SINGAPORE UNIVERSITY OF TECHNOLOGY AND DESIGN

18 September – 19 November 2021

TOPICAL REPORT

ROBOTICS & AUTOMATION

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news

AUTOMATION

Study: As a population gets older, automation accelerates

"You might think robots and other forms of workplace automation gain traction due to intrinsic advances in technology — that innovations naturally find their way into the economy. But a study co-authored by an MIT professor tells a different story: Robots are more widely adopted where populations become notably older, filling the gaps in an aging industrial work force."

Source: MIT

MSU Financial Credit Union plans automation expansion through chatbot

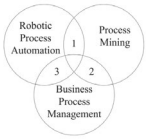
"The MSU Financial Credit Union (MSUFCU) launched an artificial intelligence (AI)-powered external chatbot this year, but already the $6.6 billion credit union is planning to expand its chatbot automations in 2022. MSUFCU continues to build its chatbots — Fran for customers and Gene for employees — but it will give them a boost with back-end."

Source: Bank Automation News

AUTONOMOUS VEHICLES

academic

AUTOMATION



Robotic process automation - a systematic mapping study and classification framework

"Robotic Process Automation (RPA) deals with the automation of rule-based process tasks to increase process efficiency and to reduce process costs. Due to the utmost importance of business process automation in industry, RPA attracts increasing attention in the scientific field as well. This paper presents the state-of-the-art in the RPA field by means of aSystematic Mapping Study (SMS). In this SMS, 63 publications are identified and analysed. From the SMS findings, aframework for systematically analysing, and comparing RPA works is derived. The discovered thematic clusters suggest further investigations to develop amore elaborated structural research approach for RPA."

Source: Taylor & Francis

Development of a novel tool for automation of the contamination

"Considering that about 100 000 m^2 of wall area per nuclear facility must be decontaminated (Hübner et al., 2017), the automation of mechanical decontamination work offers high potential to support people in performing their work and reduce errors in the decommissioning

reports

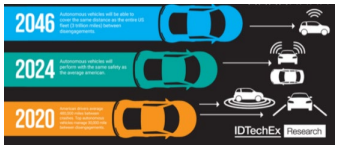
AUTOMATION

Global Industrial Automation Outlook, 2022

"This Frost & Sullivan research service analyzes the global industrial automation market from 2020 to 2025, with 2020 as the base year. The deliverable offers an in-depth look at the dynamics influencing and challenging the growth of the industrial automation market and analyzes the process automation technology segments across process, discrete, and hybrid industries. It offers a comprehensive market overview with top digital trends to watch, growth opportunity analysis, general industrial automation outlook with market forecasts, and insights on major companies including Siemens, Emerson, Yokogawa, ABB, Schneider Electric, and Rockwell. The research also highlights future growth opportunities and the strategic imperatives market participants need to consider to capitalize on growth opportunities."

Source: Frost & Sullivan

AUTONOMOUS VEHICLES



Autonomous Cars, Robotaxis & Sensors 2022-2042

What makes university students steer clear of self-driving cars?

"Driverless cars have been expected to revolutionise motoring, with some commentators predicting everyone would be a permanent backseat driver by now. But the uptake has been far slower than anticipated, despite substantial efforts from the likes of Elon Musk and other entrepreneurs in the tech and auto industries to encourage drivers to relinquish control of the wheel. While university campuses, airports, holidays parks and retirement villages are pegged as some of the potential early adopters, an Australian survey of university students published this month sheds light on why the take up of autonomous vehicles (AVs) is still relatively low. University of South Australia (UniSA) urban planner Dr Ali Soltani surveyed 152 students in 2019, prior to COVID-19, to gauge their views about self-driving cars and the likelihood of using them."

Source: University of South Australia

Drones, bots and self-driving cars: How this new Kanata North innovation centre will help drive the future of autonomous vehicles

"The term "autonomous vehicle," or "smart vehicle," refers to any vehicle equipped with decision-making systems and sensors that allow it to perceive its surroundings. Self-driving cars typically come to mind, but drones and bots are also part of this ecosystem.

"What excites me most is that we're essentially envisioning the future of this technology, which will soon be ubiquitous and indispensable to society," says Kantarci. "We're working with industry on different topics simultaneously and finding solutions to problems that the tech world is facing. It's never just a single problem or a single solution, so it requires a lot of imagination."

The centre offers rapid, low-cost experimentation for connected and autonomous vehicles, including self-driving car prototypes, drones and certain types of ground bots. Its research will focus primarily on problem-solving issues related to the connectivity, physical and cyber security, decision making and sustainability of vehicles and networks."

Source: University of Ottawa

process. Furthermore, the exposure potential for people in contaminated environments is reduced and they are protected from health hazards (Petereit et al., 2019).

In the ROBDEKON project, a competence center is being established in Germany to develop practical robotic systems for decontamination work in hazardous environments. To this end, four research institutions are working with industrial partners on the development of (partially) autonomous robotic systems for the decommissioning and decontamination of nuclear facilities, the handling of waste, and the remediation of landfills and contaminated sites (Petereit et al., 2019)."

Source: Copernicus Publications

Realization of AI-enhanced industrial automation systems using intelligent Digital Twins

"A requirement of future industrial automation systems is the application of intelligence in the context of their optimization, adaptation and reconfiguration. This paper begins with an introduction of the definition of (artificial) intelligence to derive a framework for artificial intelligence enhanced industrial automation systems: An artificial intelligence component is connected with the industrial automation system's control unit and other entities through a series of standardized interfaces for data and information exchange. This framework is then put into context of the intelligent Digital Twin architecture, highlight the latter as a possible implementation of such systems. Concluding, a prototypical implementation on the basis of a modular cyber-physical production system is described."

Source: Elsevier

New advances in the automation of context-aware information selection and guided model assembly

"The automated assembly and extension of dynamic network models using information extracted from literature are challenging due to the amount and inconsistency in published literature. Recently, efforts have been made to automatically and efficiently assemble the information extracted from literature into models. In this review, we summarize the basic concept, performance, advantages, and limitations of five automated extension methods. Each method was tested for its ability to reconstruct a model of T-cell differentiation as compared against a number of predefined system properties."

"In recent years, vast improvements to autonomous vehicle technologies such as radar, lidar, HD cameras and software have propelled robotaxis to the cusp of market-readiness. Autonomous trials from Waymo, Cruise, and others are now evolving into autonomous services, with legislative barriers clearing. New IDTechEx forecasts reveal how these services will come to dominate within 20 years, creating massive opportunities for the underlying sensors market, which grows at over 30% CAGR."

Source: IDTechEx

ROBOTICS INDUSTRY

Winners of the Robotics and Automation News Awards 2021-22

"The awful coronavirus pandemic has changed many people's lives forever. Many have lost loved ones and many more have suffered illness and inconvenience to their lives and livelihoods.

For businesses in many sectors, it has been extremely difficult to keep going through lockdowns which reduced their income to zero or thereabouts. And despite previously unimaginable levels of government support, they were forced to wind down, perhaps to fight another day sometime in the future.

Among the business sectors that grew during the past two years have been healthcare, e-commerce and logistics, for obvious reasons. This has had the effect of helping the wider public take a greater interest in automation, with many saying that there."

Source: Robotics and Automation News

Global Marketing Automation Market Research Report 2021: Voice-Based Marketing Automation (VBMA) Gains Momentum with Cutting Edge IVR Solutions

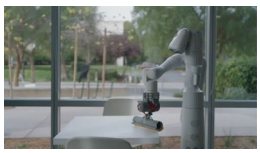
"Amid the COVID-19 crisis, the global market for Marketing Automation estimated at US$3.9 Billion in the year 2020, is projected to reach a revised size of US$6.3 Billion by 2026, growing at a CAGR of 8.6% over the analysis period. Cloud, one of the segments analyzed in the report, is projected to grow at a 9.6% CAGR to reach US$4.6 Billion by the end of the analysis period.

Growth in the global is set to be driven by rise of digital advertising, growing

Apple accelerates work on car project, aiming for fully autonomous vehicle

"Apple is pushing to accelerate development of its electric car and is refocusing the project around full self-driving capabilities, according to people familiar with the matter, aiming to solve a technical challenge that has bedevilled the auto industry.
For the past several years, Apple's car team had explored two simultaneous paths: creating a model with limited self-driving capabilities focused on steering and acceleration - similar to many current cars - or a version with full self-driving ability that does not require human intervention.
Under the effort's new leader - Apple Watch software executive Kevin Lynch - engineers are now concentrating on the second option. Mr Lynch is pushing for a car with a full self-driving system in the first version, said the people, who asked not to be identified because the deliberations are private."
Source: The Straits Times

AUTONOMOUS ROBOTS



Years Later, Alphabet's Everyday Robots Have Made Some Progress

"Last week, Google or Alphabet or X or whatever you want to call it announced that its Everyday Robots team has grown enough and made enough progress that it's time for it to become its own thing, now called, you guessed it, "Everyday Robots." There's a new website of questionable design along with a lot of fluffy descriptions of what Everyday Robots is all about. But fortunately, there are also some new videos and enough details about the engineering and the team's approach that it's worth spending a little bit of time wading through the clutter to see what Everyday Robots has been up to over the last couple of years and what their plans are for the near future."
Source: IEEE Spectrum

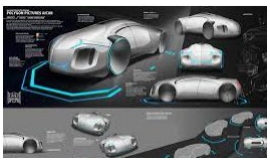
How robots can tell how clean is 'clean'

"Over the years, cleaning robots have evolved from disc-shaped vacuum cleaners found in homes to advanced models that can navigate complex spaces like airports and train stations. As COVID-19 highlights the need to keep public spaces clean, how can we be sure that the areas covered by cleaning robots are indeed clean?
Source: Cornell University

MechAnalyze: An Algorithm for Standardization and Automation of Compression Test Analysis

"The mechanical properties of hydrogels, as well as native and engineered tissues are key parameters frequently assessed in biomaterial science and tissue engineering research. However, a lack of standardized methods and user-independent data analysis has impacted the research community for many decades and contributes to poor reproducibility and comparability of datasets, representing a significant issue often neglected in publications. In this study, we provide a software package, *MechAnalyze*, facilitating the standardized and automated analysis of force-displacement data generated in unconfined compression tests. Using comparative studies of datasets analyzed manually and with *MechAnalyze*, we demonstrate that the software reliably determines the compressive moduli, failure stress and failure strain of hydrogels, as well as engineered and native tissues, while providing an intuitive user interface that requires minimal user input. *MechAnalyze* provides a fast and user-independent data analysis method and advances process standardization, reproducibility, and comparability of data for the mechanical characterization of biomaterials as well as native and engineered tissues."
Source: Mary Ann Liebert

AUTONOMOUS VEHICLES



A LiDAR Architecture Based on Indirect ToF For Autonomous Cars

"A LiDAR architecture for autonomous cars is presented and validated by numerical and experimental results. The proposed scheme is based on indirect time-of-flight principle based on continuous-wave pseudorandom codes and incoherent detection for range evaluation. The range ambiguity and resolution are controlled by the parameters of the pseudorandom code. Experimental results are reported for target detection ranging from 13 to 1,000 m, as well as a demonstration of a dual-target detection, demonstrating the efficiency of the proposed LiDAR usage of the Internet and other technologies, and surging popularity of social media networks. Companies are increasingly relying on the digital media marketing techniques such as search engine marketing, social media marketing, online advertising and mobile advertising while continuing to engage in traditional channels to gain benefits of both the worlds."
Source: Yahoo! Finance

World Robotics 2021 – Service Robots Report

"The market for professional service robots reached a turnover of 6.7 billion U.S. dollars worldwide (sample method) – up 12% in 2020. At the same time, turnover of new consumer service robots grew 16% to 4.4 billion U.S. dollars. This is according to World Robotics 2021 – Service Robots report, presented by the International Federation of Robotics (IFR). "Service robots continued on a successful path proving the tremendous market potential worldwide," says IFR President Milton Guerry. "Sales of professional service robots rose an impressive 41% to 131,800 units in 2020."
Source: International Federation of Robotics

Current Robotics Reports - Volume 2, issue 3, September 2021

"Current Robotics Reports aims to offer expert review articles on the most significant recent developments in the field of robotics. By providing clear, insightful, balanced contributions, the journal intends to serve all those who use robotic technologies in medicine, defense, service, and agriculture."
Source: Springer

GROWTH OPPORTUNITIES IN WINDOW CLEANING ROBOTS, WEEDING ROBOTS, COBOT WELDING SYSTEMS, ADDITIVE MANUFACTURING, AND DIGITAL MANUFACTURING

"The Advanced Manufacturing Technology Opportunity Engine for for November 2021 covers innovations pertaining to service robots, welding robots, weeding robots, additive manufacturing, and digital manufacturing. Some of the innovations include a high performance window cleaning robot, an autonomous weeding robot, a simulation software for additive manufacturing, cobot welding systems, and 3D printing. The Advanced Manufacturing TOE covers global innovations and developments related to manufacturing and industrial automation on a monthly basis.

One way people determine if a surface is clean is by touching and visual inspection. While this might work for a dining table or home floor, it is not always practical nor safe for large public spaces. Another issue with this method is standardisation, raising the fundamental question: how clean is 'clean'?
This ambiguity is what researchers from the Singapore University of Technology and Design (SUTD), supported by the National Robotics Programme, sought to address using autonomous robots that efficiently and systematically determine an area's cleanliness. Their work, which includes a novel framework that can be used by robots to assess cleanliness and a strategy for exploration, was published in Sensors."
Source: Singapore University of Technology and Design

SOCIAL ROBOTS

Social robots may be more persuasive if they project less authority

"When robots present themselves as human-like social agents, we tend to play along with that sense of humanity and treat them much like we would a person," says Shane Saunderson, lead author of a new paper published in *Science Robotics*. "But even simple tasks, like asking someone to take their medication, have a lot of social depth to them. If we want to put robots in those situations, we need to better understand the psychology of robot-human interactions." Saunderson says that even in the human world, there's no magic bullet when it comes to persuasion. But one key concept is authority, which can be further divided into two types: formal authority and real authority."
Source: EureAlert!

Social media bots may appear human, but their similar personalities give them away

"Social bots, or automated social media accounts that pose as genuine people, have infiltrated all manner of discussions, including conversations about consequential topics, such as the COVID-19 pandemic. These bots are not like robocalls or spam emails; recent studies have shown that social media users find them mostly indistinguishable from real humans. Now, a new study by University of architecture to operate in real scenarios of autonomous cars. A measured range error of less than 0.6 % has been achieved for both single and dual-target detection."
Source: Scientific Electronic Library Online

The influence of self-construal on the acceptability of moral decisions made by autonomous cars

"Self-construal refers to one' view of themselves as independent from (individualistic) or interdependent with others (collectivist). The quest to determine relevant moral principles in autonomous vehicles prompted the question whether one's self-construal can impact the moral appreciation of decisions of these vehicles. For instance, when presented with moral dilemmas involving autonomous cars, participants from collectivist cultures displayed weaker preference for sparing younger characters compared to those from individualistic cultures. The current study examined the effect of priming independent vs. interdependent self-construal on the acceptability of the car's decision in resolving Trolley-like dilemmas. Participants (N=100, Mage=30.88, SD=13.31) first completed the self-construal priming task and were presented with images of two possible collision scenarios followed by the autonomous car's decision."
Source: Technology, Mind and Behavior

Ethics of automated vehicles: breaking traffic rules for road safety

"In this paper, we explore and describe what is needed to allow connected and automated vehicles (CAVs) to break traffic rules in order to minimise road safety risk and to operate with appropriate transparency (according to recommendation 4 in Bonnefon et al., European Commission, 2020). Reviewing current traffic rules with particular reference to two driving situations (speeding and mounting the pavement), we illustrate why current traffic rules are not suitable for CAVs and why making new traffic rules specifically for CAVs would be inappropriate. In defining an alternative approach to achieving safe CAV driving behaviours, we describe the use of ethical goal functions as part of hybrid AI systems, suggesting that functions should be defined by governmental bodies with input from citizens and stakeholders. Ethical goal functions for CAVs would enable developers to optimise driving behaviours for safety under conditions of uncertainty whilst allowing for differentiation of products according to brand values."

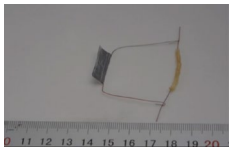
Innovations are focused toward improving product traceability, energy efficiency and reducing environmental footprints, integrating product design and manufacturing aspects for reducing time-to-market. Research focus areas include rapid prototyping (additive manufacturing), lightweighting (multimaterial joining, plastics and metals manufacturing, carbon fiber-based composite manufacturing), smart robotics (agile robots, consumer robots, swarm robotics, cobots), monitoring and control (wireless control networks, human machine interface), and simulation and modeling (design and simulation software)."
Source: Frost & Sullivan

Pennsylvania and Stony Brook University researchers, published in Findings of the Association for Computational Linguistics, gives a closer look at how these bots disguise themselves. Through state-of-the-art machine learning and natural language processing techniques, the researchers estimated how well bots mimic 17 human attributes, including age, gender, and a range of emotions."
Source: University of Pennsylvania

Giving robots social skills

"MIT researchers have now incorporated certain social interactions into a framework for robotics, enabling machines to understand what it means to help or hinder one another, and to learn to perform these social behaviors on their own. In a simulated environment, a robot watches its companion, guesses what task it wants to accomplish, and then helps or hinders this other robot based on its own goals.
The researchers also showed that their model creates realistic and predictable social interactions. When they showed videos of these simulated robots interacting with one another to humans, the human viewers mostly agreed with the model about what type of social behavior was occurring."
Source: MIT

SOFT ROBOTICS



Watch these tube-shaped robots roll up stairs, carry carts, and race one another

"Researchers have designed a 4D-printed soft robot that self-assembles when heated and can take on challenging tasks like rolling uphill and navigating a bumpy and unpredictable landscape. The prototype, which is tube-shaped, appears September 22nd in the journal *Matter*.
"Like an insect with antennae, the robot can surmount a small obstacle. But when the obstacle is too high, it will turn back," says senior author Wei Feng, a materials scientist at Tianjin University in China. "The whole process is spontaneous without human interference or control."
Source: EureAlert!

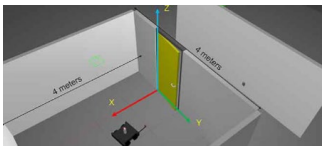
Stretchable pressure sensor could lead to better robotics, prosthetics

Source: Springer Link

Abyssal Benthic Rover, an autonomous vehicle for long-term monitoring of deep-ocean processes

"The deep-ocean carbon cycle is poorly quantified. An abyssal benthic rover was developed to make long time-series measurements of seafloor processes related to organic carbon remineralization and sequestration. Benthic Rover II (BR-II) is an autonomous dual-tracked vehicle that measures bottom water temperature and oxygen concentration, current velocity, and sediment community oxygen consumption (SCOC; respiration). BR-II is programmed to transit with low surface-contact pressure across the seafloor, photograph bottom conditions, and stop regularly to occupy respirometer incubation sites, with deployment periods up to 1 year. Now, continuously operational at a 4000-m station in the northeast Pacific over 5 years, substantial weekly, seasonal, annual, and episodic events have been recorded, which are critical to assessing the deep-ocean carbon cycle. There was a significant increase in phytodetritus cover ($P < 0.01$) arriving on the seafloor from the overlying water column between 2015 and 2020 that was negatively correlated with bottom water dissolved oxygen concentration ($P < 0.01$)."
Source: Science Robotics

AUTONOMOUS ROBOTS



Force-Vision Sensor Fusion Improves Learning-Based Approach for Self-Closing Door Pulling

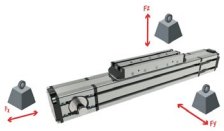
"Multiple sensors are often used in robotic applications for better situational awareness. Hence, sensor fusion becomes a key technology to manage multiple sources of information and plays a critical role to the success in robotic tasks such as object detection and tracking, autonomous navigation, and interaction with humans. With these capabilities, wheeled autonomous vehicles can be used to automate some public services… In our solution, the vehicle is equipped with a camera, a force sensor, and a concise door-opening mechanism. The method was simulated in Gazebo and the results demonstrated that the deep RL-based force-vision sensor fusion method can be successfully

"In the future, soft robotic hands with advanced sensors could help diagnose and care for patients or act as more lifelike prostheses. But one roadblock to encoding soft robotic hands with human-like sensing capabilities and dexterity has been the stretchability of pressure sensors. Although pressure sensors—needed for a robotic hand to grasp and pick up an object, or even take a pulse from a wrist—have been able to bend or stretch, their performance has been significantly affected by such movement.

Researchers at the Pritzker School of Molecular Engineering (PME) at the University of Chicago have found a way to address this issue and have designed a new pressure sensor that can be stretched up to 50 percent while maintaining almost the same sensing performance. It is also sensitive enough to sense the pressure of a small piece of paper, and it can respond to pressures almost instantaneously."

Source: TechXplore

ACTUATORS



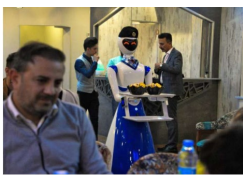
Specifying a Linear Actuator: 3 Key Factors

"Linear motion systems are business critical across an extensive range of industries, from food processing plants, to semiconductor manufacturers and packaging producers to name but a few. In fact, virtually anywhere that requires loads to be cost-effectively moved in a straight line, safely, securely and precisely.

These systems have improved automation whilst simultaneously lowering production costs, making them invaluable. Linear actuators are at the heart of a linear motion system, combining linear guides and power-transmission components in a single unit."

Source: Robotics & Automation News

ARTIFICIAL INTELLIGENCE



Robot waiters take Iraq's Mosulites back to the future

"From the rubble of Iraq's war-ravaged city of Mosul arises the sight of androids gliding back and forth in a restaurant to serve their amused clientele. "Welcome", "We wish you a

applied to the task of self-closing door pulling by a wheeled vehicle without using a robotic arm and without a pre-planned trajectory. The vehicle control was trained without using domain randomization, but it still works in variant environments."

Source: IEEE Xplore

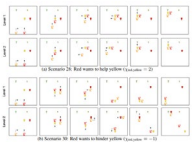
SOFT ROBOTICS

Bubble casting soft robotics

"Inspired by living organisms, soft robots are developed from intrinsically compliant materials, enabling continuous motions that mimic animal and vegetal movement. In soft robots, the canonical hinges and bolts are replaced by elastomers assembled into actuators programmed to change shape following the application of stimuli, for example pneumatic inflation. The morphing information is typically directly embedded within the shape of these actuators, whose assembly is facilitated by recent advances in rapid prototyping techniques. Yet, these manufacturing processes have limitations in scalability, design flexibility and robustness. Here we demonstrate a new all-in-one methodology for the fabrication and the programming of soft machines. Instead of relying on the assembly of individual parts, our approach harnesses interfacial flows in elastomers that progressively cure to robustly produce monolithic pneumatic actuators whose shape can easily be tailored to suit applications ranging from artificial muscles to grippers."

Source: Nature

SOCIAL ROBOTICS

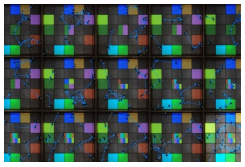


Social Interactions as Recursive MDPs

"While machines and robots must interact with humans, providing them with social skills has been a largely overlooked topic. This is mostly a consequence of the fact that tasks such as navigation, command following, and even game playing are well-defined, while social reasoning still mostly remains a pre-theoretic problem. We demonstrate how social interactions can be effectively incorporated into MDPs (Markov decision processes) by

good time in our restaurant", "We would be happy to have your opinion on the quality of the service", chime the automated attendants, red eyes blinking out of their shiny blue and white exteriors.
"On television, you see robots and touch-screen tables in the United Arab Emirates, Spain and Japan," said Rami Chkib Abdelrahman, proud owner of the White Fox which opened in June.
Source: TechXplore

BLOCKCHAIN TECHNOLOGY



Blockchain technology could provide secure communications for robot teams

"The use of blockchain technology as a communication tool for a team of robots could provide security and safeguard against deception, according to a study by researchers at MIT and Polytechnic University of Madrid, which was published today in *IEEE Transactions on Robotics*. The research may also have applications in cities where multirobot systems of self-driving cars are delivering goods and moving people across town.
A blockchain offers a tamper-proof record of all transactions — in this case, the messages issued by robot team leaders — so follower robots can eventually identify inconsistencies in the information trail."
Source: MIT

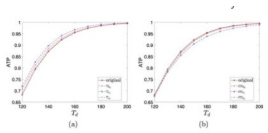
ROBOT INTERACTIONS

Works well with robots?

"MIS researcher studies the way robots and humans interact
Blame it on HAL 9000, Clippy's constant cheerful interruptions, or any navigational system leading delivery drivers to dead-end destinations. In the workspace, people and robots don't always get along.
But as more artificial intelligence systems and robots aid human workers, building trust between them is key to getting the job done. One University of Georgia professor is seeking to bridge that gap with assistance from the U.S. military."
Source: University of Georgia

reasoning recursively about the goals of other agents. In essence, our method extends the reward function to include a combination of physical goals (something agents want to accomplish in the configuration space, a traditional MDP) and social goals (something agents want to accomplish relative to the goals of other agents). Our Social MDPs allow specifying reward functions in terms of the estimated reward functions of other agents, modeling interactions such as helping or hindering another agent (by maximizing or minimizing the other agent's reward) while balancing this with the actual physical goals of each agent. Our formulation allows for an arbitrary function of another agent's estimated reward structure and physical goals, enabling more complex behaviors such as politely hindering another agent or aggressively helping them. Extending Social MDPs in the same manner as I-POMDPs (Interactivepartially observed Markov decision processes) extension would enable interactions such as convincing another agent that something is true."
Source: MIT

COLLABORATIVE ROBOTS



Analysis of assembly-time performance (ATP) in manufacturing operations with collaborative robots: a systems approach

"Reducing station processing times has a significant importance in manufacturing assembly systems. In recent years, there has been a growing interest in using collaborative robots to assist human operators in many manufacturing systems, which can not only improve ergonomics measures but also reduce processing time and increase throughput. In this paper, a system-theoretic approach is introduced to analyse the assembly-time performance (ATP) of assembly systems with collaborative robots, where ATP is defined as the probability to finish all the assembly operations in a station within a desired time interval. Specifically, the assembly operations are described by stochastic processes with both individual (human operator and robot) preparation tasks and joint collaboration tasks, characterised by general or arbitrary distributions of task times. Then an efficient algorithm is presented by using gamma distributions to approximate task times and aggregate multiple interacting

Teaching robots to think like us

"In *Applied Physics Letters*, from AIP Publishing, researchers from the University of Tokyo outline how a robot could be taught to navigate through a maze by electrically stimulating a culture of brain nerve cells connected to the machine.

These nerve cells, or neurons, were grown from living cells and acted as the physical reservoir for the computer to construct coherent signals.

The signals are regarded as homeostatic signals, telling the robot the internal environment was being maintained within a certain range and acting as a baseline as it moved freely through the maze."

Source: EurekAlert!

A step towards natural interaction between robots and animals

"Laboratory rats have been shown to have genetic consistency and similar responses to drugs with humans, and thus become ideal animal models for research and testing of new drugs. However, due to individual difference, it is still a challenging task to find a method of unified behavior control and evaluation. Actually, bioinspired robots can take advantage of their programmability and reconfigurability to replace rats, so as to effectively solve these problems. It has been verified that robots can influence or even control the behavior of actual rats to a certain extent during robot-rat interaction. Some researchers have done a lot of work related to the autonomous interaction. However, those studies still lack behavior detection, fast object tracking and automatic interaction framework."

Source: EurekAlert!

Humans And Robots Go To School Together

"A push to automate is changing the way humans and machines work together. The number of industrial robots installed in factories reached about 3 million units worldwide in 2020 – more than doubling in ten years. The IFR has researched how robotics training shapes current and future workforce education, enhancing skills development for employees."

Source: International Federation of Robotics

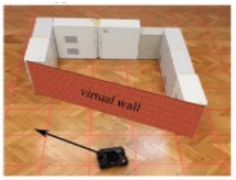
BIOMIMICRY

Guest Blog: Why We Built a Bug Robot That Can Surf

"The World Robotics report shows that Europe is the region with the highest tasks to calculate ATP. High accuracy in ATP evaluation is obtained through such an approximation method."

Source: Taylor & Francis Online

MOBILE ROBOTS



Efficient Local Path Planning Algorithm Using Artificial Potential Field Supported by Augmented Reality

"Mobile robots in industry are commonly used in warehouses and factories. To achieve the highest production rate, requirements for path planning algorithms have caused researchers to pay significant attention to this problem. The artificial potential field algorithm, which is a local path planning algorithm, has been previously modified to obtain higher smoothness of path, to solve the stagnation problem and to jump off the local minimum. The last itemized problem is taken into account in this paper—local minimum avoidance. Most of the modifications of artificial potential field algorithms focus on a mechanism to jump off a local minimum when robots stagnate. From the efficiency point of view, the mobile robot should bypass the local minimum instead of jumping off it. This paper proposes a novel artificial potential field supported by augmented reality to bypass the upcoming local minimum. The algorithm predicts the upcoming local minimum, and then the mobile robot's perception is augmented to bypass it. The proposed method allows the generation of shorter paths compared with jumping-off techniques, due to lack of stagnation in a local minimum. This method was experimentally verified using a Husarion ROSbot 2.0 PRO mobile robot and Robot Operating System in a laboratory environment."

Source: MDPI

A bipedal walking robot that can fly, slackline, and skateboard

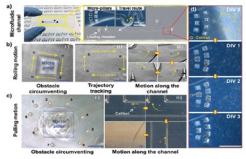
"Numerous mobile robots in various forms specialize in either ground or aerial locomotion, whereas very few robots can perform complex locomotion tasks beyond simple walking and flying. We present the design and control of a multimodal locomotion robotic platform called LEONARDO, which bridges the gap between two different locomotion regimes of flying and walking using synchronized control of distributed

robot density globally, with an average value of 114 units per 10,000 employees in the manufacturing industry. For more facts about robots watch IFR´s video news about Europe in one minute."
Source: Michigan Technological University

Researchers successfully build four-legged swarm robots

"Legged robots can navigate challenging environments such as rough terrain and tight spaces, and the use of limbs offers effective body support, enables rapid maneuverability and facilitates obstacle crossing," Ozkan-Aydin said. "However, legged robots face unique mobility challenges in terrestrial environments, which results in reduced locomotor performance. For the study, Ozkan-Aydin said, she hypothesized that a physical connection between individual robots could enhance the mobility of a terrestrial legged collective system. Individual robots performed simple or small tasks such as moving over a smooth surface or carrying a light object, but if the task was beyond the capability of the single unit, the robots physically connected to each other to form a larger multi-legged system and collectively overcome issues."
Source: University of Notre Dame

ROBOTS FOR HEALTHCARE



Microrobots for treating neurological diseases through intra-nasal administration

"The team developed a magnetically powered human nuclear transfer stem cells(hNTSC)-based microrobot and a method of minimally invasive delivery of therapeutic agents into the brain via the intranasal pathway. And they also accomplished transplanting the developed stem cell-based microrobot into brain tissue through the intranasal pathway that bypasses the blood-brain barrier. The proposed method is superior in efficacy and safety compared to the conventional surgical method and is expected to bring new possibilities of treating various intractable neurological diseases such as Alzheimer's disease, Parkinson's disease, and brain tumors, in the future."
Source: Daegu Gyeongbuk Institute of Science and Technology (DGIST)

A personalized exosuit for real-world walking

electric thrusters and a pair of multijoint legs. By combining two distinct locomotion mechanisms, LEONARDO achieves complex maneuvers that require delicate balancing, such as walking on a slackline and skateboarding, which are challenging for existing bipedal robots. LEONARDO also demonstrates agile walking motions, interlaced with flying maneuvers to overcome obstacles using synchronized control of propellers and leg joints. The mechanical design and synchronized control strategy achieve a unique multimodal locomotion capability that could potentially enable robotic missions and operations that would be difficult for single-modal locomotion robots."
Source: Science Robotics

CYBERSECURITY

Address behaviour vulnerabilities in the next generation of autonomous robots

"As service and industrial robots enter our lives, new types of cybersecurity issues emerge that involve the manipulation of a robot's behaviour. Now is the time to develop countermeasures.
Whereas cyberattacks on traditional computer systems typically compromise data, privacy and business continuity, cyberattacks on robot systems can also compromise the physical safety of users. We argue that the next generation of fully autonomous robots offers a new range of opportunities for cyberattacks, where vulnerabilities are exploited that are based on the robot's behaviour. These behaviour vulnerabilities result from the limits of both the deliberation and the perception of an autonomous robot and open the opportunity to new types of attacks that can trick robots into performing harmful actions."
Source: Nature Machine Intelligence

Autonomous Robotics in the AEC practice

"In recent years, technical development in robotics has been enhanced by leaps forward in artificial intelligence and machine learning (ML). Today's robots learn and optimize their motion, are remotely connected and ready for deployment, and can transfer learned models and behaviors between industries or applications.[1] This paradigm shift and step change in available autonomy

"Now, researchers from the Harvard John A. Paulson School of Engineering and Applied Sciences (SEAS) have developed a new approach in which robotic exosuit assistance can be calibrated to an individual and adapt to a variety of real-world walking tasks in a matter of seconds. The bioinspired system uses ultrasound measurements of muscle dynamics to develop a personalized and activity-specific assistance profile for users of the exosuit.

"Our muscle-based approach enables relatively rapid generation of individualized assistance profiles that provide real benefit to the person walking," said Robert D. Howe, the Abbott and James Lawrence Professor of Engineering, and co-author of the paper.

The research is published in Science Robotics."

Source: Harvard School of Engineering and Applied Sciences

Robotics and artificial intelligence to improve health rehabilitation

"The entrepreneurial team has developed a platform made up of four elements: a robot that interacts with the patient, an artificial intelligence system that uses a 3D sensor to control the robot, an application that can be used by health care staff to set up and track sessions, and a cloud-based storage system which contains information and analytics from all of the rehabilitation processes. "The 3D sensor allows us to know the patient's position at all times…The objective is to improve rehabilitation therapies using imitation-based activities and a series of exercises, as well as provide additional tools for health care staff to optimise these sessions. "For example, for patients like children, interacting with a robot is like playing with a toy. They never think they are going to the hospital for rehabilitation, they think they are going to play. This is the added value that we offer. On the other hand, we are also able to enrich the therapist's working situation, as they often lack tools adapted to specific patient's profiles," says José Carlos Pulido, founding CEO of Inrobics."

Source: University of Madrid

necessitates rethinking how robotics may impact the AEC industry.

Until now, contractors and fabricators have mainly used robots to replace humans in the narrow opportunity presented by "Dull, Dirty, and Dangerous" tasks (the 3Ds)—repeated millions of times with little variability. However, AEC professionals are starting to explore robots' ability to perform tasks that are "Specific, Sustainable, and Scalable" (the 3Ss). Robots complete specific tasks by producing one-off designs and sustainable tasks as they render viable reuse as well as material and waste reduction. Yet they maintain scalability by being able to effortlessly multiply into the hundreds or even millions. They are "smart" enough to work alongside humans, rather than replace them."

Source: Taylor & Francis Online

ARTIFICIAL INTELLIGENCE

Futurological fodder: on communicating the relationship between artificial intelligence, robotics, and employment

"This article examines the debate concerning the employment implications of the so-called 'Fourth Industrial Revolution' (FIR) or the increasing presence of artificial intelligence and robotics in workplaces. I analyze three 'genres' associated with this debate (academic studies including neo-classical and heterodox/post-human approaches, the 'gray literature', and popular media) and I argue that together they represent 'futurological fodder' or discourses and knowledges that 'perform' the FIR and its purported consequences. I contend further that these genres involve a complex mix of ethics and politics, and I conclude with a reflection on the political implications of the FIR debate."

Source: Taylor & Francis Online

ROBOTICS IN HEALTHCARE

Individualization of exosuit assistance based on measured muscle dynamics during versatile walking

"Variability in human walking depends on individual physiology, environment, and walking task. Consequently, in the field of wearable robotics, there is a clear need for customizing assistance to the user and task. Here, we developed a muscle-based assistance (MBA) strategy wherein exosuit assistance was derived from direct measurements of individuals' muscle dynamics during specific tasks. We recorded individuals' soleus muscle dynamics using ultrasonographic imaging during multiple walking speeds and inclines. From these prerecorded images, we estimated the force produced by the soleus through inefficient concentric contraction and designed the exosuit assistance profile to be proportional to that estimated force. We evaluated this approach with a bilateral ankle exosuit at each measured walking task. Compared with not wearing a device, the MBA ankle exosuit significantly reduced metabolic demand by an average of 15.9, 9.7, and 8.9% for level walking at 1.25, 1.5, and 1.75 meters second^{-1}, respectively, and 7.8% at 1.25 meters second^{-1} at 5.71° incline while applying lower assistance levels than in existing literature. In an additional study (n = 2), we showed for multiple walking tasks that the MBA profile outperforms other bioinspired strategies and the average profile from a previous optimization study."
Source: Science Robotics

A visit from a social robot improves hospitalized children's outlook

"A new study from UCLA finds a visit from human-controlled robot encourages a positive outlook and improves medical interactions for hospitalized children.

Robin is a social companion robot that stands at about 4 feet tall and has the capabilities to move, talk and play with others while being remotely controlled by humans. Specialists from UCLA Mattel Children's Hospital's Chase Child Life Program conducted hour-long video visits with young patients using Robin, comparing it to interactions using a standard tablet, from October 2020 to April 2021. At the conclusion of the study period, children and their parents were interviewed about their experiences and child life specialists provided feedback in a focus group. Researchers then used a transcript of the discussion to identify recurrent and salient themes."
Source: UCLA Health