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TECH FOR GROWTH FORUM

Harnessing technology to drive growth

The next business tool is a dynamic world model that learns, adapts and anticipates

AVEVA

Living digital twins combine real-time data, operational context and AI analytics to model possible futures, so business leaders can navigate uncertainty and make more informed decisions.

Masaharu Hatano deeply understands the experience of 50 million people around the world. As director of research at Japan's Senior Dementia Institute, he has a ringside view of how the disease affects the lives of patients and their families, and its sudden episodes of anxiety, wandering, delusions, even aggression. Determined to make a difference, he and his team tried a new approach. They listened to the subtle, everyday signals in each patient's life in an attempt to understand the underlying patterns behind these behavioural and psychological symptoms.

Using artificial intelligence (AI) and machine learning, the researchers paired caregivers' observations with medical and environmental data such as heart rate, movement, shifts in humidity and light to build an evolving digital portrait that tracked the onset of particular symptoms. For instance, one correlation the Dementia Care Assistive Artificial Intelligence model (DeCaAI) showed was between a sudden increase in heart rate and the onset of behavioural and psychological symptoms. Similarly, the analysis linked Japan's unstable late-summer weather and low pressure to disrupted sleep and unusual behaviour in August and September.

In all, the team identified 19 behaviour patterns, predicting each 30 to 60 minutes beforehand, with 83.2% accuracy. With real-time AI alerts of potential incidents, caregivers can support patients better.

"As the number of people living with dementia continues to rise, the burden on caregivers is also increasing," Hatano says. "There is a growing need for more efficient, data-driven care solutions."

When data starts to anticipate events

This is the promise of the living digital twin: moving from observation to anticipation. While the first generation of digital twins acted as a snapshot of a process or plant, the living digital twin also learns how a system behaves and how its parts influence one another. That means tracking heart rate, sleep patterns, weather or movement, for instance, and then looking at the relationships between them. Does a quicker pulse follow a restless night? How does that correlate to air pressure variations?

AI's pattern recognition ability can identify these relationships in real time, building a kind of world model that captures the behaviour of the plant, process or ecosystem to provide a basis for reasoning and judgement.

Like a chess grandmaster who analyses patterns on the board and mentally explores many possible sequences before making a move, a living digital twin evaluates alternative futures as new information becomes available, creating a dynamic representation of the board, the pieces and how they interact. Each move updates that world model, so the player can explore possible futures before making the next move.

Living digital twins apply the same principle to industrial value chains. As new data flows in from production processes, these AI-infused data-rich systems serve as a continuously evolving simulation layer that can be used to anticipate future states, test scenarios and provide decision support.

“Think of the living digital twin as a petri dish where you can explore millions of real-world solutions across the business—so you can converge on the best operational scenario without paying the cost of failure,” says Gallig Renaud, Fellow and Vice President, Emerging Tech Incubation at AVEVA. “Data, AI, and experimentation come together within this virtual world model to answer one question: ‘What should we do next?’”

Real-world experience backs this up. At the Thai petrochemicals major SCG Chemicals, a cross-functional AI reliability platform – built on a digital twin spanning engineering, operations and maintenance – provides end-to-end operational visibility of real-time data and analytics. Workers are empowered in different ways across the plant floor: operators receive alerts about process deviations from historical trends, cross-functional teams can collaborate in real time, and management can plan for emergencies in advance. Overall, the platform has delivered 99% plant reliability and 9x ROI in six months.

Why resilience needs simulation

Those numbers show how businesses can meet the challenge of doing more with less at a time when they also have less room to move. Geopolitical shocks and unpredictable policies mean elevated uncertainty is becoming the new normal. As organisations look ahead, resilience and agility are becoming central to the way they operate and invest.

A deeper understanding of complex systems brings greater confidence to every decision, making it easier to recognise new possibilities and act on them. Richer visual representations can provide that understanding, revealing how decisions play out before they are put into practice. On the factory floor, that means bringing together an organisation’s physical behaviour, engineering knowledge and operational history.

- Production avoids bottlenecks.
- Maintenance can optimise downtime windows.
- Purchasing can adjust orders dynamically.
- Sustainability engineers can simulate countless production scenarios to balance efficiency and emissions.

How a live model drives project efficiency

And in capital projects, it means seeing whether design choices hold up once contractors, engineers and operators are working against the same physical reality, as the engineering design company AP Consultoria e Projetos knows firsthand. By improving project visibility within an AI-infused cloud-based engineering environment, multidisciplinary teams can collaborate around a single source of truth, streamlining collaboration and improving project efficiency. Results include a 90% reduction in analysis time for pipe support type and position, while reducing total project delivery time by nearly 50%.

"If the SWOT analysis provides a snapshot of an organisation's internal capabilities and external environment, a living digital twin continuously lets us simulate complex trade-offs to predict problems and adapt in advance," Gallig Renaud says. "It's how we make industrial operations more scientific and less guesswork."

Industrial companies will still have to make the hard calls, whether around business direction, expansion, cost – or in some cases, around patient care. But more of those decisions can now be rehearsed before they're made. With a new industrial world model, uncertainty becomes easier to map, explore and work through.