Poster Abstracts (afternoon session)

Poster WePM1: Crispy Disk Grabbing by an Elephant-Trunk Inspired Robot*	
Wu, Jianing Hu, David L.	Georgia Institute of Technology Georgia Institute of Technology
Abstracts: An elephant's boneless trunk is its most versatile appendage, enabling it to grab objects as heavy as a log or as a small as a peanut. However, the strategy of how the elephant can grab more fragile items such as a tortilla chip has not been revealed yet. Here we show that the elephant can grip a tortilla chip aided by air flow which is a unique feeding behavior of mammals. The elephant accurately locate, gently suck up, slightly drop the tortilla several times, and adjust the position to grab it without any damage to the food. In this experimental and theoretical investigation, we show that an elephant's great dexterity is in part to their use of suction to bring objects closer to their trunk. Elephants suck with pressures of 10 kPa, generating air speeds of over 75 miles per hour. They use suction forces to reduce the accuracy with which they must pinpoint objects. Theoretical predication indicates that the critical height is 4.8 cm considering the unevenness of the inner walls of air passages, which matches well with the experimental results. Inspired by the suction-aided gripping mechanism, we updated a general rigid gripper with a suction pipe, which can perform suction-aided grabbing. The use of aerodynamic forces can improve the success rate of grabbing by 76% compared with the original design. This work opens up a new way to fabricate robotic arms that has the capability of grabbing small fragile objects.	
Poster WePM2: Surface EMG-Based Evaluation of a PAM-Enabled Wrist Assist Glove	
Das, Swagata Kurita, Yuichi	Hiroshima University, Higashi-Hiroshima city, Hiroshima Prefectu Hiroshima University
Abstracts: This paper demonstrates the evaluation of a proposed wrist assist glove using statistical analyses of surface EMG obtained from multiple subjects.	
Poster WePM3: Fabric-Based Flat Pneumatic Actuators for Soft Assistive Glove Application	
Yap, Hong Kai Yeow, Chen-Hua	National University of Singapore National University of Singapore
Abstracts: We present the design of a fabric-based flat pneumatic actuators for soft assistive glove application. The soft assistive glove is designed to assist hand impaired patients in performing activities of daily living and rehabilitation. The actuators consist of flexible materials such as fabric and latex bladder. The actuators achieve bi-directional flexion and extension motions. Preliminary evaluation results show that the glove can provide both active finger flexion and extension assistance for activities of daily living and rehabilitative training.	
Poster WePM4: Automatic Detection Method of Surgical Instrument and Vessel in Laparoscopic Surgery Images	

Jo, Kyungmin Choi, Bareum Choi, Jaesoon	Asan Medical Center Asan Medical Center Asan Medical Center

Abstracts:
In this paper, we propose a new technique to automatically detect surgical instruments and blood vessels in robot-assisted laparoscopic surgery images. The proposed method uses the concept of hessian matrix in the HSV color space to detect the edge, and the Otsu's method is used in the LAB color space to separate the surgical tool from the blood vessel. Real laparoscopic images were used and the processing speed was about 0.76 s at 1280p.

Poster WePM5:
LATRO: An Electro-Hydraulically Actuated Robotic Spider for Remote Characterisation and Retrievals

Arvin, Farshad Telford, Mark Watson, Simon Cheah, Wei Green, Peter Carrasco, Joaquin Lennox, Barry	University of Manchester Forth University of Manchester The University of Manchester The University of Manchester The University of Manchester The University of Manchester

Abstracts:
In this work, we introduce an electro-hydraulically actuated robot spider, Latro, which has been developed for remote characterisation in extreme environments. LATRO is a large, semi-autonomous mobile robot with cutting and grasping capabilities which will operate in either aboveground or underwater storage areas.

Poster WePM6:
Perpetual Robotic Swarm

Arvin, Farshad Watson, Simon Turgut, Ali Emre Espinosa Mendoza, Jose Luis Krajnik, Tomas Lennox, Barry	University of Manchester University of Manchester University University of Manchester Faculty of Electrical Engineering, Czech TechnicalUniversity The University of Manchester

Abstracts:
Swarm robotics is the study of the collective behavior of simple mobile robots resulting from long-term interactions among the members. Keeping a group of mobile robots fully functional requires a sufficient battery capacity, which is an issue for small size robots in scenarios over long durations. Various charging strategies, such as manual battery swapping or automated docking chargers have been implemented, which cause an interruption to the main task of a swarm. In this work, a low-cost on-the-fly charging system is proposed for use in swarm and multi robotic

research studies. The system includes a charging pad with several individual charging cells and an inductive charging receiver attached to a mobile robot. To test the proposed system, a prototype charging pad with 12 charging cells that cover the entire arena was developed, along with a small mobile robot, Mona. A series of long-term, real-world robot experiments with different arenas and behavioral configurations has demonstrated the system's ability to support perpetual operation of a multi-robotic system.

