Technical Political Forecasting using Event Data

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Presentation at the Workshop on Forecasting Political Instablility
Council on Foreign Relations,
Washington DC
31 March 2011

Main points

- Event data, originally developed under DARPA funding 1965-1980, is a well-understood technique for collecting systematic information on political interactions over time
- Contemporary automated coding methods allow data to be collected in a transparent and reproducible manner in real time at a very low marginal cost
- Statistical models provide 70%-80% accuracy in predicting violence in protracted conflicts in out-of-sample tests at policy-relevant forecast leads
- Exponential increases in the availability of information on political events has produced a major change in the viability and utility of these methods

Integrated Conflict Early Warning System

- Unclassified project funded by DARPA Information Processing Techniques Office
- Funding at $40-million for 2007-2011
  - Largest quantitative conflict analysis project since the 1970s
- Objective is real-time forecasting of indicators of political instability in Asia with 6-24 month leads, 70%-80% accuracy
- Machine-coded event data has proven to be the core methodology for accurate forecasts
- Data covers 1997-present with 8.5-million stories from 27 sources
- Model accuracy has been assessed with a strict split-sample design

Reference:
Sean O'Brien. Crisis early warning and decision support: Contemporary approaches and thoughts on future research. *International Studies Review*, 12(1):87-104, 2010.

ICEWS “Events of Interest”

Domestic Political Crisis—Significant opposition to the government, but not to the level of rebellion or insurgency (for example, power struggle between two political factions involving disruptive strikes or violent clashes between supporters)

Rebellion—Organized opposition where the objective is to seek autonomy or independence

Insurgency—Organized opposition where the objective is to overthrow the central government

Ethnic/Religious Violence—Violence between ethnic or religious groups that is not specifically directed against the government

International Crisis—Conflict between two or more states or elevated tensions between two or more states that could lead to conflict

