SINGAPORE UNIVERSITY OF TECHNOLOGY AND DESIGN

19 March – 20 May 2022

TOPICAL REPORT

ROBOTICS & AUTOMATION

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news

AUTOMATION

Why Automation Should be Part of Your Digital Signage Strategy

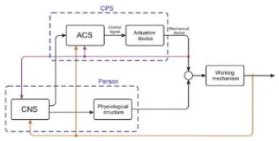
"Automation is not a futuristic word, it is just another way of ensuring your digital signs take as little effort as possible. It can work in several different ways.
For example, you could have a live feed of information that displays information based on whatever program is running. You could have the sort of automation that tells people when their next appointment is due or when their next bus is due.
Even things like having your content run on a schedule is considered automation, and it too should be part of your digital signage strategy."
Source: Robotics and Automation News

What Are the Benefits of Network Automation to IT Companies?

"In the past few years, we have seen huge advancements in the field of technology and everything has changed drastically because of these technological advancements and networking is no different, it has become complex in the past few years owing to rapid technological advancement and changes.
Due to networks becoming increasingly complex, it has been difficult for companies to operate without automation.

academic

AUTOMATION



Digital Identification of the Human Condition as a Prerequisite for the Effectiveness of the Organizational Automation (Biocybernetic) Systems Operation

"The article deals with the problems of improving modern human-machine interaction systems. Such systems are called biocybernetic systems. It is shown that a significant increase in their efficiency can be achieved by stabilising their work according to the automation control theory. An analysis of the structural schemes of the systems showed that one of the most significantly influencing factors in these systems is a poor "digitization" of the human condition. "Digitization" here is the identification of a person as a participant in the interaction with a cybernetic or cyber-physical system."
Source: MDPI

An Intelligent and Effective Cyber-Secured Smart-Home Automation System with Embedded AI

"With technological advancement, the concept of controlling household equipment remotely via the internet from anywhere in the world at any time is now a reality. This paper presents intelligent smartphone-

reports

AUTOMATION

White paper: Global trends in supply chain automation

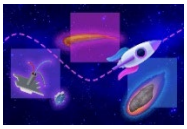
"The massive global growth in e-commerce over the past few years has fundamentally changed the logistics and supply chain sector.
Not only is there a far greater volume of goods being moved through warehouses, it is also being moved faster than ever. The increase in speed has largely been achieved using automation systems as well as digital processes, bringing artificial intelligence into the mix.
In this white paper, we will look more closely at the components of the logistics and supply chain which are enabling customers to order goods from anywhere in the world and yet receive them in record times.
Moreover, we take a closer look at perhaps the most critical component of the supply chain – the warehouse operation, and highlight some data which indicates how robotics, automation and AI are making warehouses increasingly efficient and productive."
Source: Robotics & Automation

Robotic Process Automation Platform UiPath

"The Uipath platform combines core robotic process automation (RPA) capabilities with tools for process discovery and analytics to report precisely the business impact. The

Network automation is the process of automating different tasks such as configuring, provisioning, managing, and testing network equipment using the latest technology."
Source: Robotics and Automation News

AUTONOMOUS VEHICLES



Charting a safe course through a highly uncertain environment

"MIT researchers have developed a technique that could help this spacecraft land safely. Their approach can enable an autonomous vehicle to plot a provably safe trajectory in highly uncertain situations where there are multiple uncertainties regarding environmental conditions and objects the vehicle could collide with.
The technique could help a vehicle find a safe course around obstacles that move in random ways and change their shape over time. It plots a safe trajectory to a targeted region even when the vehicle's starting point is not precisely known and when it is unclear exactly how the vehicle will move due to environmental disturbances like wind, ocean currents, or rough terrain."
Source: Massachusetts Institute of Technology

ROBOTS

How the MIT mini cheetah learns to run

"Researchers from MIT's Improbable AI Lab, part of the Computer Science and Artificial Intelligence Laboratory (CSAIL) and directed by MIT Assistant Professor Pulkit Agrawal, as well as the Institute of AI and Fundamental Interactions (IAIFI) have been working on fast-paced strides for a robotic mini cheetah – and their model-free reinforcement learning system broke the record for the fastest run recorded.
Here, MIT PhD student Gabriel Margolis and IAIFI postdoc Ge Yang discuss just how fast the cheetah can run."
Source: MIT CSAIL

Using Everyday Wifi To Help Robots See And Navigate Better Indoors

"The technology consists of sensors that use WiFi signals to help the robot map where it's going. It's a new based home automation and cyber-secured system by using an Arduino microcontroller. The system has two modes of operation, the manual mode, and automatic mode, i.e., the system can operate on its own without any interference of humans or in a dehumanized way. The hardware of the proposed method is successfully developed and its various subsystems are successfully tested. With the help of the ESP866 Wi-Fi module, the whole system can be taken to the cloud (online) mode and the system can be accessed from anywhere in the world."
Source: Springer Link

