Mobile Autonomous Navy Teams for Information Surveillance and Search (MANTISS)

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Abstract:

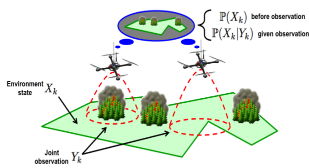
Autonomous systems can provide the Navy with valuable information about operating environments. The goal of this research is to build upon nature-inspired approaches to area coverage using swarms or teams of autonomous systems performing area coverage tasks, and to apply these systems to problems of Navy interest.

Foraging as guidance

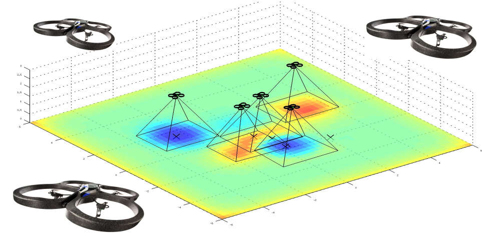
- Biological agents find most efficient paths to food
- Simple heuristics for uncertainty and unexpected constraints

Information as food

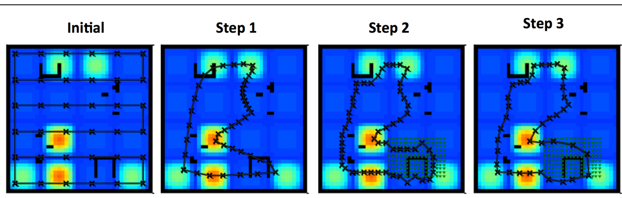
- Bayesian estimation shows where to collect information
- Information theory gives optimal sensor positions



Quadrotor sensor network using states-of-matter search to detect and simultaneously track multiple targets on the ground.

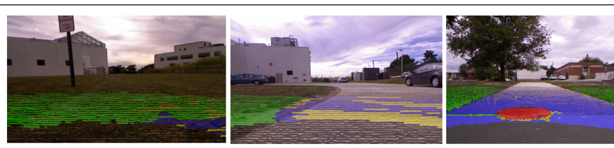


N. Sydney, D. Paley, and D. Sofge, "Physics-Inspired Robotic Motion Planning for Cooperative Bayesian Target Detection," *Robotic Science and Systems Workshop: Distributed Control and Estimation for Robotic Vehicle Networks*, Springer, 2014. (submitted)

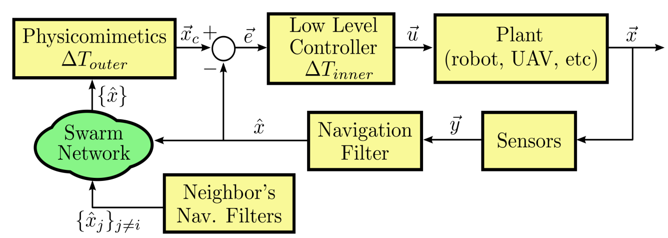


Initial	Step 1	Step 2	Step 3
Initial configuration	Ignore obstacles and motion uncertainty for initial selection of waypoints	Eliminate waypoints inside obstacles Generate collision free path using each waypoint feedback plan	Locally minimize *H* using MDP based feedback plan Eliminate waypoints Final configuration

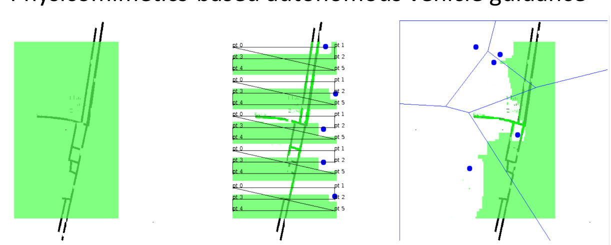
M.J. Kuhlman, P. Svec, K.N. Kaipa, D. Sofge, and S.K. Gupta, "Physics-Aware Informative Coverage Planning for Autonomous Vehicles," *2014 IEEE International Conference on Robotics and Automation* (ICRA), IEEE, 2014.



K. Sullivan, W. Lawson, D. Sofge, "Fusing Laser Reflectance and Image Data for Terrain Classification for Small Autonomous Robots," *The 13th International Conference on Control, Automation, Robotics and Vision* (ICARCV 2014), IEEE, 2014. (submitted)



Physicomimetics-based autonomous vehicle guidance



(a) Initial Condition (b) Lawnmower Paths (c) Grazing Pattern

T. Apker, S-Y Liu, D.Sofge, and J.K. Hedrick, "Application of Grazing-Inspired Guidance Laws to Autonomous Information Gathering," *2014 IEEE/RSJ International Conference on Intelligent Robots and Systems* (IROS), IEEE, 2014. (accepted)

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