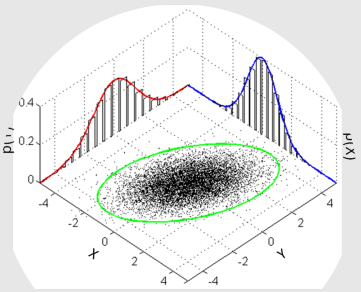

Modeling, Forecasting, and Decision Making

INTA 6004

Instructor Info

David Muchlinski

TTH: 11:00-12:00

Habersham 147

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Course Info

Preq: INTA 6003 or departmental equivalent strongly recommended

TTH

3:30-4:45

Habersham 136

About

This course will introduce students to the uses of forecasting modelings based on quantitative approaches including regression and machine learning models for the prediction of variables related to conflict and political violence.

Overview

Empirical research in political science in general – and conflict research in particular – has historically focused more on testing hypotheses by which scholars often imply an "explanation" of events and has devoted much less attention to forecasting incidents and predicting political behavior. This is changing. Efforts to build and test predictive models of many types of political events, including conflict and violence, have become more common and have gained greater acceptance in the discipline. This seminar offers an introduction to this approach, some of its applications, and core tools, as well as ongoing debates. Participants will engage with recent scholarship and produce their own research design for the forecasting project.

Readings

Required Texts

There are no required texts to purchase for this course. All required readings can be accessed through the Georgia Tech library or Google Scholar.

Grading Scheme

25%	Assigned Weekly Discussion
25%	Participation
50%	Research Design

Grades will follow the standard scale: A = 89.5-100; B = 79.5-89.4; C = 69.5-79.4; D = 60-69.4; F <60. Curving is at the discretion of the professor and will only be utilized to maintain a normal grade distribution. "Rounding" of grades will only occur if a student has no outstanding assignments.

Learning Objectives

- Students will apply the principles of forecasting to questions regarding conflict in International Affairs.
- Students will apply research skills to address problems in the field of international affairs.

FAQs

What are the Requirements for this Course?

It is crucial to read carefully assigned papers for each week. Preparation is essential. Students will be responsible for leading the discussion of the papers for a particular week and also for preparing a research design paper that you will present in preliminary form at the end of the term.

Will this Course make use of any Software?

This course will introduce students to the Seerist software platform, but otherwise will not make use of any software. Students with previous experience with statistical software such as R or Python may utilize this software for their research design projects.

What Topics will be Covered?

This is a course on conflict forecasting. We will study the historical and newer literatures related to forecasting many forms of political violence including civil wars, genocides, and other types of conflict.

Research Design

Graduate students will complete a semester-long research design project that culminates in a research design (3-6k words, standard APSA formatting rules) on a topic of their choosing. Students must submit to me by week 5 a detailed prospectus detailing their research topic. This research design must discuss the application of quantitative forecasting techniques, discuss a possible source of data to analyze, and describe in detail a methodology that uses a forecast-based research design to assess their stated research topic.

Class Participation

As this is a graduate seminar, students are expected to come to class prepared to discuss, in critical detail, the assigned readings. As usual, these discussions must demonstrate an in-depth understanding of the reading, including common themes, theoretical and empirical weaknesses of the research design, issues of measurement, connections between theory and method, and limitations of the research designs. All students are expected to contribute to discussion as I will not prepare lectures or slides.

Assigned weekly Discussion

One student each week will be responsible for leading a discussion related to the required reading(s). Students should prepare multiple questions related to each required reading so that the discussion is robust. The same student will lead the discussion at the beginning of each seminar period.

Make-up Policy and Late Work

Make-up assignments and exams will not be permitted unless in case of legitimate medical or other concerns which should be discussed privately with the professor to determine legitimacy. If an extension is granted, work must be submitted by that time. If a student submits late work without notifying the professor of any change in circumstances, such work will not be accepted and receive a score of zero. Undergraduates will be penalized one letter grade per day late, for up to 3 days after which the assignment will receive a score of zero.

Diversity and Inclusivity Statement

The Institute does not discriminate against individuals on the basis of race, color, religion, sex, national origin, age, disability, sexual orientation, gender identity, or veteran status in the administration of admissions policies, educational policies, employment policies, or any other Institute governed programs and activities. The Institute's equal opportunity and non-discrimination policy applies to every member of the Institute community. The Institute's affirmative action program, Title IX program, and related policies are developed in compliance with applicable law. Pursuant to Title IX, the Institute does not discriminate on the basis of sex in its education programs and activities. As such, the Institute does not tolerate any kind of gender-based discrimination or harassment, which includes sexual violence, sexual harassment, and gender-based harassment. Inquiries concerning the Institute's application of or compliance with Title IX may be directed to the Title IX Coordinator, Burns Newsome, burnsnewsome@gatech.edu, 404-385-5151. Additionally, inquiries concerning the application of applicable federal laws, statutes, and regulations (such as Title VI, Title IX, and Section 504) may be directed to the U.S. Department of Education's Office of Civil Rights at `www2.ed.gov/ocr`.