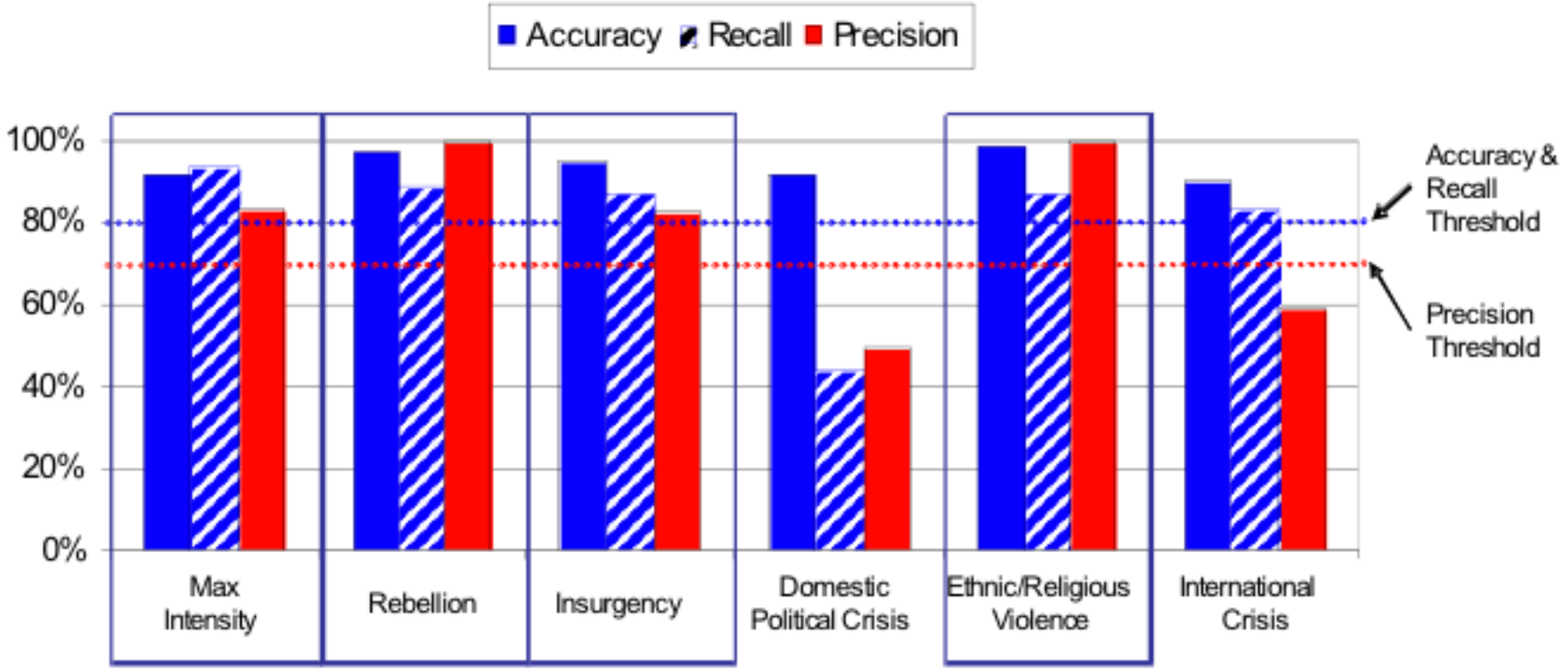
ICEWS Evaluation Criteria

$$Accuracy = \frac{number\ of\ correct\ predictions}{total\ predictions\ made}$$

$$Recall = \frac{number\ of\ correctly\ predicted\ conflicts}{total\ conflicts\ that\ occured}$$

$$Precision = \frac{number\ of\ correctly\ predicted\ conflicts}{total\ conflicts\ predicted}$$

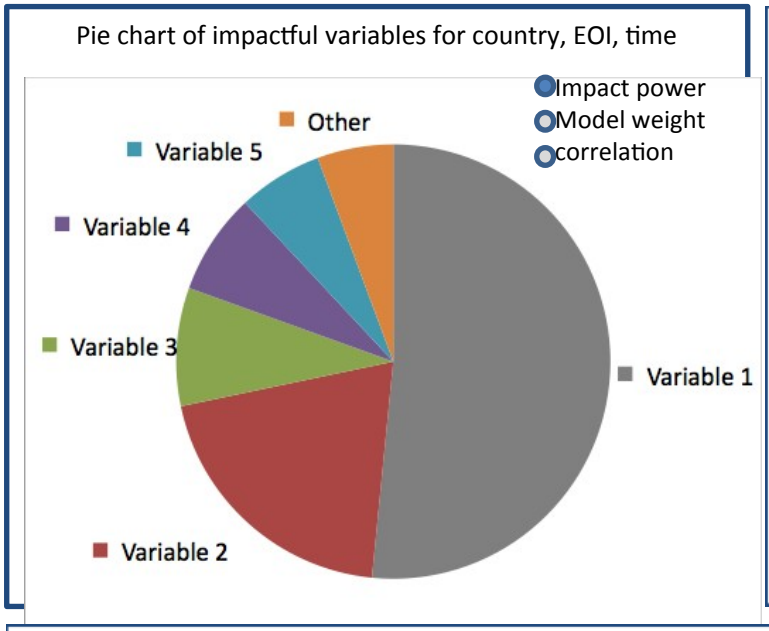
ICEWS Phase 1 Results: LM-ATL Out-of-Sample Results (DARPA Chart)

