A Search Game with Incomplete Information about Target's Energy

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Abstract. This paper deals with a two-person zero-sum search game called a *search allocation game*, in which a searcher distributes search resource to detect a target and the target moves to evade the searcher. When the searcher starts his search operation for the target, the target happens to stay at some position and have some energy for movement. The target knows the initial state consisting of its initial position and initial energy but the searcher does not. The problem is the game with private information about the target's initial state including initial energy. The payoff of the game is the detection probability of the target. We use a convex programming formulation and a linear programming one for the derivation of an equilibrium, which consists of the value of the game, an optimal distribution of searching resource by the searcher and an optimal movement strategy of the target. By some numerical examples, we analyze players' optimal strategies and evaluate the value of information about the target initial state.

Key words and phrases. Search theory, Game theory, Mathematical programming.