

An Architecture for Self-Adaptive Abstraction and Approximation in Digital Twins with Real-time Requirements

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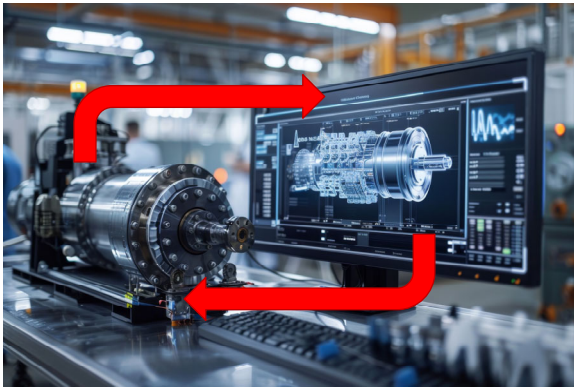


Goal

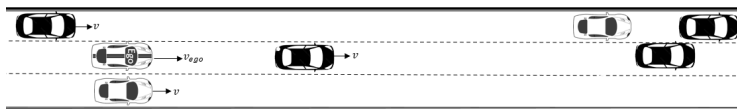
- Decision-making in real-time
- Tackle computationally expensive model's issues
- Applying technique in twining paradigm

Motivation

Digital Twins are complex systems



Real-time requirements: Meeting the deadlines

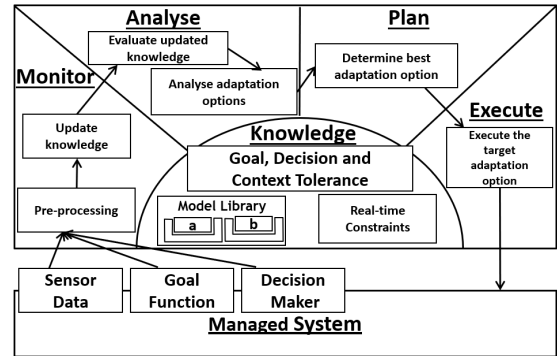


Intuition



Humans have a limited capacity to reason over making decisions

•Self Adaptation: Based on MAPE-K from IBM

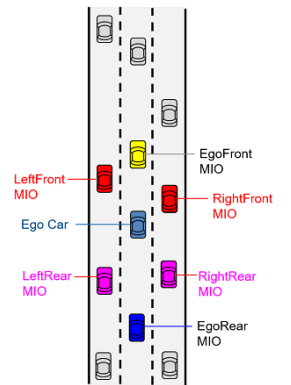


Real-time Adaptive Abstraction and Approximation Architecture

• Models:

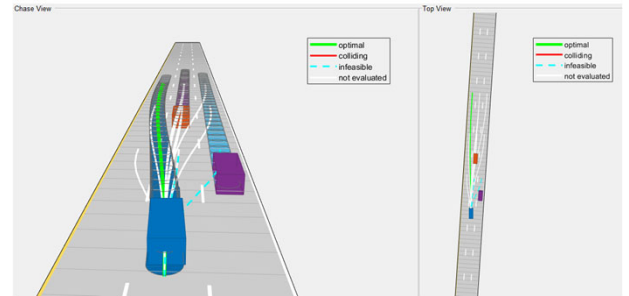
- High-validity model
- Constant acceleration model
- Constant velocity model

Less-detailed ↓



MathWorks, March 2024

• Use case: Highway Lane change system:



Key take-aways

- ✓ Self-adaptive abstraction and approximation architecture
- ✓ Switching between models within their validity frame and decrease computational cost

References



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