Poster WePM7:
Autonomous Interactive Robot Learning

Aly, Ahmed	University of Virginia
Dugan, Joanne	University of Virginia

Abstracts:
Deep Learning techniques have been around for several years. There are many domains to which they have been applied such as Computer Vision. We present an exciting approach to combine Neural Networks and Robots. The aim is to gradually improve a robot's interaction with its environment as well as the neural net. Our approach is tested on a robot classifying everyday objects. Early results show that, under the guidance of a human coach, the robot can learn from its mistakes and improve future predictions.

Poster WePM8:
Model-Based Pose Tracking for 3D Shape Representation

Khin Kyu Kyu Win, Khin Kyu Kyu Win	Yangon Technological University

Abstracts:
With recent development in camera and sensor technology for 3D model, attentions on 3D shape representation and recognition are grater for research purpose. Efficient shape representation can be benefit in applications such as 3D search engine, robotics, CAD/CAM industry, etc. In this work, a method for finding the 3D shape from the pose of a tracked object is proposed. Assumption is that tracking and matching four non-coplanar feature points in the image can know the relative geometry on the object. The method combines three algorithms; the first algorithm, KLT track moving object in camera view; the second algorithm, POSIT use to estimate pose (in terms of rotation matrix and translation vector) of tracked object; the third algorithm, ICP use to register the shape of tracked object modeled by pose from POSIT and re-projected feature points in 3D space. Experimental test and results are illustrated and verified the results using ground truth data.

Poster WePM9:
Localization Method by TOF Laser Sensor for Mobile Robot

Usagawa, Daichi	Hiroshima city university
Kito, Takumi	Hiroshima city university
Sato, Kenjiro	Hiroshima City University
Iwaki, Satoshi	Hiroshima City University

Abstracts:
We propose a beacon method for a mobile robot navigated by a TOF laser sensor on a pan-tilt actuator in a base station, and apply the method to a motion teaching interface for a care-giver robot. The position and orientation of the mobile robot can be estimated by measuring the pan-tilt angle, length of the laser beam as well as the laser spot position on a translucence screen equipped on the mobile robot using a camera. We built an experimental system composed of a differential wheeled robot with a Web camera, and evaluated the estimation errors.

Poster WePM10:
Soft Smoothly Rolling Wheel: Principle Verification

Tian, Yang	Ritsumeikan University
Ma, Shugen	Ritsumeikan University

Abstracts:
Soft mobile robots have several advantages except difficult to realize accurate control and low-speed motion. We propose a driving method using pneumatic actuators for soft wheel robot to archive high-speed motion without control. Furthermore, only one air bladder is utilized makes the structure of robot simple. Experiment results show that the control-less robot can achieve high speed (0.75m/s) with payload (592g).

Poster WePM11:
Dexclar: Dexterous, Reconfigurable, Modular Gripper for In-Hand Manipulation

Rahman, Nahian	Istituto Italiano Di Tecnologia
Canali, Carlo	Department of Advanced Robotics, Istituto Italiano di Tecnologia
Caldwell, Darwin G.	Istituto Italiano di Tecnologia
Cannella, Ferdinando	Istituto Italiano di Tecnologia

Abstracts:
In the last few decades, robotic grippers are developed by research community to solve grasping complexities of several objects as their primary objective. However, due to the increasing demands of industries, many issues are rising and remain unsolved such as in-hand manipulation, placing object with appropriate posture. Operations like twisting, altering orientation of object, in a hand, requires significant dexterity of the gripper that must be achieved from a compact mechanical design at the first place. This paper demonstrates kinematic analysis, validation and control method of a novel, modular, reconfigurable gripper, named Dexclar (DEXterous reConfigurable moduLAR); which is capable to change posture or orientation of plurality of object within in-hand, without an additional manipulator or external support. The gripper consists of four identical modular fingers, dexterous among all axes. Each modular finger of the gripper is conceived to the aim of satisfying efficient grasping, manipulation and also object release with accordance of desired posture. In this paper, the in-hand manipulation capabilities such as rotating, twisting, re-grasp are explained and synthesis analysis is described. A physical prototype and a control method have been developed to verify the central concept, several experiments have conducted and expected postures were achieved.