Accommodations for Students with Disabilities

Reasonable accommodations will be made for students with verifiable disabilities. In order to take advantage of available accommodations, students must register with the Office of Disability Services at Suite 123, Smithgall Student Services Building, 353 Ferst Drive, 404-894-2563 (Voice); 404-894-1664 (TDD). For more information on Georgia Tech's policy on working with students with disabilities, please see review the Office of Disability Service's web page at `https://policies.ncsu.edu/regulation/reg-02-20-01/`. The Office of Disability Services collaborates with students, faculty, and staff to create a campus environment that is usable, equitable, sustainable and inclusive of all members of the Georgia Tech community. Disability as an aspect of diversity that is integral to society and Georgia Tech. If students encounter academic, physical, technological, or other barriers on campus, the Disability Services team is available to collaboratively find creative solutions and implement reasonable accommodations.

Academic Integrity

Academic dishonesty in the form of cheating or plagiarism will not be tolerated. In brief, plagiarism is defined, for the purposes of this class, as: copying, borrowing, or appropriating another entity's work and presenting it as your own in a any submitted assignment, deliberately or by accident. Acts of plagiarism will be reported in accordance with the Honor Code. In order to avoid being charged with plagiarism, if you use the words, ideas, phrasing, charts, graphs, or data of another person or from published material, then you must either: 1) use quotation marks around the words and cite the source, or 2) paraphrase or summarize acceptably using your own words and cite the source. The plagiarism policy is not restricted to books, but also applies to video and audio content, websites, blogs, wiki's, AI-generated content like Chat-GPT, and podcasts. Plagiarism includes putting your name on a group project to which you have minimally contributed. For information on Georgia Tech's Academic Honor Code, please visit `http://www.catalog.gatech.edu/policies/honor-code/` or `http://www.catalog.gatech.edu/rules/18/`. Any student suspected of cheating or plagiarizing on a assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations. The student will also receive a grade of zero on the assignment at the professor's discretion and be referred to the Department Chair, Associate Chair, or Graduate Committee Chair.

Class Schedule

SECTION 1: Into to MLE

Jan 6	Overview and Discussion of Expectations	No Required Reading
Jan 8	Away at SPSA	No Class Meeting
Jan 13-15	The Epistemology of Conflict Forecasting	REQUIRED READING Adler, R. (2001). The Crystal Ball of Chaos. *Nature* 414, 480–481. Breiman, L. (2001). Statistical Modeling: The Two Cultures. *Statistical Science* 16 199–215. Hofman, J.M. et al. (2017) Prediction and Explanation in Social Systems. *Science* 355,486-488 Shmueli, G. (2010) To Explain or to Predict?, *Statistical Science* 25(3), 289–310.
Jan 20-22	The (Im)possibility of Predicting Conflict	REQUIRED READING Reichhardt, T. (2005) Harder than Rocket Science. *Nature* 435, 1024–1025. Ward, M. D. (2016). Can we Predict Politics? Toward what End?. *Journal of Global Security Studies*, 1(1), 80-91. Cederman, L-E, and N.B. Weidmann. (2017). "Predicting Armed Conflict: Time to Adjust Our Expectations?" *Science* 355 (6324): 474–76 SUPPLEMENTAL READING Chadefaux, T., 2017. Conflict forecasting and its limits. Data Science, 1(1-2), pp.7-17. Hegre, H; Metternich, NW; Nygård, HM; Wucherpfennig, J; (2017) Introduction: Forecasting in Peace Research. *Journal of Peace Research*, 54 (2) pp. 113-124. Hegre, H., Vesco, P., Colaresi, M., Vestby, J., Timlick, A., Kazmi, N. S., ... & Walterskirchen, J. (2024). The 2023/24 VIEWS Prediction Challenge: Predicting the Number of Fatalities in Armed Conflict, with Uncertainty. arXiv preprint arXiv:2407.11045.
Jan 27-29	Frequentist Regression Modeling and p-values	REQUIRED READING Goldsmith, Benjamin E, Charles R Butcher, Dimitri Semenovich, and Arcot Sowmya. 2013. Forecasting the Onset of Genocide and Politicide: Annual Out-of-Sample Forecasts on a Global Dataset, 1988–2003. *Journal of Peace Research* 50 (4): 437–52. Verdeja, E. (2016). Predicting Genocide and Mass Atrocities. *Genocide Studies & Prevention*, 9(3).

