# Optimal Sequential Decision Making Under Partial Observability Using Deep Reinforcement Learning ID# 2021-5355



## Technology Summary

The disclosed technology presents a system and method described for optimal sequential decision-making for large engineering systems/networks with multiple components under uncertain and partially observed environments using multi-agent deep reinforcement learning architecture. The technology uses a partially observable Markov decision process with a confluence of state-of-the-art AI methodology, named Deep Decentralized Multi-Agent Actor-Critic (DDMAC) with Centralized Training and Decentralized Execution (CTDE), that can incorporate operation-related various resource, performance, and risk-related constraints.

## Application & Market Utility

The current solutions for managing large infrastructure systems are based on heuristics and usually suffer from inefficiencies arising from complex systems. To address these issues, a comprehensive artificial intelligence framework was created that allows for adaptive evaluation in the presence of noisy real-time or ambiguous data. This technology was tested on an existing transportation network in Virginia, where results show a total of 45% cost savings in managing the network and an improvement of 20% over heuristically optimized condition-based policy. This technology has the potential to save up to billions of dollars upon implementation in the energy, aerospace, and automotive industries.

## Next Steps

The research team is continually testing the technology and seeking licensing opportunities.

## TECHNOLOGY READINESS LEVEL

### Seeking

Investment | Licensing | Research

#### Keywords

- Markov decision process
- Artificial intelligence
- DDMAC
- CTDE
- Optimal policies Noisy data
- Noisy du

#### Researchers

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