Invoice Generator Using Process Definition Document with Robotic Process Automation

"Robotic Process Automation (RPA) is a technology that has grown exponentially over the years, due to its usability in the process of automation process. Invoice management is a function within the organization related to the allocation of funds and is responsible for processing the invoice process for transactions between the seller and the distributor. As with all other financial processes, invoice management has become a formal challenge for organizations. The department in charge cannot overcome this problem as the maximum number of invoices should always be considered based on raw material of various kinds. Invoice process management is also known as Process Document Document in RPA technology, which reflects the automated process of capturing the flow of business process with a high degree of accuracy."
Source: International Journal of Research in Engineering, Science and Management

Connecting and Communicating with Faculty Through Workflow Automation Platforms

"Cross-disciplinary manifestations of teaching and learning centers' traditional role in fostering community and connection among faculty are especially important amid decentralization and distributed work locations spurred by the COVID-19 pandemic. This article details practical applications of codeless workflow automation platforms to support instructional and research initiatives and connect faculty during these conditions. Rather than replacing other vital forms of communication with faculty, workflow automation platforms can help centers efficiently connect faculty with each other and staff and direct time to core services such as core capabilities make it easy to build, deploy, and manage software robots (SRs) that emulate humans' interactions with information systems to perform certain tasks in business processes (BPs). Firstly, the BPs to be automated are designed, created, or recorded. They are created using drag-anddrop activities within a workflow. Then SRs work to perform BPs and an orchestrator acting as a control center designates tasks/processes to SRs and evaluates the efficiency of each one."
Source: ACM Digital Library

6 Key Hyperautomation Trends of 2022

"Sitting comfortably on the list of Gartner's Top Strategic Technology Trends for 2022 is one that has made significant waves over the last few years: **hyperautomation**. First introduced in 2019, hyperautomation has evolved into more than a trendy catchphrase: it's slated to perform 69% of work currently performed by managers by 2024.
What is hyperautomation? This supercharged automation strategy flings a fresh burst of energy into your existing initiatives, powering your businesses with even more sophisticated tools and technologies like:

- No/Low-Code Platforms
- Business Process Management (BPM) Platforms with Automation Workflows
- Process Mapping Tools
- Integration Platforms (iPaaS)
- Robotic Process Automation (RPA)
- Intelligent Document Processing (IDP)
- Artificial Intelligence and Machine Learning"

Source: Process Maker

Automation Market Size In 2022 with Top Countries Data : What are the major factors impacting Industry growth during the forecast period?

"Automation Market In 2022 (Short Description): Industrial automation software includes human-machine interface (HMI), manufacturing execution system (1v1ES), programmable logical controller (PLC), distributed control system (DCS), and supervisory control and data acquisition (SCADA). The global automation market in the automotive industry is a contributing segment of the global industrial automation software market."
Source: Market Watch

approach to indoor robot navigation. Most systems rely on optical light sensors such as cameras and LiDARs. In this case, the so-called "WiFi sensors" use radio frequency signals rather than light or visual cues to see, so they can work in conditions where cameras and LiDARs struggle -- in low light, changing light, and repetitive environments such as long corridors and warehouses.

And by using WiFi, the technology could offer an economical alternative to expensive and power hungry LiDARs, the researchers noted."

Source: University of California - San Diego

Taste of the future: Robot chef learns to 'taste as you go'

"Working in collaboration with domestic appliances manufacturer Beko, researchers from the University of Cambridge trained their robot chef to assess the saltiness of a dish at different stages of the chewing process, imitating a similar process in humans.

Their results could be useful in the development of automated or semi-automated food preparation by helping robots to learn what tastes good and what doesn't, making them better cooks... The researchers found that this 'taste as you go' approach significantly improved the robot's ability to quickly and accurately assess the saltiness of the dish over other electronic tasting technologies, which only test a single homogenised sample. The results are reported in the journal Frontiers in Robotics & AI."

Source: University of Cambridge

An easier way to teach robots new skills

"With e-commerce orders pouring in, a warehouse robot picks mugs off a shelf and places them into boxes for shipping. Everything is humming along, until the warehouse processes a change and the robot must now grasp taller, narrower mugs that are stored upside down.

Reprogramming that robot involves hand-labeling thousands of images that show it how to grasp these new mugs, then training the system all over again.

But a new technique developed by MIT researchers would require only a handful of human demonstrations to reprogram the robot. This machine-learning method enables a robot to pick up and place never-before-seen objects that are in random poses it has never encountered. Within 10 to 15 minutes, the robot would be ready to perform a new pick-and-place task."

Source: Massachusetts Institute of Technology

individual support and organizational development initiatives to serve both faculty and administrative needs."