Poster WePM12:

Isolated Sensor Cluster Network Construction with UAVs

Kim, Myunggun Son, Hungsun	UNIST Ulsan National Institute of Science and Technology

Abstracts:
This paper presents an investigation of relayed network construction to collect data from isolated sensor cluster by using UAVs as communication relay. Static sensor cluster transmits data to distanced operating station with high data rate, and it could be easily isolated in disaster condition. Thus, the wireless network system constructed with UAVs is suggested in this research.

Poster WePM13:
Reducing the Number of Iterations in Pose Graph SLAM Optimisation

Harsányi, Károly Kiss, Attila Majdik, Andras Sziranyi, Tamas	Hungarian Academy of Sciences Institute for Computer Science and Institute for Computer Science and Control of the Hungarian Acad Hungarian Academy of Sciences MTA SZTAKI

Abstracts:
In this paper we propose a novel algorithm to compute the initial structure of pose graph based Simultaneous Localization and Mapping (SLAM) systems. We perform a Breadth-First Search (BFS) on the graph in order to obtain multiple votes regarding the location of a certain robot position from all of its processed neighbors. Next, we define the initial location of a pose as the average of the multiple alternatives. By adopting the proposed initialization approach the number of iteration needed for optimization is significantly reduced while the computational complexity remains lightweight. Initial results using generally accepted benchmark datasets show the advantages of the proposed method.

Poster WePM14:
Hybrid Model for Passive Locomotion Control of a Bipedal Robot

Mondal, Soumyarka Nandi, Gora Chand	Morgan Stanley IIIT, Allahabad

Abstracts:
The present research describes the development of a hybrid biped model using an analytical three link leg model as base model which produces approximate real-world trajectories and passive gait data have also been collected from the human subjects while walking down a slope. The pattern between the deviation of the actual trajectories and the base model generated trajectories have been found using a back propagation based artificial neural network architecture. It has been observed that this base model with learning based compensation enables the biped to better adapt in a real walking environment, showing better limit cycle behaviours.

Poster WePM15:
An Open-Source C++ Library for Robotics and Optimal Control

Neunert, Michael Giftthaler, Markus Pardo, Diego Buchli, Jonas	ETH Zurich Swiss Federal Institute of Technology (ETH) Zurich, Switzerland ETH Zürich ETH Zurich

Abstracts:

We introduce the "Robotics and Optimal Control Toolbox", an open-source C++ library developed for optimal control and trajectory optimization. The toolbox is designed for high efficiency and online control. This abstract outlines its general concept, its major building blocks and highlights selected application examples. A open-source pre-release including reference examples is provided.

Poster WePM16:

Semantic Labeling of Indoor Environments from 3D RGB Maps

Durner, Maximilian Brucker, Manuel Ambrus, Rares Marton, Zoltan-Csaba Wendt, Axel Joerg Jensfelt, Patric Arras, Kai Oliver Triebel, Rudolph	German Aerospace Center DLR German Aerospace Center Royal Institute of Technology (KTH) Stockholm Sweden German Aerospace Center (DLR) Robert Bosch LLC, Research and Technology Center KTH - Royal Institute of Technology University of Freiburg Technical University Munich

Abstracts:

We present an approach to automatically assign semantic labels to rooms reconstructed from 3D RGB maps of apartments. Evidence for the room types is generated using state of the art deep learning techniques for scene classification and object detection based on automatically generated virtual RGB views, as well as from a geometric analysis of the 3D structure of the map. The evidence is merged in a Conditional Random Field, using statistics mined from different datasets of indoor environments. We evaluate our approach qualitatively and quantitatively and compare to related methods. To address the lack of datasets containing complete 3D RGB maps of real-world apartments with ground truth labels, we will release the data we created and used for the experimental evaluation.

Poster WePM17:

Enhancing Situational Awareness for Teleoperation Tasks

Park, Sangsoo Park, Sungjun Lee, Hyunjin Son, Hyoung Il	Gwangju Institute of Science and Technology (GIST, Republic of K Gwangju Institute of Science and Technology (GIST) Chonnam national university Chonnam National University

Abstracts:

This paper introduced ongoing researches on situational awareness using psychophysical methodologies to improve the performance of teleoperation tasks.

