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Cybernetic Training for Autonomous Robots: Generalizable Autonomy in Robot Manipulation Towards Human Augmentation

Semi-Supervised autonomy, with the maturation and integration of artificial intelligence and machine learning, is the next frontier of robotics. Existing robots perform poorly in dynamic and unstructured environments. Traditional machine learning requires a time-consuming and expensive trial-and-error approach. The state-of-the-art AI and ML solutions are environment-specific and hard to replicate as conditions change. As a result, many industries cannot benefit from the efficiencies offered by these technological advancements. Cybernetic Training for Autonomous Robots (CYTARTM) technology framework is focused on bringing autonomy to unstructured workplaces. This framework uses multi-modal sensor data to optimally perceive, interact, and conceptualize unstructured environments. Combined with our success-based reinforcement learning AI approach, the semi-supervised autonomy framework harnesses the power of real-time and learned-behavior data inputs that enable robots to execute task-specific autonomy in unstructured environments successfully. CYTARTM framework deploys an advanced robot learning methodology to teach a robot how to mimic the way humans successfully learn tasks in unstructured environments, including underwater environments, construction sites, and tarmacs, greatly reducing the reliance on traditional AI/ML approaches requiring large quantities of task-specific training data to execute simple tasks. The talk will discuss the benefits of robotic systems that combine human intelligence, instincts, and judgment with machines' strength, endurance, and precision to bring autonomy to unstructured workplaces. These robots can augment human performance and awareness and provide the ability for them to operate autonomously when trained or remotely supervised by a human operator in unstructured, dynamic environments. The benefits can be multiplied by allowing such systems to leverage AI/ML technologies to learn from their operators how to execute tasks and then be able to conduct those tasks independently in a weakly structured environment.

Keywords: AI/ML, Inverse Reinforcement Learning, Dexterous Robotics

Biography:

Dr. Denis Garagic serves as Chief Technology Officer for Sarcos Technology and Robotics Corporation. In this role, Dr. Garagic is responsible for technical guidance across all innovation, engineering, and technology teams. Dr. Garagic oversees overall technology development and utilization plans and plays an integral role in helping to develop the company's strategic direction, development, and future growth. He has more than 25 years of experience in AI&ML, Optimization and Controls technologies. Dr. Garagic has written more than 40 journals, articles, and conference papers and holds several patents in applied controls for autonomous robotics and machine learning. He received his B.S. and M.S. degrees in Mechanical Engineering and Technical Cybernetics from The Czech Technical University in Prague and his Ph.D. in Mechanical Engineering from The Ohio State University.