A Practical Guide to Generating Event Data

Philip A. Schrodt
Pennsylvania State University
schrodt@psu.edu
http://eventdata.psu.edu
Outline

- Existing data sets
- Unix and programming
- Downloading and formatting
- Named entity recognition
- Coding with TABARI
- Actor and event ontologies
- Aggregation
- High-volume coding
## Existing data sets

<table>
<thead>
<tr>
<th>Dataset</th>
<th>Focus</th>
<th>Geographical</th>
<th>Years</th>
<th>Geo-located?</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACLED</td>
<td>Conflict</td>
<td>Primarily Africa</td>
<td>1997–2010</td>
<td>Yes</td>
<td>Raleigh et al. 2010</td>
</tr>
<tr>
<td>GTD</td>
<td>Terrorism</td>
<td>Global</td>
<td>1970–2010</td>
<td>Yes</td>
<td>START 2012</td>
</tr>
<tr>
<td>ICEWS</td>
<td>General</td>
<td>Asia; global</td>
<td>1998–2010</td>
<td>No</td>
<td>O’Brien 2010</td>
</tr>
<tr>
<td>KEDS</td>
<td>General</td>
<td>Primarily Middle East</td>
<td>1979–2011</td>
<td>No</td>
<td>Schrodt and Gerner 2010</td>
</tr>
<tr>
<td>KOSVED</td>
<td>One-sided violence</td>
<td>Selected states</td>
<td>varies by case</td>
<td>No</td>
<td>Schneider et al. 2012</td>
</tr>
<tr>
<td>MID3 Incidents</td>
<td>Conflict</td>
<td>Global</td>
<td>1993–2001</td>
<td>Yes; MID- LOC</td>
<td>COW 2007; Braithwaite 2010</td>
</tr>
<tr>
<td>SPEED</td>
<td>General</td>
<td>Global</td>
<td>1946–2010</td>
<td>City</td>
<td>Nardulli 2011</td>
</tr>
<tr>
<td>UCDP/PRIO</td>
<td>Conflict</td>
<td>Global</td>
<td>1946–2011</td>
<td>Conflict site</td>
<td>Themnér and Wallensteen 2011; Hallberg 2012</td>
</tr>
<tr>
<td>ACD</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Urban and Hoelscher 2012; King and Lowe 2006</td>
</tr>
<tr>
<td>WITS</td>
<td>Terrorism</td>
<td>Global</td>
<td>2004–2010</td>
<td>City</td>
<td>NCTC 2011</td>
</tr>
</tbody>
</table>

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
Integrated open, real time data generation
Event Data in the [original] DARPA period

- Nation-state orientation; most analysis dealt with Cold War major power relations
- Global coverage
- Human coding
- Source texts were major Western newspapers
- Statistical models were relatively simple
Contemporary Event Data

- Substate and nonstate actors; most analysis deals with protracted conflicts
- Single-conflict and regional coverage
- Automated coding
- Source texts are from wire services (Reuters, AFP, BBC)
- Statistical models are very complex
ICEWS Phase I 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
Forthcoming Event Data

- Global coding, Jan-1979 to Jun-2012
- 180-million events based on open news sources
- CAMEO event, actor and sub-state agent coding
  - 15,000 verb phrase dictionary
  - 40,000+ political actors and agents
- Geolocated to city level
- Planned quarterly updates, backfit to 1900 or possibly 1800
What we know about event data in 2012 that confirms what we suspected in 1975

- Media fatigue is a major factor in event reporting
- WEIS and its derivatives—IDEA and CAMEO—contains most of the major categories required to code political interactions
- Human coding has about 25% error rate in long-term projects even when coders are initially trained to 90%+ accuracy. Multi-year, multi-institution projects may have substantially lower accuracy
- It is impossible for human coders to keep up with coding in real time
- Comments and meetings are about 30% to 50% of most event data
- Violent events are reported disproportionately
What we know about event data in 2012 that we didn’t know in 1975

• Machine coding to a level of accuracy comparable to (or better than) multi-institution human coding teams is straightforward

• Vast quantities of news reports are available in machine-readable form and can be downloaded automatically and for free using RSS feeds

• Some of the original WEIS categories cannot be consistently differentiated

• Scales and detailed coding categories add relatively little information; event reports alone explain about 50% to 75% of the variance
  • (but journal editors keep telling authors to remove this statistical finding from articles accepted for publication)
What we know about event data in 2012 that we *didn’t know* in 1975, continued

- News sources vary dramatically in their coverage; these effects differ by region and time. However, news service reports provide substantially greater coverage than individual newspapers
  - There appears to have been an exponential increase in the number of available stories starting about 2005.
  - Following the model of the study of pre-modern systems, we can apply what we’ve learned from conflicts where we have good data to conflicts where the data is not as good.

- Regionally specific data sets provide better coverage than global data data sets. It is difficult to maintain consistent coverage across the entire international system
  - This assessment may change with the newer global data sets
Pre-requisites

- “With great power comes great responsibility”
Pre-requisites

- “With great power comes great responsibility”
- Sourced variously to Luke 12:48, Voltaire, Gandalf, and Albus Dumbledore but in fact...
Pre-requisites

• “With great power comes great responsibility”
• Sourced variously to Luke 12:48, Voltaire, Gandalf, and Albus Dumbledore but in fact...
• Stan Lee, Spiderman I
Why do we have to learn all this technical crap?!?!?

Subtext: I just want to study politics!!!

• Hey, dude, we’re “scientists”…
• Could be worse…you could be a medical student…
  • Or a medieval historian
• The past fifty years have, in fact, marked a transition from where political science “research tools” consisted of a comfortable chair and a snifter of brandy to where we can make effective use of highly complex machines
  • Burt Monroe’s legislative debate data sets at Penn State are second in size to the Sloan Sky Survey of the entire universe
• None of this is likely to change any time soon
This?...
Or this…

Theories of International Politics and Zombies

Daniel W. Drezner
Computing Power

Control Data Corporation 3600 (ca.1965)
32 K (48-bit) RAM memory
1 processor
~1-million operations per second
Output: line printer
Computing Power

Control Data Corporation 3600 (ca.1965)
- 32 K (48-bit) RAM memory
- 1 processor
- ~1-million operations per second
- Output: line printer

Penn State High Performance Computing Facility
- 15 cluster computers
- 100 to 2000 2.66 Ghz processors in each cluster
- ~50 Gb RAM accessible to each processor
- 130 Tb disk space
- 4 interactive visualization rooms
Computing Power

Control Data Corporation 3600
(ca.1965)
32 K (48-bit) RAM memory
1 processor
~1-million operations per second
Output: line printer

Penn State High Performance Computing Facility
15 cluster computers
100 to 2000 2.66 Ghz processors in each cluster
~50 Gb RAM accessible to each processor
130 Tb disk space
4 interactive visualization rooms

Motorola Razr
16 Gb RAM memory
Dual processor
~500-million operations per sec
540 x 860 color display
Open Source Software
I WANT YOU TO OPEN SOURCE!

WWW.MIL-OSS.ORG
Statistics Packages :: Cars

Stata

R

SAS

SPSS
R:

- Open source
• Open source
• Widely used in all approaches to statistical analysis and pattern recognition
• CRAN library provides almost immediate access to new methods
  • events (event data aggregation)
  • tm (text miner)
• Robust scripting capabilities; easily interfaces with C/C++ when needed
• Skill set is widely available
NLP Components :: Smart Phones
NLP... it’s all components
Evolution of Statistical Training in Political Science

- 1985: Objective is to get grad students to take advanced courses in econometrics
  - Hint: deadends— SEM, co-integration models
Evolution of Statistical Training in Political Science

• 1985: Objective is to get grad students to take advanced courses in econometrics
  - Hint: deadends—SEM, co-integration models

• 2010: Objective is to develop advanced techniques that will be adopted in other disciplines
  - Imai, Sekhon, Fowler, Gill, King
  - Hint: Medical schools are rumored to pay better than the liberal arts
The Transition We Need in Programming

• Old model:
  - “We’ll just hire a programmer because that will be more efficient than doing it ourselves”
The Transition We Need in Programming

- Old model:
  - “We’ll just hire a programmer because that will be more efficient than doing it ourselves”