Poster WePM18:
Design of an Underwater Drone for Bio-Logging

HAN, HyunTae	YAMAGATA University
Hiwatashi, Masaki	Yamagata University
Tsumaki, Yuichi	Yamagata University

Abstracts:
A research approach called bio-logging has been recently utilized in the investigation of animal behavior. Specifically, this method has been used to study the behavior of sperm whales. Zoologists have tried to observe the preying behavior of sperm whales by fixing a data logger (camera) to the whale's back. Such attempts have not been successful so far. To tackle this problem, we design an underwater drone that will be used to attach the camera to the mouth area of the sperm whale.

Poster WePM19:
Attentional RGB-D Object Detection for Mobile Robot Monitoring

Imamoglu, Nevrez	National Institute of Advanced Industrial Science and Technolgy
Shimoda, Wataru	University of Electro-Communications
Zhang, Chi	Jiangxi University of Finance and Economics
Kanezaki, Asako	National Institute of Advanced Industrial Science and Technology
Fang, Yuming	Jiangxi University of Finance and Economics
Nishida, Yoshifumi	National Institute of Advanced IndustrialScienceandTechnology

Abstracts:
Instead of processing the whole scene, previously,we demonstrated that space-based saliency (based on the changes detected) can improve CNN based semantic segmentation to focus only on novel region for robot monitoring system. Our initial evaluation for focused object detection is done on a data collected from mobile robot with an RGB-D sensor.Focusing on an area of attention can improve vision task rather than processing the whole scene. So, we can achieve improved detection and tracking for specific objects with focused CNN approach.Change based attentional cues can be successful if the environment is known. However, if the robot enters a new environment with no prior knowledge or if there is a sensory error in localization, change detection based saliency will not be reliable and change may not be the only needed attentional cues for observation. Therefore, to define focus area for CNN model, we are introducing multi-model saliency that integrates salient cues from bottom-up and top-down information from spatial and objectness based features. These bottom-up and top-down salient cues includes features obtained from color image, depth image, 3D data. And, we demonstrated that our multi-modal salient feature fusion can give very reliable attentional cues for object (e.g. human) detection and tracking in indoor environment for mobile robot monitoring. Our saliency maps resulted in better or close performance values compared to state-of-the-art models.

Poster WePM20:
Evaluation of Personal Characteristic on Stress in Autonomous Driving Passengers

Sawabe, Taishi	Nara Institute of Science and Technology
Okajima, Tomoya	Nara Institute of Science and Technology
Kanbara, Masayuki	Nara Institute of Science and Technology
Hagita, Norihiro	ATR

Abstracts:
Many of autonomous driving research focus on efficiency and safety. In order for the autonomous mobility to be accepted by passengers, they have to be perceived as safe and comfortable for passengers. Since perceived safety and comfort depend on each passengers' driving experience, habits, knowledge, personality, and preference. It is necessary to personalize the autonomous driving system to optimize its behavior for each passenger. But there are still few studies on personalization of autonomous driving, and there is not enough verification of what kind of difference caused by individual stress. In this study, we show the difference in individual passengers' stress objectively based on physiological measurements. By using these data to attempt classifying passengers by susceptibility to stress factors. We evaluate characteristics of passengers' stress actually obtained from experimental data using a robot wheelchair and physiological measurements.

Poster WePM21:
A Delay-conscious Communication Model for Mobile Robot Navigation

Kato, Yuka	Tokyo Woman's Christian University
Tanaka, Mamiko	Tokyo Woman's Christian University

Abstracts:
Recently, many studies have been made actively on robot services using computer networks, such as cloud robotics. These services are required to be conscious of uncertainty and instability of communication networks. Particularly for mobile robots, correspondence to delay in communication time and its variation is an important research topic. From these backgrounds, in this paper, we propose a delay-conscious communication model for remote navigation of mobile robots under cloud environment.

