Scalable Active Monitoring for Agriculture and Disaster Relief

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1 Active Monitoring

Path planning for mapping under uncertainty/ monitoring large areas... Subsections will be divided based on their approach to the problem statement.

1.1 Transect Monitoring

1.1.1 Nomenclature

- k robots
- Transect:
  - rxn sampled locations
  - where $k \leq r, n >> r$
  - n-axis of the grid is parallel to the direction with highest variability
  - each robot can only visit one item per row, r. Max no. of visits per robot is n
- examples of use cases: Plankton monitoring (T2A)

1.1.2 Traditional/Baseline methods

Heuristic Design:

1. Discretise space into rectagular grid (with an axis along highest variability)
2. Sample with k robots (K-travelling salesman problem)
3. Cons:
   - constrained by sampling design (no optimisation for uncertainty)
   - does not take into account higher sampling resolution of robots

1.1.3 Gaussian Processes

TBD.

1.1.4 MEPP

Maximum Entropy Path Planning

1.1.5 M^{2}IPP

Maximum Mutual Information Path Planning Mutual information = measure of reduction in uncertainty

1.1.6 Tale of Two Algorithms

MEPP(m) and M^2IPP(m): approximations of MEPP and M^2IPP for faster compute time. (also performance guarantee for MEPP) scales linearly with time horizon, n

1.1.7 greedy MEPP (gMEPP)

1.1.8 greedy M^2IPP (gM^2IPP)

2 Considering Localisation Uncertainty

eg. indoor temperature mapping

2.1 Informative Planning Framework

Uncertainty in mapping and Planning GP env rep gen fr inputs (of active sensors?)

3 Concerns of the Paradigm

1. computational efficiency/ scalability (for large areas) [T2A]
2. uncertainty management
3. parameter tuning?
3. robustness
4. scalability for more robots? [LINN]

Glossary

k-travelling salesman problem NP-hard problem. 2