# Identifying the Patterns of Terrorism in India
## A Two Mode Social Network Approach

Rithvik Yarlagadda (Penn State/University of Maryland), Diane Felmlee (Penn State),
Dinesh Verma (IBM US), Scott Sigmund Gartner (Penn State)

***Abstract:*** **Studies examining terrorism assume incidents and groups are independent. We identify when terrorist groups share choices over target locations. These conditions demonstrate convergent decision-making and implicit networks. Using a two-mode network analytics approach to analyze Islamic terrorism in India between 1990 and 2015, we find that violent target locations occur in clusters. The most central targets of violence are Srinagar and New Delhi, which have high strategic and political value. Our approach: 1) demonstrates that cluster analysis can assist in identifying group aliases, 2) identifies unexpected locations for violence that may indicate the involvement of external factors, facilitating counter terrorism efforts, and 3) provides a tool for identifying the underlying structures of global terrorism.**

***Keywords: Social Networks; Terrorism; Two Mode Centrality; Subgroups; India***

### I. INTRODUCTION

India experiences high rates of terrorist activity (Global Terrorism Index 2016), and a recent surge of Islamic terrorism, but terrorist activity within India has only been sparingly studied with social network approaches (exceptions include Basu 2005; Saxena et al. 2004).

Terrorist groups often pick specific locations, referred to as hot spots (Braithwaite and Li 2007) that cluster, and as our analysis shows, this pattern occurs in India. The identification of clusters can help to detect the characteristics of locations that make them prone to violence. We employ a two-mode network analysis that allows us to uncover clustering and indirect ties between attack locations. Extremist groups act in ways that are not independent of each other; they group together through attacking the same geographical targets, creating a structural duality between actors and events (Breiger, 1974). Examining this interconnectedness furthers our understanding of the underlying processes of terrorism.

We hypothesize that there are important dynamics that make locations more likely to be targets of extremist violence:

Hypothesis 1: The strategic importance of locations increases the likelihood of being targeted by terrorists
1A: State and national capitals, and 1B: Cities and more populated areas are more likely to be targeted

Hypothesis 2: Violence is more likely to occur within or near a region with an ongoing conflict

### II. METHODS

**Data**. The primary sources for data are: [1] Global Terrorism Database (GTD) which is an open-source database maintained by the National Consortium for the Study of Terrorism and Responses to Terrorism (START); and [2] South Asian Terrorism Portal (SATP). The GTD data consist of 51 locations and 154 events, representing the total number of terrorist attacks, bombing or explosions, successfully carried out in India by extremist groups between 1990 and 2015. The second data set from South Asian Terrorism Portal (SATP) provides data on 15 Indian Islamist groups.

**Two-Mode Network Analysis**. Two mode networks connect two different types of nodes, "actors" and "events," where direct ties exist only between nodes belonging to different types (Wasserman and Faust 1994). We used the data from GTD to construct a 51 by 15 two mode network, in which the rows represent locations that experienced incidents and the columns represent extremist organizations. An entry in the "m" x "n" cell of the matrix represents the number of attacks in location *m* by actor *n*. For centrality analysis, this matrix was dichotomized to a binary matrix, with a 1 indicating the occurrence of any attack, and 0 otherwise. In order to perform centrality and subgroup analyses, the two-mode network is converted into two one-mode networks, each representing location and extremist organizations. The two corresponding matrices of these one-mode networks are symmetrized to result in an effective analysis.

### III. RESULTS

See Figures 1, 2, and 3

### IV. CONCLUSIONS

Our results have suggestions for understanding terrorism in India and globally. First, this analysis shows that Lashkar-e-Taiba (LeT) is the most active extremist Islamic group and Srinagar and New Delhi are the most central targets. Second, we find that distance from Pakistan affects target location. Third, the analysis demonstrates that clustering occurs among locations

based on their strategic importance: especially state capitals. Conversely, clustering occurs among most of domestic and international terrorist groups, suggesting these groups are not fully independent actors.

