Swarm Behavior in AI

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Swarm Behavior in Nature

- Ants
  - Pheromones
- Bees
  - Dancing
  - Deciding
- Particles
  - “Best outcome”

Ant Colony Optimization Concept

Finding best, shortest, path

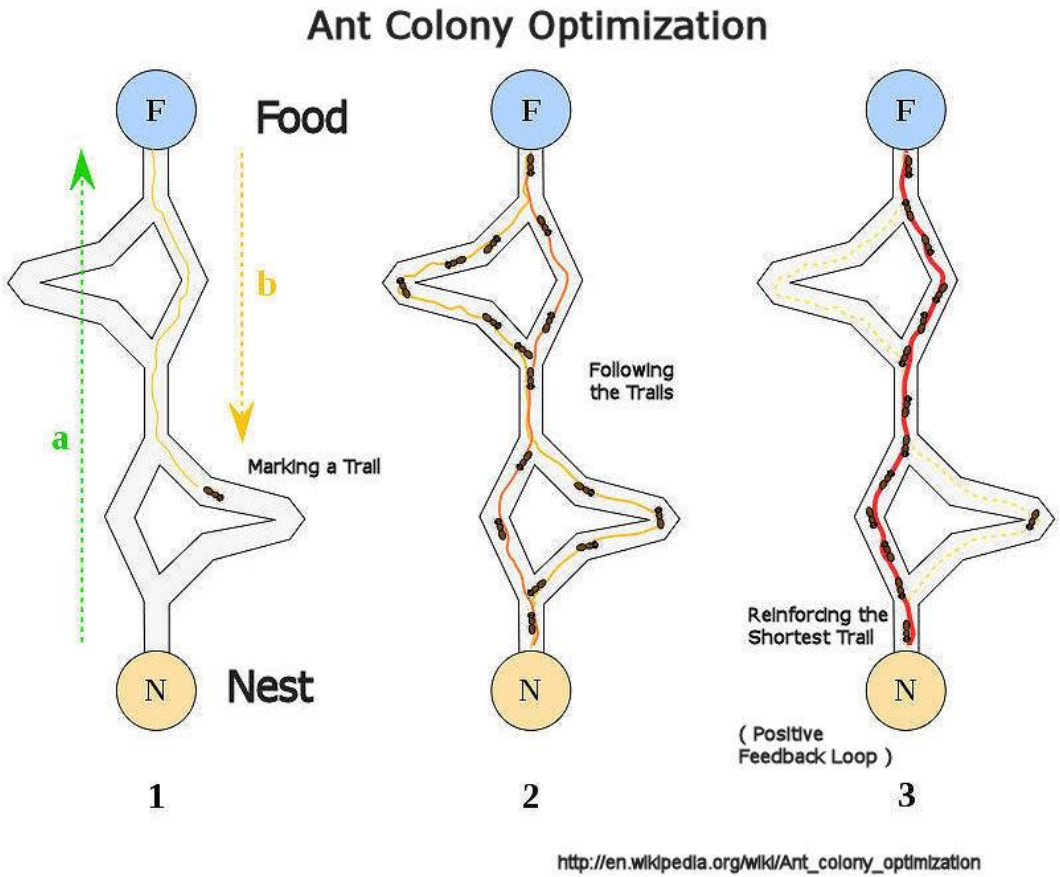
$V_{i,g} = X_{r0,g} + F(X_{r1,g} - X_{r2,g})$