- Reality
  - Computer science departments and ExxonMobil can’t find enough programmers either
  - You take a serious efficiency hit in trying to explain what you want done
  - You may take a serious efficiency hit in not doing the task in the best way—NLP (and statistics) are specialized subfields
  - Programmers frequently are trained to focus on GUIs, (e.g. Java) which usually just get in the way in research computing
Why people don't want to be programmers

- Programming is a craft, not a science
  - “Between the mathematics that make [the computer] theoretically possible and the electronics that makes it practically feasible lies the programming that makes it intellectually, economically and socially useful. Unlike the extremes, the middle remains a craft, technical rather than technological, mathematical only in appearance.”
  - Michael Sean Mahoney, Histories of Computing (Harvard University Press)

- Practice, practice, practice

- Programmer efficiency varies by a factor of 10 to 20, which can be very demoralizing

- Popular perception of programmers
Why people don't want to be programmers

• Programming is a craft, not a science
  • “Between the mathematics that make [the computer] theoretically possible and the electronics that makes it practically feasible lies the programming that makes it intellectually, economically and socially useful. Unlike the extremes, the middle remains a craft, technical rather than technological, mathematical only in appearance.”
  Michael Sean Mahoney, Histories of Computing (Harvard University Press)
  • Practice, practice, practice

• Programmer efficiency varies by a factor of 10 to 20, which can be very demoralizing

• Popular perception of programmers
We need to utilize…

- Some formal training in core algorithms and data structures
  - Not just AP Java
- Rapid development scripting languages: perl and Python
- Lingua franca (and GUI): Java
- High performance: C/C++
- Regular expressions are to text analysis what calculus was to modeling physical systems
Why Python

- Open source (of course...tools want to be free...)
- Standardized across platforms and widely available/documented
- Automatic memory management (unlike C/C++)
- Generally more coherent than perl, particularly when dealing with large programs
- Text oriented rather than GUI oriented (unlike Java)
- Extensive libraries but these are optional (unlike Java)
- C/C++ can be easily integrated by high-performance applications
- Tcl can be used for GUI
Why use Unix?

- Stable and compact
  - About 20 commands will do almost everything you need; they haven't changed in 30 years
- Core of all major operating systems except Windows
  - Linux, OS-X, Android
  - Most functions are identical across OS-X and Linux
- Standardized set of compilers, so identical code can run on multiple systems.
  - “make” command will compile code on any machine
- Used in most cluster computers
- Research software is more likely to be written for Unix
- Command line is more efficient than mouse/menus in advanced applications
TABARI Basics: #1 Problem people have running TABARI

Are your files in Unix format, not Windows or the old Macintosh format?
• If you saved them in Excel, they are not
• If you processed them on a Windows system, they are not

• There are a variety of ways to solve this—I use BBEdit—but you have to address it

(Or send me the modified code for TABARI to address it automatically)
TABARI Basics: #2 Problem
people have running TABARI

See problem #1
TABARI Basics: #3 Problem
people have running TABARI

R T F M
Basic challenges that make text analysis hard
Event Data Generation Process

Event and actor ontology → Verb and noun phrase dictionaries → Automated coding program → EOI predictions

Download/RSS news stories

Specify models → Calibrate models
An event is an interaction which can be described in a natural language sentence which has as its subject and direct or indirect object an element of a set of actors, and as the verb an element of a set of actions, all of which are transitive verbs, and which can be associated with a specific point in time.
Olympic swimmer Michael Phelps admitted Sunday that he had engaged in "regrettable" behavior and "demonstrated bad judgment" after a photo was published that appeared to show him smoking cannabis.

Israeli aircraft bombed Gaza on Sunday hours after its leaders vowed to deal a blow to Hamas in response to new rocket fire two weeks following the end of a bloody war in the Palestinian enclave.

The world economic crisis spells the death of globalization and action is needed to protect the poor, said organizers of the World Social Forum as it wrapped up in Brazil on Sunday.

Israeli aircraft on Sunday bombed an empty police station in central Gaza and tunnels along the Hamas-ruled enclave's southern border with Egypt, witnesses said.

Palestinian president Mahmud Abbas lashed out at his Hamas rivals on Sunday, as officials from Palestinian groups gathered in Cairo amid hopes of bolstering a ceasefire in the Gaza Strip.
Israel vowed to strike back at Hamas on Sunday after renewed rocket fire from the Islamists' Gaza stronghold two weeks after the end of a bloody war in the battered Palestinian territory.

US Middle East envoy George Mitchell met Saudi Arabia's King Abdullah on Sunday on the last leg of a Middle East tour aimed at reviving the Israeli-Palestinian peace process.

Israeli Defence Minister Ehud Barak and Foreign Minister Tzipi Livni on Sunday voiced conflicting views on an emerging Egyptian-brokered ceasefire with Hamas in the Gaza Strip.

Pro-Palestinian groups meeting at the World Social Forum that ended Sunday launched a call for a worldwide boycott of Israel and a day of action on March 30.

The political supremo of Palestinian Islamist movement Hamas, Khaled Meshaal, on Sunday ruled out any "permanent ceasefire" until Israel ends its crippling blockade of the Gaza Strip.
## What it actually looks like

```
METADATA HTTP-EQUIV="Content-Type" CONTENT="text/html; charset=utf-8">
<html>
<head>
<title>Full Article</title>
<style type="text/css">
<!--body { font-size: 100%}-->
</style>
</head>
<body bgcolor="#FFFFFF" text="#000000">
<table width="100%" border="0" cellspacing="0" cellpadding="5" align="center">
<tr> 
<td class="k9"><a href="http://www.factiva.com"><img src="http://global.factiva.com/img/factivaw.gif" border="0"></a></td>
<td>
<div align="right"><img src="http://global.factiva.com/img/djnrw.gif" width="117" height="36"></div>
</td></tr>
</table>
<table width="100%" border="0" cellspacing="0" cellpadding="5" align="center">
<tr>
<td valign="top" colspan="2" align="right" bgcolor="#FFFFFF" class="source">
<hr>
</td>
</tr>
</table>  
<table width="100%" border="0" cellspacing="0" cellpadding="5" align="center">
<tr>
<td valign="top" colspan="2" align="right" bgcolor="#FFFFFF" class="source">
<hr> </td>
</tr>
</table>
</body>
</html>
```
CAIRO, Dec 1 (Reuters) - Egyptian police shot and killed an African migrant on Tuesday as he tried to slip across the Sinai peninsula desert border to Israel, a security source said.

Egyptian police have stepped up efforts in recent months to control the frontier with Israel following an increase in human trafficking through Egypt. At least 17 migrants have been killed at the border since May, the latest one two weeks ago.
The Sinai border is on one of the main routes for African migrants and refugees, almost all unarmed, seeking work or asylum in Israel. Egyptian police say the smugglers who ferry migrants to the border region sometimes fire on security forces.

The security source said police did not know the dead man's nationality, but he appeared to be in his early twenties. Eritreans are the largest group of people trying to cross into Israel from Egypt, but Ethiopians and Sudanese also make the trek.

Analysts and aid workers say the flow of migrants from the Horn of Africa through Egypt to Israel has increased in recent months as it has become more difficult to travel on other northward routes, such as via Libya to Europe.

(Reporting by Rasha Kamal; writing by Yasmine Saleh; editing by Tim Pearce)

(yasmine.saleh@reuters.com ; +20 2 2578 3290; Reuters Messaging: yasmine.saleh.reuters.com@reuters.net)
Text Sources
International news sources

- Reuters
- Agence France Presse (AFP)
- BBC (various news feeds)
- AP and UPI
- Xinhau (excellent Africa coverage)
- New York Times
- Washington Post
International news sources

- This is very much a moving target due to the changing dynamics of news gathering
- Coverage differs dramatically by region: “follow the money”
- Generally only available 1990 (or so) to the present; NYT Historical is an exception
- Most of these have web pages where you can get current content, but past content is limited
Lexis-Nexis and Factiva

- No one has figured out how to automate the downloads of these
  - Instead, get your search string as precise as possible to reduce unnecessary downloads, then slog away...
- The LN search engine is very unpredictable: it is not designed for this sort of thing. Money (as in “DARPA”) was insufficient to solve the problem
  - Note that this contradicts the advice immediately above about refining the search string
- Factiva is far more reliable but somewhat more awkward to use
  - Money could solve that problem, but more money than you probably have.
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
Google News

• 4500 English-language sources
• Appears to have a facility for duplicate detection
• It’s Google…
What about new social media?

