

TOPICAL REPORT

ROBOTICS & AUTOMATION

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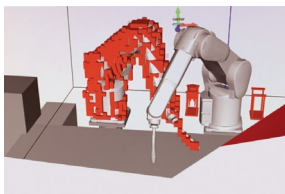
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AUTOMATION



The new wave of robotic automation

"Realtime Robotics has developed a combination of proprietary software and hardware that reduces system deployment time by 70 percent or more, reduces deployment costs by 30 percent or more, and reduces the programming component of building a robotic system in the industrial robot space by upwards of 90 percent."

Source: MIT

Automation of glue application on shoe soles

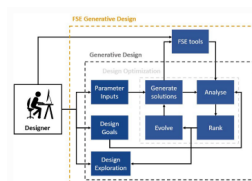
"Manual application of glue on shoe sole results in excess fills, under fills, glue being sprayed outside the sole. These result in glue wastage and inconsistent output. Automation with an industrial robot involves manual robot teaching for every variant so that the shoe sole can be precisely located. This is highly time consuming and requires skilled robot programmer to be available on floor."

Source: International Federation of Robotics

Automated pick, pack and palletization

"The order is placed through the order fulfilment system. Once the order is triggered, the robot erects a carton from the stacked cartons. The robot system determines the volume of the

AUTOMATION



Automation in Fire Safety Engineering Using BIM and Generative Design

"Building Information Modelling (BIM) is a modern technology and process that has had a dramatic impact on the Architecture, Engineering and Construction (AEC) industry over the last decade [1]. The latest statistics show that at least 18 countries around the world are mandating BIM for use in public projects, and this enforcement of BIM adoption continues to proliferate in other countries around the world [2, 3]; with different governments sometimes using different strategies to incentivise the use of BIM in the AEC industry [4]. Also, BIM is becoming an integral part of the design process, right from the conceptual stage—where project stakeholders can leverage different Levels of Development for BIM projects (i.e. from LOD 100 to LOD 500) [5]. This integration of design modelling and analysis from the beginning of a project can streamline coordination, communication, and collaboration."

Source: Springer Link

Impacts of electrification & automation of public bus on

AUTOMATION



6 automation trends in 2021

"Automation has become more prominent around the world in recent years. In 2021, this increase in adoption has led to automation being present in a variety of business industries, as well as in consumer's homes."

Source: Beta News

Global Warehouse Automation Robots, Technologies, and Solutions Market Report 2021-2030

"This research study is an outcome of extensive research on digitization and automation of the warehousing industry across the globe.

The report exhaustively talks about the leading warehouse automation projects conducted in the last decade to evaluate the trend within the warehousing industry for greenfield and brownfield automation; semi-automated and fully automated; technologies defining the automation, mobile and collaborative robots for material handling.

The number of warehouses is increasing rapidly worldwide with the increasing penetration of e-commerce. Along with this, the capacity and the size of the warehouses is also increasing at a

empty carton that has been erected using computer vision. Then, formulates the optimum stacking pattern in the carton based on the order using Artificial Intelligence." Source: International Federation of Robotics

Manufacturing Masks – Using Your Own Production Facilities

"The demand for medical face masks has risen particularly steeply. These are not the everyday fabric or "community" masks that keen crafters around the world are now churning out.

Although such face coverings do lower the risk of the wearer passing on the coronavirus to others (source control), they fall short of the stringent requirements in medical and industrial environments, where the wearer needs to be protected from infection and/or pollutants."

Source: Robots and Automation News

Using robots to address the welder shortage

"Automated welding solutions are used across a range of industries, most commonly observed in the automotive industry where arc welding has been automated since the 1960s as a reliable method of manufacturing that increases accuracy, safety and efficiency.

The primary driver of automated welding solutions has always been a desire for reduced long term costs, increased reliability and productivity."

Source: Robots and Automation News

AUTONOMOUS VEHICLES



Why Not Use Self-Driving Cars as Supercomputers?

"Car buyers now consider factors like safety, fuel economy, and resale value. But some businesses are beginning to talk about the computing power packed into autonomous vehicles as a selling point.

The Rand Corporation estimates that autonomous vehicles on roads could save hundreds of thousands of lives and change the world, but they could also change the world when parked in the garage. The computing power in autonomous cars could be harnessed to tackle problems as personal as editing a high-definition video or as global as decoding a new virus."

Source: Wired

ROBOTICS INDUSTRY

sustainability—A case study in Singapore

"Electrification and automation are attracting interest from the public-transportation sector for their potential to improve energy efficiency, cost efficiency, and environmental performance. Singapore is planning to integrate autonomous buses/minibuses into its transportation system by 2030. However, before the island-wide deployment of autonomous vehicles, there is a need to evaluate their effects on sustainability. A study was therefore conducted in Singapore to evaluate the costs and environmental impacts of autonomous electric minibuses, and the results are revealed and discussed here. This paper presents a case study to demonstrate the impacts of replacing human-driven diesel buses with electrified and automated minibuses on life-cycle costs and greenhouse gas (GHG) emissions for seven routes."

Source: Springer Link

AI Perspectives in Smart Cities and Communities to Enable Road Vehicle Automation and Smart Traffic Control

"Smart cities and communities (SCC) constitute a new paradigm in urban development. SCC ideate a data-centered society aimed at improving efficiency by automating and optimizing activities and utilities. Information and communication technology along with Internet of Things enables data collection and with the help of artificial intelligence (AI) situation awareness can be obtained to feed the SCC actors with enriched knowledge. This paper describes AI perspectives in SCC and gives an overview of AI-based technologies used in traffic to enable road vehicle automation and smart traffic control. Perception, smart traffic control and driver modeling are described along with open research challenges and standardization to help introduce advanced driver assistance systems and automated vehicle functionality in traffic. To fully realize the potential of SCC, to create a holistic view on a city level, availability of data from different stakeholders is necessary."

Source: MDPI

Automation of technological processes in mechanical engineering

"This article discusses trends of production development in the engineering industry. The need to control automation processes at various stages of product manufacture has been identified. It

greater extent. Owing to this the warehouses are increasingly focusing on using automation solutions for greater material handling capacity and reduced time-to-handle."

Source: Business Wire

Automation Trends to Expect in 2021

"Technology is changing the world rapidly. Automation is also a recently discovered area of technology, which is introducing amazing solutions to organizations to reduce downtime and boost productivity.

The automation technologies run automatically without any manual support. They work with machines, equipment and digital solutions as well.

Automation technology has entered everyone's daily lives in different ways and they don't even realize it. The self-driving vehicles, data cleaning system of your smart devices, IVR, smart home notification, self-healing and bots are some basic examples of automation technology."

Source: Data Semantics

ROBOTICS



Investment in Robotics Research – Global Report 2021

"The strategic plan Made in China 2025 comes as a blueprint to upgrade the manufacturing capabilities of Chinese industries. In order to promote the rapid development of intelligent robot technology, the key special projects of "Intelligent Robots" are being deployed in accordance with the requirements of the "Innovation Chain". The focus is on basic cutting-edge technologies of intelligent robots, new-generation robots, key common technologies, industrial robots, service robots and special robots. The development objectives aim to generate continuous growth of the industrial scale. China wants to cultivate at least three leading enterprises with international competitiveness and create more than five clusters of robot-supporting industries. The statistical yearbook "World Robotics" by IFR shows that China reached a robot density of 187 units per 10,000 workers in the manufacturing industry – the country ranks 15th worldwide."

Source: International Federation of Robotics

Global Robot Report 2021 presented

"As the economy gradually opens up after the pandemic, Asia, Europe and



7 Dancing Robots from Boston Dynamics

"Boston Dynamics, the company known for its high-tech robotic developments, has recently created a new artistic presentation, involving 7 Spot robots dancing in unison. The company commented their endeavor saying that 'it was an opportunity to test the limits of their cybernetic creations'."

Source: Technology Org

FANUC produces 750,000th robot

"FANUC Corporation, one of the world's most prominent suppliers of automation technology, produced its 750,000th industrial robot, which is more than any other manufacturer in this segment...At present, FANUC produces around 8,000 industrial robots every month at its factories in Japan, although monthly capacity is available up to 11,000 units. The company is renowned for its highly automated production facilities, where thousands of robots demonstrate reliability, dexterity and speed in the build of FANUC products that include robots, controllers and machine tools. The company will deliver its 750,000th robot to a European customer."

Source: International Federation of Robotics

ARTIFICIAL INTELLIGENCE



New AI strategy enables robots to rapidly adapt to real world environments

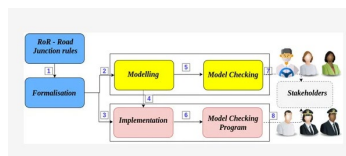
"Delivery services may be able to overcome snow, rain, heat and the gloom of night, but a new class of legged robots is not far behind. Artificial intelligence algorithms developed by a team of researchers from UC Berkeley, Facebook and Carnegie Mellon University are equipping legged robots with an enhanced ability to adapt to and navigate unfamiliar terrain in real time."

Their test robot successfully traversed sand, mud, hiking trails, tall grass and dirt piles without falling. It also outperformed alternative systems in adapting to a weighted backpack thrown onto its top or to slippery, oily slopes."

was concluded that automation leads to increasing the efficiency of production, economic activities and quality of products, as well as making and introducing new products. On the basis of Russian and foreign experience the key stages of realization of automatic control system for technological processes were pointed out. Using the example of Business Units, the stages of implementing the latest automated equipment were considered. The project team conducted a survey of the business unit and determined that automation of the casting process in the foundry should be carried out."

Source: IOP Science

AUTONOMOUS VEHICLES



A Double-Level Model Checking Approach for an Agent-Based Autonomous Vehicle and Road Junction Regulations

"Usually, the design of an Autonomous Vehicle (AV) does not take into account traffic rules and so the adoption of these rules can bring some challenges, e.g., how to come up with a Digital Highway Code which captures the proper behaviour of an AV against the traffic rules and at the same time minimises changes to the existing Highway Code? Here, we formally model and implement three Road Junction rules (from the UK Highway Code). We use timed automata to model the system and the MCPAL (Model Checking Agent Programming Language) framework to implement an agent and its environment. We also assess the behaviour of our agent according to the Road Junction rules using a double-level Model Checking technique, i.e., UPPAAL at the design level and AJPF (Agent Java PathFinder) at the development level."

Source: MDPI

The Future of Autonomous Cars in the Daily Life of Cities: A Systematic Mapping Study

"An autonomous car is a driverless vehicle for the purpose of navigating autonomously and safely over the earth's surface. Interest in this type of transport has increased significantly in recent years and it is possible that the number of these vehicles on the streets will increase, changing the daily lives of cities. In this context, this work aims to understand the technological limitations and impacts

America are adjusting their funding programs for robotics research. But what are the goals of the officially operated government programs today? The International Federation of Robotics has researched and published the results with the 2021 update of the "World Robotics R&D Programs".

"The first version of our report 'World Robotics R&D Programs' was presented in June last year. Since then, dozen of countries have updated their robotics research and development programs," says Prof. Dr. Jong-Oh Park, IFR Research Committee Vice-Chair and Executive Board member." The five most advanced robotics countries - South Korea, Japan, Germany, USA and China - have very different strategic focuses."

Source: Wiley Industry News

First-Quarter 2021 Robot Sales Increase 20% Over Q1 2020, Reports A3

"The COVID-19 pandemic slowed the global economy over the past year, but robot orders in the first quarter of 2021 were 19.6% higher than in the same period last year, announced the Association for Advancing Automation today."

The Ann Arbor, Mich.-based organization said that North American companies purchased 9,098 units valued at \$466 million in Q1, with non-automotive companies purchasing 28% more robots over Q1 2020, and automotive OEMs and component suppliers combined seeing a 12% increase year over year. "Robot sales have increased considerably, as more and more companies in every industry recognize that robotics and automation can help them compete globally," stated Jeff Burnstein, president of the Association for Advancing Automation (A3). "While advances in robot technology, ease of use, and new applications remain key drivers in robot adoption, worker shortages in manufacturing, warehousing, and other industries are a significant factor in the current expansion of robot use that we're now seeing."

Source: Robotics 247v

INDUSTRY REPORT

Geographical Area	Reported Robotics Sales (\$ million)
North America	466
Europe	385
Asia	375
Latin America	100
Middle East	100
Africa	100
Oceania	100
Global	1,536

Growth opportunities in robotics, additive manufacturing, sustainable

AI and Robots Are a Minefield of Cognitive Biases

"This is a guest post. The views expressed here are solely those of the author and do not represent positions of IEEE Spectrum or the IEEE.

I believe many were impressed to see the [Mini Cheetah](#), developed in my MIT Biomimetic Robotics Laboratory, perform a backflip. While jumping backwards and landing on the ground is very dynamic, eye-catching and, of course, difficult for humans, the algorithm for the particular motion is incredibly simple compared to one that enables stable walking that requires much more complex feedback loops. Achieving robot tasks that are seemingly easy for us is often extremely difficult and complicated. This gap occurs because we tend to think of a task's difficulty based on human standards."

Source: IEEE Spectrum

Giving robots better moves

"For most people, the task of identifying an object, picking it up, and placing it somewhere else is trivial. For robots, it requires the latest in machine intelligence and robotic manipulation.

That's what MIT spinoff RightHand Robotics has incorporated into its robotic piece-picking systems, which combine unique gripper designs with artificial intelligence and machine vision to help companies sort products and get orders out the door."

Source: MIT

Artisan robots with AI smarts — soon at a factory near you

"To return to operation, skilled technicians use all the tools in their kit – machining, bending, welding and surface treating, making just the right part as quickly and as accurately as possible. But there's a declining number of technicians with the right skills, and the quality of things made by hand is subject to the skills and mood of the artisan on the day the part is made.

Both problems could soon be solved by artificially intelligent robotic technicians. These systems can take measurements; shape, cut or weld parts using varied tools; pass parts to specialized equipment, and even purchase needed materials – all without human intervention."

Source: Technology Org

ROBOT DESIGNS

of using autonomous cars, observing the feasibility, adaptation, traffic legislation, and perceived benefits. Following the method of systematic literature review proposed by Kitchenham, 69 primary studies from relevant bases in the area of Technology were analyzed. These studies showed some evidence by indicating, for example, that there will be a change in the way people relate to cars, particularly in terms of sharing them, in addition to impacts on urban mobility."

Source: ACM Digital Library

Multi-attribute decision making on mitigating a collision of an autonomous vehicle on motorways

"Autonomous vehicles have the potential to improve automotive safety, largely by removing human error as a possible cause of collisions. However, it cannot be guaranteed that autonomous vehicles will be able to eliminate all collisions. Therefore, automotive safety will continue to be a necessity for automotive design. This paper proposes a decision making system which selects the least severe collision for an autonomous vehicle to take, when facing multiple imminent and unavoidable collisions on a motorway. The novel decision making system developed combines simulation results and multi-attribute decision making (MADM) methods. The simulator includes models of vehicle dynamics and the manoeuvre trajectory path. MADM methods are used to decide which vehicle(s) the autonomous vehicle should collide with, based on the severity of collisions. Severity of collisions is calculated in the simulator using the following variables: impact velocity between autonomous vehicle and vehicle ahead, impact velocity between vehicle behind and autonomous vehicle, manoeuvre acceleration and time-to-collision. Various MADM methods are investigated and three methods are selected including the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS), the Analytical Hierarchy Process (AHP), and the Analytical Network Process (ANP)."

Source: Elsevier

Effects of the autonomous vehicle crashes on public perception of the technology

"In March 2018, an Uber-pedestrian crash and a Tesla's Model X crash attracted a lot of media attention because the vehicles were operating under self-driving and autopilot mode respectively at the time of the crash. This study aims to conduct before-and-after sentiment analysis to examine how these two fatal crashes

manufacturing, and industrial automation

"The Advanced Manufacturing Technology Opportunity Engine for July 2021 covers innovations related to robotics, additive manufacturing, sustainable manufacturing, and industrial automation.

The Advanced Manufacturing TOE covers global innovations and developments related to manufacturing and industrial automation on a monthly basis. 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

Growth opportunities in robotic arms, cobots, 3d printing, and sustainable manufacturing

"The Advanced Manufacturing Technology Opportunity Engine for June 2021 covers innovations in robotic arms, collaborative robots, 3D printing, carbon capture and utilization, and carbon-neutral manufacturing.

The Advanced Manufacturing TOE covers global innovations and developments related to manufacturing and industrial automation on a monthly basis. 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



Slender robotic finger senses buried items

"MIT researchers have now designed a sharp-tipped robot finger equipped with tactile sensing to meet the challenge of identifying buried objects. In experiments, the aptly named Digger Finger was able to dig through granular media such as sand and rice, and it correctly sensed the shapes of submerged items it encountered. The researchers say the robot might one day perform various subterranean duties, such as finding buried cables or disarming buried bombs."

Source: MIT

Designing exploratory robots that collect data for marine scientists

"The robot moved up and down the stream, using its chemical sensors to detect the composition of the flowing water. Its many measurements revealed a short-lived but massive influx of greenhouse gases in the water during the annual "flushing" of the estuary as ice thawed and receded. For Preston, the experiment's success was a heartening affirmation of how robotic platforms can be leveraged to help scientists understand the environment in fundamentally new ways."

Source: MIT

Contact-aware robot design

"Most robotic hands are designed for general purposes, as it's very tedious to make task-specific hands. Existing methods battle trade-offs between the complexity of designs critical for contact-rich tasks, and the practical constraints of manufacturing, and contact handling.

This led researchers at MIT's Computer Science and Artificial Intelligence Laboratory (CSAIL) to create a new method to computationally optimize the shape and control of a robotic manipulator for a specific task. Their system uses software to manipulate the design, simulate the robot doing a task, and then provide an optimization score to assess the design and control."

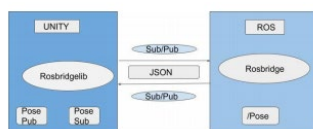
Source: MIT

SOCIAL ROBOTS

have affected people's perceptions of self-driving and autonomous vehicle technology using Twitter data. Five different and relevant keywords were used to extract tweets. Over 1.7 million tweets were found within 15 days before and after the incidents with the specific keywords, which were eventually analyzed in this study. The results indicate that after the two incidents, the negative tweets on "self-driving/autonomous" technology increased by 32 percentage points (from 14% to 46%). The compound scores of "pedestrian crash", "Uber", and "Tesla" keywords saw a 6% decrease while "self-driving/autonomous" recorded the highest change with an 11% decrease. Before the Uber-incident, 19% of the tweets on Uber were negative and 27% were positive."

Source: IATSS Research

FIELD ROBOTICS



A Simulated Environment for Traversability Estimation Experiments in Field Robotics Applications

"We present an environment for simulated experiments in field robotics, and especially in experiments on estimating the traversability of foliage and other objects that appear as obstacles but that can be overcome by the robot without circumventing them. The simulated environment is developed in the Unity real-time development platform, integrated with the ROS middleware. In the preliminary experiments presented here, we demonstrate that our environment is able to simulate the sensory input needed in order to train supervised traversability estimation models."

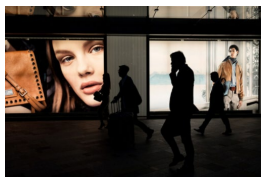
Source: ACM Digital Library

SOCIAL ROBOTICS



Face recognition framework based on effective computing and adversarial neural network and its implementation in machine vision for social robots

"In recent years, with the continuous breakthrough of computer vision technology, the accuracy of object detection and target recognition has been improved by leaps and bounds. Face recognition is one of the important research directions in the

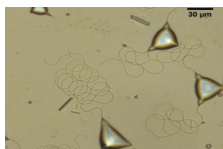


When Robots Flatter the Customer

"Under the supervision of Prof. Dr. Oliver Bendel, Liliana Margarida Dos Santos Alves wrote her master thesis "Manipulation by humanoid consulting and sales hardware robots from an ethical perspective" at the School of Business FHNW. The background was that social robots and service robots like Pepper and Paul have been doing their job in retail for years. In principle, they can use the same sales techniques – including those of a manipulative nature – as salespeople. The young scientist submitted her comprehensive study in June 2021. According to the abstract, the main research question (RQ) is "to determine whether it is ethical to intentionally program humanoid consulting and sales hardware robots with manipulation techniques to influence the customer's purchase decision in retail stores" (Alves 2021)."

Source: Robophilosophy

MICROROBOTS



Scientists create rechargeable swimming microrobots using oil and water

"By combining oil drops with water containing a detergent-like substance, the scientists found they could produce artificial swimmers that are able to swim independently and even harvest energy to recharge.

The oil droplets use fluctuating temperature changes in their surrounding environment to store energy and to swim. When cooled, the droplets release thin 'tail-like' threads into the environment. The friction generated between the tails and surrounding fluid, pushes the droplet causing them to move."

Source: Queen Mary University of London

MOBILE ROBOTS



Berkshire Grey unveils new mobile robots

field of computer vision, which is widely used in mobile payment, safe city, criminal investigation and other fields. Traditional face recognition methods need to extract face image features manually. The extracted features are greatly affected by subjective factors, and time-consuming and laborious. Deep learning is the most important technology in the field of computer vision at present. Compared with traditional face recognition methods, it can extract more essential features of face image without manual participation. In this paper, we build a face recognition system based on neural computing model and the principle of neural network. The experimental results show that the proposed method has high detection rate and short processing time."

Source: Elsevier

Manufacturing Life, What Life? Ethical Debates Around Biobanks and Social Robots

"In this paper, we explore how the definition of life takes on an essential character in the ethical debates around health technologies, with life thus being manufactured in the tensions and conflicts around the use of such artefacts and devices. We introduce concepts from science and technology studies (STS) to approach bioethics, overcoming the dualistic conception that separates the natural and the technological and questioning the dominant rationality that divides life into dualities. Drawing on two research projects in which we have been involved in recent years, one regarding biobanks and the other regarding social care robots, we explore how the ethical discussions about biobanks and robots imply particular notions of life. We argue that the contemporary epistemic category of life is a manufactured life in which various rationalities coexist: one rationality based on a separation between the technological and the human, focused on pragmatism and functionalities that tend towards a dualized notion of life divided into qualified and non-qualified life, and another rationality based on a non-essentialist ontology, focused on the mediating role of health technologies, that entails a distributed life appearing as a precarious effect of a network."

Source: Springer Link

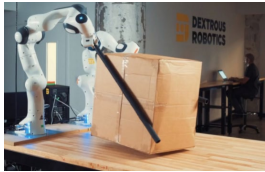
Social Robots in Special Education: A Systematic Review

"In recent years, social robots have become part of a variety of human activities, especially in applications involving children, e.g.,

"The World Robotics report shows that Europe is the region with the highest 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: Robotics and Automation News

ROBOT GRIPPERS

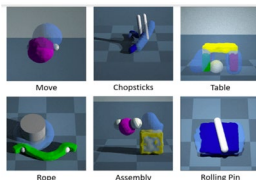


Dextrous Robotics Wants To Move Boxes With Chopsticks

"One of the more novel approaches to this task comes from Dextrous Robotics, a Memphis TN-based startup led by Evan Drumwright. Drumwright was a professor at GWU before spending a few years at the Toyota Research Institute and then co-founding Dextrous in 2019 with an ex-student of his, Sam Zapolsky. The approach that they've come up with is to do box manipulation without any sort of suction, or really any sort of grippers at all. Instead, they're using what can best be described as a pair of moving arms, each gripping a robotic chopstick."

Source: IEEE Xplore

ROBOT LEARNING



Training robots to manipulate soft and deformable objects

"A new simulation environment, PlasticineLab, is designed to make robot learning more intuitive. By building knowledge of the physical world into the simulator, the researchers hope to make it easier to train robots to manipulate real-world objects and materials that often bend and deform without returning to their original shape. Developed by researchers at MIT, the MIT-IBM Watson AI Lab, and University of California at San Diego, the simulator was launched at the International Conference on Learning Representations in May."

Source: MIT

HUMAN-ROBOT COLLABORATIONS

entertainment, education, companionship. The interest of this work lies in the interaction of social robots with children in the field of special education. This paper seeks to present a systematic review of the use of robots in special education, with the ultimate goal of highlighting the degree of integration of robots in this field worldwide. This work aims to explore the technologies of robots that are applied according to the impairment type of children. The study showed a large number of attempts to apply social robots to the special education of children with various impairments, especially in recent years, as well as a wide variety of social robots from the market involved in such activities. The main conclusion of this work is the finding that the specific field of application of social robots is at the first development step; however, it is expected to be of great concern to the research community in the coming years."

Source: MDPI

SWARM ROBOTICS



Swarm Robotics: Past, Present, and Future [Point of View]

"Swarm robotics deals with the design, construction, and deployment of large groups of robots that coordinate and cooperatively solve a problem or perform a task. It takes inspiration from natural self-organizing systems, such as social insects, fish schools, or bird flocks, characterized by emergent collective behavior based on simple local interaction rules [1] [2]. Typically, swarm robotics extracts engineering principles from the study of those natural systems in order to provide multirobot systems with comparable abilities. This way, it aims to build systems that are more robust, fault-tolerant, and flexible than single robots and that can better adapt their behavior to changes in the environment."

Source: IEEE Xplore

Swarm Intelligence and Swarm Robotics in the Path Planning Problem

"In this chapter, we introduce the basic characteristics of swarm intelligence, the path planning problem for robots, and how to apply the self-organizing migrating algorithm, a representative of swarm intelligence to solve that real-world problem. We set up simulations in the Matlab environment with four



Getting dressed with help from robots

"Scientists from MIT's Computer Science and Artificial Intelligence Laboratory (CSAIL) have recently created a new algorithm to help a robot find efficient motion plans to ensure physical safety of its human counterpart. In this case, the bot helped put a jacket on a human, which could potentially prove to be a powerful tool in expanding assistance for those with disabilities or limited mobility.

"Developing algorithms to prevent physical harm without unnecessarily impacting the task efficiency is a critical challenge," says MIT PhD student Shen Li, a lead author on a new paper about the research. "By allowing robots to make non-harmful impact with humans, our method can find efficient robot trajectories to dress the human with a safety guarantee.""

Source: MIT

SOFT ROBOTICS



University of Maryland Engineers Have 3D Printed a Soft Robotic Hand That Can Play Nintendo

"A team of researchers from the University of Maryland has 3D printed a soft robotic hand that is agile enough to play Nintendo's Super Mario Bros.—and win!

The feat, highlighted on the front cover of the latest issue of Science Advances, demonstrates a promising innovation in the field of "soft robotics", which centers on creating new types of flexible, inflatable robots that are powered using water or air rather than electricity. Soft robots' inherent safety and adaptability has sparked interest in their use for applications like prosthetics and biomedical devices. Unfortunately, controlling the fluids that make these soft robots bend and move has been especially difficult—until now."

Source: University of Maryland

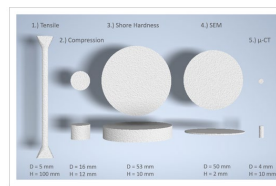
Air-powered computer memory helps soft robot control movements

"Engineers at UC Riverside have unveiled an air-powered computer memory that can be used to control soft robots. The innovation overcomes

common possible scenarios to demonstrate the effectiveness of the solution."

Source: Springer Link

SOFT ROBOTICS



Synthesis and characterization of the properties of thermosensitive elastomers with thermoplastic and magnetic particles for application in soft robotics

"In the currently rapidly developing field of soft robots, smart materials with controllable properties play the central role. Thermosensitive elastomers are soft, smart materials whose material properties can be controlled by changing their temperature. The aim of this work is to investigate the mechanical properties, to analyze the surface, the inner structure, and the heat transfer within the thermosensitive elastomer materials. This should provide a knowledge base for new combinations, such as a combination of thermosensitive and the well-known magneto sensitive elastomers, in order to realize new applications. Thermoplastic polycaprolactone particles were incorporated into a flexible polydimethylsiloxane matrix to produce thermosensitive elastomer samples. With a low melting point in the range of 58–60°C, polycaprolactone offers good application potential compared to other thermoplastic materials such as polymethacrylate with a melting point above 160°C."

Source: Wiley Online Library

Stimulus-driven liquid metal and liquid crystal network actuators for programmable soft robotics

"Sophisticated soft matter engineering has been endorsed as an emerging paradigm for developing untethered soft robots with built-in electronic functions and biomimetic adaptation capacities. However, the integration of flexible electronic components into soft robotic actuators is challenging due to strain mismatch and material incompatibilities. Herein, we report a general strategy to integrate electrically conductive liquid metals (LMs) and shape-morphing liquid crystal networks (LCNs) towards multifunctional and programmable soft robotics. A unique colloidal LM ink

one of the biggest obstacles to advancing soft robotics: the fundamental mismatch between pneumatics and electronics. The work is published in the open-access journal, PLOS One.

Pneumatic soft robots use pressurized air to move soft, rubbery limbs and grippers and are superior to traditional rigid robots for performing delicate tasks. They are also safer for humans to be around. Baymax, the healthcare companion robot in the 2014 animated Disney film, Big Hero 6, is a pneumatic robot for good reason."

Source: UC Riverside

SUSTAINABILITY



Recycling robot could help solve soft plastic waste crisis

"Engineering researchers are developing a unique method to increase the recycling of soft plastics by creating a smart robot that can identify, sort and separate different types of recyclable waste... Working alongside industry partners as part of a federal government Cooperative Research Centre Project grant, researchers from the Centre for Internet of Things (IoT) and Telecommunications at the University of Sydney are developing a unique method to increase recycling of soft plastics – by creating a smart, automated robotic system that uses and AI to sort recyclable waste."

Source: International Federation of Robotics

BIOMIMICRY



Insect-sized robot navigates mazes with the agility of a cheetah

"University of California, Berkeley, engineers have created a lightweight and durable robot that achieves exquisite control and agility by modulating the electrostatic forces between its feet and surfaces. With the help of these footpads, the robot can navigate a Lego maze in seconds."

Source: University of Berkeley

with superior adhesion and photothermal conversion efficiency was judiciously designed and fabricated by ultrasonically LM and miniature carboxylated gold nanorods (MiniGNR-COOH) in an aqueous suspension of biological bacterial cellulose."

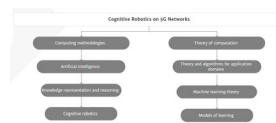
Source: Royal Society of Chemistry

Soft robotics: the route to true robotic organisms

"Soft Robotics has come to the fore in the last decade as a new way of conceptualising, designing and fabricating robots. Soft materials empower robots with locomotion, manipulation, and adaptability capabilities beyond those possible with conventional rigid robots. Soft robots can also be made from biological, biocompatible and biodegradable materials. This offers the tantalising possibility of bridging the gap between robots and organisms. Here, we discuss the properties of soft materials and soft systems that make them so attractive for future robots. In doing so, we consider how future robots can behave like, and have abilities akin to, biological organisms."

Source: Springer Link

COGNITIVE ROBOTICS



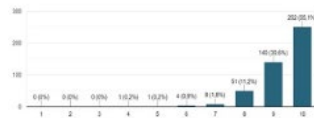
Cognitive Robotics on 5G Networks

"Emotional cognitive ability is a key technical indicator to measure the friendliness of interaction. Therefore, this research aims to explore robots with human emotion cognitively. By discussing the prospects of 5G technology and cognitive robots, the main direction of the study is cognitive robots. For the emotional cognitive robots, the analysis logic similar to humans is difficult to imitate; the information processing levels of robots are divided into three levels in this study: cognitive algorithm, feature extraction, and information collection by comparing human information processing levels. In addition, a multi-scale rectangular direction gradient histogram is used for facial expression recognition, and robust principal component analysis algorithm is used for facial expression recognition. In the pictures where humans intuitively feel smiles in sad emotions, the proportion of emotions obtained by the method in this study are as follows: calmness accounted for 0%, sadness accounted for 15.78%, fear accounted for 0%, happiness accounted for 76.53%, disgust accounted for 7.69%, anger

accounted for 0%, and astonishment accounted for 0%."

Source: ACM Digital Library

EDUCATIONAL ROBOTICS



Implementation and evaluation of a remote seminar on the pedagogical use of educational robotics

"This article describes distance teacher training for educational robotics' pedagogical use, e.g., the planning, the implementation, and the evaluation by the teachers involved. The training seminars were organized as part of the Greek eTwinning community's seminars. They were based on a Teacher Practice Community of the South Aegean about using ICT in teaching practice. From 2018 we have included seminars on educational robotics. There is a growing interest in the use of educational robotics in teaching practice. Although the topic is such that face-to-face contact and experimentation with the subject is considered necessary, we tried to educate teachers using remote learning methodology. The project was successful, and the evaluation of the seminars was very positive."

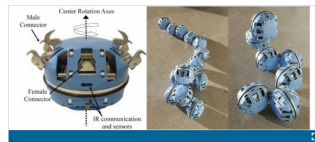
Source: Advances in Mobile Learning Educational Research

Systematic Literature Review of Realistic Simulators Applied in Educational Robotics Context

"This paper presents a systematic literature review (SLR) about realistic simulators that can be applied in an educational robotics context. These simulators must include the simulation of actuators and sensors, the ability to simulate robots and their environment. During this systematic review of the literature, 559 articles were extracted from six different databases using the Population, Intervention, Comparison, Outcomes, Context (PICOC) method. After the selection process, 50 selected articles were included in this review. Several simulators were found and their features were also analyzed. As a result of this process, four realistic simulators were applied in the review's referred context for two main reasons. The first reason is that these simulators have high fidelity in the robots' visual modeling due to the 3D rendering engines and the second reason is because they apply physics engines, allowing the robot's interaction with the environment."

Source: MDPI

INDUSTRIAL ROBOTS



Reversible Execution for Robustness in Embodied AI and Industrial Robots

"Reversible computation is a computing paradigm where execution can progress backward as well as in the usual, forward direction. It has found applications in many areas of computer science, such as circuit design, programming languages, simulation, modeling of chemical reactions, debugging, and robotics. In this article, we give an overview of reversible computation focusing on its use in robotics. We present an example of programming industrial robots for assembly operations where we combine classical AI planning with reversibility and embodied AI to increase the robustness and versatility of industrial robots."

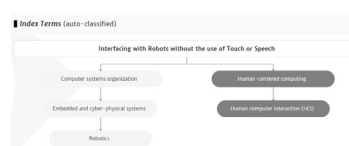
Source: IEEE Xplore

Rigid Precision Reducers for Machining Industrial Robots

"Machining robots are expected to significantly change existing production systems in the near future. The quality of the machining process with robots is mainly governed by the accuracy and stiffness of the robots. Therefore, a precision reducer for the robot joint is an important component that governs the accuracy of machining robots. This paper presents a review of rigid precision reducers for machining robots. Initially, an overview of the machining robots and their features is introduced. The importance of a precision reducer as a component of a robot for machining is explored. A cycloid reducer is the best candidate among precision reducers, considering both the structural compliance and kinematic accuracy of the machining robots."

Source: Springer Link

HUMAN-ROBOT INTERACTION



Interfacing with Robots without the use of Touch or Speech

"As the field of robotics develops, so do the methods of interfacing with and controlling those robots. Many modern robots can be communicated with using

commands that require neither speech nor touch. The two main motivations behind this trend are the assistance of people with disabilities and the desire for more natural Human-Robot Interaction (HRI). In allowing nonverbal communication with robots, accessibility of the systems increases to allow more people to interact with and benefit from robotics systems. Additionally, nonverbal communication provides more natural communication, which can lead to many benefits in HRI. This paper provides an overview of existing technologies in touchless and nonverbal human-robot interfaces; it presents the most prevalent interface methods, their uses, and limitations. Discussions are provided on future directions for research."

Source: ACM Digital Library

Collection of Metaphors for Human-Robot Interaction

"The word "robot" frequently conjures unrealistic expectations of utilitarian perfection: tireless, efficient, and flawless agents. However, real-world robots are far from perfect—they fail and make mistakes. Thus, roboticists should consider altering their current assumptions and cultivating new perspectives that account for a more complete range of robot roles, behaviors, and interactions. To encourage this, we explore the use of metaphors for generating novel ideas and reframing existing problems, eliciting new perspectives of human-robot interaction. Our work makes two contributions. We (1) surface current assumptions that accompany the term "robots," and (2) present a collection of alternative perspectives of interaction with robots through metaphors. By identifying assumptions, we provide a comprehensible list of aspects to reconsider regarding robots' physicality, roles, and behaviors. Through metaphors, we propose new ways of examining how we can use, relate to, and co-exist with the robots that will share our future."

Source: MIT

ROBOTICS IN HEALTHCARE



Humanoid service robots: The future of healthcare?

"Humanoid service robots made swift progress in extending a helping hand to the strained global healthcare during the COVID-19 pandemic. This case provides an overview of the robots' inclusion in healthcare regarding pre- and intra-pandemic

contexts. Specific focus is devoted to humanoid service robots as their shape, size, and mobility make them advantageous in using the physical spaces designed for humans. A collection of examples from hospitals worldwide is presented in illustrating the humanoid service robots' deployment in healthcare during the COVID-19 pandemic. The pointed future directions aim to facilitate better decision- and policy-making that may ease human anxiety and promote greater acceptance."

Source: Sage Journals

Towards Verifiable COVID-19 Aerosol Disinfection using Ultraviolet Light with a Mobile Robot

"Robots are being increasingly used to fight against the novel Coronavirus (SARS-CoV-2) in the current global pandemic. In previous work, we looked at the use of sophisticated mobile manipulation robots to perform surface disinfection in the context of the Ebola Virus Disease, using ultraviolet light. In this work, a human supervisor designates a surface to be disinfected. Then the robot autonomously plans a set of motions to disinfect the surface, using an ultraviolet light held in its gripper. Finally, the system displays the amount of ultraviolet radiation delivered to each part of the surface, so that the human supervisor can verify that the operation was successful. In this paper, we describe this work, and discuss how it could be adapted to the other pathogens, including SARS-CoV-2."

Source: ACM Digital Library

UAV



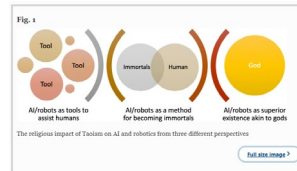
An autonomous drone for search and rescue in forests using airborne optical sectioning

"Autonomous drones will play an essential role in human-machine teaming in future search and rescue (SAR) missions. We present a prototype that finds people fully autonomously in densely occluded forests. In the course of 17 field experiments conducted over various forest types and under different flying conditions, our drone found, in total, 38 of 42 hidden persons. For experiments with predefined flight paths, the average precision was 86%, and we found 30 of 34 cases. For adaptive sampling experiments (where potential findings are double-

checked on the basis of initial classification confidences), all eight hidden persons were found, leading to an average precision of 100%, whereas classification confidence was increased on average by 15%. Thermal image processing, classification, and dynamic flight path adaptation are computed on-board in real time and while flying. We show that deep learning-based person classification is unaffected by sparse and error-prone sampling within straight flight path segments."

Source: Science Robotics

EDITORIAL



Editorial Introduction to Special Issue on Religion in Robotics

"In our world, religion and robotics may be regarded as distinct areas of human activity. In fact, they are not only deemed distinct, but also oppositional: it is widely acknowledged that here is little room for "the divine" in the realm of scientific investigation and technological development, and robotics is not considered an exception. However, in some ways, this intuitive categorization appears to be stereotyped and superficial. Generally speaking, it is straightforward to observe that, if one focuses on the study of religion and its impact on human cognition and societies as addressed by anthropologists, social scientists, psychologists, cognitive scientists or other human-centered research disciplines, the opposition with robotics research is only apparent. All these disciplines obviously share with robotics (and with research and technological development in general) a sound experimental approach, which is based on the formulation of hypotheses, the collection of data, and then the statistical analysis of such data to verify if hypothesis shall be accepted or rejected."

Source: Springer Link