Introduction

Political scientists are often interested in explaining concepts that are difficult if not impossible to observe. Examples of unobservable concepts include political knowledge, political ideology, democracy, respect for human rights, or inequality in developing countries. A key challenge for political scientists and social scientists generally, is creating models that can explain these concepts while also capturing the uncertainty associated with their measurement.

This course will provide an introduction to measurement models generally with specific focus on Bayesian measurement models and measurement models that make use of text data and the relational data typical of social network analysis. The course will also emphasize the use of construct validity to assess new and existing measures in applied research. I motivate the development of the models introduced in this class with a discussion of the Bayesian perspective on the relationship between data and model parameters. This perspective is useful because it shifts the burden of validity from the primary source documentation and raw data to the model parameters that bind these diverse pieces of information together.

Though this class serves as an introduction to latent variable modeling specifically and measurement theory more generally, there is a lot of ground to cover and a lot fascinating research being done in political science and elsewhere. There are many articles, working papers, and books that could be on this syllabus that we do not have time to cover. I have tried to include much of this information in the suggested reading sections of this syllabus. We will also talk about much of this material during the final week or two of class.
Class Expectations

The class will meet twice a week for 1.5 hours. We will split our time across two or three distinct activities during each class period: (1) lecture, (2) discussion, and (3) programming. The Class Schedule section below provides details about each of these sections across the 15 weeks of the semester. Read all of the assigned materials and be prepared to discuss each piece at the assigned class meeting. There are six (or so) problem sets for the course that are each worth 10% of the final grade. Each problem set should take approximately 5-20 hours to complete. 20% of the grade comes from the data project. The remaining 20% of the course grade is for participation in the classroom discussions.

Assignments

1. **Discussion Reading**: There will be at least one discussion reading assigned per week. We will devote some of our time to discussing and assessing the measurement strategy employed by this article.

2. **Data project (individual version)**: 5-10 page written summary of latent variable estimates derived from a set of manifest variables and fully specified model. The paper should justify the link between the theory and the model parameterization, which links the manifest variable with the latent variable. Describe each manifest variable in detail and assess the construct validity of each individually and the construct validity of the latent variable itself. Make sure to assess the **translational validities**: Face validity and Content validity, and the **criterion-related validities**: Predictive validity, Concurrent validity, Convergent validity, Discriminant validity.

3. **Data project (group version)**: Complete a publication quality manuscript that motivates the use of a latent variable. The paper should fulfill all the requirements specified in the Data project (individual version) above. I expect that group projects will be submitted to at least one political science conference and should be submitted for journal review after additional revisions over the summer.

4. **Problem Sets 1-6**: Complete applied bi-weekly problem sets. I encourage students to work on these problem sets in groups. Each student must complete each problem set.

Due dates appear below in the Class Schedule section. Assignments are due at the beginning of the class in the week of the due date.

Acknowledgments

Elements of the syllabus and other class materials created for this class are based in part on the Bayesian Statistics class offered by Seth Hill at University of California, San Diego and the Measurement class offered by Keith Poole at UCSD and now the University of Georgia. Some additional material also comes from the Research Design (204A) course developed by David Lake and Mathew McCubbins at UCSD.
Text Books

Required Books


Suggested Books

We will read select portions of some of the titles listed here in addition to articles listed below. Additional supplementary books are also listed below.


Class Schedule

Week 1: The Politics of Measurement and the Measurement of Politics

Lecture and Discussion Readings:


Suggested Readings:


Week 2: Introduction to Latent Variable Models

Lecture and Discussion Readings:


Suggested Readings:


### Week 3: Theories of Measurement and Latent Variable Models

The first problem set is due by the beginning of class this week.

*Lecture and Discussion Readings:*


### Week 4: Introduction to Probability and Models of Probability

*Lecture and Discussion Readings:*


*Suggested Readings:*


### Week 5: Probability Models Using STAN

*Lecture and Discussion Readings:*

Suggested Readings:


Week 6: The Latent Variable Model Using STAN

The first draft of the data project is due.

Lecture and Discussion Readings:


Week 7: Dynamic Versions of the Latent Variable Model

The second problem set is due by the beginning of class this week.

Lecture and Discussion Readings:


Suggested Readings:


**Week 8: Additional Extensions to the Latent Variable Model**

**Lecture and Discussion Readings:**


**Suggested Readings:**


Week 9: Text as Data

The third problem set is due by the beginning of class this week.

Lecture and Discussion Readings:


Suggested Readings:


Week 10: Latent Variable Models of Text

Lecture and Discussion Readings:


Suggested Readings:


5. Lauderdale, Benjamin E and Tom S Clark. 2014. “Scaling politically meaningful dimensions using texts and votes.” American Journal of Political Science
Week 11: Related Models of Scale Development and Assessment

The fourth problem set is due by the beginning of class this week.

Lecture Readings:


Suggested Readings:


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**Week 12: Relational Models of Data**

*Lecture and Discussion Readings:*


*Suggested Readings:*

Week 13: Measurements of Social Network Structures (part 1)

The fifth problem set is due by the beginning of class this week.

Lecture and Discussion Readings:


Week 14: Measurements of Social Network Structures (part 2)

Lecture and Discussion Readings:


Suggested Readings:


Week 15: Construct Validity, Conclusion Validity, and the Philosophy of Science

The sixth problem set is due by the beginning of class this week.

Lecture and Discussion Readings:


Suggested Readings:


Week 16: Finals Week

The group or individual measurement projects are due by the scheduled final exam time this week.
Week 16+: Selected Additional Articles

This class presents a lot of material about measurement. It is not a class about social network analysis, text analysis, Bayesian statistics, “big data,”, or the development of algorithms. We have considered text books and articles that use all these tools. There are many articles across the subfields and outside of political science that we have not considered that are helpful for those interested in exploring these other topics in more depth. In this section, I’ve added a few more articles that political scientists should consider when trying to understand the developments of these different fields over the last few decades. Also see the suggested reading sections above for much more. I will add additional information and modify these sections as I continue to work in these areas and teach this course.


Academic Dishonesty

The Department of Political Science, along with the College of the Liberal Arts and the University, takes violations of academic dishonesty seriously. Observing basic honesty in one’s work, words, ideas, and actions is a principle to which all members of the community are required to subscribe.

All course work by students is to be done on an individual basis unless an instructor clearly states that an alternative is acceptable. Any reference materials used in the preparation of any assignment must be explicitly cited. Students uncertain about proper citation are responsible for checking with their instructor.

In an examination setting, unless the instructor gives explicit prior instructions to the contrary, whether the examination is in class or take home, violations of academic integrity shall consist but are not limited to any attempt to receive assistance from written or printed aids, or from any person or papers or electronic devices, or of any attempt to give assistance, whether the one so doing has completed his or her own work or not.

Lying to the instructor or purposely misleading any Penn State administrator shall also constitute a violation of academic integrity.

In cases of any violation of academic integrity it is the policy of the Department of Political Science to follow procedures established by the College of the Liberal Arts. More information on academic integrity and procedures followed for violation can be found at: http://laus.la.psu.edu/current-students/academics/academic-integrity/college-policies

Note to students with disabilities: Penn State welcomes students with disabilities into the University’s educational programs. If you have a disability-related need for reasonable academic adjustments in this course, contact the Office for Disability Services. For further information regarding policies, rights and responsibilities please visit the Office for Disability Services (ODS) Web site at: www.equity.psu.edu/ods/

Instructors should be notified as early in the semester as possible regarding the need for reasonable accommodations.