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Novel Computation

MASSING

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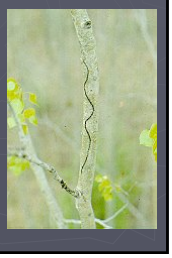
Multi-Agent Search Strategies in Natural Groups

- Start date October 2005
- Foraging strategies
- Natural societies
- Agent-based behavioural models
- Multi-agent search algorithms
- Bio-mimetic search

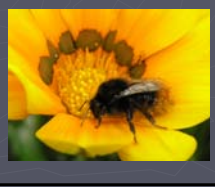
Aims

- Model search strategies
- Static problems
- Dynamic problems
- Requirements
- Fundamental algorithms
- Hard computational problems
- Applications



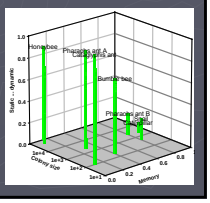
Background

- Ant algorithms
- Dorigo – inspiration, not bio-mimetic
- Models unrealistic/over-simplified
- Different strategies
- Type of problem
- Ecological niche occupied



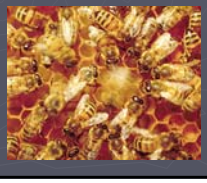
Dynamic Problems

- Ant algorithms (ACO) – static
- Natural search – dynamic
- Food source exploitation
- Requirements / Parameters of strategy
- Colony Size
- Foraging range
- Communication – local/general
- Memory – multiple types



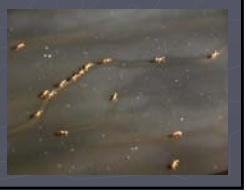
Solutions – Study Species

- Honeybee: colony = 60,000
- Pharaoh's ant: colony = 2000
- Bumble bee: colony = 200
- Social caterpillar: colony = 100
- Social snail: colony <100
- Well-studied species
- Parameters available
- Model = predict agent behaviour



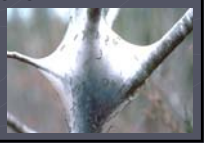
Example: Pharaoh's Ant

- Pharaoh's ant: colony = 2000
- Monomorphic pest ant
- Multiple trail pheromones
- Short-lived trail pheromone (c.20 min)
- Long-lived trail pheromones (c.2 days)
- Trail networks
- Negative pheromone
- Specialists in trail following/marking



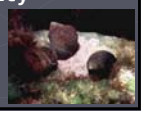
Dynamic Computational Problems

- Objective in search algorithm design is balancing exploration and exploitation of search space
- Natural systems strive for optimum solution even when the environment is changing
- Many industrial problems demand effective use of resources in highly dynamic situations
- - utilisation of servers in the delivery of www resources
- - channel assignment and hand-over in mobile telephony.



Wider Applications

- John Seely Brown, chief scientist at Xerox, "envisages a future where every manmade object contains a multitude of sensors, effectors and logical elements that communicate via wireless, peer-to-peer technologies, to produce smart appliances, buildings, roads *etc*."
- Van Parunak has a multi-agent vision where, "software developers simply selects the agent behaviour desired in the final application, and the agents self-organize to perform the required functionality"



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