Interpretations of Nash Equilibrium Points

Boróka Olteán-Péter
Óbuda University and University of Sapientia, Marosvásárhely, Romania

Even though the Nash equilibrium is a concept of game theory, we apply it in economy, in geometry as well. The Nash equilibrium is an optimal outcome of a procedure where every player keeps their strategy, and does not want to deviate from their chosen. It conceptualizes the behavior of game participants to determine the best outcomes. It also contains predictions regarding the decision of the players if they use same decisions at the same time. In this study we compute Nash equilibrium points and visualize the output of the chosen algorithm.

There exist several algorithms to compute Nash equilibrium points, such as Lemke and Howson, Elzen and Talman (see [1]), Harsanyi (see [2]), etc. One of the most popular implementation is the Lemke and Howson algorithm which was developed for bimatrix games. This algorithm is "the best known among the combinatorial algorithms for finding a Nash equilibrium" where each players' game is interpreted as a best-response polytope. The Lemke-Howson algorithm uses the idea of maintaining a single guess as to what the supports should be, and in each iteration the guess is changed only a little bit. In this study we are going to present the mathematical concept of Nash equilibrium points and a data visualization based on the Lemke and Howson algorithm. The aim of visualization dashboard is to expand our limited study for uncountable cases with freely adjustable input. This tool makes the Nash equilibrium points more understandable for general users independently of the context of the use of the Nash equilibrium points.

The aim of data visualization tool is to become more distant from the game theory concept of the Nash equilibrium points and based on mathematical functions to determine a more general form of this this type of equilibrium point. This study also contains a summery of existing algorithms.

[1] A. H. Elzen and A. J. J. Talman. A procedure for finding nash equilibria in bimatrix games. *ZOR Zeitschrift für Operations Research Methods and Models of Operations Research*, 35(1):27–43, January 1991.

[2] J. C. Harsanyi. The tracing procedure: A bayesian approach to defining a solution forn-person noncooperative games. *International Journal of Game Theory*, 4(2):61–94, June 1975.