Experiment 2 Proposal

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I. Randomly generate 100 unique scenarios of true trajectories
   A. Various scenario sizes
      i. $P \in [4, 6, 8, 10]$
      ii. $T \in [4, 6, 8, 10]$
   B. Generate 50 crossing scenarios and 50 parallel scenarios of each size
   C. Save true position data

II. Randomly generate 30 noise perturbations (η)
   A. $\eta \sim \mathcal{N}(0, 1)$
   B. Save perturbations

III. Calculate error ϵ
   A. Consider noise coefficients $\sigma \in [0.1, 2.0]$ with step size 0.1
   B. $\epsilon = \sigma\gamma$

IV. Generate detections
   A. $x_{jt} = \alpha_j^T + \beta_j^T * t + \epsilon$
   B. Let $\mathcal{D}_t = \{x_{1t}, ..., x_{jt}, ..., x_{Pt}\}$ be the unordered set all all detections for scan t

V. Simulate missed detections
   A. Known missed detection rate of γ
   B. Simulate random variable $\psi_{jt} \sim \mathcal{U}(0, 1)$ for each detection x_{jt}
   C. Remove detection if $\psi_{jt} > (1 - \gamma)$

VI. Simulate false alarms
   A. Known false alarm rate of λ

B. Simulate random variable $\mu_t \sim \text{Pois}(\lambda)$ for each scan t

C. Randomly generate μ_t false alarms F_{it} uniformly within the scenario space

D. Let $\mathcal{F}_t = \{F_{1t}, ..., F_{\mu_t t}\}$ bet the unordered set of false alarms for scan t

VII. Assemble scans and data

A. Scan of data now represented by $\mathcal{X}_t = \mathcal{D}_t \cup \mathcal{F}_t$ for all t

B. Data ($\boldsymbol{\mathcal{X}}$) is the set of all scans $\mathcal{X}_t$

VIII. Run heuristic on each simulation

A. Heuristic - run heuristic with a range of starting points (N)

B. N = [100 1,000 10,000]

IX. Warm start MIO with each heuristic solution

A. Run MIO for a range of time limits $\{1, T, 2T, 3T\}$

B. Terminate optimization after time limit reached

C. Save solution at termination

X. Save all data and metrics

A. Heuristic, MIO, and total run times

B. Heuristic and MIO objective scores (both absolute value and RSS)

C. Heuristic and MIO assignments (x_{it} assigned to j)

XI. After completion of all simulation runs, analyze performance

A. Scalability

i. Objective score (either abs value or RSS) vs time

ii. Choice to add bound vs time

iii. Summary of run times with comparison by # heuristic starting points (N)

iv. Show in panels of PxT for comparison

B. Quality of Solution

i. Performance measures

a. RSS

b. Developed performance metric (δ)

c. % correct assignments

ii. Compare Random, Heuristic, MIO, and Ideal

iii. Plot vs σ in panels of PxT for comparison