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Supervised Autonomy: Why It Will Shape The Human-Robot Workforce Of The Future

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From virtual assistants to self-driving vehicles, autonomous

robotic technology is fast becoming integrated into our everyday lives, both at home and at work.

Across the industrial workforce, for example, interest in autonomous robotics is booming. Autonomous robots are beginning to help to solve key challenges, including widespread labor shortages and supply chain disruptions that were exacerbated by the Covid-19 pandemic. The U.S. Chamber of Commerce reports that nearly 3 million Americans have left the workforce since the beginning of 2020, and between January 2020 and January 2022, the labor force participation rate dropped more than 1%. Simply put, there are too many jobs and not enough workers—and this is especially true in labor-driven industries like construction, manufacturing and warehousing. In addition, given the already tight labor market, on-the-job injuries can lead to significant staffing challenges.

Automation, and specifically autonomous robots, can help offset these challenges by augmenting the human workforce. In fact, according to a recent Peerless Research Group survey, 23% of the organizations that participated use automation or autonomous robots in their warehouses, distribution centers or manufacturing operations, with another 21% planning to deploy robots within the next three years.

Despite significant advances in artificial intelligence (and despite what science fiction wants us to believe), most industries are not quite ready to implement fully autonomous robotic systems. Beyond performing structured, repetitive tasks that are typical on a factory floor, robotic autonomy is not rapidly achieved, especially in outdoor settings with uncontrolled lighting or varying environmental conditions, or when tasks are different each time they are performed. Rather, developing a system that

can gain and process meaningful data on its own requires long periods of training, for both the system and its human operators. Autonomous robots also must be use-case-specific; a robotic system being used at height on a construction site would require different sensors, cameras and communication systems than one being used on the ocean floor. At this point in time, keeping humans in the loop for decision-making and error handling is critical to a successful robotic implementation. This is where supervised autonomy comes into play.

The Role Of Supervised Autonomy

Rather than approaching autonomy as an all-or-nothing application, we should instead think of it as a spectrum. On one side, there is teleoperation, in which operators maintain complete control over a robot from a safe, remote distance. Teleoperation remains the most conventional method of operating a robot since it allows the operator to be in complete control of the robot.

Fully autonomous systems fall on the other side of the spectrum. These robotic systems do not require any human interaction to perform tasks and are responsible for all decision-making, actions and error handling. Outside of those repetitive tasks that we see in areas such as automotive factories or fulfillment centers, most industries are still years away from seeing a widespread

deployment of fully autonomous robots that can think and adapt to changing environments on their own in outdoor conditions or unstructured environments, such as on construction sites.

Existing autonomous robots perform poorly in dynamic and unstructured environments. Traditional machine learning (ML) requires a time-consuming and expensive trial-and-error training approach. Existing AI/ML solutions are environment-specific and hard to replicate as conditions change. Success-based training teaches robots control strategies to execute complex tasks through demonstrations and iterative learning and generalizes control skills to new (unobserved) situations autonomously.

Supervised autonomy, then, bridges the gap between teleoperated robotics and full autonomy. By automating specific tasks—but by keeping the human in the loop—robots using supervised autonomy and success-based training can help to improve worker safety and productivity while providing operators with the ability to intervene when necessary. Since the robot is programmed to perform specific operations on its own, supervised autonomy can minimize the amount of time workers need to spend in hazardous environments and performing fatigue-inducing tasks. The repeatability factor of supervised autonomy can reduce errors, leading to increased productivity and efficiency. And, unlike cobots, which require humans and robots to be in close proximity, supervised autonomy enables humans to oversee operations from a safe, remote distance. It also provides a compelling solution by increasing the autonomy of commercial robotics platforms that learn from experience to operate safely and effectively across relevant tasks and conditions (e.g., maintenance, repair depots or airfields).

Consider, for instance, tasks that involve working at height. Instead of requiring a worker to climb into a bucket truck to inspect a power line, a mobile robot can be integrated with an aerial lift and programmed to perform these tasks on its own while an operator stays safely on the ground, ready to intervene from a remote distance if necessary. This is also the case for maritime applications, which require commercial divers to perform construction, maintenance and inspection tasks in deep ocean water where frigid temperatures and low visibility create extreme hazards. Using supervised autonomy, an underwater robotic system can perform subsea tasks while skilled operators remain topside to guide operations.

While we are years away from fully autonomous robots that can think, act and error-correct on their own, robotic systems using supervised autonomy are being demonstrated today. For industries wanting to gain a competitive advantage, supervised autonomy can provide companies with the tools they need to combat widespread labor shortages, reduce on-the-job injuries and increase productivity. By addressing the gaps in traditional automation processes, supervised autonomy will prove to be a game-changer across the industrial landscape.

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