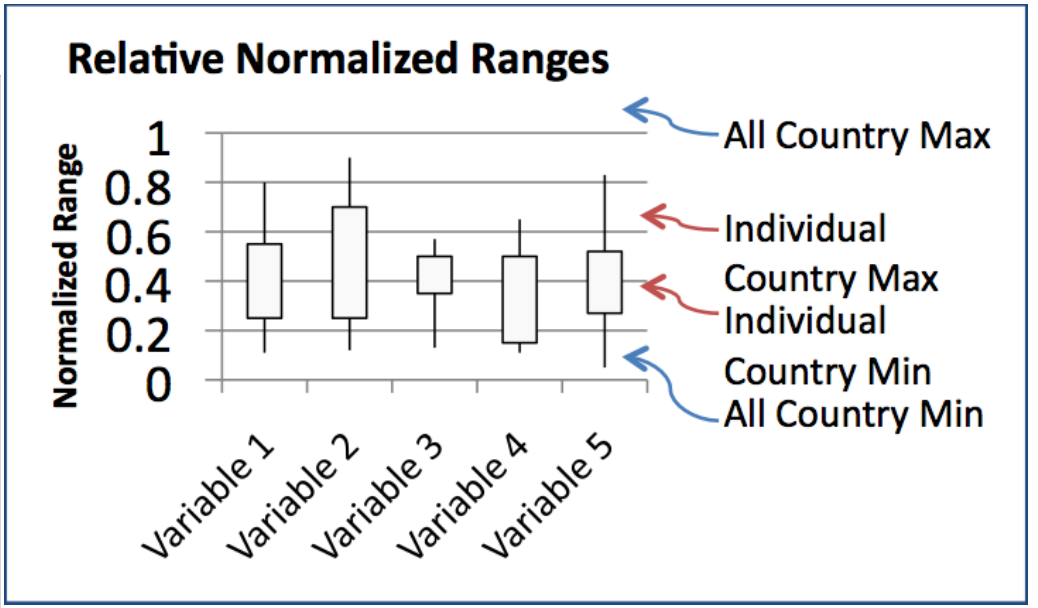


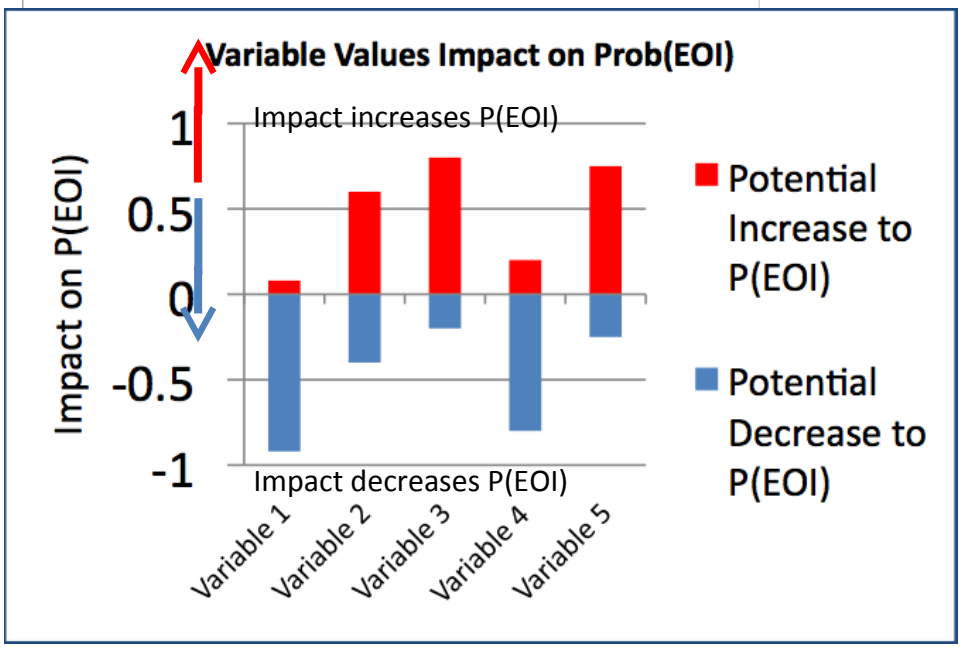
- Exceeds metrics for the maximum intensity index and 3 instability events: Rebellion, Insurgency, and Ethnic/Religious Violence – Passes Phase 1 gates
- By integrating improved versions of best models from multiple perspectives, team achieves more accurate, precise forecasts than any one model alone

