Syllabus: Economics 805, Part 1
Evolution and Learning in Games

Course Description

The aim of this course is to introduce a variety of topics from evolutionary game theory (= myopic disequilibrium dynamics in games played by large populations) and the theory of learning in games (= disequilibrium dynamics in games played by small groups of players). We will start with an extended introduction to the theory population games and evolutionary dynamics using both (some) simulations and (mostly) formal analyses. After this we will more briefly consider a variety of topics, with candidates including (i) evolution in extensive form games; (ii) geometric game dynamics; (iii) stochastic evolution in cooperative games; (iv) learning via calibrated forecasts.

All of the topics we study in this course require some knowledge about dynamical systems and Markov chains. Some topics require more advanced knowledge of probability theory and an assortment of other areas of mathematics. We will cover the essential mathematics in lecture, but we will likely sacrifice mathematical diligence in favor of covering more game theory models less rigorously.

Course requirements

In the first portion of the course (about 8 lectures), the basic reading material will be some combination of my chapter from the *Handbook of Game Theory* and my book. There will be a few problem sets that will be collected and graded. The aim here is to equip you with a basic command of evolutionary game theory and some of the relevant mathematics.

The second portion of the course will focus on a few individual papers and book chapters. Some of the aims here are (i) to expose you to a variety of current research topics; (ii) to help you develop the habit of reading theory papers closely; and (iii) to acquaint you with the mathematics you would need to learn to pursue research in each of these areas.

The homework for the second portion of the course will be to closely read a paper, either one from a list of suggestions or one that you find on your own and I approve. You will write a report summarizing the paper and explaining the main ideas of the proofs. Part of the way one learns to do theory is by reading papers closely until you have mastered part of the literature, and the aim here is to help you develop this habit.
References

General references

Evolution in extensive form games

Geometric and higher-order game dynamics

More deterministic game dynamics

Stochastic evolutionary dynamics


Stochastic stability in cooperative games


Learning via calibrated forecasts


Two introductory-level math references


Software and guides

