## Area Coverage Problem in Wireless Sensor Networks

### Author Names and Affiliations

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### Problem Statement

**Input**
- $k$: the number of sensor types
- $n$: the number of sensors
- $n_i$: the number of sensors for type $i$ ($i = 1..k$), such that $\sum_{i=1}^{k} n_i = n$
- $r_i$: the sensing radius of sensor for type $i$ ($i = 1..k$)
- $W, H$: the width and the length of the 2D domain $A$ respectively

**Output**
- The position for each sensor node

**Objective**
- Maximize the area coverage of $n$ sensors on $A$ ($\text{coA}$)  
  \[ \text{coA} = \text{area}(\bigcup_{i=1}^{k} C_i(x_j, y_j) \cap A) \to \text{max} \]

### Contributions

- Propose a new function to evaluate quality of solution: $\text{Olap}$
- Propose algorithms to solve this problem:
  - Genetic algorithm ($\text{IGA}$)
  - Particle Swarm Optimization ($\text{PSO, DPSO}$)
  - Cuckoo Search ($\text{ICS}$)
  - Chaotic Flower Pollination ($\text{CFPA}$)
- Analyse convergence of proposed algorithms

### Abstract

We are interested in a new model of area coverage problem in wireless sensor networks that is to maximize covered area in a region of interest with a given number of sensors instead of finding the minimum number of sensors such that the region of interest can be completely supervised.

### Results

![Image](a)  
(a) The best solutions found by IGA (a), PSO (b), ICS (c), CFPA (d) after 30 runnings times on the largest instance.

### Future work

- Apply to wireless sensor networks with obstacles
- Apply to dynamic wireless sensor networks
- Integrate with other objectives and constraints:
  - Connectivity assurance
  - Energy optimization

### References