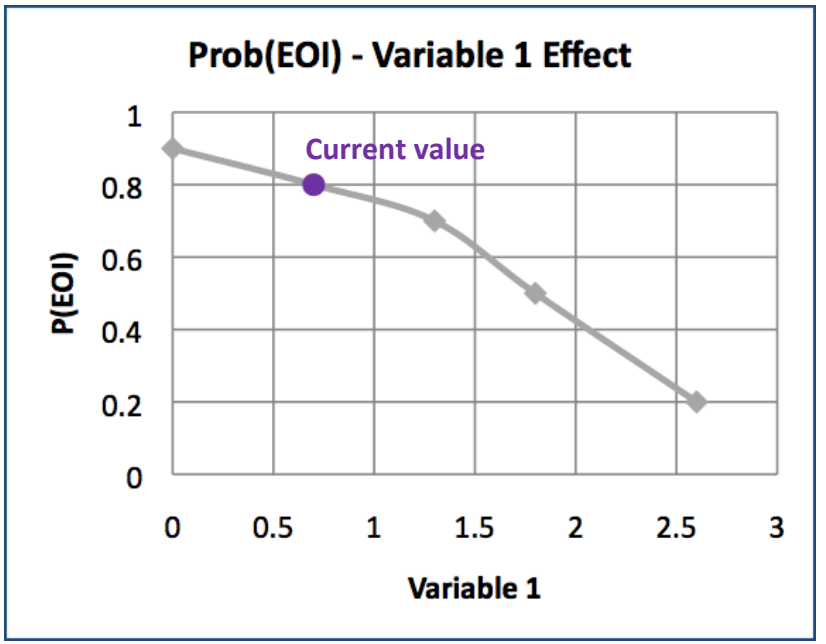
Components of a forecast

Lockheed ATL iTrace System









ICEWS Phase 1 Event Data

- 30-gigabytes of text from Lexis-Nexis
- 25 sources
- 8-million stories
- 26-million sentences
  - Only first four sentences coded in each story
- 3-million events
- Generally two orders of magnitude greater than any prior event coding effort

Example: 18 December 2007

BAGHDAD — Iraqi leaders criticized Turkey on Monday for bombing Kurdish militants in northern Iraq with airstrikes that they said had left at least one woman dead.

The Turkish attacks in Dohuk Province on Sunday — involving dozens of warplanes and artillery — were the largest known cross-border attack since 2003. They occurred with at least tacit approval from American officials. The Iraqi government, however, said it had not been consulted or informed about the attacks.

Massoud Barzani, leader of the autonomous Kurdish region in the north, condemned the assaults as a violation of Iraqi sovereignty that had undermined months of diplomacy. "These attacks hinder the political efforts exerted to find a peaceful solution based on mutual respect."

New York Times, 18 December 2007

http://www.nytimes.com/2007/12/18/world/middleeast/18iraq.html?_r=1&ref=world&oref=slogin (Accessed 18 December 2007)

TABARI Coding

BAGHDAD — Iraqi leaders criticized Turkey on Monday for bombing Kurdish militants in northern Iraq with airstrikes that they said had left at least one woman dead.

TABARI Coding: Verb

BAGHDAD — Iraqi leaders criticized Turkey on Monday for bombing Kurdish militants in northern Iraq with airstrikes that they said had left at least one woman dead.

Event Code: 111

TABARI Coding: Actors

BAGHDAD — Iraqi leaders criticized Turkey on Monday for bombing Kurdish militants in northern Iraq with airstrikes that they said had left at least one woman dead.

Event Code: 111

Source: IRQ

Target: TUR

TABARI Coding: Agents

BAGHDAD — Iraqi leaders criticized Turkey on Monday for bombing Kurdish militants in northern Iraq with airstrikes that they said had left at least one woman dead.

Event Code: 111

Source: IRQ GOV

Target: TUR

TABARI Coding: Verb [2]

BAGHDAD — Iraqi leaders criticized Turkey on Monday for bombing Kurdish militants in northern Iraq with airstrikes that they said had left at least one woman dead.

Event Code: 111

Source: IRQ GOV

Target: TUR

Event Code: 223

TABARI Coding: Actors [2]

BAGHDAD — Iraqi leaders criticized Turkey on Monday for bombing Kurdish militants in northern Iraq with airstrikes that they said had left at least one woman dead.

Event Code: 111

Source: IRQ GOV

Target: TUR

Event Code: 223

Source: TUR

Target: IRQKRD

TABARI Coding: Agents [2]

BAGHDAD — Iraqi leaders criticized Turkey on Monday for bombing Kurdish militants in northern Iraq with airstrikes that they said had left at least one woman dead.