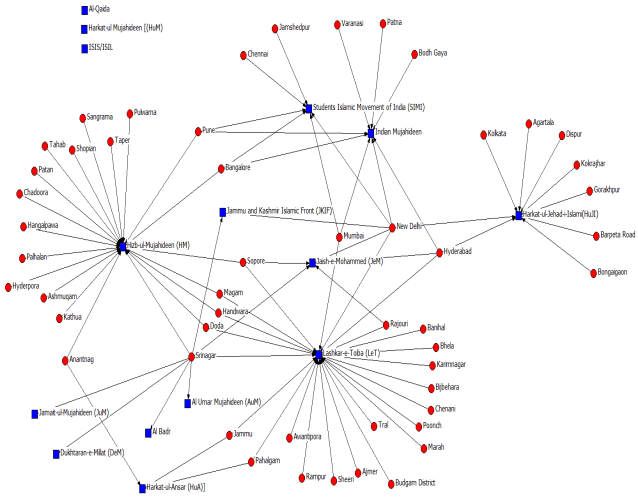


Fig. 1. Two Mode Network (Red = Target Locations; Blue = Islamist Terrorist Organizations)

## A. *Network Clustering*

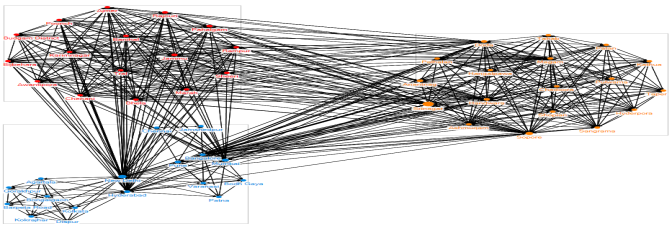

Fig. 2. Subgroups of Target Locations

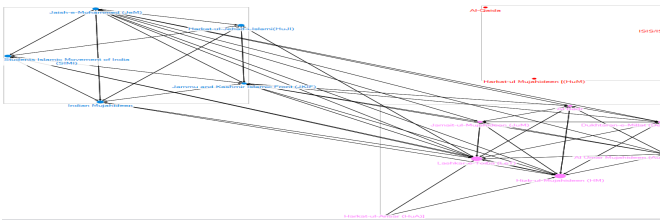

Fig. 3. Subgroups of Terrorist Groups

More generally, this study suggests that terrorist groups create implicit networks through their targeting. Implicit networks are emergent, rather than designed, and can provide insight into the dynamics that structure behavior and are especially useful for providing insight into terrorist networks. Additionally, we find encouraging evidence for the further employment of two-factor centrality for analyzing terrorism patterns.

These findings have a number of counter-terrorism policy implications. First, this study suggests that counter-terrorism resources should be focused on areas most likely to be targeted, such as state capitals, national capitals and symbolic cities/areas. Second, if a known group targets an unexpected geographical region, different from their previous attack locations, then that may suggest that the group is garnering additional support from external sources. Third, given that several terrorist groups cluster together because they attack the same locations, it may be possible to identify cases in which one group masquerades as the other. That is, groups operating behind the mask of another could be better exposed through two-mode network analyses of their joint targeting behavior.

Analyzing the connections between extremist groups and terrorist activity provides insight into terrorist networks and activity that facilitates counter-terrorism.

## V. Acknowledgement

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## References

[1] Basu, A. 2005. “Social network analysis of terrorist organizations in India.” In North American Association for Computational Social and Organizational Science (NAACSOS) Conference (pp. 26-28). NAACSOS.

[2] Breiger, Ronald L. 1974. “The Duality of Persons and Groups.” *Social Forces* 53(2): 181-190.

[3] Clauset, Aaron., Newman, M. E. J, and Cristopher Moore. 2004. “Finding Community Structure in Very Large Networks” *Physical Review E* 70(6): 1-6.

[4] Everton, Sean. F. 2012. “Disrupting Dark Networks” *Cambridge University Press*

[5] Freeman, Linton C. 1979. “Centrality in Social Networks: Conceptual Clarification” *Social Networks* 1: 215-239

[6] Newman, M. E. (2008). The mathematics of networks. The new Palgrave encyclopedia of economics, 2(2008), 1-12.

[7] Piazza, James A. 2009. “Is Islamist Terrorism More Dangerous?: An Empirical Study of Group Ideology, Organization, and Goal Structure” *Terrorism and Political Violence* 21: 62-88.

[8] Reed, Brian. 2007. “A Social Network Approach to Understanding Insurgency” *Parameters* 38: 19-30.

[9] Saxena, S., Santhanam, K., and Basu, A. 2004. “Application of social network analysis (SNA) to terrorist networks in Jammu & Kashmir.” *Strategic Analysis* 28(1): 84-101.