The Application of Agent-Based Co-Evolutionary Sytem with Predator-Prey Interactions to Solving Multi-Objective Optimization Problems.

Rafał Dre`zewski, and Leszek Siwik

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Summarized by:

Michael Cochez

Problem Setting

- Portfolio building
- Maximize profit
- Minimize risk

MAX Profit

$$\max Rp = \sum_{i=1}^{p} w_i * R_i$$

$$\sum_{i=1}^{p} w_i = 1$$
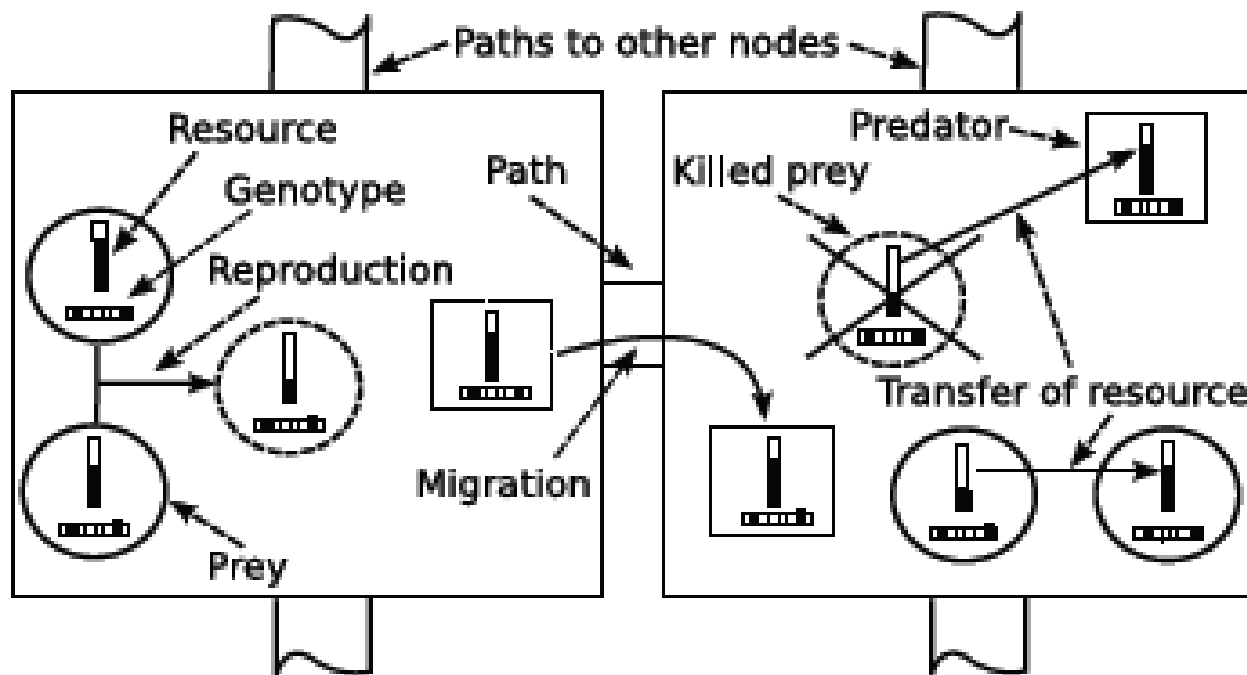
$$R_i = G(R_{i1..n}, R_{m1..n}, n) + e_i$$

