Related Work Survey

3D Path Planning for UAVs for Maximum Information Collection

- **URL**: http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=6564676
- Plans the paths of UAVs in 3 dimensions that avoids forbidden regions and maximizes information collection from desired regions
- Formulates problem as a multiple Travelling Salesman Problem and uses the Pattern Search method to solve this problem.
- Using the grid of desired and forbidden regions, this approach uses a genetic algorithm with initial population of the solutions from the mTSP to optimize the waypoints being used for the UAVs.
- They don't talk about scalability, they only did tests with up to 3 UAVs, and they are using a GA whilst solving mTSP. It is probably safe to say that their algorithm doesn't scale well with respect to anything in their parameter space.

Path Planning of Autonomous Underwater Vehicles for Adaptive Sampling Using Mixed Integer Linear Programming

- **URL**: http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=4768634
- Path planning algorithm that optimizes an objective function to move around the ocean to collect information about desired regions
- It is assumed that the desired regions are known *a priori*
- The objective is to sample the regions of greatest uncertainty and to maximize the information gain
- It plans using a constraint programming based on motion constraints
- I have no idea what their results are supposed to mean

Physics-Inspired Robotic Motion Planning for Cooperative Bayesian Target Detection

- **In press. N. Sydney et al. 2014**
- Uses a states of matter approach for area coverage and target detection / tracking.
- At gas state, the quads move down a surface gradient w/ random walk
- At liquid state, quads move down a potential surface

- At solid state, quads move down a potential gradient and have a spring force between other quads
- The surface simulates the temperature and is governed by an inverse log likelihood ratio w/ temperature diffusion.
- When target is "seen", the area within a certain radius of the target on the surface gets its value decremented and the heat is diffused.
- Has inherent potential field issues (i.e. valleys, riveras, local minima)
- Non simulation testing has only been performed with one quadrotor.
- Does NOT perform well for coverage, but does very well for tracking.

Physics-Aware Informative Coverage Planning for Autonomous Vehicles

- **In press. M. Kuhlman et al. ICRA 2014.**
- Tries to solve the problem of informed single vehicle persistent monitoring of a given area.
- Given a closed set of way points, t, update the waypoints in t to minimize path cost and maximize the information gained.
- Uses a Markov Decision Process (MDP) to generate collision free way points. These MDPs take into account the uncertainty of being blown off course.
- The results show that the collision free paths are developed almost all of the time ($> 88\%$). There is no mention about coverage or about how the planner optimizes the objective function.
- This algorithm is for static desired regions and static obstacles so the path is pre-generated. The generation takes a few minutes to make the path and is therefore not scalable and cannot be used in a real-time situation.
- Lastly, the approach is only feasible for a single vehicle, for multiple vehicles the solution would scale exponentially.