Computational Behavioral and Social Science II

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1. Course Description:

The interplay between individual and society is crucial for our understanding of society, be it human or animal ones. Traditionally, the philosophical investigations of issues about human nature and societies rely heavily on personal experience and intuitions. In many scientific disciplines, computational models provide the most precise theories comparing to other types of models. In the past several decades, researches in philosophy, statistics, and machine learning showed that it is possible to establish valid scientific theories and causal structures automatically from empirical data under a variety of different background assumptions. The recent developments of data mining, machine learning, and simulation techniques provide novel methods for the investigations of traditional social science issues. This course will in vestigate how we can gain and use behavioral and social science knowledge from experience using computational scientific methods.

This is the second half of a one-year seminar on computational behavioral and social science. In the last semester, we reviewed the common scientific methods and some major results in four distinct branches of behavioral and social sciences. We have also talked about the general philosophical issues of scientific confirmation and explanation in the philosophy of science literature. In this semester, we will focus on the naturalistic methodology of social science. More specifically, we will investigate how to apply the theory of complexity and dynamic systems to social sciences. If time allowed, we will examine further the principles of causal inferences in social sciences.

2. Aims of the Course:

- Introduce important issues and well-known theories in the philosophy of social science;
- Introduce the mathematical theory of non-linear dynamic systems, chaos and fractals to social scientists;
- Combining artificial intelligence, simulation technology and social science, creatively investigate novel scientific methods to explain major phenomenon and solve important issues in human social reality;
- Investigate the conceptual foundation and philosophical implications of the complexity theory and the emergence phenomenon.

Topics:

1. Philosophy of Social Science (2 Weeks)
   (a) Value and Objectivity
   (b) Naturalized Epistemology
   (c) Reductionism and Methodological Individualism
2. Complex Systems(4 weeks)
   (a) Linear Dynamic Systems
   (b) Non-linear Dynamic Systems
   (c) Chaos
   (d) Fractals
3. Social Complexity(3 weeks)
   (a) Social Complexity Theory
   (b) Agent-based Modeling
4. Emergence(2 weeks)
   (a) Social Emergence
   (b) Cognitive Science and Social Science
5. Causality(3 weeks)
   (a) Causal Inference in Social Sciences
   (b) Causality and Emergence

3. General Requirements:

- Class participation:
  This is a discussion course. We value well-informed contributions to class discussion.
- Careful reading:
  We will talk about your questions and ideas about the readings in class. Be prepared and do the reading before classes so that you can participate in the discussion.

4. Course Project:

The purpose of the project is to inform you how to conduct research on an issue you find interesting or important. You can either choose one of the suggested topics I provide or pick your own topic.

- You will provide: (i) a presentation (ii) final paper
- The paper should be well-written.

Proposal. If you would like to choose your own topic, please discuss your idea with me before you start to work on it.

Presentation. Prepare for 30 minutes presentation and 10 minutes for comment and response. Choose a date and let me know.

Final Paper: 5-6 pages, Due June 17. Submit a docx or pdf file by email. Send it to 6687@*cnu.edu.cn*

5. Course Evaluation:

Presentation/Paper/Participation: 30/60/10

6. Readings

Here is a list of all the readings:

- Mark Risjord. (2010) *Philosophy of Social Science A Contemporary Introduction*, Routledge.
- Paul Blanchard, Robert L. Devaney, and Glen R. Hall. (2012) *Differential Equations*, 4th edition. Cengage Learning.
- Stephen P. Turner. (2018) *Cognitive Science and the Social: A Primer*, Routledge.
- Claudio Cioffi-Revilla. (2017) *Introduction to Computational Social Science Principles and Applications*, 2nd edition. Springer.
- Uri Wilensky, William Rand. (2015) *Introduction to Agent-Based Modeling: Modeling Natural, Social, and Engineered Complex Systems with NetLogo*, The MIT Press.
- Keith Swayer. (2005) *Social Emergence*, Cambridge University Press.
- Mark A. Bedau, Paul Humphreys. (2008) *Emergence: Contemporary Readings in Philosophy and Science*, A Bradford Book.
- Judea Pearl. (2009) *Causality: Models, Reasoning and Inference*, 2nd edition. Cambridge University Press.
- Krzysztof Chalupka, Frederick Eberhardt, Pietro Perona. "Causal feature learning: an overview". *Behaviormetrika* 44(1), December 2016.

I will send the reading materials to you via email one week before the corresponding class.