After this generation

$V_{i,g} = X_{best,g} + F(X_{r1,g} - X_{r2,g})$

Small robots

Ant Colony Optimization Concept



Bees Attractiveness

Find which action is the most attractive next

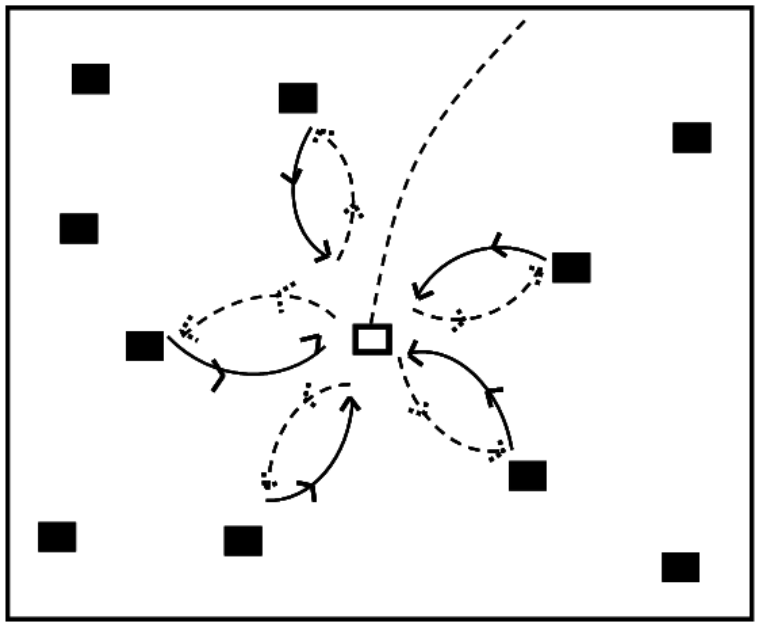
$$Pi = \frac{fi}{\sum_{j} f j}$$

Military use

Bees Attractiveness

Swarming

- **Several or more units**
- **Sustainable pulsing**
- **Dispersed, non-linear**

