Introduction

Review of relevant literature

Course Material

All subparts of this section are taken from the \*\*\*\*\*ECE1657 Course notes\*\*\*\*ADD CITATION

Continuos Kernel Games

Continuous Kernel games, also refered to as Infinite Action-set Games invole some predefined game , where the follow hold true:

* represents a convex, nonempty, compact set, and is continuous in its elements.
* : is a continuous function in all its arguments
* represents the action of player

With notation representing the action profile of all players. For a continuos game, there exists a Nash Equilibirum NE if for some optimal action :

Equivalently for any player the action belongs to his or her Best-Response strategy BR:

Where the Best-Response strategy BR is defined as:

Debreu-Fan-Glicksberg NE Theorem

An important theorem when considering the convergence of continuous games to an NE is the Debreu-Fan-Glicksberg NE Theorem.

Consider a Game, defined as . represents a convex, nonempty, compact set and is a continuous function in and is convex in . Then admits at least a Nash Equilibrium in “pure” strategies.

The use of this theorem allows a guaranteed NE solution, so long as our game is convex it its set and cost function.

Repeated games and iterative algorithms

Consider a game, where the players repeatedly play the game. As a result. It is iterated some number k times where each Player uses the information of to update his or her strategy. Eventually after some k iterations, the Players will gradually converge towards a NE solution, if one exists.

In order to find such a convergence, iterative algorithms can be used.

* Best Response (BR) Play:
* Gradient Play:

Where \*\*\*\*\*define variables

These two algorithms were studied in class, but little was done in terms of analysing their specific properties. In other words \*\*\*identify gap a bit better

>>>>>>>>>>>>>>>>>>identify gap somewhere here

>>>>>>>>>>>>>>>>>>maybe a citation here as well, on some of the other things with the two algorithms

Objective

The objective of this paper is to explore the two iterative algorithms, BR Play and Gradient Play in order to identify their characteristics and use cases in solving continuous games.

Specifically the following questions will be explored through experimenting with the cost functions:

* What are the limitations for BR Play and Gradient Play? When should one algorithm be used over the other?
* What is the efficiency of each algorithm? Which converges to a NE solution quicker in terms of time and number of iterations? When does one converge faster over the other?
* How does changing different parameters affect the performance of each algorithm?

The goal at the end of the project is to have some deliverable to encompass the results of this finding. Furthermore, the programming steps taken to achieve the simulations should be done in a repeatable and adaptable way to promote further testing and research into the topic.