Source: Ingenta Connect

The age of holistic consolidation and automation of cyber security

"Solution saturation is plaguing the cyber security market. Technology has driven the security strategy for security teams for far too long, which only compounds the problem, leaving them with too many tools, and with cross-functionality and gaps remaining in their security posture. Organisations need to shift the way they think about their cyber security challenges and how they can overcome them."

Source: MAG Online Library

AUTONOMOUS VEHICLES

A Hybrid CNN Real-Time Object Identification and Classification Approach for Autonomous Vehicles

"Autonomous Vehicles (AVs) are progressively attaining attention globally. It consists of clear and transparent potential future in the upcoming generations and it is estimated that it will intensely differ the transportation as we know it by today. An automated driving system is a complicated and complex association of several constituents. The identification and classification of any object and traffic road sign is an important job for any autonomous vehicle at the same time achieving the 100% accuracy is also difficult and complex task. In this paper, we have put forward the proposal for hybrid CNN deep learning model for real-time identification and classification of objects and simulation-based results proved that the modified version CNN model performed very well with accuracy more than 95%."

Source: Springer Link

Neuroevolutionary Multi-objective approaches to Trajectory Prediction in Autonomous Vehicles

"The incentive for using Evolutionary Algorithms (EAs) for the automated optimization and training of deep neural networks (DNNs), a process referred to as neuroevolution, has gained momentum in recent years. The configuration and training of these networks can be posed as optimization problems. Indeed, most of the recent works on neuroevolution

ROBOTICS INDUSTRY

Growth Opportunities In Robotics, Additive Manufacturing, Atomic Layer Deposition And Drive Systems

"The Advanced Manufacturing Technology Opportunity Engine for May 2022 covers innovations pertaining to robotics, additive manufacturing, atomic layer deposition and drive systems. Some of the innovations profiled include Volumetric 3-Dimensional (3d) Printing Technique, Underwater Robot for Offshore Applications, Remotely Operated Demolition Robotic Solutions, Atomic Layer Deposition (ALD) Technology among others.

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 Robotics, Smart Welding, Industrial Iot Platform And 3d Printing

"The Advanced Manufacturing Technology Opportunity Engine for April 2022 covers innovations pertaining to robotics, smart welding, IIoT and 3D printing. Some of the innovations profiled include smart welding solutions, low case wire arc additive manufacturing technology, additive manufacturing for the construction industry, IIoT platform, robotic exoskeletons integrated with Artificial intelligence, humanoid robot for the healthcare industry and weeding robots suitable for the agricultural industry among others.

The Advanced Manufacturing TOE covers global innovations and developments related to manufacturing and industrial

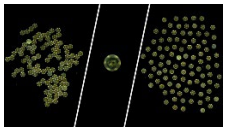
How to compete with robots

"When it comes to the future of intelligent robots, the first question people ask is often: how many jobs will they make disappear? Whatever the answer, the second question is likely to be: how can I make sure that *my* job is not among them?

In a study just published in *Science Robotics*, a team of roboticists from EPFL and economists from the University of Lausanne offers answers to both questions. By combining the scientific and technical literature on robotic abilities with employment and wage statistics, they have developed a method to calculate which of the currently existing jobs are more at risk of being performed by machines in the near future. Additionally, they have devised a method for suggesting career transitions to jobs that are less at risk and require smallest retraining efforts."

Source: Ecole Polytechnique Fédérale de Lausanne

MICROROBOTS



Microrobot collectives display versatile movement patterns

"Researchers at the Max Planck Institute for Intelligent Systems (MPI-IS), Cornell University and Shanghai Jiao Tong University have developed collectives of microrobots which can move in any desired formation. The miniature particles are capable of reconfiguring their swarm behavior quickly and robustly. Floating on the surface of water, the versatile microrobotic discs can go round in circles, dance the boogie, bunch up into a clump, spread out like gas or form a straight line like beads on a string."

Source: Max Planck Institute for Intelligent Systems

SOFT ROBOTICS

New sensor that mimics automatic human reaction to heat could pave the way for 'soft robots of the future'

"The device has been built by a team of experts from Liverpool Hope University, who say it's the first sensor that can trigger this "sensory impulse" that the robotics community has yet seen.

The findings have been published in IEEE Xplore last December 15, 2021 as have focused their attention on single-objective optimization. Moreover, from the little research that has been done at the intersection of neuroevolution and evolutionary multi-objective optimization (EMO), all the research that has been carried out has focused predominantly on the use of one type of DNN: convolutional neural networks (CNNs), using well-established standard benchmark problems such as MNIST. In this work, we make a leap in the understanding of these two areas (neuroevolution and EMO), regarded in this work as neuroevolutionary multi-objective, by using and studying a rich DNN composed of a CNN and Long-short Term Memory network."