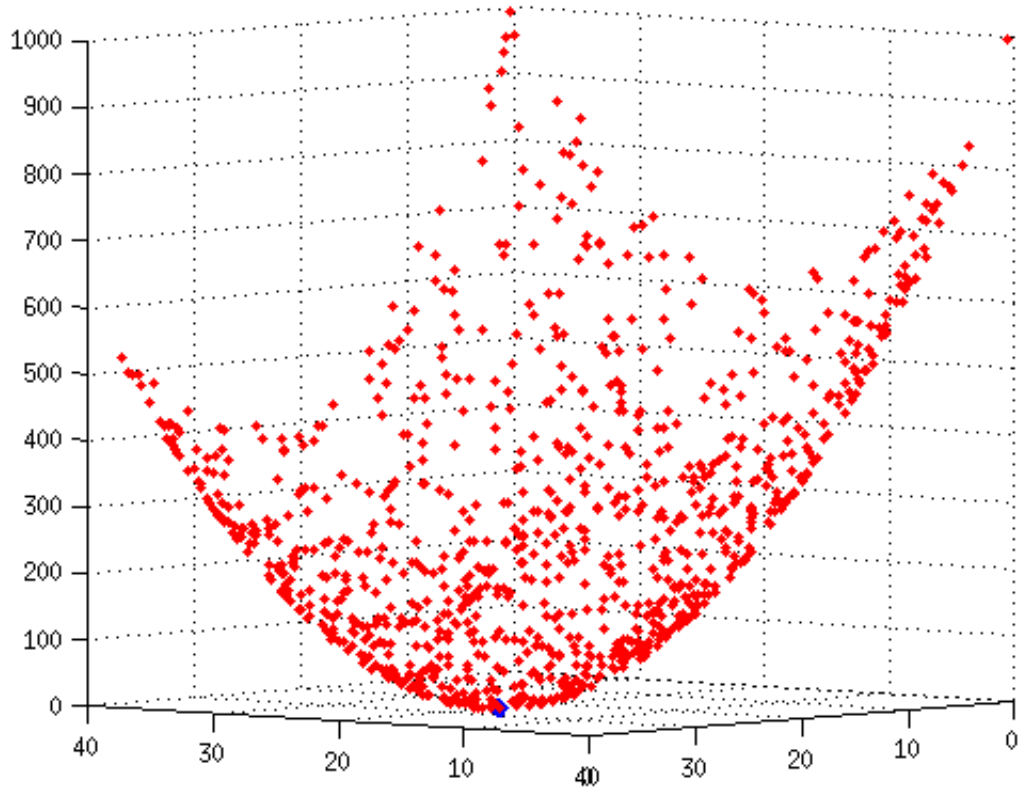


Particle Optimizer

Hyperspace

Neighborhoods

Particle Optimizer



Kilobots

https://www.youtube.com/watch?v=dDsmbwOrHJs

Time 0:45

Axon AI

AXON:Investigate

AXON:Anticipate

AXON:Monitor

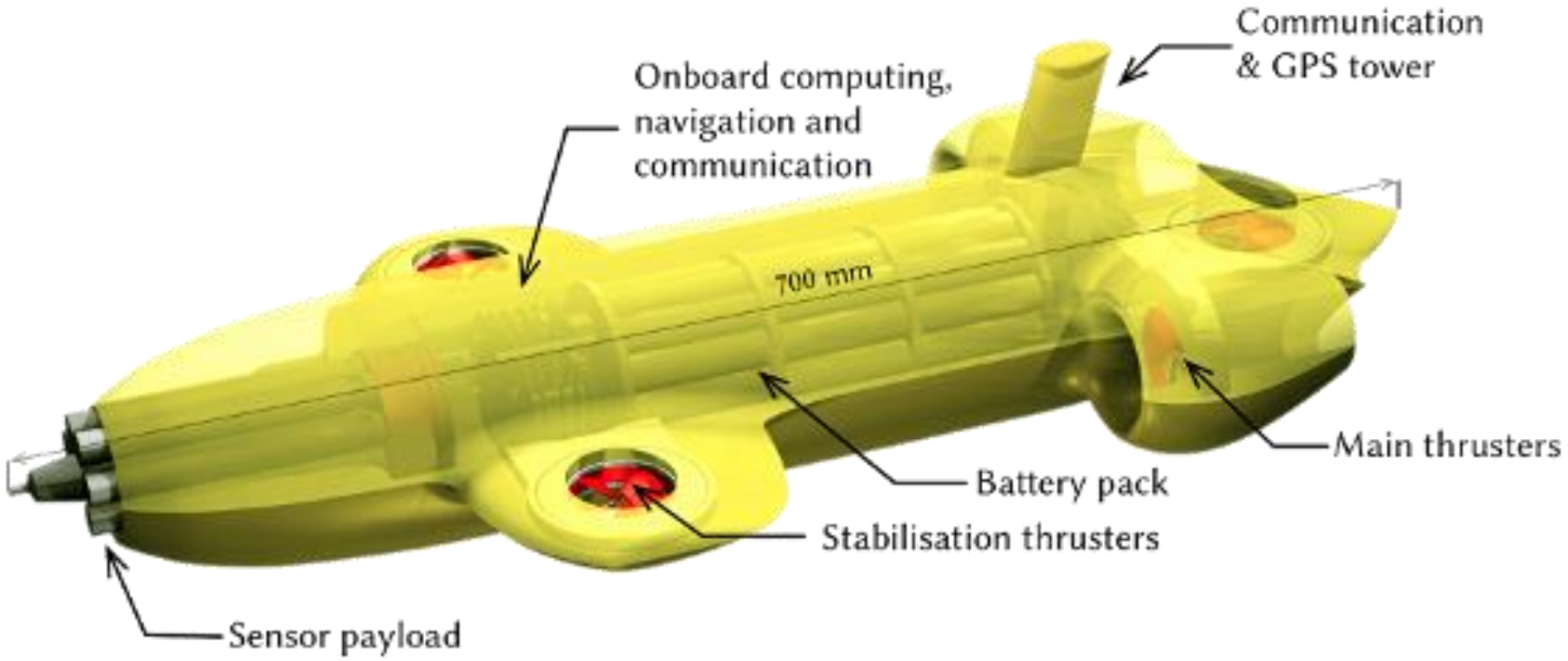
Hydromea

AUV

Mulitple sensors

Could use more swarm

Hydromea


Communication
& GPS tower
Onboard computing,
navigation and
communication
700 mm
Main thrusters
Battery pack
Stabilisation thrusters
Sensor payload

Sentien

Search and rescue

Pathing swarm

- not shortest

Many more possiblilies

Conclusion

Most from nature. More not found?

A lot of applications

A growing field especially in robotics

Thank an ant!

Any Questions?

Resources

1. http://s3.amazonaws.com/academia.edu.documents/2802676/5je4pzbrb4xznml.pdf?AWSAccessKeyId=AKIAJ56TQJRTWSMTNPEA&Expires=1479646679&Signature=F936A9YVJb2XFKgTSS7U%2FanFKR8%3D&response-content-disposition=inline%3B%20filename%3DBee_colony_optimization_a_cooperative_le.pdf
2. https://books.google.com/books?hl=en&lr=&id=a1FsCQAAQBAJ&oi=fnd&pg=PR3&dq=ant+swarm+behavior&ots=mFF3RZzMcF&sig=EBAcwjHHfzHkd2Pcm61qYBw5Ago#v=onepage&q&f=false
3. https://en.wikipedia.org/wiki/Swarm_behaviour
4. https://en.wikipedia.org/wiki/Swarm_intelligence
5. http://www.ppgia.pucpr.br/~alceu/mestrado/aula3/PSO_2.pdf
6. http://axonai.com/our-work/

More Resources

1. http://hydromea.com/technology.html
2. http://sentienrobotics.com/release/
3. http://www.dailykos.com/story/2010/4/11/856217/-
4. https://www.mathworks.com/matlabcentral/fileexchange/46985-particle-swarm-optimization--vectorized-code-
5. https://en.wikipedia.org/wiki/Swarm_behaviour