

Department of Information Technology

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'Human-Like' Brain Helps Robot out of a Maze

HIGHLIGHTS

Researchers from Eindhoven University of Technology (TU/e) and the Max Planck Institute for Polymer Research in Mainz, Germany, have proven that the neuromorphic robots can move autonomously

⇒ ['Human-like' brain helps robot out of a maze](#)

⇒ [How to move deeper into the Cloud Continuum with 5 key practices](#)

Researchers at the Eindhoven University of Technology (TU/e) and the Max Planck Institute for Polymer Research in Mainz, Germany, have proven that robots can learn to successfully navigate the twists and turns of a maze. Their robot bases its decisions on a human-like brain. The study, titled Organic neuromorphic electronics for sensorimotor integration and learning in robotics, has been published in Science Advances. This study paves the way to exciting new applications of neuromorphic devices in health and beyond.

Machine learning and neural networks have a drawback because they consume too much power to train the algorithms. This power issue is one of the reasons that researchers have been trying to develop computers that are much more energy efficient. The human brain is a great example for a thinking machine unrivalled in its low power consumption due to how it combines memory and processing.

In our research, we have taken this model to develop a robot that is able to learn to move through a labyrinth”,

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explains Imke Krauhausen, PhD student at the department of Mechanical Engineering at TU/e and principal author of the paper. "Just as a synapse in a mouse brain is strengthened each time it takes the correct turn in a psychologist's maze, our device is 'tuned' by applying a certain amount of electricity. By tuning the resistance in the device, you change the voltage that control the motors. They in turn determine whether the robot turns right or left."

The robot that Krauhausen and her colleagues used for their research is a Mindstorms EV3, a robotics kit made by Lego. Equipped with two wheels, traditional guiding software to make sure it can follow a line, and a number of reflectance and touch sensors, it was sent into a 2 m² large maze made up out of black-lined hexagons in a honeycomb-like pattern.

Another clever thing about the research is the organic material used for the neuromorphic robot. This polymer (known as p(g2T-TT)) is not only stable, but it also is able to 'retain' a large part of the specific states in which it has been tuned during the various runs through the labyrinth. This ensures that the learned behavior 'sticks', just like neurons and synapses in a human brain remember events or actions.

The use of polymer instead of silicon in the field of neuromorphic computing was pioneered by Paschalis Gkoupidenis of the Max Planck Institute for Polymer Research in Mainz and Yoeri van de Burgt of TU/e, both co-authors of the paper. In their research (dating from 2015 and 2017), they proved that the material can be tuned in a much larger range of conduction than inorganic materials, and that it is able to 'remember' or store learned states for extended periods. Since then, organic devices have become a hot topic in the field of hardware-based artificial neural networks.

'How to move deeper into the Cloud Continuum with 5 key practices'

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<https://www.accenture.com/us-en/blogs/>

I got into the field of technology because I'm fascinated by the potential it creates for people and all types of organizations, including government, non-profit, start-ups and large companies alike. That's why I want to talk to you today about the Cloud Continuum.

In my current role advising businesses how to leverage technology in their companies, I often think back to those early jobs where the goal was very different, but the process was much the same. No matter what big change an organization hopes to achieve, a first step is knowing your purpose, aligning strategy to it and seeing the potential for technology to improve how we work and the products and services we provide.

THIS IS ESPECIALLY TRUE FOR CLOUD.

Although we've been talking about cloud for decades, businesses today are at a tipping point where cloud spend will soon surpass non-cloud spend. When I talk to clients now, they're at a different place. They aren't asking how to migrate to the cloud, but about how to get more value out of cloud by creating different experiences and products and simplifying how work gets done.

Too often, we hear that the "cloud spigot" is turned on with rising costs, but we're still not moving fast enough to innovate around customer needs. And digital natives have the advantage of changing the DNA of outdated industry processes and norms.

Additionally, cloud is no longer a single technology. It's a dynamic continuum of capabilities—from public to edge. Our recent research refers to this as the Cloud Continuum because innovations that used to be exclusively in the public cloud can now be found in multiple locations and destinations, creating a seamless continuum of capabilities to meet ever-changing business needs.

Strategic leaders view cloud as a future operating model rather than a static destination. A fitness retailer provides a great example of how to use cloud capabilities to power a new business model. They did this by coupling sensor-collected data and real-time analytics from those using their stationary bikes, to drive a better user experience, resulting in the ability to scale on-demand and more than 20% quarter-on-quarter growth.

‘How to move deeper into the Cloud Continuum with 5 key practices’

Strategic leaders are discovering how to capitalize on the Cloud Continuum and, in many instances shaping their industry transformation. They are two to three times more likely to innovate and re-engineer knowledge work, target up to 50% more business measures and are more likely to use cloud to meet corporate sustainability goals.

They do this by viewing cloud as a future operating model rather than a static destination. Not only do they pick the right cloud-based services, but they are also leveraging advanced practices to maximize business value.

MOVE DEEPER WITH 5 KEY PRACTICES.

How do we get there? While each organization has a different strategy, we see five leading practices that truly change and maximize value from the Cloud Continuum.

1. **Business Use Cases** – Above all, organizations must focus on industry-specific opportunities, offerings, and partnerships and look at how cloud is changing the game. Whether creating personalized offerings with omnichannel or more predictive and secure supply chains, high-value use cases exist and should be at the center of any cloud program. This shifts strategies from digitization and SaaS to intellectual property, vertical industry solutions and more strategic ecosystem partnerships.
2. **Value from Data** – Organizations closely coupling cloud and applied intelligence initiatives to exploit value from data are getting more traction. They are scaling advanced analytics and using AI and ML capabilities and marketplace data to differentiate experiences and solutions beyond the competition. For example, a fast-food company doubled market capitalization in two years through its cloud transformation, enabling self-service kiosks and allowing new customer channels and hyper-personalized loyalty programs.
3. **People & Ways of Working** – Organizations that prioritize people and culture as a part of their cloud transformation experience 60% greater value. Our research shows better results across the board, including customer experience, worker productivity and organizational agility and innovation. Key to success is a focus on alignment, ability and adoption. First, they align the C-suite, both business and IT, creating a combined understanding of the value of implementing new solutions from the continuum. They invest in their people to increase cloud skills and digital fluency across

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the entire organization and build structures that enable products versus siloed functions. Finally, they adopt new operating models to move faster, eliminate handoffs and continuously evolve and experiment with the data and technology.

4. Architecting for Hybrid – While the Cloud Continuum presents boundless opportunities, organizations can select and assemble the optimal set of services from multiple venues across the Continuum to fit their own business problems. To do so, organizations are moving from siloed cloud architectures to forward-looking platform strategies that enable intelligent decisioning across multiple clouds and new venues (such as IoT, Edge and Mobile).

5. Mastering the Cloud Economy – Lastly, organizations are fundamentally changing how they strategically invest in, and operationally manage technology enabled by consumption-based cloud expense models. They are taking a more product-centric approach to total cost of ownership and using agile funding approaches to break the monolith of traditional technology funding cycles.

To enable this, more mature "FinOps" or financial operating processes and tooling are used to increase transparency on value and costs for business units and functions in near real-time. For example, a large global financial services company established a FinOps capability that enabled more than \$7M in cost savings; it also enabled reporting in an hour that used to take a month.

THE CLOUD CONTINUUM IS A JOURNEY

While the Cloud Continuum holds potential to create significant business upsides, mastering new practices is the key to successfully transforming the organization across the board. No matter where an organization is on the Continuum, more ROI and continuous improvement are possible. I've had the pleasure of working with several organizations as they work through this process and it's always a learning experience. I liken the cloud journey to settling into a new home. You move into your new home with your new stuff from your old place. Some of that stuff will fit in and some will have to go. Similarly, the cloud is not just a place to store things; the solutions available in the market today are there to offer different levels of cloud services and help clients differentiate, uplift revenue, free up cash flow and create new experiences.