MIN Risk

$$\min {}_{Risk} = \min H(w, R_{i1..n}, R_{m1..n}, n)$$

Multi Objective Problem

$$\begin{cases} \max \sum_{i=1}^{p} wi * Ri \\ \min risk \\ \text{every symbol except } w \text{ constant} \\ s.t. w \in \Re^p : \sum_{i=1}^{p} w_i = 1 \wedge w_i \geq 0 \end{cases}$$
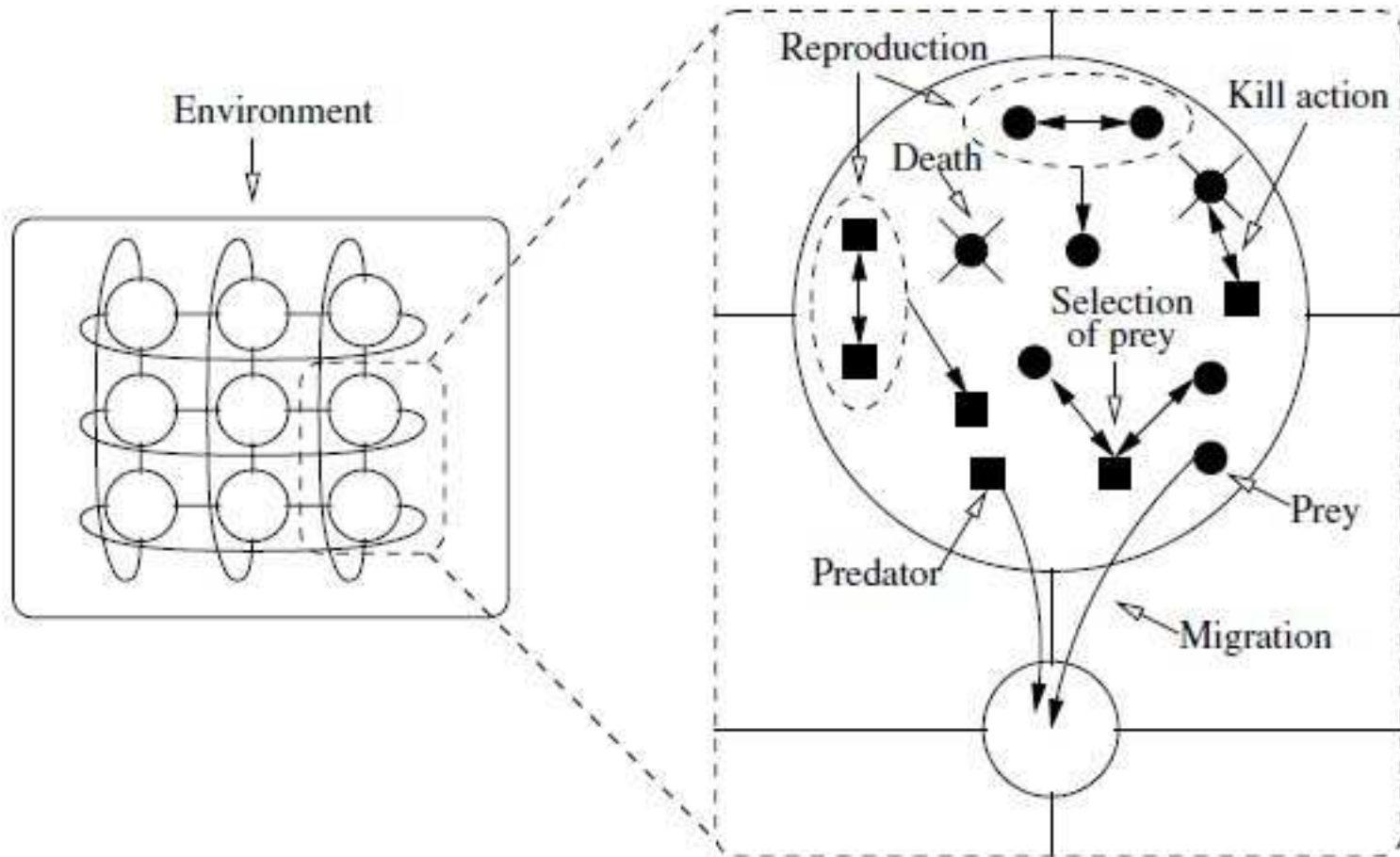
How the problem was solved:

CoEMAS with predator prey mechanism

Agent Goals

- Prey
  - Get resources from a dominated prey
  - Reproduce
  - Interact, give resources to dominating prey
  - Migrate
- Predator
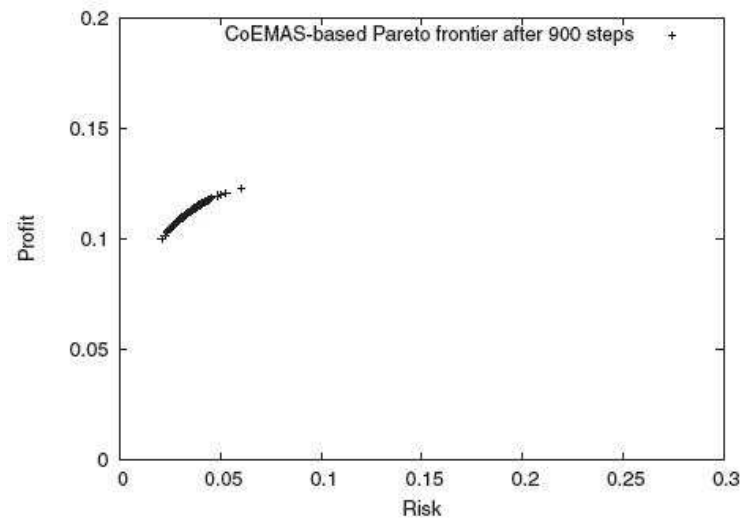 - Get resources from Prey it is interested in