Source: Cornell University

Study of ROS-Based Autonomous Vehicles in Snow-Covered Roads by Means of Behavioral Cloning Using 3DCoAutoSim

"Autonomous driving in winter weather conditions has always been a unique challenge, and as such it is an interesting research topic. Due to reasons related to safety and local laws, simulators have become one of the first choice for the required research. This paper extends the capabilities of the 3DCoAutoSim simulation platform with a realistic simulation environment for the study of autonomous driving with ROS-controlled vehicles in adverse weather conditions such as snow-covered roads. The weather-related details of the environment such as snow fall and car tracks on the snow were implemented by using Unity3D's physics and graphics engine."

Source: Springer Link

An Approach to Real-Time Collision Avoidance for Autonomous Vehicles Using LiDAR Point Clouds

"This paper proposes a novel approach for solving the problem of collision avoidance for autonomous vehicles starting from data provided by LiDAR sensors. Rather than attempting the actual recognition of pedestrians or other moving or static objects – as in the solutions based on machine learning - we define "safety bubbles" around the vehicle and all the other moving entities identified within the on-vehicle LiDAR sensing area, and issue a signal for the upper control layers when the boundary of the vehicle's safety bubble intersects with other objects' bubbles. The shape and size of these safety bubbles are dynamically adjusted depending on the speed of the objects. This 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

Industrial Robotics Market Size In 2022 with Top Countries Data : Which is the most influencing segment growing in the global Industry?

"According to this latest study, In 2022 the growth of Industrial Robotics Market will have significant change from previous year. Over the next five years the Industrial Robotics Market will register a magnificent spike in CAGR in terms of revenue, In this study, 2021 has been considered as the base year and 2022 to 2026 as the forecast period to estimate the market size for Industrial Robotics."

Source: Market Watch

5 Robotics Trends in 2022

"2021 was a transformative year in development, adoption, funding, and M&A activity in the robotics industry. 2022 is off to a robust start and all signs point to rapid robotics growth over the next decade. Below are five key robotics trends to watch in 2022."

Source: Robotics Tomorrow

Service Robots 2022-2032: Technologies, Players & Markets

"Service robots are becoming increasingly popular. This report provides a comprehensive analysis of the major application areas of service robots, including delivery and logistics robots, cleaning and disinfection robots, social robots, agricultural robots, kitchen and restaurant robots, and underwater robots. It covers key technologies, market analysis, and 10-year granular regional market forecasts. The report provides an understanding of the market dynamics, competitive landscape, market outlook, and promising applications.

Robots have the potential to revolutionize so many aspects of the

an early-access article and published this month in the *IEEE Sensors Journal*. Lead author Alexander Co Abad, of Hope's School of Mathematics, Computer Science and Engineering, says the system is so robust it can measure temperature changes of 30 degrees C per second – similar to how someone might quickly pull their hand away from the threat of being burned."
Source: Robotics & Automation News

Dancing In the Light

"Mastering control over the dynamic interplay among optical, chemical and mechanical behavior in single-material, liquid crystalline elastomers, results in microposts that combine bending, twisting and turning into complex dances. The advancement could contribute toward further development of soft robotics and other devices."
Source: University of Pittsburgh

Twisted Soft Robots Navigate Mazes Without Human Or Computer Guidance

"Researchers from North Carolina State University and the University of Pennsylvania have developed soft robots that are capable of navigating complex environments, such as mazes, without input from humans or computer software.
"These soft robots demonstrate a concept called 'physical intelligence,' meaning that structural design and smart materials are what allow the soft robot to navigate various situations, as opposed to computational intelligence," says Jie Yin, corresponding author of a paper on the work and an associate professor of mechanical and aerospace engineering at NC State.
The soft robots are made of liquid crystal elastomers in the shape of a twisted ribbon, resembling translucent rotini. When you place the ribbon on a surface that is at least 55 degrees Celsius (131 degrees Fahrenheit), which is hotter than the ambient air, the portion of the ribbon touching the surface contracts, while the portion of the ribbon exposed to the air does not. This induces a rolling motion in the ribbon. And the warmer the surface, the faster it rolls."
Source: North Carolina State University

SWARM ROBOTICS

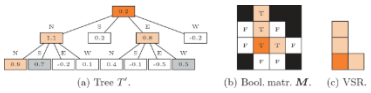
UAE scientists figure out way to get swarm robots to split up tasks efficiently

solution is an extension/adaptation of an idea successfully applied in one of our previous works in the context of the problem of obstacle avoidance for mobile robots."
Source: Sciendo

Enhanced decision making in multi-scenarios for autonomous vehicles using alternative bidirectional Q network

