## 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.