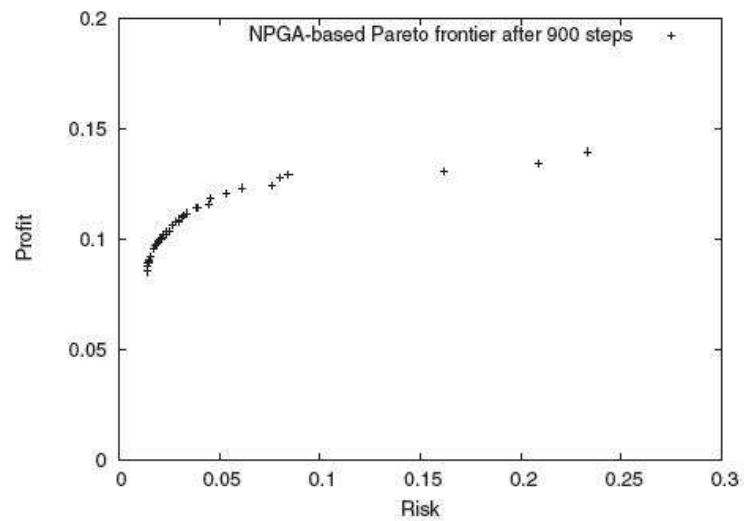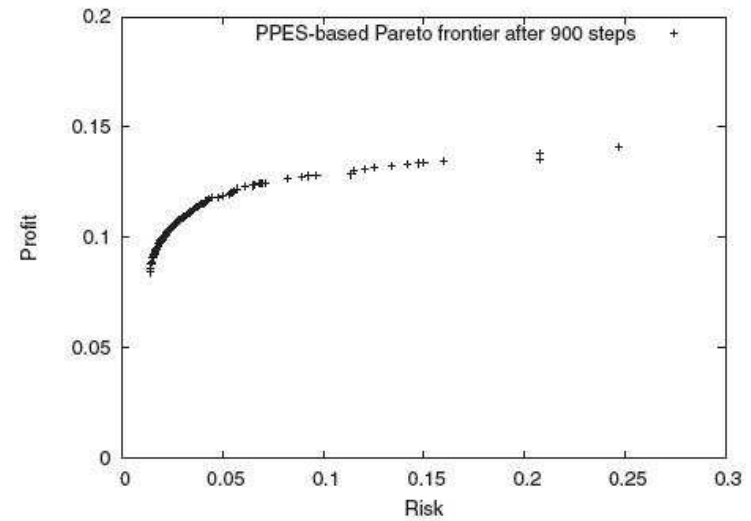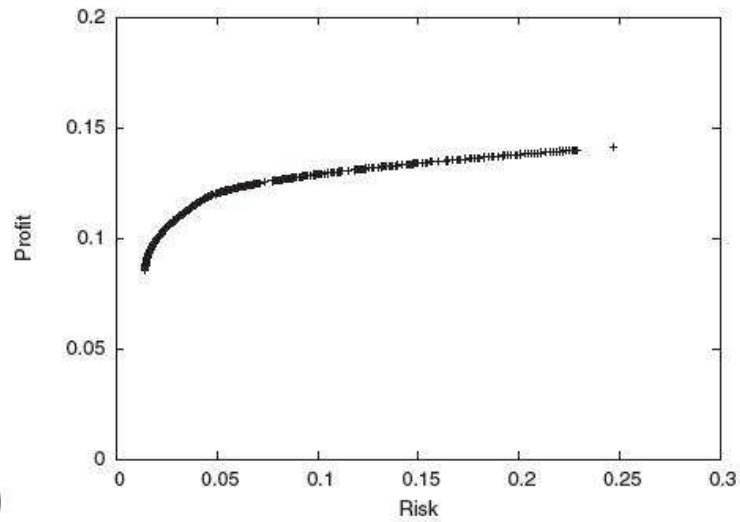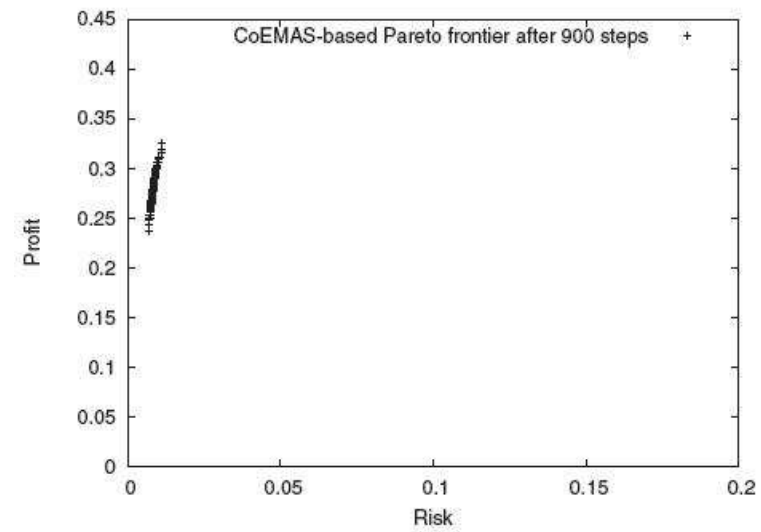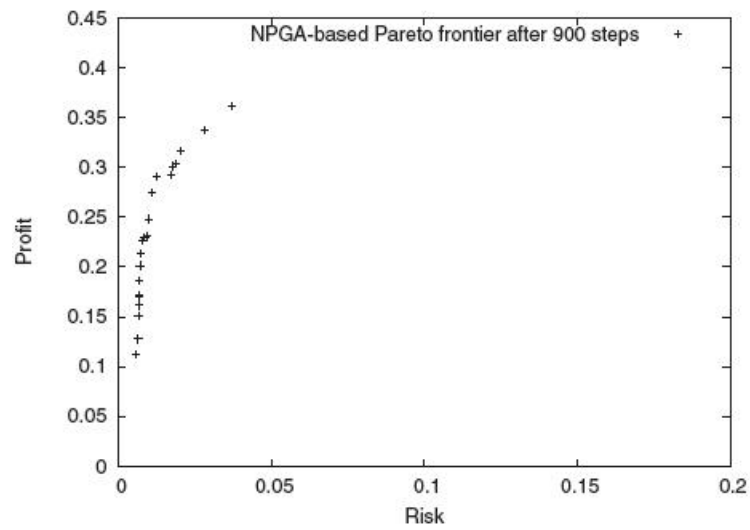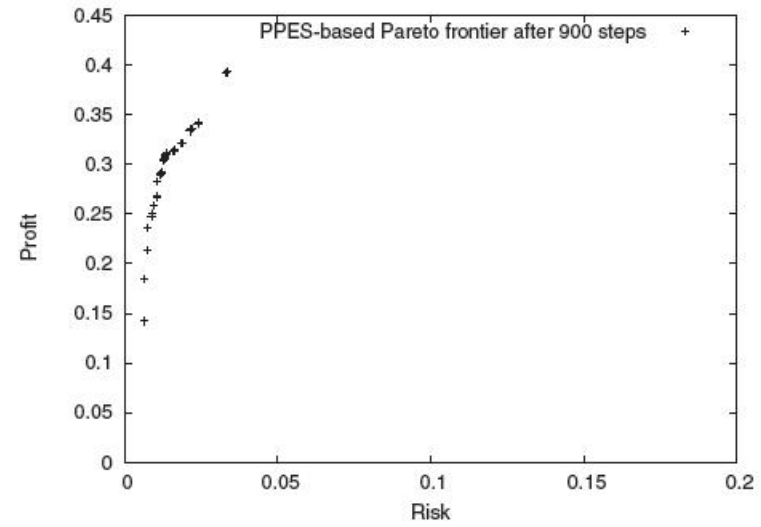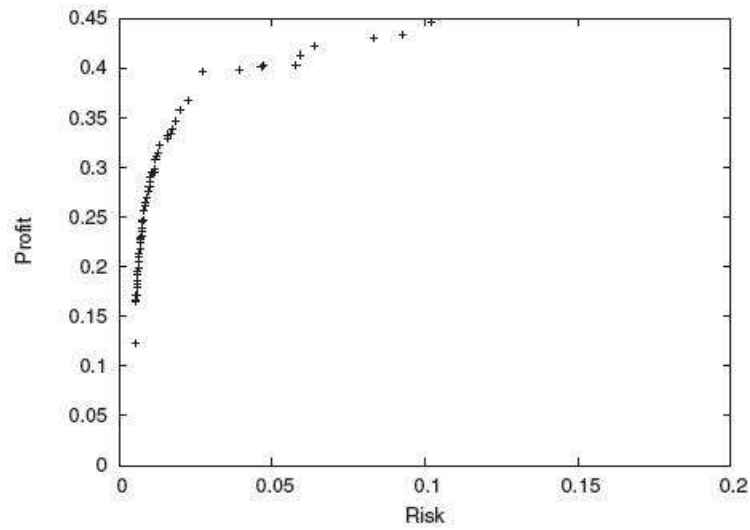 - Migrate

Agent actions

Concrete

- Each prey has a encoded solution in its genotype
- Each predator is interested in one dimension (part of general approach)
- 2 experiments
  - P=3
  - P=17
  - Warsaw Stock Exchange
  - Market index = WIG20

Result (3 stocks)

Result (17 stocks)

Conclusions (from paper)

- The CoEMAS is numerous and close to Pareto frontier.

- Diversity of population is worse than PPES and NPGA.

- (From other paper) By more iterations, CoEMAS tends to focus solutions around small part of frontier.

- More research is needed…

Own opinion

- Use of agents looks natural and has easy concepts which are explainable to decision makers.

Own opinion

- Other problems seemed to have better results.
- Too heavy and undifferentiated for most universal MAS
- Implementation <> Theory
- Use of agent platform implies that there is no guaranteed results within certain time.
- Idea …

References

1. R. Drezewski and L. Siwik. The application of agent-based co-evolutionary system with predator-prey interactions to solving multi-objective optimization problems. In Proceedings of the 2007 IEEE Symposium Series on Computational Intelligence. IEEE, 2007.

2. R. Drezewski. Multi-objective Optimization Technique Based on Co-evolutionary Interactions in Multi-agent System. In Lecture Notes in Computer Science. Volume 4448/2007(179-188). Springer Berlin / Heidelberg, 2007

3. http://www.stanford.edu/~wfsharpe/art/sr/sr.htm