"To further enhance decision making in autonomous vehicles field, grant more safety, comfort, reduce traffic, and accidents, learning approaches were adopted, mainly reinforcement learning. However, possibility in upgrading these algorithms is still available due to many limitations including : convergence rate, stability, handling multiple dynamic environments, raw performance, robustness, and complexity of algorithms. To tackle these problems, we propose a novel extension of the well-known deep Q network called "alternative bidirectional Q network" that aims mainly to enhance stability and performance with improving exploration and Q values update policies, to overcome the literature gap that generally focuses on only one policy to handle decision making in multiple scenarios (avoiding obstacles, goal-oriented environments, etc.)."
Source: Springer Link

SOFT ROBOTICS



On the Schedule for Morphological Development of Evolved Modular Soft Robots

"Development is fundamental for living beings. As robots are often designed to mimic biological organisms, development is believed to be crucial for achieving successful results in robotic agents, as well. What is not clear, though, is the most appropriate scheduling for development. While in real life systems development happens mostly during the initial growth phase of organisms, it has not yet been investigated whether such assumption holds also for artificial creatures. In this paper, we employ a evolutionary approach to optimize the development—according to different representations—of Voxel-based Soft Robots (VSRs), a kind of modular robots. In our study, development consists in the addition of new voxels to the VSR, at fixed time instants, depending on the development schedule. We experiment with different schedules

modern world, from optimizing industrial efficiency to improving our everyday lives. Unlike the traditional robots used in industrial applications, service robots are primarily designed to support people in their daily life. As a broad definition, service robot covers a wide range of applications and types of robots, ranging from logistics and delivery robots, social robots, cleaning robots, disinfection robots, robotic chefs/kitchen robots, robotic waiters/restaurant robots, agricultural robots, and underwater robots. While the service robot market is at a much earlier stage of development than the traditional industrial robots, there is increasing effort within this space to promote the adoption of service robots. The intensity of competition and stage of development varies significantly depending on the application. IDTechEx's latest report on "Service Robots 2022-2032" takes a deep dive into the applications mentioned above with an analysis of the technologies, players, and markets with granular forecasts for the next 10 years."
Source: ID Tech Ex

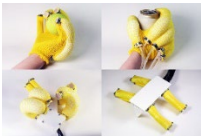
"The ideas – published in the paper, Group-Size Regulation in Self-organized Aggregation in Robot Swarms – could spark interest in better ways of controlling lots of simple robots to do more complicated tasks independently, with little or no outside communication.
Much prior work has been done to organizing swarms of drones to perform impressive tasks, such as a coordinated light show. But these approaches often relied on centralized coordination, expensive equipment in each drone, or both.
The TII researchers are exploring different ways to scale a swarm using a mass of simple robots working in concert with a few smarter ones."
Source: Robotics and Automation News

Molecular robots work cooperatively in swarms

"Swarm robotics is a new discipline, inspired by the cooperative behavior of living organisms, that focuses on the fabrication of robots and their utilization in swarms to accomplish complex tasks. A swarm is an orderly collective behavior of multiple individuals. Macro-scale swarm robots have been developed and employed for a variety of applications, such as transporting and accumulating cargo, forming shapes, and building complex structures.

A team of researchers, led by Dr. Mousumi Akter and Associate Professor Akira Kakugo from the Faculty of Science at Hokkaido University, has succeeded in developing the world's first working micro-sized machines utilizing the advantages of swarming. The findings were published in the journal *Science Robotics*. The team included Assistant Professor Daisuke Inoue, Kyushu University; Professor Henry Hess, Columbia University; Professor Hiroyuki Asanuma, Nagoya University; and Professor Akinori Kuzuya, Kansai University."
Source: Hokkaido University

ACTUATORS



Soft assistive robotic wearables get a boost from rapid design tool

"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: MIT CSAIL

and show that, similarly to living organisms, artificial agents benefit from development occurring at early stages of life more than from development lasting for their entire life."
Source: Springer Link

Modeling the Locomotion of Articulated Soft Robots in Granular Medium

"We introduce a numerical tool for modeling articulated soft robots that couples discrete differential geometry-based simulation of elastic rods, our model for the articulated structure, and other external forces. Parallel to simulations, we build an untethered robot testbed, in the granular medium, comprised of multiple flexible flagella that are rotated about an axis by a motor. Drag from the granules causes the flagella to deform and the deformed shape generates a net forward propulsion. External drag depends on the flagellar shape, while the change in flagellar shape is the result of the competition between the external loading and elastic forces. We find reasonable quantitative agreement between experiments and simulations."
Source: IEEE Xplore

Bioinspired light-fueled water-walking soft robots based on liquid crystal network actuators with polymerizable miniaturized gold nanorods