Ward, Michael, Greenhill, Brian & Bakke, Kristin. (2010). The Perils of Policy by p-value: Predicting Civil Conflicts. *Journal of Peace Research*. 47. 363-375.

SUPPLEMENTARY READING

Hegre, H., & Sambanis, N. (2006). Sensitivity Analysis of Empirical Results on Civil War Onset. *Journal of Conflict Resolution*, 50(4), 508-535.

King, G., & Zeng, L. (2001). Logistic Regression in Rare Events Data. *Political Analysis*, 9(2), 137-163.

Feb 3-5 The Early Days of Conflict Prediction

REQUIRED READING

Beck, N, G King, and L Zeng. 2000. Improving Quantitative Studies of International Conflict: A Conjecture. *American Political Science Review*, 94, Pp. 21–36

De Marchi, S., Gelpi, C, and Grynaviski, JD. 2004. Untangling Neural Nets. *American Political Science Review*. 98(2): 371-378.

Beck, N., G. King, and L. Zeng. 2004. Theory and Evidence in International Conflict: A Response to de Marchi, Gelpi, and Grynaviski. *American Political Science Review* 98, 379-389

De Mesquita, B. B. (1980). An Expected Utility Theory of International Conflict. *American Political Science Review*, 74(4), 917-931.

Feb 10-12 Forecasting Political Instability

REQUIRED READING

Baillie, E., Howe, P. D., Perfors, A., Miller, T., Kashima, Y., & Beger, A. (2021). Explainable Models for Forecasting the Emergence of Political Instability. *PLOS One*, 16(7).

Bowlsby, D., Chenoweth, E., Hendrix, C., & Moyer, J. D. (2020). The Future is a Moving Target: Predicting Political Instability. *British Journal of Political Science*, 50(4), 1405-1417.

King, G. and Zeng, L. 2001 Improving Forecasts of State Failure, *World Politics*, 53(4): 623-658.

Goldstone, J. A., Bates, R. H., Epstein, D. L., Gurr, T. R., Lustik, M. B., Marshall, M. G., Ulfelder, J., & Woodward, M. (2010). A Global Model for Forecasting Political Instability. *American Journal of Political Science*, 54(1), 190–208.

Feb 17-19 Machine Learning vs. Classical Approaches

REQUIRED READING

Blair, R. A., & Sambanis, N. (2020). Forecasting Civil Wars: Theory and Structure in an Age of "Big Data" and Machine Learning. *Journal of Conflict Resolution*, 64(10), 1885-1915.

Beger, A., Morgan, R. K., & Ward, M. D. (2021). Reassessing the Role of Theory and Machine Learning in Forecasting Civil Conflict. *Journal of Conflict Resolution*, 65(7-8), 1405-1426.

Blair, R. A., & Sambanis, N. (2021). Is Theory Useful for Conflict Prediction? A Response to Beger, Morgan, and Ward. Journal of Conflict Resolution, 65(7-8), 1427-1453.

Colaresi, M., & Mahmood, Z. (2017). Do the robot: Lessons from machine learning to improve conflict forecasting. Journal of Peace Research, 54(2), 193-214.

Muchlinski, D., Siroky, D., He, J., & Kocher, M. (2016). Comparing Random Forest with Logistic Regression for Predicting Class-Imbalanced Civil War Onset Data. *Political Analysis*, 24(1), 87-103.

SUPPLEMENTARY READING

D'Orazio, V., & Lin, Y. (2022). Forecasting conflict in africa with automated machine learning systems. *International Interactions*, 48(4), 714-738.

Ettensperger, F. (2022). Forecasting conflict using a diverse machine-learning ensemble: Ensemble averaging with multiple tree-based algorithms and variance promoting data configurations. *International Interactions*, 48(4), 555-578.

Jonas Vestby, Jurgen Brandsch, Vilde Bergstad Larsen, Peder Landsverk & Andreas Forø Tollefsen. (2022) Predicting (de-)escalation of sub-national violence using gradient boosting: Does it work?. *International Interactions* 48:4, pages 841-859.

Siroky, DS. (2009) Navigating Random Forests and related advances in algorithmic modeling." *Statistical Surveys* (3) 147 - 163, 2009.

Montgomery, J. M., & Olivella, S. (2018). Tree-Based Models for Political Science Data. *American Journal of Political Science*, 62(3), 729–744

Feb 24-26 Deep Learning for Conflict Prediction

REQUIRED READING

Brandt, P. T., D'Orazio, V., Khan, L., Li, Y. F., Osorio, J., & Sianan, M. (2022). Conflict Forecasting with Event Data and Spatio-Temporal Graph Convolutional Networks. *International Interactions*, 48(4), 800-822.