Event Code: 111

Source: IRQ GOV

Target: TUR

Event Code: 223

Source: TUR

Target: IRQKRD REB

Event Model: Core Innovation

- Once calibrated, real-time event forecasting models can be run entirely without human intervention
  - Web-based news feeds provide a rich multi-source flow of political information in real time
  - Statistical models can be run and tested automatically, and are 100% transparent
- In other words, for the first time in human history—quite literally—we have a system that can provide real-time measures of political activity without any human intermediaries

Expansion to Global Coverage

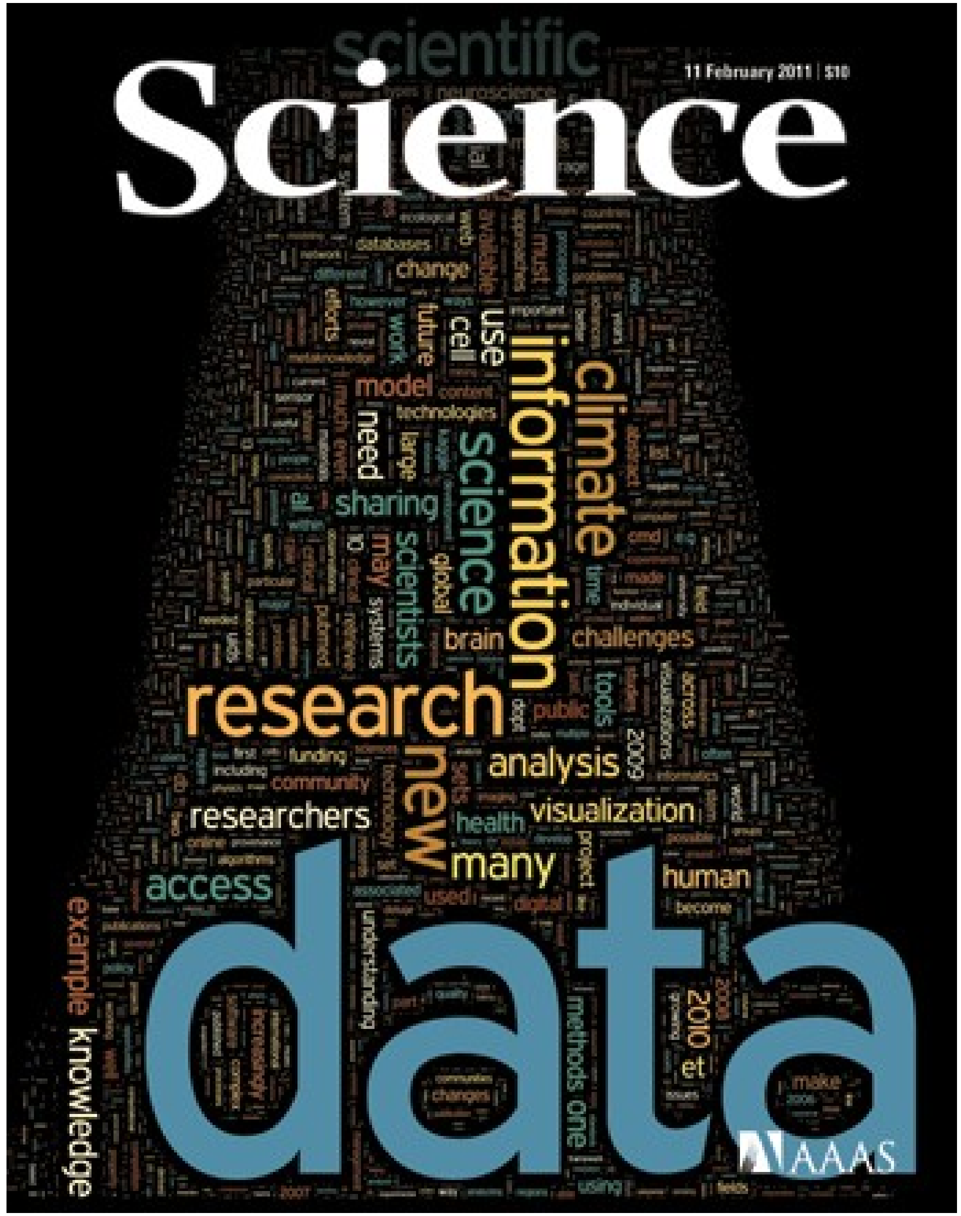
- Projecting an additional 25M stories, 2000-2011
  - International sources appear to provide most of the coverage in English
- Intake of existing political entity lists such as rulers.org, CIA World Factbook, Joshua Project, various non-state actor databases (corporations, IGOs, NGOs, militant groups)
- Rapid development of remaining actor dictionaries using named-entity recognition tools
- Incorporation of open-source natural language processing software to improve coding accuracy and consistency
- Objective: complete project by August 2011

Why now?