"Walking on water is a unique locomotion mode found in aquatic living creatures. However, it remains challenging to create light-driven aquatic soft robots that can walk freely on water surface. Herein, water strider-inspired water-walking soft robots that can be remotely controlled by light are demonstrated through combining superhydrophobic floating surface with hierarchical nanostructures and light-driven soft-actuation legs that are fabricated through in situ embedding of judiciously designed polymerizable miniaturized gold nanorods (MiniGNR nanomonomer) in liquid crystal network (LCN)-based soft actuators. The MiniGNRs-LCN soft actuators act as driving paddles to enable propulsive motion on the water surface, and the superhydrophobic surface facilitates the aquatic soft robots with weight-bearing and drag-reducing ability."
Source: Science Direct

SoRoCAD: A Design Tool for the Building Blocks of Pneumatic Soft Robotics

"Soft robotics uses soft, flexible materials and elastic actuation

ROBOT-HUMAN INTERACTIONS

Robots dress humans without the full picture

"Robots are already adept at certain things, such as lifting objects that are too heavy or cumbersome for people to manage. Another application they're well suited for is the precision assembly of items like watches that have large numbers of tiny parts — some so small they can barely be seen with the naked eye.

"Much harder are tasks that require situational awareness, involving almost instantaneous adaptations to changing circumstances in the environment," explains Theodoros Stouraitis, a visiting scientist in the Interactive Robotics Group at MIT's Computer Science and Artificial Intelligence Laboratory (CSAIL)."

Source: MIT CSAIL

Researchers develop algorithm to divvy up tasks for human-robot teamsv

"Researchers at Carnegie Mellon University's Robotics Institute (RI) have developed an algorithmic planner that helps delegate tasks to humans and robots. The planner, "Act, Delegate or Learn" (ADL), considers a list of tasks and decides how best to assign them. The researchers asked three questions: When should a robot act to complete a task? When should a task be delegated to a human? And when should a robot learn a new task?

"There are costs associated with the decisions made, such as the time it takes a human to complete a task or teach a robot to complete a task and the cost of a robot failing at a task," said Shivam Vats, the lead researcher and a Ph.D. student in the RI. "Given all those costs, our system will give you the optimal division of labor.""

Source: Carnegie Mellon University

3D PRINTING

How to print a robot from scratch: New 3D-printing approach melds solids, liquids

"Imagine a future in which you could 3D-print an entire robot or stretchy, electronic medical device with the mechanisms to create systems that are more adaptable and tolerant to unknown environments, and safer for human-machine interaction, than rigid robots. Pneumatic soft robots can be fabricated using more affordable materials compared to traditional robots and make use of technologies such as 3D printing, making them an attractive choice for research and DIY projects. However, their design is still highly unintuitive, and at up to two days, design iterations can take prohibitively long: The behavior of, e.g., a pneumatic silicone gripper only becomes apparent after designing and 3D printing its mold, casting, curing, assembling, and testing it. We introduce SoRoCAD, a design."

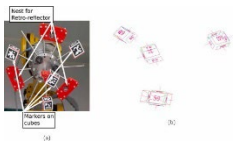
Source: ACM Digital Library

Actuated Materials and Soft Robotics Strategies for Human-Computer Interaction Design

"The fields of programmable matter, actuated materials, and Soft Robotics are becoming increasingly more relevant for the design of novel applications, interfaces, and user experiences in the domain of Human-Computer Interaction (HCI). These research fields often use soft, flexible materials with elastic actuation mechanisms to build systems that are more adaptable, compliant, and suitable for a very broad range of environments. However, at the intersection between HCI and the aforementioned domains, there are numerous challenges related to fabrication methods, development tools, resource availability, nomenclature, design for inclusion, etc. This workshop aims to explore how to make Soft Robotics more accessible to both researchers and nonresearchers alike."

Source: ACM Digital Library

INDUSTRIAL ROBOTS



Identification of elasto-static parameters of an industrial robot using monocular camera

"This article discusses the identification of elasto-static parameters of an industrial robot using measurements from a monocular camera. The method of identification involved a parametric method for estimation and the experimental strategy involved joint wise actuation about a particular pose, inspired by the geometric method of parameter identification. The measurements were made using a monocular camera utilizing fiducial

press of a button—no tedious hours spent assembling parts by hand.
That possibility may be closer than ever thanks to a recent advancement in 3D-printing technology led by engineers at CU Boulder. In a new study, the team lays out a strategy for using currently available printers to create materials that meld solid and liquid components—a tricky feat if you don't want your robot to collapse.
"I think there's a future where we could, for example, fabricate a complete system like a robot using this process," said Robert MacCurdy, senior author of the study and assistant professor in the Paul M. Rady Department of Mechanical Engineering.
MacCurdy, along with doctoral students Brandon Hayes and Travis Hainsworth, published their results April 14 in the journal Additive Manufacturing."
Source: University of Colorado at Boulder

