Automatically Detecting the Resonance of Terrorist Movement Frames

Extended Abstract

Ugochukwu Etudo
University of Connecticut
University Pl, Stamford, CT, USA
ugochukwu.etudo@uconn.edu

Victoria Yoon
Virginia Commonwealth University
301 W. Main St, Richmond, VA, USA
vyyoon@vcu.edu

Keywords: Online Radicalization, Terrorism, Ontology, Information Extraction

Automatically Detecting the Resonance of Terrorist Movement Frames

Terrorism today has taken the form of a "leaderless resistance." Terrorist organizations were once anchored by strong leaders with direct command and control over a parsimonious, secretive network of operatives. For instance, the Soufan Group estimates that at the time of the 9/11 terror attacks, Al-Qaeda had about 300 members who drew inspiration directly from their Sheikh (Usamah Bin-Laden). The US led decimation of these command and control structures has forced these groups to seek different organizing structures. Instead of drawing inspiration from a charismatic leader, terrorist organizations now rely on compelling ideologies. The increased reliance by terrorist organizations on ideological indoctrination has been associated with the rise of lone wolf terrorism in Western States (Hamm & Spaaj, 2015). Lone wolf terrorism represents acts of terror perpetrated by a person who (1) operates individually, (2) is not a member of any terrorist group or organization and (3) conceived of their act without the explicit direction of an outside command and control hierarchy (Spaaij, 2012). The obvious implication of this definition is that lone wolf terrorism cannot be interdicted by traditional intelligence tactics. That is, group infiltration and surveillance cannot possibly be effective when terrorist organizations are not involved in the planning and execution of acts of terror. Former FBI director Robert Mueller III at a congressional hearing remarked: "I am particularly concerned about loosely affiliated terrorists and lone offenders, which are inherently difficult to interdict given the anonymity of individuals that maintain limited or no links to established terror groups but *act out of sympathy with a larger cause.*"[1]

In response to the evolution of terroristic radicalization into ideologically driven, Web based operations, this research develops a collection of interdependent information systems design artifacts that serve as a platform to automatically identify radical ideologies on the Web. In this research, we build a conceptual bridge between the lone wolf and the extremist group[2] using theoretical formulations of social movements available from the critical school of sociology. More specifically, using collective action framing theory (CAFT), we conceive of group attempts to enable potential lone wolves as a collection of framing tasks intended to spur action. We argue and show that there exists a latent pattern to ideological formulation that lends the domain to abstract conceptualizations. We formalize one such abstract conceptualization in the form a Semantic Web Ontology – the Terror Beliefs Ontology (TBO). TBO models the concepts and meaning-making relationships that can, collectively, be used to model the frames that constitute a radical ideology. Frames are schemata of interpretation that enable people perceive and label occurrences in their life-spaces. These schemata govern the meanings that people attach to events and are critical to guiding the ideologically driven actions of people. Terror organizations are very actively involved in the fabrication of these interpretive lenses. Indeed, we argue that the collection of such frames produced by a given terrorist organization are sufficient to identify its ideology.

The Terror Beliefs ontology guides an information extraction system, the Frame Discovery System (FDS). FDS looks to populate TBO by labeling words within a corpus of textual documents with named entity labels and identifying relationships that exist between those labels. Both the labels and relationships that can exist between them are drawn from the taxonomy of TBO. To accomplish this, FDS is equipped with a collection of trained named entity recognition (NER) and relation extraction (RE) classifiers. The classifiers are implemented variously as conditional random fields (CRFs) and multinomial logistic regressions using the Stamford CoreNLP API (Manning et al., 2014). We trained classifiers to identify mentions of religions (P:0.81, R:0.97, F1:0.88), ideologies (P:0.74, R:0.51, F1:0.6), groups of peoples (P:0.74, R:0.32, F1:0.45), mentions of civilians (P:1.0, R:0.5, F1:0.67), and several others. We trained relation extractors for

---

[1] Robert S. Mueller III, "War on Terrorism." Testimony before the Select Committee on Intelligence of the United States Senate, Washington, DC, 11 February 2003

[2] Caren et al (2012) merge the concept of social movement communities (of which terrorist organizations are a type) with a new concept of social movement online communities where these communities are sustained networks of "individuals who work to maintain an overlapping set of goals and identities tied to a social movement linked through quasi-public online discussions" (p. 163).

relationships such as isComplicitWith (P:0.95, R:0.59, F1:0.73), takeUpArmsAgainst (P:0.84, R:0.70, F1:0.77) and several others.

Given populated instances of the Terror Beliefs Ontology, we developed a Frame Resonance Detection System (FRDS). FRDS performs comparisons of TBO individuals. It is the component of the overall framework that makes the final determination as to the resonance of some document of concern with one or more radical ideologies. The use of FRDS assumes a pipeline of activities involving the overall framework. First, the framework must be made aware of a corpus of radical documents only labelled by organization. Ideally, these documents should be propaganda materials created by the labelled organization. Once the frame discovery system has annotated these documents, its stores its findings by loading its annotations into an instance of TBO. Once such material has been ingested, we say that the framework is *aware* of a particular radical ideology. Documents of concern may, at this point be processed by FRDS. A document of concern is any text-based document that an analyst (potential user of the system) wishes to consider for the resonance of one or more radical ideologies. In our formal evaluation of the framework, we use religious forum dumps provided by the Artificial Intelligence Lab at the University of Arizona as our documents of concern. Documents of concern are labelled by FDS and loaded into a separate instance of TBO. FRDS compares two populated instances of TBO for the resonance of a radical ideology. The core function of FRDS is to featurize the comparison instances of TBO into a single vector of resonance scores. FRDS uses a rule-based classifier to classify such instances until enough classifications have been obtained to begin the process of automatically training machine learning classifiers to classify documents of concern. FRDS learns a different classifier for each terrorist organization's radical ideologies. FRDS consistently classifies documents of concern to one or more radical ideologies with F-measures over 80%.

In conclusion, this is the first knowledge driven framework in this domain within the academic literature. The artifact can learn about any terroristic ideology, whether it be white supremacy or salafi jihadism. It provides the first machine readable structure for ideologies of any kind, where this structure is query-able. This entire framework is strongly based on theory and rigorous empirical work. Collective Action Framing theory is relied upon to guide an empirical thematic coding exercise that results in the design of TBO.

References

Hamm, M., & Spaaj, R. (2015). Lone Wolf Terrorism in America: Using Knowledge of Radicalization Pathways to Forge Prevention Strategies.

Manning, C. D., Surdeanu, M., Bauer, J., Finkel, J. R., Bethard, S., & McClosky, D. (2014). The stanford corenlp natural language processing toolkit. In *ACL (System Demonstrations)* (pp. 55–60).

Spaaij, R. (2012). *Understanding Lone Wolf Terrorism Global Patterns, Motivations and Prevention*. London New York: Springer Dordrecht Heidelberg.