Operational Choices in Generating Real Time Political Event Data

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Event Data: Core Innovation

Once calibrated, monitoring and forecasting models based on real-time event data can be run [almost...] entirely without human intervention

- Web-based news feeds provide a rich multi-source flow of political information in real time
- Statistical and machine-learning models can be run and tested automatically, and are 100% transparent

In other words, for the first time in human history we can develop and validate systems which provide real-time measures of political activity without any human intermediaries

Major phases of event data

- 1960s-70s: Original development by Charles McClelland (WEIS; DARPA funding) and Edward Azar (COPDAB; CIA funding?). Focus, then as now, is crisis forecasting.
- 1980s: Various human coding efforts, including Richard Beale's at the U.S. National Security Council, unsuccessfully attempt to get near-real-time coverage from major newspapers
- 1990s: KEDS (Kansas) automated coder; PANDA project (Harvard) extends ontologies to sub-state actions; shift to wire service data
- early 2000s: TABARI and VRA second-generation automated coders; CAMEO ontology developed
- 2007-2011: DARPA ICEWS project
- 2012-present: full-parsing coders from web-based news sources: open source PETRARCH coders and proprietary Raytheon-BBN ACCENT coder

Open Event Data Alliance software

Birdcage

Basic, Integrated, and Reliably Distributed Coding, Actors, and Geolocation for Events

PETRARCH family of automated event data coders and dictionaries for CAMEO ontology

PLOVER Event Data Ontology

FJOLTYNG: PLOVER- and universal dependency-based event coder

PETRARCH-based web scraping and event coding pipeline

Overview of operational issues

Most of the infrastructure required for the automated production of political event data is now available through commercial sources and open-source software developed in other fields: it no longer needs to be developed specifically for event event production. However, a number of open questions remain:

- OEDA experience in the difficulties of maintaining a cloud-based software pipeline
- Maximizing vs "white-listing" news sources
- Coding ontology: weaknesses in CAMEO
- Approaches to multi-language coding
- Open source versus closed software solutions

Challenges discovered in OEDA's "Phoenix" project

Real time data is easy to get *started*—we have multiple software pipelines available on GitHub—but *keeping it running* is a challenge...

- Cloud services are still evolving
- We selected an unreliable (but inexpensive!) provider which required periodic reboots: we eventually had to abandon this.
- Filtering, even for white-listed sources, needs to be robust
- We over-estimated the maturity of our coding program, PETRARCH-2, and didn't provide systematic dictionary updates
- As a volunteer organization, maintaining continuity when individuals moved to new responsibilities was difficult

Phoenix is currently hosted through a U.S. National Science Foundation project at the University of Texas/Dallas, but that funding ends in early 2019.

Maximizing vs "white-listing" news sources

OEDA has deliberately chosen not to maximize the number of sources we code:

- Coding "everything" is surprisingly demanding in terms of computing resources, particularly when computationally-intensive parsing and/or translation is involved
- Obscure sources with unconventional editing are likely to cause coding errors and increase demands on dictionaries
- Censorship, rumors and "fake news" are a serious issues
- Most applications of event data rely on central tendencies, not finding a "needle in haystack"

Systematic research needs to be done on what, if anything, is gained from sources beyond those commonly used: the number of events generated by ICEWS drops off steeply beyond about twenty high-frequency sources.

Possible news sources

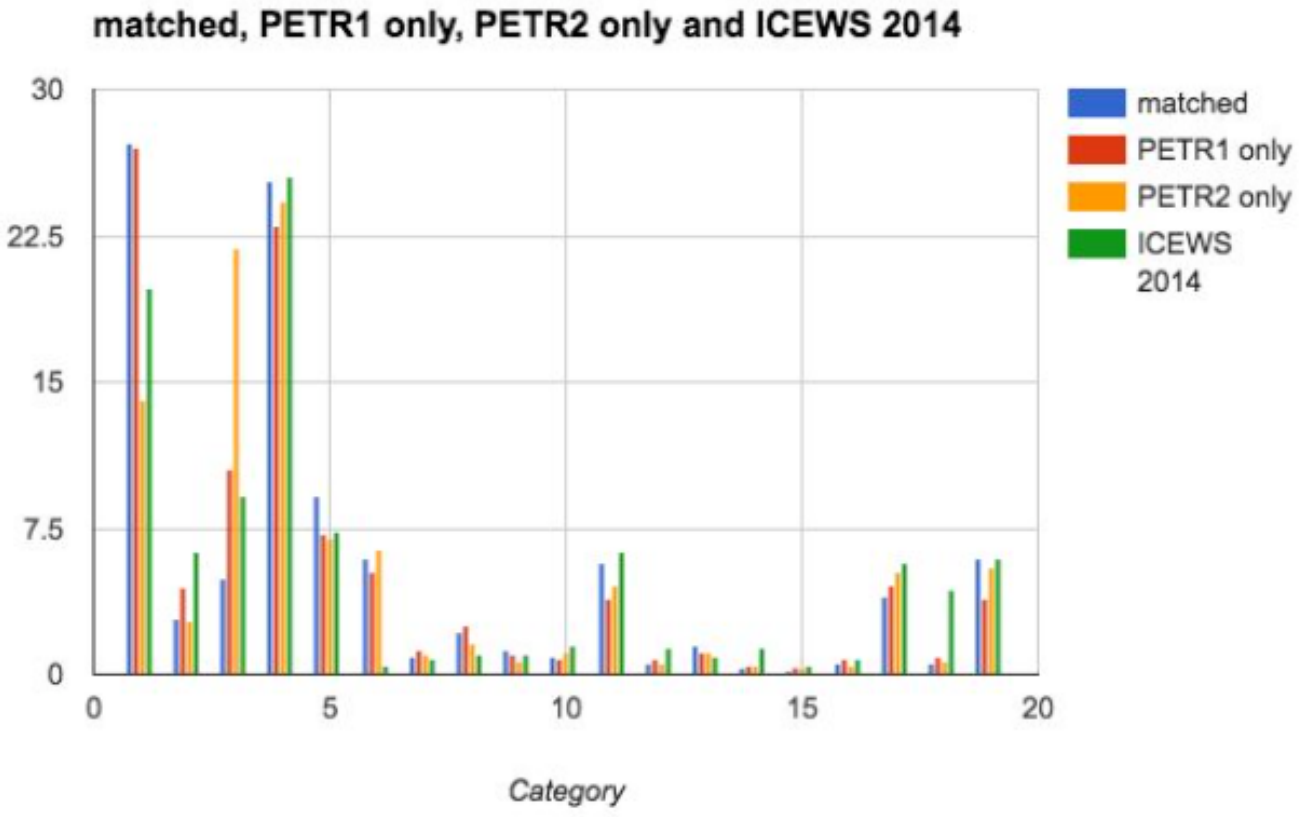
- International news services: most common sources for most data; quality is fairly uniform but attention varies
- Local media: quality varies widely depending on press independence, local elite control, state censorship, and intimidation of reporters
- Local NGO networks: these can provide very high quality information but require extended time and effort to set up
- Social media: These can be useful in very short term (probably around 6 to 18 hours) but have a number of issues
  - most content is social rather than political
  - bots of various sorts produce large amount of content
  - difficult to ascertain veracity: someone in Moscow or Ankara may be pretending to be in Aleppo

Coding schemes: WEIS primary categories (ca. 1965)

01	Yield	11	Reject
02	Comment	12	Accuse
03	Consult	13	Protest
04	Approve	14	Deny
05	Promise	15	Demand
06	Grant	16	Warn
07	Reward	17	Threaten
08	Agree	18	Demonstrate
09	Request	19	Reduce Relationship
10	Propose	20	Expel
		21	Seize
		22	Force

This was updated around 2002 into the CAMEO system, which is used in all of the systems in the United States. However, CAMEO was explicitly designed for the study of international mediation, not as a general-purpose political event ontology.

"CAMEO-World" across coders and news sources



Between-category variance is massively greater than the between-coder variance.

PLOVER

Political Language Ontology for Verifiable Event Records

Event, Actor and Data Interchange Specification

Open Event Data Alliance

http://openeventdata.org/

http://ploverdata.org/

DRAFT Version: 0.6b2

March 2017

PLOVER objectives

- Only the 2-digit event "cue categories" have been retained from CAMEO. These are defined in greater detail than they were in WEIS and CAMEO.

- Some additional consolidation of CAMEO codes, and a new category for criminal behavior

- Standard optional fields have been defined for some categories, and the "target" is optional in some categories.

- A set of standardized names ("fields") for line-delimited JSON (`http://www.json.org/`) records are specified for both the core event data fields and for extended information such as geolocation and extracted texts;

- We have converted all of the examples in the CAMEO manual to an initial set of English-language "gold standard records" for validation purposes—these files are at `https://github.com/openeventdata/PLOVER/blob/master/PLOVER_GSR_CAMEO.txt`—and we expect to both expand this corpus and extend it to at least Spanish and Arabic cases.

Event, Mode, and Context

Most of the detail found in the 3- and 4-digit categories of CAMEO is now found in the *mode* and *context* fields in PLOVER. More generally, PLOVER takes the general purpose "events" of CAMEO (as well as the earlier WEIS, IDEA and COPDAB ontologies) and splits these into "$event - mode - context$" which generally corresponds to "$what - how - why$." We anticipate at least four advantages to this:

1. The "$what - how - why$" components are now distinct, whereas various CAMEO subcategories inconsistently used the *how* and *why* to distinguish between subcategories.
2. We are probably increasing the ability of automated classifiers—as distinct from parser/coders—to assign *mode* and *context* compared to their ability to assign subcategories.
3. In initial experiments, it appears this approach is *much* easier for humans to code than the hierarchical structure of CAMEO because a human coder can hold most of the relevant categories in working memory (well, that and a few tables easily displayed on a screen)
4. Because the words used in differentiate *mode* and *context* are generally very basic, translations of the coding protocols into languages other than English is likely to be easier than translating the subcategory descriptions found in CAMEO.

Approaches to multi-language coding

- Ignore it on the assumption that most quality sources will be available in English, e.g. on `/en/` branches of news web sites. This could be tested: I'm guessing English is sufficient for many places but not Latin America and possibly not for Arabic and Chinese.
- Native language dictionaries: UT/Dallas NSF project is producing these for Arabic and Spanish, and has developed tools for assisting on this. These are highly labor intensive.
- Machine translation: systematic experiments are needed here, and obviously the technology is rapidly improving
- "Bag of words" machine-learning approaches such as support vector machines, neural networks, and word-embedding approaches (Google's `Word2Vec`). These require a large number of training cases.

Open versus proprietary software

I'm not exactly a neutral observer on this issue...

- The open source environment for both natural language processing and event coding is now extraordinarily rich and largely has standardized on the Python programming language. It is thoroughly international.
- Open source software is nonetheless only "free as in puppy:" very substantial investment of labor is required to effectively use a complex open source system
- Continued maintenance and documentation of an open source system depends on the development of a large user community: there are serious network effects in operation
- There may still be some institutional resistance to open source

Remaining challenges: source texts

- Gold standard records
  - These are essential for developing example-based machine-learning systems
  - They would allow the relative strengths of different coding systems to be assessed, which also turns out to be essential for academic computer science publications
  - We don't want "one coder to rule them all": different coders and dictionaries will have different strengths because the source materials are very heterogeneous.

- An open text corpus covering perhaps 2000 to the present. This is useful for
  - Robustness checks of new coding systems
  - Tracking actors who were initially obscure but later become important
  - Tracking new politically-relevant behaviors such as cyber-crime and election hacking

Remaining challenges: institutional

- Absence of a "killer app": we have yet to see a "I absolutely must have one of those!" moment.
  - Commercial applications such as Cytora (UK) and Kensho (USA) are still low-key and below-the-radar.
- Sustained funding for professional staff
  - (IMHO) Academic incentive structures are an extremely inefficient and unreliable method for generating well-documented, production-quality software.
  - 24/7/365 real-time systems occasionally break for unpredictable reasons, and need to have expert supervision even though they mostly run unattended
  - Updating and quality-control on dictionaries is essential and is best done with long-term (though part-time) staff
  - This effort could easily be geographically decentralized

Thank you

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Slides:
`http://eventdata.parusanalytics.com/presentations.html`

Links to open source software:
`https://github.com/openeventdata/`

Phoenix real-time data:
`http://eventdata.utdallas.edu/data.html`

ICEWS data:
`https://dataverse.harvard.edu/dataverse/icews`

Cline Center historical data:
`http://www.clinecenter.illinois.edu/data/event/phoenix/`

Supplementary Slides

Event data coding programs

- TABARI: C/C++ using internal shallow parsing.
  `http://eventdata.parusanalytics.com/software.dir/tabari.html`
- JABARI: Java extension of TABARI : alas, abandoned and lost following end of ICEWS research phase
- DARPA ICEWS: Raytheon/BBN ACCENT coder can now be licensed for academic research use
- Open Event Data Alliance: PETRARCH 1/2 coders, Moredcai geolocation. `https://github.com/openeventdata`
- NSF RIDIR Universal-PETRARCH: multi-language coder based on dependency parsing with dictionaries for English, Spanish and Arabic
- Numerous experiments in progress with classifier-based and full-text-based systems

PLOVER output


```
{
    "id": "test-0056-0036_1",
    "date": "2015-02-12",
    "source": [{"actorText": "Russian Foreign Minister Sergei Lavrov", "code": "RUS", "sector": "GOV"},
               {"actorText": "Iranian counterpart Mohammad Javad Zarif", "code": "IRN"}],
    "target": [{"actorText": "Syria crisis", "code": "SYR"}],
    "event": "DISCUSS",
    "eventText": "discussed",
    "mode": "mode-holder",
    "context": "context-holder",
    "text": "MOSCOW: Russian Foreign Minister Sergei Lavrov and his Iranian counterpart Mohammad Javad
     Zarif discussed the Syria crisis by phone Wednesday, the Russian Foreign Ministry said in a statement
    "language": "en",
    "publication": "mudflat test data",
    "coder": "Parus Analytics",
    "version": "0.5b1",
    "dateCoded": "2017-03-20",
    "comment": "test output from mudflat",
},
```

PLOVER: ASSAULT modes

Name	Content
beat	physically assault
torture	torture
execute	judicially-sanctioned execution
sexual	sexual violence
assassinate	targeted assassinations with any weapon
primitive	primitive weapons: fire, edged weapons, rocks, farm implements
firearms	rifles, pistols, light machine guns
explosives	any explosive not incorporated in a heavy weapon: mines, IEDS, car b
suicide-attack	individual and vehicular suicide attacks
heavy-weapons	crew-served weapons
other	other modes

Adapted from Political Instability Task Force Atrocities Database:
`http://eventdata.parusanalytics.com/data.dir/atrocities.html`

PLOVER: general contexts

Name	Content
political	political contexts not covered by any of the more specific categories below
military	military, including military assistance
economic	trade, finance and economic development
diplomatic	diplomacy
resource	territory and natural resources
culture	cultural and educational exchange
disease	disease outbreaks and epidemics
disaster	natural disaster
refugee	refugees and forced migration
legal	national and international law, including human rights
terrorism	terrorism
government	governmental issues other than elections and legislative
election	elections and campaigns
legislative	legislative debate, parliamentary coalition formation
cbrn	chemical, biological, radiation, and nuclear attacks
cyber	cyber attacks and crime
historical	event is historical
hypothetical	event is hypothetical

Simple models are good!

Recent study on predicting criminal recidivism showed equivalent results could be obtained from

- A proprietary 137-variable black-box system costing $22,000 a year
- Humans recruited from Mechanical Turk and provided with 7 variables
- A two-variable statistical regression model

For this problem, there is a widely-recognized "speed limit" on predictive accuracy of around 70% and, as with conflict forecasting, multiple methods can achieve this.

Source: *Science* 359:6373 19 Jan 2018, pg. 263; the original research is reported in *Science Advances* 10.1126/sciadv.aao5580 (2018)