ThoughtForge

Bringing Common Sense to Robots.

Customer Case Study: Multinational Oil & Gas company headquartered in Europe.

Important note: *Customer name changed to Acme due to confidentiality agreement. The details below are results from a multi-phase product engagement between Acme, a repeat customer, and ThoughtForge*.

Overview

Acme, a multinational company headquartered in Europe is one of the world's seven oil & gas supermajors. The environments Oil & Gas industry workforce operates in are inherently risky. Therefore, a key safety goal and objective within this industry to eliminate sending workers into potentially hazardous situations and environments such as elevated or enclosed spaces or exposing people to high or low temperatures.

"Typically, work by roughnecks on the rig floor can be very dangerous and inconsistent. Replacing drillers with robots promises to cut non-productive time (NPT) and offer a safer, more consistent approach."

--Petroleum Review (Source)

Acme's strategy for achieving its goals revolves around driving digital transformation and innovation. One of the many ways to drive digital transformation on Acme's sites is to deploy robots for the inspection of its facilities or perform hazardous tasks within these facilities. In this application, the robots will do the activities such as grabbing and turning valves, inspecting for corrosion or damages, and checking gauges, which currently performed by employees.

Problem

Getting these robots to production requires overcoming significant challenges. Conceptually, it should be easy to utilize current techniques (Inverse Kinematics (IK) or Deep Re-enforcement Learning (DRL)) and information from training data (engineering diagrams and simulations) to program a robot to perform the desired task. And the training data must exactly match the physical world (or vice versa) for the robot to train on and perform the task successfully. However, Acme facilities change constantly due to inspections, repairs, and maintenance. This difference is compounded when taken across hundreds of such facilities across the globe. This results in robot failing to perform the task in real world because it trained on older information and needs constant retraining.

Moreover, training a single robot control model to perform one task in one facility requires operationally expensive and scalable infrastructure, takes 7+ months of training time, costs US $300k - $500k, and additional 3 months of validation before deployment. Even though Acme has a model that may perform in a facility, the massive volume of slight differences across multiple facilities, both long and constant training and retraining times, prohibitive costs, and validation schedules make it impractical to create, train, deploy, and manage these robots at scale.

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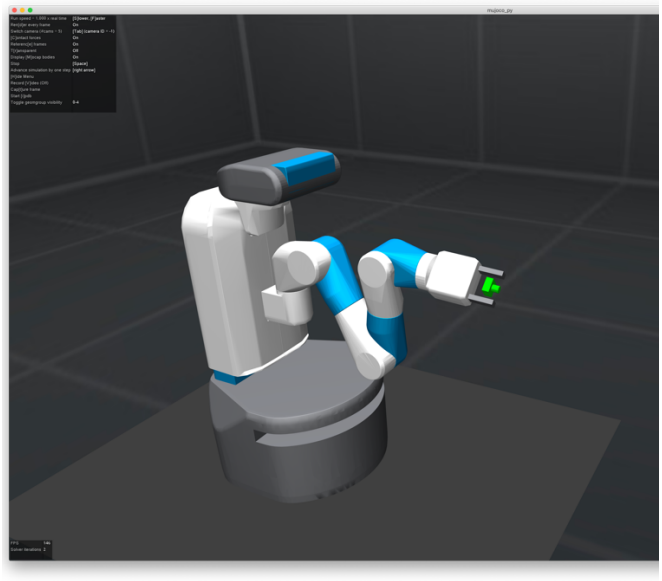
Current Approaches

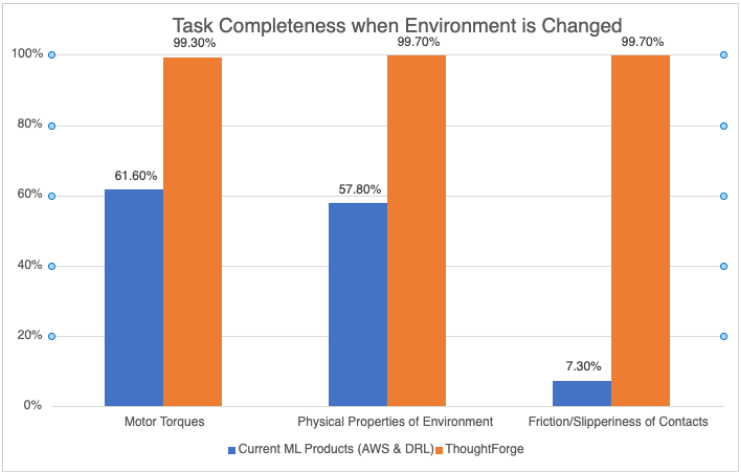
To alleviate infrastructure pains, Acme uses existing offerings like AWS SageMaker, Microsoft Bonsai, open-source DRL libraries (Ray RLLib), and home-grown algorithms. However, these offerings are expensive, suffer from long training cycles, and require their operating environments to be precise. And the resulting robot control models still fail as they cannot adapt in real time to changes in the real world.

Results

ThoughtForge trained a single robotic control model to manipulate valves of different shapes (triangle, circular, and square) under varying physical and environmental conditions. ThoughtForge deployed the resulting trained model on robotic arm with 6 DOF. The image below shows the robotic arm completing the task by reaching for, grabbing, and turning the valve.



We also compared and contrasted ThoughtForge's model against state-of-the-art Deep Reinforcement Learning models. ThoughtForge's model **maintained 99%+ task completion accuracy under changing conditions**, compared to Deep Reinforcement Learning models which degraded significantly.



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The data and graphs below were gathered while solving Acme's robot use case with both ThoughtForge and existing offerings. Acme with ThoughtForge achieved **90,000X higher sample efficiency resulting in faster and cheaper training**.

Advantages | Competitors	**ThoughtForge**	Google	Microsoft Bonsai	Amazon Web Services
Training Times*	**Minutes**	Months	Months	Months
Adapts in Real-Time*	**Yes**	No	No	No
Robust to Real World*	**Yes**	No	No	No
Eliminates Retraining for New Environments	**Yes**	No	No	No

ThoughtForge's autonomous platform solves for Acme's pain by creating, deploying, and managing autonomous robots that operate accurately and robustly in the real world. ThoughtForge's autonomous models negated the need for constant retraining as our patent-pending framework adapts to real world changes in real time without sacrificing accuracy. Additionally, ThoughtForge's fully managed service significantly reduces time-to-market, training costs, and total cost of ownership (infrastructure + headcount costs). And we are fully compatible with existing infrastructure, hardware, and algorithms.

Conclusions

Enterprises increasingly want to achieve autonomy and drive digital adoption. While robots have the potential to improve safety, reduce costs, and drive products to market faster, creating and managing adaptive and robust robots, in real time, and at reasonable costs is beyond the reach of all.

ThoughtForge enables Data Scientists and Robotics Engineers to quickly create, deploy, and manage autonomous robots for the real world. We are a cloud native and fully managed service that is fully compatible with existing resources, libraries, and algorithms.

Any enterprise Development or Data Science team looking to build and deploy autonomous robotic control should ask:

1. How do I shorten my robotic control model development time from 7+ months to a few hours or a week?
2. How can I create robotic control models that are robust to changing environments and adapt in real time?
3. How do I deploy robotic control models in a few hours with reliable validation and high accuracy?
4. How can I make it simple to maintain an autonomous robot in production?

After assessing and answering these questions, it should be clear that the only viable path to achieving a strong business outcome is ThoughtForge. **Get in touch and let us help you with your use cases at** info@thoughtforge.ai