MEDICAL TECHNOLOGY

Robotic surgery is safer and improves patient recovery time

"The study, published in JAMA and funded by The Urology Foundation with a grant from the Champniss Foundation, also found robotic surgery reduced the chance of readmission by half (52 per cent), and revealed a "striking" four-fold (77 per cent) reduction in prevalence of blood clots (deep vein thrombus & pulmonary emboli) - a significant cause of health decline and morbidity - when compared to patients who had open surgery.
Patients' physical activity - assessed by daily steps tracked on a wearable smart sensor - stamina and quality of life also increased.
Unlike open surgery, where a surgeon works directly on a patient and involves large incisions in the skin and muscle, robot-assisted surgery allows surgeons to guide minimally invasive instruments remotely using a console and aided by 3D view. It is currently only available in a small number of UK hospitals."
Source: University College London

Joystick-operated robot could help surgeons treat stroke remotely

"MIT engineers have developed a telerobotic system to help surgeons quickly and remotely treat patients experiencing a stroke or aneurysm. With a modified joystick, surgeons in markers. The joint compliance values were obtained using a two-stage approach which made it easy to analyze the observability of parameters to be identified. Coupled with the proposed strategy of experiments, it was possible to check the observability of parameters throughout the whole workspace. It was found that most of the workspace regions of the robot where the experiments were feasible, had high values of observability which simplified the experiments."
Source: Elsevier

A practical and synchronized data acquisition network architecture for industrial robot predictive maintenance in manufacturing assembly lines

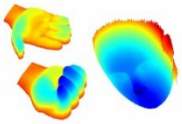
"This manuscript presents a methodology and a practical implementation of a network architecture for industrial robot data acquisition and predictive maintenance. We propose a non-intrusive and scalable robot signal extraction architecture, easily applicable in real manufacturing assembly lines. The novelty of the paper lies in the fact that it is the first proposal of a network architecture which is specially designed to address the predictive maintenance of industrial robots in real production environments. All the infrastructure needed for the implementation of the architecture is comprised of traditional well-known industrial assets. We synchronize the data acquisition with the execution of robot routines using common Programmable Logic Controllers (PLC) to obtain comparable data batches."
Source: Elsevier

How to compete with robots by assessing job automation risks and resilient alternatives

"The effects of robotics and artificial intelligence (AI) on the job market are matters of great social concern. Economists and technology experts are debating at what rate, and to what extent, technology could be used to replace humans in occupations, and what actions could mitigate the unemployment that would result. To this end, it is important to predict which jobs could be automated in the future and what workers could do to move to occupations at lower risk of automation. Here, we calculate the automation risk of almost 1000 existing occupations by quantitatively assessing to what extent robotics and AI abilities can replace human abilities required for those jobs. Furthermore, we introduce a method

one hospital may control a robotic arm at another location to safely operate on a patient during a critical window of time that could save the patient's life and preserve their brain function.
The robotic system, whose movement is controlled through magnets, is designed to remotely assist in endovascular intervention — a procedure performed in emergency situations to treat strokes caused by a blood clot. Such interventions normally require a surgeon to manually guide a thin wire to the clot, where it can physically clear the blockage or deliver drugs to break it up."
Source: Massachusetts Institute of Technology

TECHNOLOGY



How Eye Imaging Technology Could Help Robots and Cars See Better

"Even though robots don't have eyes with retinas, the key to helping them see and interact with the world more naturally and safely may rest in optical coherence tomography (OCT) machines commonly found in the offices of ophthalmologists.
One of the imaging technologies that many robotics companies are integrating into their sensor packages is Light Detection and Ranging, or LiDAR for short. Currently commanding great attention and investment from self-driving car developers, the approach essentially works like radar, but instead of sending out broad radio waves and looking for reflections, it uses short pulses of light from lasers."
Source: Duke University

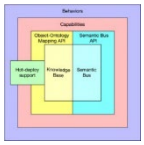
SECURITY

Prioritising security in the robotics industry

"As an industry, the tech sector overlooked the need for strict security measures for IoT, and we must ensure the same doesn't happen with robotics.
This starts with a watertight, proactive security strategy that ensures that there are enough levels of protection in place. For instance, just having a password in place won't be enough to keep hackers out.
Multi-factor authentication methods should be implemented to ensure a business is doing all it can to keep its

to find, for any occupation, alternatives that maximize the reduction in automation risk while minimizing the retraining effort."
Source: Science Robotics

SOCIAL ROBOTS



A reference architecture for social robots

"Social robotics poses tough challenges to software designers who are required to take care of difficult architectural drivers like acceptability, trust of robots as well as to guarantee that robots establish a personalized interaction with their users. Moreover, in this context recurrent software design issues such as ensuring interoperability, improving reusability and customizability of software components also arise. Designing and implementing social robotic software architectures is a time-intensive activity requiring multi-disciplinary expertise: this makes it difficult to rapidly develop, customize, and personalize robotic solutions. These challenges may be mitigated at design time by choosing certain architectural styles, implementing specific architectural patterns and using particular technologies. Leveraging on our experience in the MARIO project, in this paper we propose a series of principles that social robots may benefit from."
Source: Elsevier