Mainstream media
What about new social media?

Mainstream media

Internet and new social media
New social media

• The good
  • Widely available to elites
  • More or less uncensored in open many societies
  • Should provide early information on changing sentiment prior to observing actual collective action

• The bad
  • No filters and mostly politically irrelevant: “Wanna getta pizza? ;)
  • Easily manipulated by anyone—business, government, NGOs—who wants to go to the trouble of doing so

• The ugly
  • No standardization of content

• Utility in prediction
  • Multiple studies show this seems to work in the 6 to 48 hour range
New Social Media

Police tell high school students to disguise their identity on FaceBook

+ 

Students choose the first country they recognize in an alphabetical list....Afghanistan

OMG! Jihadis are checking out the junior prom!
New social media in text analysis

Mainstream media

Internet and new social media
Number of stories found with “Palestinian killed” NEXIS search string

<table>
<thead>
<tr>
<th>Newspaper</th>
<th></th>
<th>Wire Service</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Los Angeles Times</td>
<td>3</td>
<td>Xinhau</td>
<td>8</td>
</tr>
<tr>
<td>New York Times</td>
<td>4</td>
<td>BBC (Factiva)</td>
<td>10</td>
</tr>
<tr>
<td>Washington Post</td>
<td>4</td>
<td>Associated Press</td>
<td>11</td>
</tr>
<tr>
<td>Jerusalem Post</td>
<td>6</td>
<td>Agence France Presse</td>
<td>18</td>
</tr>
<tr>
<td>New York Times, full text</td>
<td>8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Comparison of newspaper and wire service coverage of Palestinian deaths, Nov-Dec 2003
Duplicate detection: sources

- **Use of newswires**
  - This is the reason for newswires
  - Detecting exact duplicates is easy

- **Updating and corrections of previous stories**

- **News summaries**

- **Chronologies**

- **Multiple independent sources (Reuters, AFP, BBC)**

- **Except for exact duplicates, this is a difficult problem**
  - “Near duplicate detection
  - One-a-Day filter

- **Duplication probably amplifies the signal you want: a story is more likely to be repeated if it is important**
How many sources are needed?

- Probably 80% can be obtained from the major international sources
- Local sources do not necessarily give you better coverage of important political events
- Censorship (official or voluntary) is an issue
- International coverage follows the money
- There is probably a lot of regional variation on this
- Same for non-English sources: possibility of using machine translation
Source and consistency of text

How much work will be involved in getting the text into a form you can use?

• ASCII/UniCode text, for example news reports
• HTML, but web formats change frequently
  • Python has modules for removing HTML tags: don't try doing this just with regular expressions
• PDF
  • Try the tm module in R
• Scanned/OCR text
• Proprietary word processing formats (Word)
• New media sources such as blogs and tweets
Style of language

• News reports and official documents are usually formal, syntactically-correct English
• Quotations and letters are a mix of formal and informal
• Open-ended responses range from formal to very fragmentary
• New media sources are often very informal and abbreviated
• Variants of English and changes in usage over time (e.g. slang, memes)
• Languages other than English
Intellectual property

• Copyright law is generally open to “fair use” in research and education. However, institutional contracts with data providers are more limited
  • Information does not necessarily want to be free
• Human subjects considerations—and therefore IRB review—apply to identifiable data
• A lot of the legal issues, particularly involving content on the web, are still very open
  • You probably do not want to be a test case
  • Just because someone claims IP rights doesn't mean they actually have those right
  • You still probably do not want to be a test case
• Public institutions have considerable protection from sovereign immunity, though many have been wimps in asserting this.
And of course, costs

• Is the information source already formatted?
  • Spinn3R, Thomas
  • Web pages vary dramatically in ease of downloading

• How much data do you actually need?
  • Text data sets are frequently much, much larger than typical political science data such as surveys and national indicators
  • Will just a sample be sufficient?
  • Are you coding more information than you will actually use?

• How much time will it take to code each document?
  • Who’s going to train and supervise the manual coders?
  • How much can be fully automated?
  • How good is good enough?
TABARI
Textual Analysis By Augmented Replacement Instructions (TABARI)

- ANSI C++, approximately 14,000 lines of code
- Open-source (GPL)
- Unix, Linux and OS-X operating systems (gcc compiler)
- “Teletype” interface: text and keyboard
  - Easily deployed on a server
- Codes around 5,000 events per second on contemporary hardware
  - Speed is achieved through use of shallow parsing algorithms
  - Speed can be scaled indefinitely using parallel processing
- Standard dictionaries are open source, with around 15,000 verb phrases for events and 30,000+ noun phrases for actors
Additional automated coding systems

• VRACoder (Bond, VRA, Cambridge, MA)
  • IDEA coding system
  • Deep parsing
  • Proprietary, Windows environment

• PERICLES (Shellman, Strategy Analysis Enterprises)
  • CAMEO coding system, dictionaries
  • Multi-field capabilities
  • Open-source, C#/.NET environment

• JABARI-NLP (Lockheed Martin)
  • TABARI structure with open-source parsing
  • Some geolocation capabilities; extensive substate actor coding
MIT Robotics 101: First exercise

“Design a robot to wash dishes”
Robotics 101: First Exercise
Most frequent answer
Robotics 101: First Exercise
Slightly more appropriate answers
Robotics 101: First Exercise
Correct answer
Event Coding systems

- WEIS
  - Charles McClelland, Rodney Tomlinson, DARPA
- COPDAB
  - Edward Azar
- PANDA
  - Doug Bond
- IDEA
  - Doug Bond, Craig Jenkins and Charles Taylor
- CAMEO
  - Deborah Gerner and Philip Schrodt
Categorization of Political Interactions

- Distinct English-language verb phrases: 5,000 to 10,000 (MUC, KEDS, PANDA projects)
- Micro-level categories: 50 to 150 (WEIS, BCOW, IDEA, CAMEO)
- Macro-level categories: 10 to 20 (WEIS, COPDAB, IPB, World Handbook)
CAMEO: Event Coding

• Combines ambiguous categories in WEIS (promise/agree, grant/reward, warn/threaten)
• Eliminates WEIS subcategories for which no examples could be found
• Substantially expands coding for acts of violence
• Coding categories can be expanded to three levels
  • Originally designed for coding mediation but subsequently generalized for coding actions of militarized non-state actors
• Complete coding manual with examples of all event categories
• Implemented with a 15,000 verb phrase dictionary
CAMEO: Actor Coding

- Systematic hierarchical scheme for coding sub-state and non-state actors
- Typical full actor code has three levels
  - State
  - Role
  - Identity
- Example: Hamas is coded PSEREBHMS
  - PSE: ISO-3166-alpha-3 code for the West Bank and Gaza
  - REB: Militarized opposition group
  - HMS: individual code for Hamas
- Additional rules standardize the coding of IGOs, NGOs, government leaders and so forth
CAMEO Actor Coding: Block 1

- ISO-3166-1-alpha 3 country codes
- Religious/ethnicity codes
  - HURIDOCS religion codes
  - Maoz/Henderson religion codes?
  - ??? ethnicity codes
- Generic International/Transnational Actor Codes
CAMEO Actor Coding: Block 2

- Generic Domestic Actor/Role codes
  Modified from PANDA/IDEA codes
- Sub-state Region codes
  Possibility of using various UN and ISO geographical sources that code economic data
- Religious/ethnicity codes
- Special International/Transnational Actor Codes
- Country codes for NGOs and MNCs
CAMEO Actor Coding: Block 3

- Generic Domestic Actor/Role codes
- Religious/ethnicity codes
- Branches of international organizations
- Special Actor Codes
Human and Automated Coding
Reliability in content analysis

• **Stability**—the ability of a coder to consistently assign the same code to a given text;
• **Reproducibility**—intercoder reliability;
• **Accuracy**—the ability of a group of coders to conform to a standard.