Can event data analysis produce non-trivial forecasts?

… when some interaction occurs with Kuwait, this interaction disproportionately sets off other interactions in the system. This result initially seems counterintuitive because Kuwait is the least powerful of the states we are studying, though that status may be the *reason* Kuwait is so important. If this characteristic holds generally, we may find that minor powers are more important in determining interaction interdependence than major powers.

Philip A. Schrodt and Alex Mintz. 1988.
"A Conditional Probability Analysis of Regional Interactions in the Middle East." *American Journal of Political Science* 32:217-230


Science
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scientific
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climate
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scientists
challenges
analysis
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researchers
many
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AAAS

European Media Monitor

- Project of the EU's Joint Research Center
- Monitors over 4000 sites from 1600 key news portals world-wide plus 20 commercial news feeds and, for some applications, also specialist sites.
- Retrieves over 40000 reports per day in 43 languages.
- Classifies all news according to hundreds of subjects and countries.
- Access on the web, via email and by RSS.
- Runs 24 hours per day, 7 days a week.

Source: http://emm.jrc.it/overview.html

Ideal characteristics technical forecasting models

- Ability to predict at least as well as a human analyst
  - This may be easier than we think. Tetlock estimates the predictive accuracy of human political analysts is only slightly greater than 50% for difficult forecasting problems.
  - Early work (1980s) in "expert systems" for classification problems showed the systems tended to be about 10% more accurate than humans and achieved this accuracy using less information.
- Known probabilities of forecasting outcomes—true positives, false positives, false negatives, true negatives—with confidence intervals
- Ability to calibrate the level of Type I and Type II errors using an ROC curve
- Consistent and affordable real time updating

Factors encouraging technical political forecasting

- Conspicuous failures of existing methods
- Success of forecasting models in other behavioral domains
  - Macroeconomic forecasting
  - Elections
  - Demographic and epidemiological forecasting
  - Famine forecasting: USAID FEWS model
  - Example: statistical models for mortgage repayment were quite accurate
- Technological imperative
  - Increased processing capacity
  - Information available on the web
  - “Moore’s Law states that computing power doubles every 18 months. Human cognitive ability is pretty much a constant. This leads to some interesting and not always desirable substitution effects”
    Larry Bartels, Princeton University

Factors encouraging technical political forecasting

- Demonstrated utility of existing methods
  - Political Instability Task Force
  - ICEWS
- Decision-makers now expect visual displays of analytical information
  - “They won’t read things any more”
- Ahmed Chalabi
  - At least *some* SME sources can be problematic, even if they do understand the language and culture
  - Also see N. Machiavelli (1513) on the topic of trusting exiles

Contemporary Technical Political Forecasting

- State Failures Project 1994
- Joint Warfare Analysis Center 1997
- FEWER [Davies and Gurr 1998]
- Various UN and EU forecasting projects
- Center for Army Analysis 2002-2005
- Swiss Peace Foundation FAST 2000-present
- Political Instability Task Force 2002-present
- DARPA ICEWS 2007-present
- Peace Research Center Olso and Uppsala University political forecasting models

Questions?