Social robots and the risks to reciprocity

"A growing body of research can be found in which roboticists are designing for reciprocity as a key construct for successful human–robot interaction (HRI). Given the centrality of reciprocity as a component for our moral lives (for moral development and maintaining the just society), this paper confronts the possibility of what things would look like if the benchmark to achieve perceived reciprocity were accomplished. Through an analysis of the value of reciprocity from the care ethics tradition the richness of reciprocity as an inherent value is revealed: on the micro-level, as mutual care for immediate care givers, and on the macro-level, as foundational for a just society. Taking this understanding of reciprocity into consideration, it becomes clear that HRI cannot achieve this bidirectional value of reciprocity; a robot must deceive users into believing it is capable of reciprocating to humans or is

sensitive data safe. This could also make privilege escalation more challenging for attackers. Even using an OS with a containerised architecture could guarantee that attackers will operate in a sandbox."
Source: Robotics & Automation News

deserving of reciprocation from humans."
Source: Springer Link

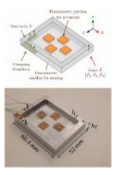
Language matters: humanizing service robots through the use of language during the COVID-19 pandemic

"Service robots are emerging quickly in the marketplace (e.g., in hotels, restaurants, and healthcare), especially as COVID-19-related health concerns and social distancing guidelines have affected people's desire and ability to interact with other humans. However, while robots can increase efficiency and enable service offerings with reduced human contact, prior research shows a systematic consumer aversion toward service robots relative to human service providers. This potential dilemma raises the managerial question of how firms can overcome consumer aversion and better employ service robots. Drawing on prior research that supports the use of language for building interpersonal relationships, this research examines whether the type of language (social-oriented vs. task-oriented language) a service robot uses can improve consumer responses to and evaluations of the focal service robot, particularly in light of consumers' COVID-19-related stress."
Source: Springer Link

Affective Attitudes Toward Robots at Work: A Population-Wide Four-Wave Survey Study

"Robotization of work is progressing fast globally, and the process has accelerated during the COVID-19 pandemic. Utilizing integrated threat theory as a theoretical framework, this study investigated affective attitudes toward introducing robots at work using a four timepoint data ($n = 830$) from a Finnish working population longitudinal study. We used hybrid multilevel linear regression modelling to study within and between participant effects over time. Participants were more positive toward introducing robots at work during the COVID-19 pandemic than before it. Increased cynicism toward individuals' own work, robot-use self-efficacy, and prior user experiences with robots predicted positivity toward introducing robots at work over time."
Source: Springer Link

COLLABORATIVE ROBOTS



Resonant sensors for multi-axis force and torque estimation in collaborative robotics

"This paper presents a complete design methodology for a multi-axis resonant force sensor. The proposed device has been designed to be useable in a context of physical interaction between robots and humans. The proposed solution allows the three force components and the three torque components to be measured simultaneously and can be inserted into an interface handle or a robot end-effector. The information on wrench can then be used to detect and control interactions for cooperative tasks between humans and robots. In the context of sensors for robotic co-manipulation, it is imperative to guarantee not only a certain level of performance (accuracy, dynamics, size) but also to guarantee certain non-functional specifications associated with safety, measurement redundancy or functional integration of the sensor into its environment."

Source: Elsevier

SERVICE ROBOTS

Service robots for affective labor: a sociology of labor perspective

"Profit-oriented service sectors such as tourism, hospitality, and entertainment are increasingly looking at how professional service robots can be integrated into the workplace to perform socio-cognitive tasks that were previously reserved for humans. This is a work in which social and labor sciences recognize the principle role of emotions. However, the models and narratives of emotions that drive research, design, and deployment of service robots in human–robot interaction differ considerably from how emotions are framed in the sociology of labor and feminist studies of service work. In this paper, we explore these tensions through the concepts of affective and emotional labor, and outline key insights these concepts offer for the design and evaluation of professional service robots. Taken together, an emphasis on interactionist approaches to emotions and on the demands of affective labor, leads us to argue that service employees are under-represented in existing studies in human–robot interaction."

Source: Springer Link

DESIGN THINKING

Evaluating Design Cards for Supporting Design Thinking in the Context of Open Robotics and IoT Competitions

"Although educational robotics and IoT competitions have been described as a productive learning field in the context of STEAM education, there is a lack of research concerning the design process that occurs in student teams and the connection with design thinking methodologies. This study aims to propose and evaluate an approach for supporting design thinking in the context of STEAM, educational robotics and IoT, for elementary school students. The proposed methodology relies on participatory design approaches and is based on 40 design cards, which aim at the supported exploration of problems, needs, opportunities, and ideas."

Source: Springer Link