Advantages of automated coding

• Fast and inexpensive
• Transparent: coding rules are explicit in the dictionaries
• Reproducible: a coding system can be consistently maintained over a period of time without the “coding drift” caused by changing teams of coders.
• Coding dictionaries can be shared between institutions
• The coding of individual reports is not affected by the biases of individual coders. Dictionaries, however, can be so affected.
• It is possible to create rules for difficult technical and cultural vocabulary that is otherwise difficult to learn
Disadvantages of automated coding

• Automated thematic coding has problems with disambiguation

• Automated syntactic coding makes errors on complex sentences by incorrectly identifying the object of the sentence.

• Requires a properly formatted, machine-readable source of text, therefore older paper and microfilm sources are difficult to code.

• Development of new coding dictionaries is time-consuming—KEDS/PANDA initial dictionary development required 2-labor-years. (Modification of existing dictionaries, however, requires far less effort)
Human and machine coding tradeoffs

• Machine coding uses only information that is explicit in the text; human coders are likely to use implicit knowledge of the situation.
• Machine coding is not affected by boredom and fatigue
• Human coders can more effectively interpret idiomatic and metaphorical text, provided they are familiar with the context
• Human coders can more effectively deal with complex subordinate phrases and other unexpected grammatical constructions
Summary

**Advantage to human coding**
- Small data sets
- Data coded only one time at a single site
- Existing dictionaries cannot be modified
- Complex sentence structure
- Metaphorical, idiomatic, or time-dependent text
- Money available to fund coders and supervisors

**Advantage to machine coding**
- Large data sets
- Data coded over a period of time or across projects
- Existing dictionaries can be modified
- Simple sentence structures
- Literal, present-tense text
- Money is limited
Implications for automated coding

• Old objective:
  Machine coding should attempt to duplicate human coders
    • Also human coding accuracy is probably much worse that the 80% that is usually claimed

• Alternative objective:
  Optimize coding systems and models to use information that can be coded most reliably by machine
### Word frequency in English

<table>
<thead>
<tr>
<th>% of usage</th>
<th># of words</th>
</tr>
</thead>
<tbody>
<tr>
<td>40%</td>
<td>50</td>
</tr>
<tr>
<td>60%</td>
<td>2,300</td>
</tr>
<tr>
<td>85%</td>
<td>8,000</td>
</tr>
<tr>
<td>99%</td>
<td>16,000</td>
</tr>
</tbody>
</table>

- Total words in American English: about 600,000
- Total words in technical English (all fields): about 3-million
Functional Words

Very short words such as

- **Articles:** a an the
- **Interrogatives:** who what when where why how
- **Prepositions:** to from at in above below
- **Auxillary verbs:** have has was were been
- **Markers:** by in at to (French de, German du, Arabic fi)
- **Pronouns:** I you he she him her his hers

In English, the specificity of a word is *generally* proportional to its length. These short will typically be in the stop word list, though a few longer words (e.g. “though” and “although”) also will be stop words.

Marker words have multiple uses: *Random House College Dictionary* lists 29 meanings for “by,” 31 for “in,” 25 for “to,” and 15 for “for.”
It gets harder: Disambiguation ("Bat")

• **Noun**
  • wooden (or aluminum) cylinder used in the game of baseball
  • small flying mammal

• **Verb**
  • act of batting ("at bat")
  • blinking ("bat an eye")

• **Idiomatic uses**
  • "go to bat for": defending or interceding;
  • "right off the bat": immediately;
  • "bats in the belfry": commentary on an individual’s cognitive ability

• **Foreign phrases**
  • "bat mitzvah": a girl’s coming-of-age ceremony (Hebrew).
WordNet word senses: “bat”

Noun
S: (n) **bat**, chiropteran (nocturnal mouselike mammal with forelimbs modified to form membranous wings and anatomical adaptations for echolocation by which they navigate)
S: (n) **bat**, at-bat ((baseball) a turn trying to get a hit) "he was at bat when it happened"; "he got four hits in four at-bats"
S: (n) **squash racket**, squash racquet, **bat** (a small racket with a long handle used for playing squash)
S: (n) **cricket bat**, **bat** (the club used in playing cricket) "a cricket bat has a narrow handle and a broad flat end for hitting"
S: (n) **bat** (a club used for hitting a ball in various games)

Verb
S: (v) **bat** (strike with, or as if with a baseball bat) "bat the ball"
S: (v) **bat**, flutter (wink briefly) "bat one's eyelids"
S: (v) **bat** (have a turn at bat) "Jones bats first, followed by Martinez"
S: (v) **bat** (use a bat) "Who's batting?"
S: (v) **cream**, **bat**, clobber, drub, thrash, lick (beat thoroughly and conclusively in a competition or fight) "We licked the other team on Sunday!"
Disambiguation, cont.

• Any of these uses might be encountered in an English-language text. Multiple uses might be found in a single sentence:

  “The umpire didn’t bat an eye as Sarah lowered her bat to watch the bat flying around the pitcher.”
Disambiguation, cont.

• Words can also change from verbs to nouns without modification. Consider
  • I plan to drive to the store, then wash the car.
  • When John returned from the car wash, he parked his car in the drive.

• In summary:

  "Verbing weirds language."
  Bill Watterson, *Calvin and Hobbes*
WordNet word senses: “attack”

Noun
S: (n) attack, onslaught, onset, onrush ((military) an offensive against an enemy (using weapons)) "the attack began at dawn"
S: (n) attack (an offensive move in a sport or game) "they won the game with a 10-hit attack in the 9th inning"
S: (n) fire, attack, flak, flack, blast (intense adverse criticism) "Clinton directed his fire at the Republican Party"; "the government has come under attack"; "don't give me any flak"
S: (n) approach, attack, plan of attack (ideas or actions intended to deal with a problem or situation) "his approach to every problem is to draw up a list of pros and cons"; "an attack on inflation"; "his plan of attack was misguided"
S: (n) attack, attempt (the act of attacking) "attacks on women increased last year"; "they made an attempt on his life"
S: (n) attack, tone-beginning (a decisive manner of beginning a musical tone or phrase)
S: (n) attack (a sudden occurrence of an uncontrollable condition) "an attack of diarrhea"
S: (n) attack (the onset of a corrosive or destructive process (as by a chemical agent)) "the film was sensitive to attack by acids"; "open to attack by the elements"
S: (n) attack (strong criticism) "he published an unexpected attack on my work"

Verb
S: (v) attack, assail (launch an attack or assault on; begin hostilities or start warfare with) "Hitler attacked Poland on September 1, 1939 and started World War II"; "Serbian forces assaulted Bosnian towns all week"
S: (v) attack, round, assail, lash out, snipe, assault (attack in speech or writing) "The editors of the left-leaning paper attacked the new House Speaker"
S: (v) attack, aggress (take the initiative and go on the offensive) "The Serbs attacked the village at night"; "The visiting team started to attack"
S: (v) assail, assault, set on, attack (attack someone physically or emotionally) "The mugger assaulted the woman"; "Nightmares assailed him regularly"
S: (v) attack (set to work upon; turn one's energies vigorously to a task) "I attacked the problem as soon as I got out of bed"
S: (v) attack (begin to injure) "The cancer cells are attacking his liver"; "Rust is attacking the metal"
**WordNet word senses:**

```
“head”
```

**Noun**

S: (n) head, caput (the upper part of the human body or the front part of the body in animals; contains the face and brains) "he stuck his head out the window"

S: (n) head (a single domestic animal) "200 head of cattle"

S: (n) mind, head, brain, psyche, nous (that which is responsible for one's thoughts and feelings; the seat of the faculty of reason) "his mind wandered"; "I couldn't get his words out of my head"

S: (n) head, chief, top dog (a person who is in charge) "the head of the whole operation"

S: (n) head (the front of a military formation or procession) "the head of the column advanced boldly"; "they were at the head of the attack"

S: (n) head (the pressure exerted by a fluid) "a head of steam"

S: (n) head (the top of something) "the head of the stairs"; "the head of the page"; "the head of the list"

S: (n) fountainhead, headspring, head (the source of water from which a stream arises) "they tracked him back toward the head of the stream"

S: (n) head, head word ((grammar) the word in a grammatical constituent that plays the same grammatical role as the whole constituent)

S: (n) head (the tip of an abscess (where the pus accumulates))

