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Networks model of the East Turkistan terrorism

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HIGHLIGHTS

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ABSTRACT

The presence of the East Turkistan terrorist network in China can be traced back to the rebellions on the BAREN region in Xinjiang in April 1990. This article intends to research the East Turkistan networks in China and offer a panoramic view. The events, terrorists and their relationship are described using matrices. Then social network analysis is adopted to reveal the network type and the network structure characteristics. We also find the crucial terrorist leader. Ultimately, some results show that the East Turkistan network has big hub nodes and small shortest path, and that the network follows a pattern of small world network with hierarchical structure.

1. Introduction

China has been threatened by the East Turkistan terrorist groups frequently in the past for many years. This necessitates us to know more about this group. "East Turkistan terrorists group" are a group of national separatists who attempt to separate the Xinjiang Uygur Autonomous Region from China through all kinds of terrorist activities in order to establish the so-called "East Turkistan" country [1]. On September 11, 2002, the United Nations Security Council formally added the East Turkistan Islamic Movement to the UN list of terrorist groups and individuals [2]. Since the 1990s, the East Turkistan terrorist groups had planned and organized a series of violent terror attacks inside and outside Chinese territory including a lot of explosions, assassinations, arson attacks, poisonings, and assaults. Available statistics show that the East Turkistan terrorist forces were responsible for over 385 terrorist incidents in Xinjiang from 1990 to 2007. These incidents resulted in 300 deaths of all nationalities and more than 2000 injuries (http://www.cnr.cn/news/2007/108504371823/html).

With the development of the society, the East Turkistan terrorist groups have formed a complex network [3]. Some authorities have realized that knowledge about the structure of the East Turkistan network and how the East Turkistan networks operate will be a key factor in winning the so-called "net war" [4,5]. For this complex network, two questions are focused on by scientists: (1) which kinds of network type do the East Turkistan terrorist network belong to? (2) What

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network structure characteristics do the East Turkistan terrorist network have? This article endeavors to answer these two questions and provides the most up-to-date picture of the East Turkistan terrorist network in China.

2. Related work

2.1. Related conception

Social network is defined as a social structure consisting of many individuals who have the common interest, friendship, trust, etc. A social network can be expressed as a matrix $G = (V, E)$, where V is a set of nodes representing individuals and E is a set of edges representing the link between individuals. Then matrix G is

$$G = \begin{pmatrix} a_{11} & a_{12} & \cdots & a_{1j} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2j} & \cdots & a_{2n} \\ & & \vdots & & \vdots & \\ a_{i1} & a_{i2} & \cdots & a_{ij} & \cdots & a_{in} \\ & & \vdots & & \vdots & \\ a_{n1} & a_{n2} & \cdots & a_{nj} & \cdots & a_{nn} \end{pmatrix}. \tag{1}$$

If node i is linked to node j, then $a_{ij} = 1$, else $a_{ij} = 0$.

To understand the network structure, the method of social network analysis (SNA) is adopted usually [4]. SNA views social relationships in terms of nodes and ties. Nodes are the individual actors in the network, whereas ties are the relationships among the actors. Next, SNA is employed to analyze the terrorist network in China. In this research, Four indices are involved in SNA.

(1) Degree centrality. The definition of degree centrality is given by [6]

$$C_d(k) = \sum_{\substack{j=1 \\ j\neq i}}^{n} a(j, k), \tag{2}$$

where n is the total number of nodes in a network, and $a(i, k)$ is a binary variable indicating whether a link exists between nodes i and k. This index assists the analyst in identifying the leaders in a terrorist network.

(2) Closeness centrality. The closeness centrality of a node k is defined as the sum of its distances to all other nodes. