

# Ant colony optimization for automatic design of strategies in an adversarial model

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**Abstract** Adversarial decision making is aimed at determining optimal strategies against an adversarial enemy who observes our actions and learns from them. The field is also known as decision making in the presence of adversaries. Given two agents or entities  $S$  and  $T$  (the adversary), both engage in a repeated conflicting situation in which agent  $T$  tries to learn how to predict the behaviour of  $S$ . One defense for  $S$  is to make decisions that are intended to confuse  $T$ , although this will affect the ability of getting a higher reward. It is difficult to define good decision strategies for  $S$  since they should contain certain amount of randomness. Ant-based techniques can help in this direction because the automatic design of good strategies for our adversarial model can be expressed as a combinatorial optimization problem that is suitable for Ant-based optimizers. We have applied the Ant System (AS) and the Max-Min Ant System (MMAS) algorithms to such problem and we have compared the results with those found by a Generational Genetic Algorithm in a previous work. We have also studied the structure of the solutions found by both search techniques. The results are encouraging because they confirm that our approach is valid and MMAS is a competitive technique for automatic design of strategies.

## 1 Introduction

Adversarial decision making is aimed at determining optimal strategies against an adversarial enemy who observes our actions and learns from them. This situation arises in many areas of real life, with particular (but not the only one) interest in counter-terrorist combat and crime prevention [13, 20].

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