S: (n) head (the length or height based on the size of a human or animal head) "he is two heads taller than his little sister"; "his horse won by a head"

S: (n) capitulum, head (a dense cluster of flowers or foliage) "a head of cauliflower"; "a head of lettuce"

S: (n) head (an individual person) "tickets are $5 per head"

S: (n) head (a user of (usually soft) drugs) "the office was full of secret heads"

S: (n) promontory, headland, head, foreland (a natural elevation (especially a rocky one that juts out into the sea))

S: (n) head (a rounded compact mass) "the head of a comet"

S: (n) head (the foam or froth that accumulates at the top when you pour an effervescent liquid into a container) "the beer had a large head of foam"

S: (n) pass, head, straits (a difficult juncture) "a pretty pass"; "matters came to a head yesterday"

S: (n) headway, head (forward movement) "the ship made little headway against the gale"

S: (n) point, head (a V-shaped mark at one end of an arrow pointer) "the point of the arrow was due north"

S: (n) question, head (the subject matter at issue) "the question of disease merits serious discussion"; "under the head of minor Roman poets"
WordNet word senses: “head” continued

Noun
S: (n) heading, header, head (a line of text serving to indicate what the passage below it is about) "the heading had little to do with the text"
S: (n) head (the rounded end of a bone that fits into a rounded cavity in another bone to form a joint) "the head of the humerus"
S: (n) head, caput (the upper part of the human body or the front part of the body in animals; contains the face and brains) "he stuck his head out the window"
S: (n) head (the rounded end of a bone that fits into a rounded cavity in another bone to form a joint) "the head of the humerus"
S: (n) read/write head, head ((computer science) a tiny electromagnetic coil and metal pole used to write and read magnetic patterns on a disk)
S: (n) head ((usually plural) the obverse side of a coin that usually bears the representation of a person's head) "call heads or tails!"
S: (n) head (the striking part of a tool) "the head of the hammer"
S: (n) head ((nautical) a toilet on board a boat or ship)
S: (n) head (a projection out from one end) "the head of the nail", "a pinhead is the head of a pin"
S: (n) drumhead, head (a membrane that is stretched taut over a drum)

Verb
S: (v) head (to go or travel towards) "where is she heading?"; "We were headed for the mountains"
S: (v) head, lead (be in charge of) "Who is heading this project?"
S: (v) lead, head (travel in front of; go in advance of others) "The procession was headed by John"
S: (v) head, head up (be the first or leading member of (a group) and excel) "This student heads the class"
S: (v) steer, maneuver, manoeuvre, manoeuvre, direct, point, head, guide, channelize, channelise (direct the course; determine the direction of travelling)
S: (v) head (take its rise) "These rivers head from a mountain range in the Himalayas"
S: (v) head (be in the front of or on top of) "The list was headed by the name of the president"
S: (v) head (form a head or come or grow to a head) "The wheat headed early this year"
S: (v) head (remove the head of) "head the fish"
Memes, idioms, metaphors and slang

• Political text frequently uses distinct idiomatic phrases
  • “Right to life”, “right to choice”
• Memes can have a high frequency for brief periods of time
  • “lipstick on a pig”
  • “top kill”, “junk shot”, “Deep Horizon”
• Military metaphors are common in political (and sports) rhetoric
  • “Tea Party insurgency”, “battleground state”
• OMG! WTF! Like IMHO slang expressions are common, and rapidly changing, in new media (lol…)
Pre-processing

• We see distinct words, sentences, punctuation and make distinctions between entities and actions.

• A computer sees none of this… and more

• It must be instructed to distinguish what we think is important – “tokenizing”
Further processing

• Next step is to get machine to pay attention to the tokens that are relevant to our goals – and to ignore those that are not.
• Explicitly delineate relevant tokens – keywords
• Remove generally irrelevant stuff
  • Stop words
  • Stemming
    Note: In event data coding, this is usually done implicitly in the dictionaries rather than as an explicit processing step
Stop words and Stemming

Stop words
• a about above after again against all almost alone along... take taken than that the their them then...

Stemming
• Suffix stripping
  • “ing”

• N-grams
  • “post office”

• Lemmatization
  • “meeting”

• It’s complicated!
Lessons from ICEWS and GDELT: dictionary calibration

• Existing verb-phrase dictionary required relatively little modification
• Actor dictionaries would benefit from re-structuring into general and country specific dictionaries
  • General: international actors, both state and non-state
  • General: discard phrases
  • General: WordNet-based agent dictionaries
• KEDS, ICEWS: Specific national and regional actors
• GDELT: CountryInfo.txt
TABARI Project file

Coding file for events for ICEWS Nov09 coding, 10 November 2009
<dochead> Text source: leads only. Source: Agence France Press and Reuters
<doctail> For further information on the TABARI automated coding program and CAMEO coding system, consult http://web.ku.edu/keds
<verbsfile> CAMEO.091023.master.verbs
<actorsfile> nouns_adj_null.091023.txt
<actorsfile> Countries.091023.actors
<actorsfile> Internatnl.090916.rev.actors
<agentfile> ICEWS.091023sorted.agents
<issuesfile> GTDS.issues
<optionsfile> CAMEO.09b5.options
<textfile> LN.Texts0911.97.1
<textfile> LN.Texts0911.97.2
<textfile> LN.Texts0911.98.1
<textfile> LN.Texts0911.98.2
<textfile> LN.Texts0911.99.1
<textfile> LN.Texts0911.99.2
<textfile> LN.Texts0911.99.3
<eventfile> ICEWS.Nov09.pt1.evt
<coder> PAS
<session 1> <coder PAS> <date Wed 11 Nov 2009> <start 11:41 CST> <end 12:10 CST>
<records 6933308> <actorchanges 0> <verbchanges 0> <last 0>
<session 2> <coder PAS> <date Wed 11 Nov 2009> <start 12:17 CST> <end 12:43 CST>
<records 6933308> <actorchanges 0> <verbchanges 0> <last 0>
TABARI Verbs Dictionary

ABDUCT [181]; shan 7/24/93
- + * AT_GUNPOINT FROM CAR $ [181]; sls 28 Mar 2008
- + HOSTAGE * IN_ $ FREED [0841]; sls 28 Mar 2008
- * AND_KILLED BY_ $ [1823]; sks 18 Mar 2008
- * AFTER ATTACK [181]; ab 31 Dec 2005
- + HOSTAGE * IN_ $ [181]; sks 18 Mar 2008
- * OF_ + IN_ $ [181]; JON 5/26/95
- + * BY_ $ [181]; BERT 12/31/97
- + IN_ $ { WAS | WERE } * [181]; sls 21 Sep 2007
ABIDE [---]; shan 2/20/93
- WOULD NOT * [120]
- FAIL * [120]; JON 5/8/95
ABSOLVE [---]; ab 31 Dec 2005
- + WAS_ * IN_ $ [080]; HUX 12/28/97
ABSTAIN [---]; jw 10/25/91
- * FROM VIOLENCE [087]; ab 10 Nov 2005
ACCELERAT [---]; sls 24 Sep 2007
- * DEPLOYMENT TO_ + [154]; SLS 28 Nov 2007
- * BUILDUP FORCE [154]; sls 24 Sep 2007
ACCEPT [---]; jw 11/14/91
- MUST_ * OF_ + GOVERNMENT [102]; SPK 30 Jan 2008
- * LOAN FROM_ + [071]; SPK 07 Mar 2008
- WILL DECIDE WHETHER TO_ * [014]
- * REQUEST JOIN MISSION [031]; ab 10 Nov 2005
- * ELECTION_DEADLINE [083]; ai 05 May 2008
- * RESPONSIBILITY [015]; jap 25 Jun 2003
- SAID WOULD NEVER * [120]
- CANNOT * PROPOSAL [120]; ab 31 Dec 2005
- * PLAN TO_RESOLVE [037]; sls 01 Mar 2008
- NOT * PEACEKEEP [1245]; BNL 06 May 2003
- LEANED TOWARD * [---]; jap 25 Jun 2003
- * JURISDICTION [063]; ab 10 Nov 2005
ABADAN [IRN] ;JON 5/24/95
ABASSI_MADANI [DZAREBFIS] ; PAS 98.2.26
ABBASI_MADANI [DZAREBFIS] ; from "FIS"
ABD-AL-LLAH_AL-KHATIB [JORGOV] ;*** 06 Feb 2004
ABDALLAH_BAALI [DZAGOV]
ABDALLAH_DJABALLAH [DZAOPP] ; PAS 98.2.27 the leader of the Reform Movement
ABDEL_BOUMEZBEUR [DZAREB] ; from ARMED ISLAMIC GROUP, GIA
ABDEL_GHANI_MESKINI [DZAREB] ; from ARMED ISLAMIC GROUP, GIA
ABDEL_HALIM_KHADDAM [SYRGOV] ;LRP 08 Mar 2004
ABDEL-HAK_AYADIA [DZAREB] ; from ARMED ISLAMIC GROUP, GIA
ABDEL-HALIM ABU GHAZALA [EGYGOV <890501] [---] ; Shan 2/21/93
ABDELAZIZ_BELKHADEM [DZAGOV >000826] [DZAELI]
ABDELAZIZ_BOUTEFLIKA [DZAGOV >990415] [DZAOPP]
ABDELAZIZ_BOUTEFLIKA_OF_ALGERIA [DZAGOV >990415] [DZAOPP] ;*** 06 Feb 2004
ABDELAZIZ_ZIARI [DZAGOV] ;*** 06 Feb 2004
ABDELHAK_BENHAMOUDA [DZALAB] ; PAS 98.2.26 Assassinated union leader
ABDELHAMID_TEMMAR [DZAGOV >010531] [DZAELI]
ABDELKADER_BENSALAH [DZAGOV] ; PAS 98.2.26 speaker of the government-appointed Transitional National Council a quasi-parliament
ABDELKADER_HACHANI [DZAOPP] ; Peaceful Society
ABDELLATIF_BENACHENHOU [DZAGOV] ; ab 10 Jun 2003
ABDELMADJID_SID_SAID [DZALAB]
ABDELMAJID_DAHOUMANE [DZAREB] ; from ARMED ISLAMIC GROUP, GIA
ABDELMALEK_SELLAL [EGYGOV] ;*** 06 Feb 2004
ABDESSELAM_BOUCHOUAREB [DZAGOV 010531-020616] [DZAELI]
ABDUL_KARIM_QASIM [####] ; mj 18 Apr 2006
ABDUL-KARIM_AL-KABARITI [JORGOV <970307] [JORELI] ; sms 14 Sep 2007
CountryCodes

- <CountryCode>ATG</CountryCode>
- <CountryName>ANTIGUA_AND_BARBUDA</CountryName>
- <COW-Alpha>AAB</COW-Alpha>
- <COW-Numeric>58</COW-Numeric>
- <FIPS-10>AC</FIPS-10>
- <ISO3166-alpha2>AG</ISO3166-alpha2>
- <ISO3166-alpha3>ATG</ISO3166-alpha3>
- <Nationality>ANTIGUANS</Nationality>
- <Nationality>BARBUDANS</Nationality>
- <Capital>SAINT_JOHN'S</Capital>
- <Capital>ST._JOHN'S</Capital>
- <MajorCities>REDONDA</MajorCities>
- <Premiers>
  - VERE_CORNWALL_BIRD_[19670227 - 19710214] [19760201 - 19811101]
  - GEORGE_WALTER_[19710214 - 19760201] [B:19280101] [D:20080101]
- <Premiers>
- <Governors-GENERAL>; representing the british monarch as head of state
  - SIR_WILFRED_E._JACOBS_[19811101 - 19930610]
  - JAMES_CARLISLE_[19930610 - 20070717] [B:19370101]
  - LOUISE_LAKE-TACK_[20070717] [B:19440101]
- <Governors-GENERAL>
- <Prime ministers>
  - VERE_CORNWALL_BIRD_[19811101 - 19940309]
  - LESTER_BIRD_[19940309 - 20040324] [B:19380101]
  - BALDWIN_SPENCER_[20040324] [B:19480101]
- <Prime ministers>
- <Leaders>
- <Government>
- <Synonyms>
  - VERE_BIRD_[19670227 - 19710214] [19760201 - 19811101]
PoliNER/CodeCatcher
CodeCatcher

SENTENCES: [N = 743]

[1] {Israeli}[ISR] shelling of a central {Gaza}[PSE] stronghold of the Ezzedine Al-Qassam Brigades, the armed wing of >>> Hamas <<<, killed one fighter on Tuesday, {Palestinian}[PSE] medics and witnesses said.

[2] Top >>> Hamas <<< official Mahmud Al-Zahar on Tuesday rejected the conditions set by {Palestinian}[PSE] president Mahmud Abbas for talks aimed at halting the factional struggle that has torn the territories apart.

[3] {Palestinian}[PSE] president Mahmud Abbas said on Monday that he was ready to "open a new page" with >>> Hamas <<< if the Islamist movement gave up its control of the {Gaza}[PSE] Strip.

[4] {Israeli}[ISR] forces in the northern {Gaza}[PSE] Strip killed seven {Palestinians}[PSE] overnight, including three militants from the >>> Hamas <<< movement that has ruled the {Gaza}[PSE] Strip since June, medics said on Wednesday.

[5] Former {Palestinian}[PSE] {lawmakers}[~LEG] and journalists shaved their heads in public on Wednesday in protest at the humiliating shaving of the moustache of a Fatah official by >>> Hamas <<< men in {Gaza}[PSE].

SENTENCE:
{Israeli}[ISR] shelling of a central {Gaza}[PSE] stronghold of the Ezzedine Al-Qassam Brigades, the armed wing of >>> Hamas <<<, killed one fighter on Tuesday, {Palestinian}[PSE] medics and witnesses said.

CODES: 1:ISR 2:PSE
:: Hamas_ [ PSE ]
->[]
A maximum of nine codes are extracted from the selected sentence; these are displayed after the selected sentence. The initial code defaults to the first code prior to the target if it exists, otherwise the first code after the target. If there are no codes, the code is set to the discard code ###.

c< n >: add the code < n > from the list

c< n >+< m >: combine codes < n > and < m >. If the second code is an agent code i.e.

starts with |the| is removed.

c++ n >: append code < n >

ca: append text to the code

cr: remove the last three characters from the code

cc: clear code (set to empty string)

cn: enter a complete new code

c-: set null code [- - -]

c-< n; a; s; t;# >: set codes [NOUN],[ADJT],[STOP],[TIME],[NUMR]

c#: set simple discard code ###

c#< s; h; f; a >: set discard codes for sports, history, formatting, arts
Using Multiple News Sources

• “Splicing” events from multiple sources has proven to be a major problem. Coverage of major events appears to be similar but coverage of minor events such as meetings and comments can vary substantially.

• All sources appear subject to “media fatigue”—interest in a crisis will decline over time. Competition between stories—for example US-Iraq versus Israel-Palestine—also affects coverage.

• Overall availability of machine-readable news stories increased dramatically starting around 2000, creating a serious discontinuity. Stories continue to increase exponentially.
<table>
<thead>
<tr>
<th></th>
<th>Major WEIS Categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Yield</td>
</tr>
<tr>
<td>02</td>
<td>Comment</td>
</tr>
<tr>
<td>03</td>
<td>Consult</td>
</tr>
<tr>
<td>04</td>
<td>Approve</td>
</tr>
<tr>
<td>05</td>
<td>Promise</td>
</tr>
<tr>
<td>06</td>
<td>Grant</td>
</tr>
<tr>
<td>07</td>
<td>Reward</td>
</tr>
<tr>
<td>08</td>
<td>Agree</td>
</tr>
<tr>
<td>09</td>
<td>Request</td>
</tr>
<tr>
<td>10</td>
<td>Propose</td>
</tr>
<tr>
<td>11</td>
<td>Reject</td>
</tr>
<tr>
<td>12</td>
<td>Accuse</td>
</tr>
<tr>
<td>13</td>
<td>Protest</td>
</tr>
<tr>
<td>14</td>
<td>Deny</td>
</tr>
<tr>
<td>15</td>
<td>Demand</td>
</tr>
<tr>
<td>16</td>
<td>Warn</td>
</tr>
<tr>
<td>17</td>
<td>Threaten</td>
</tr>
<tr>
<td>18</td>
<td>Demonstrate</td>
</tr>
<tr>
<td>19</td>
<td>Reduce Relationship</td>
</tr>
<tr>
<td>20</td>
<td>Expel</td>
</tr>
<tr>
<td>21</td>
<td>Seize</td>
</tr>
<tr>
<td>22</td>
<td>Force</td>
</tr>
</tbody>
</table>
Goldstein Scale for WEIS Events

<table>
<thead>
<tr>
<th>Code</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>010</td>
<td>1.0</td>
<td>YIELD</td>
</tr>
<tr>
<td>011</td>
<td>0.6</td>
<td>SURRENDER</td>
</tr>
<tr>
<td>012</td>
<td>0.6</td>
<td>RETREAT</td>
</tr>
<tr>
<td>013</td>
<td>2.0</td>
<td>RETRACT</td>
</tr>
<tr>
<td>014</td>
<td>3.0</td>
<td>ACCOMODATE, CEASEFIRE</td>
</tr>
<tr>
<td>015</td>
<td>5.0</td>
<td>CEDE POWER</td>
</tr>
<tr>
<td>020</td>
<td>0.0</td>
<td>COMMENT</td>
</tr>
<tr>
<td>021</td>
<td>-0.1</td>
<td>DECLINE COMMENT</td>
</tr>
<tr>
<td>022</td>
<td>-0.4</td>
<td>PESSIMISTIC COMMENT</td>
</tr>
<tr>
<td>023</td>
<td>-0.2</td>
<td>NEUTRAL COMMENT</td>
</tr>
<tr>
<td>024</td>
<td>0.4</td>
<td>OPTIMISTIC COMMENT</td>
</tr>
<tr>
<td>070</td>
<td>7.0</td>
<td>REWARD</td>
</tr>
<tr>
<td>071</td>
<td>7.4</td>
<td>EXTEND ECON AID</td>
</tr>
<tr>
<td>072</td>
<td>8.3</td>
<td>EXTEND MIL AID</td>
</tr>
<tr>
<td>073</td>
<td>6.5</td>
<td>GIVE OTHER ASSISTANCE</td>
</tr>
<tr>
<td>110</td>
<td>-4.0</td>
<td>REJECT</td>
</tr>
<tr>
<td>111</td>
<td>-4.0</td>
<td>TURN DOWN</td>
</tr>
<tr>
<td>112</td>
<td>-4.0</td>
<td>REFUSE</td>
</tr>
<tr>
<td>113</td>
<td>-5.0</td>
<td>DEFY LAW</td>
</tr>
<tr>
<td>170</td>
<td>-6.0</td>
<td>THREATEN</td>
</tr>
<tr>
<td>171</td>
<td>-4.4</td>
<td>UNSPECIFIED THREAT</td>
</tr>
<tr>
<td>172</td>
<td>-5.8</td>
<td>NONMILITARY THREAT</td>
</tr>
<tr>
<td>173</td>
<td>-7.0</td>
<td>SPECIFIC THREAT</td>
</tr>
<tr>
<td>174</td>
<td>-6.9</td>
<td>ULTIMATUM</td>
</tr>
<tr>
<td>220</td>
<td>-9.0</td>
<td>FORCE</td>
</tr>
<tr>
<td>221</td>
<td>-8.3</td>
<td>NONINJURY DESTRUCTION</td>
</tr>
<tr>
<td>222</td>
<td>-8.7</td>
<td>NONMIL DESTRUCTION</td>
</tr>
<tr>
<td>223</td>
<td>-10.0</td>
<td>MILITARY ENGAGEMENT</td>
</tr>
</tbody>
</table>
Event Categories

- **Verbal Cooperation:** The occurrence of dialogue-based meetings (i.e. negotiations, peace talks), statements that express a desire to cooperate or appeal for assistance (other than material aid) from other actors. CAMEO categories 01 to 05.

- **Material Cooperation:** Physical acts of collaboration or assistance, including receiving or sending aid, reducing bans and sentencing, etc. CAMEO categories 06 to 09.

- **Verbal Conflict:** A spoken criticism, threat, or accusation, often related to past or future potential acts of material conflict. CAMEO categories 10 to 14.

- **Material Conflict:** Physical acts of a conflictual nature, including armed attacks, destruction of property, assassination, etc. CAMEO categories 15 to 20.
Israel-Palestine: Conflict and mediation 1979-98
Levant Event Data Set

Verbal Cooperation

Material Cooperation

Verbal Conflict

Material Conflict
Israel-Palestine 1992-2010
Visualization by Jay Yonamine

Weekly level event counts between Israel-Palestine-Lebanon

- Material Conflict
- Verbal Conflict
- Verbal Cooperation
- Material Cooperation
Syria, April 2012
Violence in Homs, Jan to June 2012
Violence in Syria: Ushahidi and event data
Goldstein series: UAE–Kuwait, 1979-97
Full-story vs. lead-sentence events
Worst graph ever produced by the KEDS project

Figure 3.11. Number of events generated per month for Kazakhstan, Tajikistan, Turkmenistan and Uzbekistan, 1992-1999
Hidden Markov models: Accuracy by positive and negative predictions

• “Correct”—percentage of the weeks that were correctly forecast, the percentage of time that a high or low conflict week would have been predicted correctly.

• “Forecast”—percentage of the weeks that were forecast as having high or low conflict actually turned out to have the predicted characteristic; the percentage of time that a type of prediction is accurate.
Balkans Hidden Markov Model:
Accuracy for 23-Category Coding System

<table>
<thead>
<tr>
<th>Experiment</th>
<th>%accuracy</th>
<th>% high correct</th>
<th>% low correct</th>
<th>% high forecast</th>
<th>% low forecast</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>77.6</td>
<td>29.3</td>
<td>89.5</td>
<td>40.8</td>
<td>83.7</td>
</tr>
<tr>
<td>P3</td>
<td>76.0</td>
<td>29.0</td>
<td>87.9</td>
<td>37.9</td>
<td>82.9</td>
</tr>
<tr>
<td>P6</td>
<td>76.9</td>
<td>25.9</td>
<td>90.6</td>
<td>42.6</td>
<td>82.0</td>
</tr>
<tr>
<td>N1</td>
<td>54.2</td>
<td>92.7</td>
<td>45.3</td>
<td>28.1</td>
<td>96.4</td>
</tr>
<tr>
<td>N3</td>
<td>49.0</td>
<td>88.1</td>
<td>39.6</td>
<td>25.9</td>
<td>93.3</td>
</tr>
<tr>
<td>N6</td>
<td>47.7</td>
<td>88.5</td>
<td>37.4</td>
<td>26.3</td>
<td>92.8</td>
</tr>
</tbody>
</table>
### Balkans Hidden Markov Model: Accuracy for 5-Category Coding System

<table>
<thead>
<tr>
<th>Experiment</th>
<th>%accuracy</th>
<th>% high correct</th>
<th>% low correct</th>
<th>% high forecast</th>
<th>% low forecast</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>74.4</td>
<td>46.2</td>
<td>81.5</td>
<td>38.9</td>
<td>85.6</td>
</tr>
<tr>
<td>P3</td>
<td>71.7</td>
<td>44.1</td>
<td>78.9</td>
<td>35.4</td>
<td>84.4</td>
</tr>
<tr>
<td>P6</td>
<td>71.4</td>
<td>44.2</td>
<td>78.8</td>
<td>36.4</td>
<td>83.8</td>
</tr>
<tr>
<td>N1</td>
<td>61.9</td>
<td>90.7</td>
<td>54.6</td>
<td>33.7</td>
<td>95.8</td>
</tr>
<tr>
<td>N3</td>
<td>57.8</td>
<td>87.0</td>
<td>50.2</td>
<td>31.4</td>
<td>93.6</td>
</tr>
<tr>
<td>N6</td>
<td>56.8</td>
<td>85.9</td>
<td>48.8</td>
<td>31.5</td>
<td>92.7</td>
</tr>
</tbody>
</table>
## Difference in Accuracy between 23-Category and 5-Category Coding Systems

<table>
<thead>
<tr>
<th>Experiment</th>
<th>% accuracy</th>
<th>% high correct</th>
<th>% low correct</th>
<th>% high forecast</th>
<th>% low forecast</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>3.2</td>
<td>-16.9</td>
<td>8.0</td>
<td>1.9</td>
<td>-1.9</td>
</tr>
<tr>
<td>P3</td>
<td>4.3</td>
<td>-15.1</td>
<td>9.0</td>
<td>2.5</td>
<td>-1.5</td>
</tr>
<tr>
<td>P6</td>
<td>5.5</td>
<td>-18.3</td>
<td>11.8</td>
<td>6.2</td>
<td>-1.8</td>
</tr>
<tr>
<td>N1</td>
<td>-7.7</td>
<td>2.0</td>
<td>-9.3</td>
<td>-5.6</td>
<td>0.6</td>
</tr>
<tr>
<td>N3</td>
<td>-8.8</td>
<td>1.1</td>
<td>-10.6</td>
<td>-5.5</td>
<td>-0.3</td>
</tr>
<tr>
<td>N6</td>
<td>-9.1</td>
<td>2.6</td>
<td>-11.4</td>
<td>-5.2</td>
<td>0.1</td>
</tr>
</tbody>
</table>

Positive value: 23-category has higher accuracy
Simplifying Event Scales

Goldstein: Goldstein weights
difference: cooperative events = 1; conflictual events = -1.
total: all events = 1.
conflict: cooperative event = 0; conflictual events = 1.
cooperation: cooperative event = 1; conflictual events = 0.
report: 1 if any event was reported in the month, 0 otherwise
## Discriminant Analysis Results

<table>
<thead>
<tr>
<th>Weighting scheme</th>
<th>%correct</th>
<th>variance explained</th>
<th>canonical correlation</th>
<th>Wilks' λ</th>
<th>significance</th>
<th># factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goldstein</td>
<td>85.6%</td>
<td>76.3%</td>
<td>0.85</td>
<td>0.008</td>
<td>&lt;.001</td>
<td>6</td>
</tr>
<tr>
<td>difference</td>
<td>89.7%</td>
<td>74.7%</td>
<td>0.85</td>
<td>0.007</td>
<td>&lt;.001</td>
<td>7</td>
</tr>
<tr>
<td>total</td>
<td>94.4%</td>
<td>83.0%</td>
<td>0.93</td>
<td>0.001</td>
<td>&lt;.001</td>
<td>6</td>
</tr>
<tr>
<td>conflict</td>
<td>88.2%</td>
<td>76.9%</td>
<td>0.86</td>
<td>0.007</td>
<td>&lt;.001</td>
<td>6</td>
</tr>
<tr>
<td>cooperation</td>
<td>92.3%</td>
<td>82.2%</td>
<td>0.91</td>
<td>0.002</td>
<td>&lt;.001</td>
<td>7</td>
</tr>
<tr>
<td>report</td>
<td>89.2%</td>
<td>73.6%</td>
<td>0.87</td>
<td>0.008</td>
<td>&lt;.001</td>
<td>7</td>
</tr>
<tr>
<td>random date</td>
<td>61.0%</td>
<td>69.5%</td>
<td>0.66</td>
<td>0.131</td>
<td>.37</td>
<td>0</td>
</tr>
<tr>
<td>random dyad</td>
<td>57.4%</td>
<td>68.8%</td>
<td>0.67</td>
<td>0.119</td>
<td>.18</td>
<td>0</td>
</tr>
</tbody>
</table>
Cluster boundaries under various weighting systems

- Goldstein difference
- Total cooperation
- Conflict
- Report

Years: Jun.79 to Jun.95
Why does detailed coding make so little difference?—sources of error in event data

- Reporting error
  - Missing events—limited reporting, censorship
  - False events—rumors and propaganda
- Coding error
  - Individual—coders are not correctly implementing the event coding system
  - Systemic—event coding system does not reflect political behavior
- Model specification
  - Model may be using the wrong indicators
  - Mathematical structure of the model does not produce good predictions
  - Models with diffuse information structures—neural networks, VAR, HMM—are good at adapting to missing information
Event Categories

- **Verbal Cooperation**: The occurrence of dialogue-based meetings (i.e. negotiations, peace talks), statements that express a desire to cooperate or appeal for assistance (other than material aid) from other actors. CAMEO categories 01 to 05.

- **Material Cooperation**: Physical acts of collaboration or assistance, including receiving or sending aid, reducing bans and sentencing, etc. CAMEO categories 06 to 09.

- **Verbal Conflict**: A spoken criticism, threat, or accusation, often related to past or future potential acts of material conflict. CAMEO categories 10 to 14.

- **Material Conflict**: Physical acts of a conflictual nature, including armed attacks, destruction of property, assassination, etc. CAMEO categories 15 to 20.
ICEWS Substate Actor Categories

•.gov: government agents such as the executive, police, and military
•.par: political parties
•.opp: armed opposition---rebels and military groups
•.soc: society in general---civilians, businesses, professional groups
•.ios: international actors
•.usa: United States
High-volume, near-real-time coding

- News sources from RSS feeds, news aggregators and other web-based sources
- These are relatively stable, but the formatters and downloading still need occasional updating
- Background processing for
  - Parsing
  - Location
  - Context
  - New actor/entity identification
  - Duplicate reports
- Recoding in cluster computing environment
  - ICEWS: 9-million stories can be recoded in about half an hour using a 12-node cluster
KEDS High-volume processing suite

Objective: “embarrassingly parallel” processing on a cluster computer (i.e. just split and recombine the files; similar to Google's MapReduce)

Tasks

- Sort multiple files into chronological order
- Duplicate detection
- Post-download filtering (particularly if using LN) and date-consistency checking (eliminates records with bad or out-of-range dates)
- Create `.project` files which run with current version of TABARI in parallel mode
- Split file for coding, then recombine results into a single chronological sequence
Pre-parsing

• Use open-source linguistics tools—not the coding program—to handle most of the parsing tasks.
  • OpenNLP: http://opennlp.apache.org
  • GATE: http://gate.ac.uk/
  • University of Illinois Cognitive Computation Group:
    http://cogcomp.cs.illinois.edu/page/software
  • LingPipe's “Competition” page: http://alias-i.com/lingpipe/web/competition.html
    • Dictionaries would then be modified to use this information

• Parsing tasks
  • Entity identification/disambiguation
  • Parts of speech, particularly noun/verb disambiguation
  • Subject, verb and object phrase delineation
  • Pronoun coreferencing

• With sufficient information, coding becomes largely a bookkeeping problem: almost all of the knowledge is in the dictionaries
Contextual Coding

• Determine the context of the report from the complete story, rather than each individual sentence
• Location
  • Ideally to as much detail as possible, using gazetteers, most in the public domain
  • However, some stories do not have a location
  • Location can also be used to resolve agents
  • Resolves ambiguous common names and acronyms
• Better filtering of sports, business, entertainment and historical stories
• General categories and then the use of specialized dictionaries
  • For example “attack” has a different meaning depending on whether a story involved military action, debate or cyber-attack
Questions?

Philip A. Schrodt
   Political Science
   227 Pond Laboratory
   Pennsylvania State University
   University Park, PA 16801

Phone: 814-863-8978

Email: schrodt@psu.edu

Project Web Site: http://eventdata.psu.edu
Some additional considerations
But Phil, the best models are classified!

• Hollywood tells me so
• Yeah, right…
• No systematic evidence of this: if it is true, government is spending vast resources to obscure this fact
• Clearly isn’t operating at the policy level
• Probably some models have worked at some points in the past but they have not proven robust
  • Serious snake-oil sales going on here as well…
• Even if this is true, we need to reverse-engineer these to get them into the unclassified literature and acquaint policy-makers with the techniques
• [but it probably isn’t true…]
What methods do real intelligence agencies use to predict political events?

“Two weeks ago, a group of senior intelligence officials in the [U.S.] Defense Dept. sat for an hour listening to a briefing by Michael Drosnin, who claims—I am not making this up—that messages encoded in the Hebrew text of the Old Testament provide clues to the whereabouts of Osama bin Laden. He has given similar briefings to top officials of Mossad, the Israeli intelligence agency.”

Bill Keller
*International Herald-Tribune*, 8-9 March 2003, pg. 6

[Insight as to why the Bush administration never found bin-Laden, perhaps?]
Easy Problems
Hard Problems