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USING EVOLUTIONARY GAMES THEORY FOR PLAYERS BEHAVIOR ANALYSIS IN COMPETITIVE SHOOTING GAMES: A LITERATURE REVIEW

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Introduction. The game theory is getting more attention as reinforced learning becomes more advanced and popular. The evolutionary approach means that we determine one’s strategy selection process based on the changing environment. The term ‘evolution’ has to be interpreted as the process of learning based on the information exchange between agents and has its connection with its biological counterpart.

Evolutionary game is an any formal game theory model, in which [1]:

1. Strategies are shifting in time replacing lower payoff strategies with higher payoff.
2. There is an inertia in decision making process of an agent.
3. Agents do not systematically attempt to influence each other’s strategies.

We will further use Friedman’s definition and would not narrow definition with assumptions as large population, bounded rationality, observable strategy and random matching. [1]

History of the Evolutionary games theory and finance. The evolutionary game theory applications differ from the orthodox game theory. Initially, it was used to address problems in evolutionary biology (Maynard Smith and Price, 1973; Maynard Smith, 1982; Taylor and Jonker, 1978). There, tendency of a strategy to change presented by behaviour of the population and ability to adapt. Later in economics evolutionary approach was used to investigate foundations of Nash Equilibrium and selection between several NE (e.g. Bin-more, 1991; Fudenberg and Kreps, 1993; Samuelson and Zhang, 1992)

Replicator dynamics. In finance, a research was focused on properties of the replicator equation. [2] It describes the evolution of the population strategy distribution and allows fitness function to incorporate the distribution of the population types (or agents types, as in economics). [3]

Behaviour analysis in cybersports. Cybersport is a competitive computer game, where players compete with each other. From a game theory point of view it can be subdivided to the set of strategies to be studied and analyzed. To narrow the subject we will further use "Counter Strike: Global Offensive" (referred as CS:GO) as a prime example of a cybersports title. Counter Strike: Global Offensive is a competitive team-based shooting game, where players play either as attacking, or defending side. One game lasts 30 rounds, or until one team scores 16 points. After 16 round teams switch sides. They have to manage in-game economy to allocate resources, apply both tactical and strategic thinking and rely on mechanical skills. [7]

Game analysis. Mathematically speaking, CS:GO is:

- Both cooperative (in a team) and non-cooperative as a whole,
- Asymmetric, as two teams have different roles. It can be considered partly symmetrical if strategy considers only a half term,
- Non-zero-sum,
- Simultaneous,
- Imperfect information,
- Possibly combinatorial,
- Continuous and possibly differential,
- Evolutionary.

Evolutionary game theory applications in behaviour analysis in cybersport. Still to be done. Evolutionary strategy could be applied at the scale of a whole game if we use changing ingame economy as a target reward function

Conclusion. The game theory, by itself, is a well-studied field. But its applications are limited and its models can, and may, be narrowed to a more specific topics. Cybersport, as it is relatively fresh topic, is mostly unresearched.

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Abstract. The paper is dedicated to the overview of current state of the evolutionary games approach to the building of environments to analyze players behavior. The evolutionary game theory applications differ from the orthodox game theory. Initially, it was used to address problems in evolutionary biology and later was suited for broader range of problems.

We will oversee the development of the evolutionary games theory in finance and its applications in behavior analysis in competitive gaming.

The paper is focused on replicator dynamics, learning model based on it and its possible application to behavior analysis based on fuzzy algorithms and approaches used in economics to be applied to the new emerging field of cybersports.

Keywords: game theory, cybersports, evolutionary games, behavior analysis, replicator strategy.