Poster WePM22:
Real-Time Perception Meets Reactive Motion Generation

Kappler, Daniel	Max-Planck Institute for Intelligent Systems
Meier, Franziska	Max Planck Institute for Intelligent Systems
Issac, Jan	Max Planck Institute for Intelligent Systems
Mainprice, Jim	Max Planck Institute
Garcia Cifuentes, Cristina	Max Planck Institute for Intelligent Systems
Wüthrich, Manuel	Max-Planck-Institute for Intelligent Systems
Berenz, Vincent	Max Planck Institute for Intelligent Systems
Schaal, Stefan	MPI Intelligent Systems & University of Southern California
Ratliff, Nathan	Lula Robotics Inc.

Bohg, Jeannette	Max-Planck Institute for Intelligent Systems

Abstracts:
We address the challenging problem of robotic grasping and manipulation in the presence of uncertainty. This uncertainty is due to noisy sensing, inaccurate models and hard- to-predict environment dynamics. Our approach emphasizes the importance of continuous, real-time perception and its tight integration with reactive motion generation methods. We present a fully integrated system where real-time object and robot tracking as well as ambient world modeling provides the necessary input to feedback controllers and continuous motion optimizers. Specifically, they provide attractive and repulsive potentials based on which the controllers and motion optimizer can online compute movement policies at different time intervals. We extensively evaluate the proposed system on a real robotic platform in four scenarios that exhibit either challenging workspace geometry or a dynamic environment. We compare the proposed integrated system with a more traditional sense-plan-act approach that is still widely used. In 333 experiments, we show the robustness and accuracy of the proposed system.

Poster WePM23:
BM-Arm: A Biologically Inspired Reconfigurable Cable Robot for the Study of Human Motion

Eden, Jonathan Paul	The University of Melbourne
SONG, Chen	The Chinese University of Hong Kong
Tan, Ying	The University of Melbourne
Oetomo, Denny	The University of Melbourne
Lau, Darwin	The Chinese University of Hong Kong

Abstracts:
Multi-link cable driven robots (MCDRs) have found increased application in the study of human motion due to the strong parallels between cable and muscle actuation. Existing MCDRs are typically limited in their capability to study a range of human-like motions, due to their use of fixed mechanism and cable structures and a lack of software compatibility. This poster presents the Bio-Muscular Arm (BM-Arm) as a reconfigurable bio-inspired MCDR that can be used in benchmarking different algorithms for the study of human motion. It is shown that the robot allows for reconfigurability through the use of 96 different possible base attachment locations as well as custom built arm sleeves which provide 28 different attachment locations on each link. Using the author's recently presented cable-robot analysis and simulation platform for research (CASPR), it is also shown that the BM-Arm can be simulated using a range of different algorithms for inverse dynamics, forward kinematics and control. Furthermore, online hardware implementation is also supported using a ROS-based extension of CASPR (CASPR-ROS) that can allow for hardware based benchmarking.

Poster WePM25:
Home Social Robots Sharing Indoor Activities with Friends: Field Study

Jeong, Kwangmin	Yonsei University
Kim, Aram	Yonsei University
Kim, Hyemi	Yonsei University
Lee, JeeHang	KAIST
Kim, Jinwoo	Yonsei University

Abstracts:

Population living alone has been rapidly increasing worldwide, resulting in the spread of social isolation and loneliness among these people. This study aimed to provide a solution to such predicament by home social robots designed to boost perceived social connectedness of users. We conducted the field study with 12 participants, building a smart home in their house with a few sensors and prototype robots to find whether these robots can mitigate social isolation and loneliness problems. The result exhibits participants experienced the increase of social interactions with friends while having little fatigue from communication or privacy concerns. It also shows robot interactions helped lower perceived distances to friends and silence in the house eventually lowering loneliness.

Poster WePM26:

Tacking Control of Sailboats Based on Force Polar Diagram

Sun, Qinbo	Central South University
Qiao, Zhuhan	Chinese University of Hong Kong(Shenzhen)
Strömbeck, Carl	Lund University, Faculty of Engineering
Qu, Yang	Wuhan University of Technology
QIAN, Huihuan	The Chinese University of Hong Kong, Shenzhen
Xu, Yangsheng	The Chinese University of Hong Kong

Abstracts:

Compared with past researches based on acquiring wind speed and direction by a wind sensor and controlling the system using a velocity polar diagram, an alternative way based on Force Polar Diagram (FPD) is proposed. The sail angle that produces the maximum forward force along the boat's heading is computed. The method is validated based on experiments in a wind controlled water pool. The maximum speed is increased by 56%, the time is shortened by 44%, and the motion agility is improved in an autonomous tacking motion.