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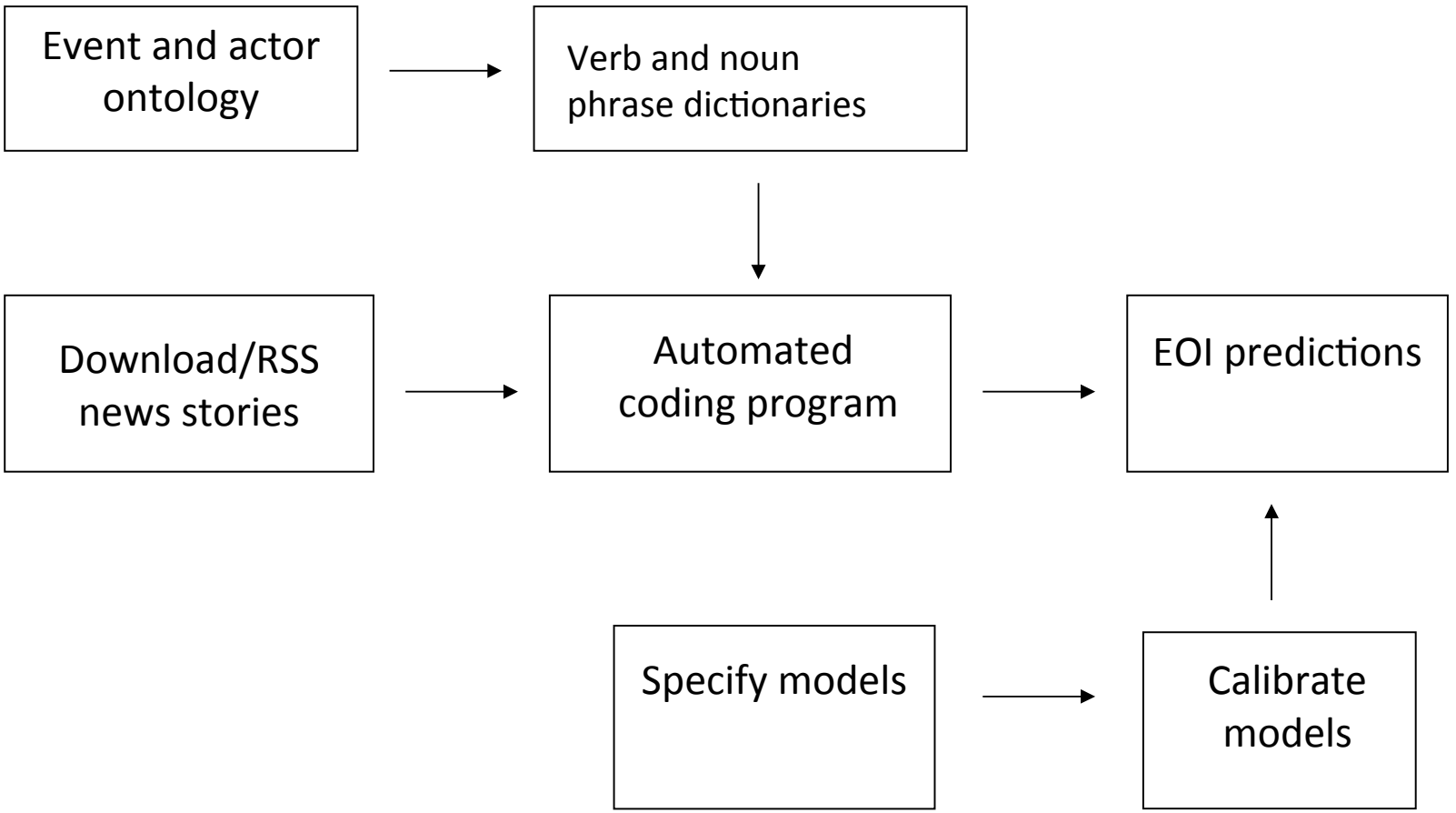
Event Data Generation Process



Coding Event Data: Opportunities

- Automated coding can maintain a consistent list of sub-state actors, including date restrictions. This can be modified as one gains experience with the conflict, then the data can be re-coded
- Automated methods are reasonably good at generating numerical totals for deaths and demonstration sizes
  - Duplicated stories are a challenge here
- In many parts of the world, local newspapers are now available electronically, particularly in real-time
- Thematic coding of political statements is a possibility
- Automated geo-coding is also a possibility

Getting to real time event data: Updating and calibration

- How frequently do the automated coding dictionaries need to be updated manually?
  - This depends heavily on the success of the automated actor detection software
  - Affective story classification models will also require occasion updating given rhetorical shifts, though some of this can be automated
- How frequently do the models need to be updated?
  - This is a tradeoff between the information available in a large data set versus the currency of using the most recent data