Malone, I. (2022). Recurrent Neural Networks for Conflict Forecasting. *International Interactions*, 48(4), 614-632.

Radford, B. J. (2022). High Resolution Conflict Forecasting with Spatial Convolutions and Long Short-Term Memory. *International Interactions*, 48(4), 739-758.

SUPPLEMENTARY READINGS

Muchlinski, D., Yang, X., Birch, S., Macdonald, C., & Ounis, I. (2021). We need to go deeper: Measuring electoral violence using convolutional neural networks and social media. *Political Science Research and Methods*, 9(1), 122-139.

		Mueller, H., & Rauh, C. (2018). Reading between the lines: Prediction of political violence using newspaper text. *American Political Science Review*, 112(2), 358-375.
Mar 3-5	No Class	Away at ISA
Mar 10-12	Ensemble Methods and Stacking	REQUIRED READING Ettensperger, Felix. (2022) Forecasting Conflict using a Diverse Machine-Learning Ensemble: Ensemble Averaging with Multiple Tree-based Algorithms and Variance Promoting Data Configurations. *International Interactions* 48:4, 555-578. Montgomery, Jacob M, Florian M Hollenbach, and Michael D Ward. 2012. Improving Predictions Using Ensemble Bayesian Model Averaging. *Political Analysis* 20 (3): 271–91. Clarke, B. (2003). Comparing Bayes Model Averaging and Stacking when Model Approximation Error Cannot be Ignored. J*ournal of Machine Learning Research*, 4(Oct), 683-712. Yao, Y., Vehtari, A., Simpson, D., & Gelman, A. (2018). Using Stacking to Average Bayesian Predictive Distributions (with discussion). *Bayesian Analysis*, 13(3), 917-1003.
Mar 17-21	Spring Break	
Mar 26-29	Predicting Escalation and Continuous Targets	REQUIRED READING Hegre, Håvard, Paola Vesco & Michael Colaresi (2022) Lessons from an Escalation Prediction Competition, *International Interactions*, 48:4, 521-554 Vesco, Paola , Håvard Hegre, Michael Colaresi, Remco Bastiaan Jansen, Adeline Lo, Gregor Reisch & Nils B. Weidmann. (2022). United they stand: Findings from an Escalation Prediction Competition, *International Interactions*, 48:4, 860-896
Mar 31- Apr 2	Conflict Prediction Using New Data Sources	REQUIRED READING Scholz, S., Weidmann, N. B., Steinert-Threlkeld, Z. C., Keremoğlu, E., & Goldlücke, B. (2024). Improving Computer Vision Interpretability: Transparent Two-Level Classification for Complex Scenes. Political Analysis, 1-15. della Porta, D., Hunger, S., Hutter, S., & Lavizzari, A. (2024). Expanding protest event analysis through videos. *Mobilization: An International Quarterly*, 29(2), 245-262.
Apr 7-9	LLMs for Conflict Forecasting	REQUIRED READING Ye, C., Hu, Z., Deng, Y., Huang, Z., Ma, M. D., Zhu, Y., & Wang, W. (2024). Mirai: Evaluating LLM agents for Event Forecasting. arXiv preprint arXiv:2407.01231.

		Ansari, A. F., Stella, L., Turkmen, C., Zhang, X., Mercado, P., Shen, H., ... & Wang, Y. (2024). Chronos: Learning the language of time series. arXiv preprint arXiv:2403.07815. Skorupa Parolin, E., Hosseini, M., Hu, Y., Khan, L., Brandt, P. T., Osorio, J., & D'Orazio, V. (2022). Multi-coped: A multilingual multi-task approach for coding political event data on conflict and mediation domain. *In Proceedings of the 2022 AAAI/ACM Conference on AI, Ethics, and Society* (pp. 700-711). Osorio, J., & Vásquez, J. (2023). Classifying organized criminal violence in mexico using ml and LLMs. In *Proceedings of the 6th Workshop on Challenges and Applications of Automated Extraction of Socio-political Events from Text* (pp. 1-10).
Apr 14-17	Taking Stock	REQUIRED READING Håvard Hegre, Håvard Mokleiv Nygård, Peder Landsverk, (2021) Can We Predict Armed Conflict? How the First 9 Years of Published Forecasts Stand Up to Reality, International Studies Quarterly, 65:3, 660–668. Rød, Espen Geelmuyden, Tim Gåsste, Håvard Hegre, (2024) A review and comparison of conflict early warning systems, International Journal of Forecasting, 40:1, Pages 96-112.
Apr 21	TBD	
Apr 30	RESEARCH DESIGN	Due to Canvas 17:30