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Theater Torpedo Inventory Optimization

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Theater Torpedo Inventory Optimization



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Research Objective

Develop formal methods for obtaining optimal loadouts of torpedoes for anti-submarine warfare (ASW)

Method

- Consider:
 - Multiple types of ASW platforms with variable capacities and capabilities
 - Uncertain scenarios
 - Diverse adversary fleets
 - Limited budget
- Develop Torpedo Assignment Stochastic Optimization Model (TASOM)
 - TASOM-1: Minimize $E[\# \text{ of Missed Targets (Subs)}]$
 - TASOM-2: Minimize deviation from kill-probability goal

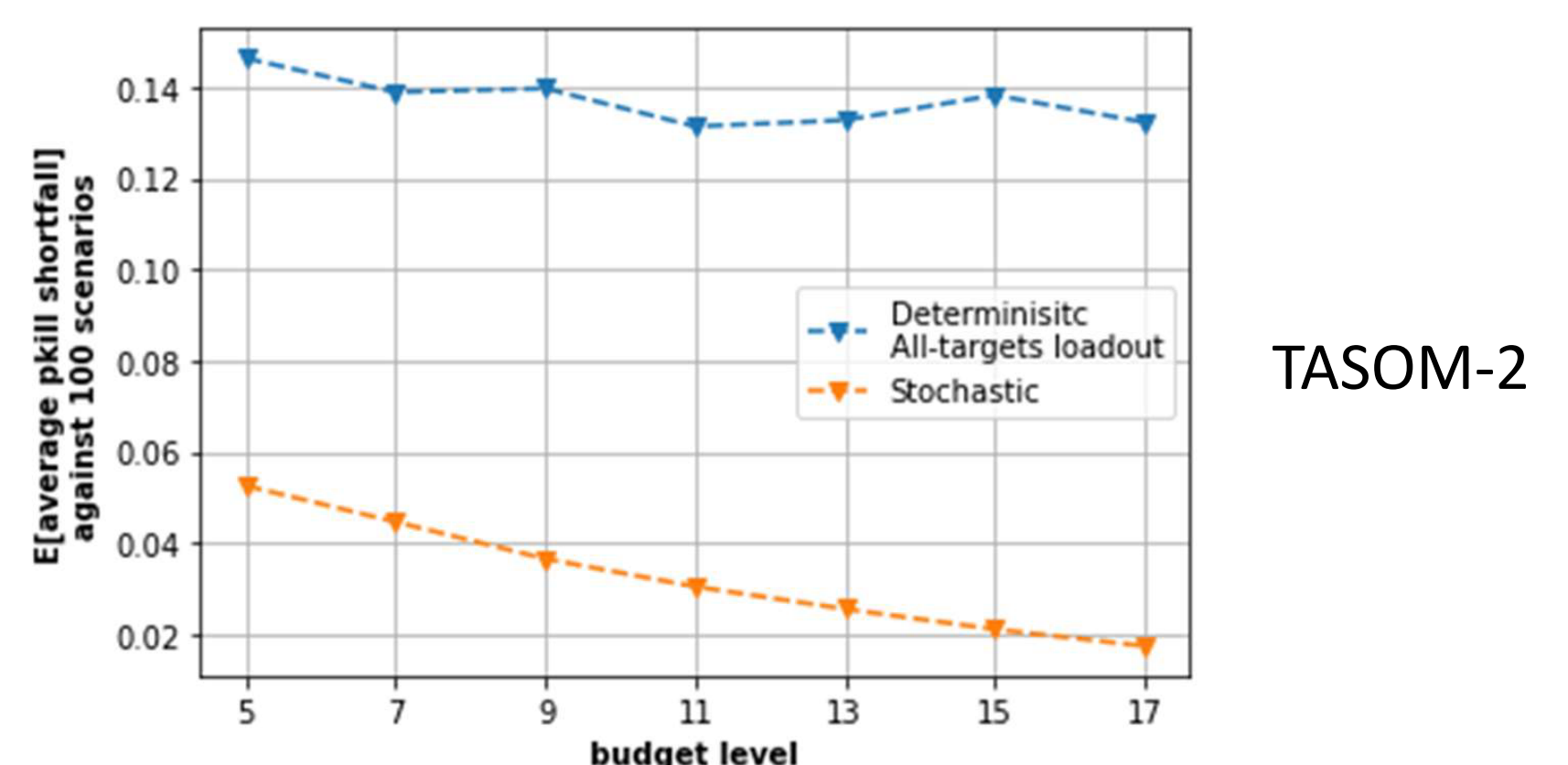
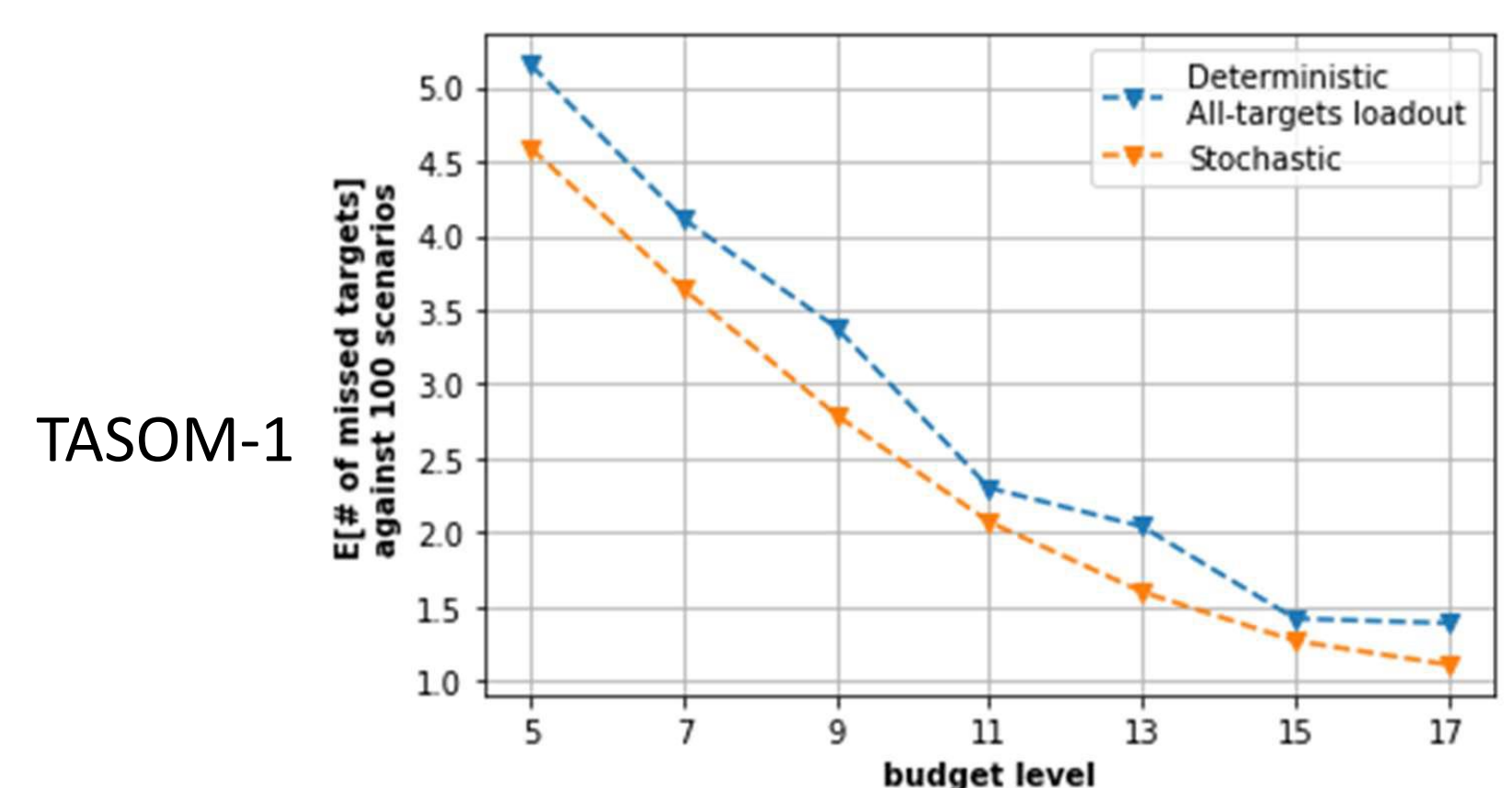


Test and Evaluation

- Simulated 100 random threat scenarios
 - Blue:
 - Four destroyers
 - Embarked MH-60R detachments
 - Two P8 squadrons
 - P_k goal: 90%
 - Red:
 - 20 adversary's submarines of different classes
 - 5 – 10 are deployed per randomly generated scenario
- Compared the performance of TASOMs with a deterministic optimization model

Results

- TASOM-1 performs marginally better than the average loadout:
 - $E[\text{Missed targets} | \text{Average loadout, Cost} = \text{Average}] = 2.13$
 - $E[\text{Missed targets} | \text{TASOM-1, Cost} = \text{Average}] = 1.82$
- The effect of TASOM-2 is more prominent:
 - Average P_k given average loadout = 0.78
 - Average P_k given TASOM-2 = 0.87
- When compared to “All-Targets” scenario, the two models behave similarly.
- Models are implemented in an accessible user interface



Future Work:

- Focus on further developing TASOM-2
- Introduce variable penalties for probabilities shortfalls
- Expand the treatment of cost
- Consider more realistic ASW scenarios



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