang, Mengxin; Zhu, Jiannan; Liu, Yimin
- An Equivariant Filter for Visual Inertial Odometry 14432
van Goor, Pieter; Mahony, Robert

Session ThET3 : Visual Servoing

- Subsequent Keyframe Generation for Visual Servoing 14439
Crombez, Nathan; Buisson, Jocelyn; Yan, Zhi; Ruichek, Yassine
- Defocus-based Direct Visual Servoing 14446
Caron, Guillaume
- Siame-Se(3): Regression in Se(3) for End-To-End Visual Servoing 14454
Felton, Samuel; Fromont, Elisa; Marchand, Eric
- Human-Piloted Drone Racing: Visual Processing and Control 14461
Pfeiffer, Christian; Scaramuzza, Davide

Session ThAT5 : Visual-Inertial Localization

- VID-Fusion: Robust Visual-Inertial-Dynamics Odometry for Accurate External Force Estimation 14469
Ding, Ziming; Yang, Tiankai; Zhang, Kunyi; Xu, Chao; Gao, Fei
- Run Your Visual-Inertial Odometry on NVIDIA Jetson: Benchmark Tests on a Micro Aerial Vehicle 14476
Jeon, Jinwoo; Jung, Sungwook; Lee, EungChang; Choi, Duckyu; Myung, Hyun
- LIRO: Tightly Coupled Lidar-Inertia-Ranging Odometry 14484
Nguyen, Thien-Minh; Cao, Muqing; Yuan, Shenghai; Lyu, Yang; Nguyen, Thien Hoang; Xie, Lihua
- Control of a Flexible Continuum Manipulator for Laser Beam Steering 14491
Mo, Hangjie; Wei, Ruofeng; Ouyang, Bo; Xing, Liuxi; Liu, Yunhui; Sun, Dong

Session ThJT5 : Wearable Robots

Macro-Mini Actuation of Pneumatic Pouches for Soft Wearable Haptic Displays <i>Do, Brian; Okamura, Allison M.; Yamane, Katsu; Blumenschein, Laura</i>	14499
Sensing and Control of a Multi-Joint Soft Wearable Robot for Upper-Limb Assistance and Rehabilitation <i>Proietti, Tommaso; O'Neill, Ciarán Tomás; Hohimer, Cameron; Nuckols, Kristin; Clarke, Megan; Zhou, Yu Meng; Lin, David; Walsh, Conor James</i>	14506
Kinematics-Based Control of an Inflatable Soft Wearable Robot for Assisting the Shoulder of Industrial Workers <i>Zhou, Yu Meng; Hohimer, Cameron; Proietti, Tommaso; O'Neill, Ciarán Tomás; Walsh, Conor James</i>	14515
Artificial Neural Networks to Solve Forward Kinematics of a Wearable Parallel Robot with Semi-Rigid Links <i>Prado, Antonio; Zhang, Haohan; Agrawal, Sunil</i>	14524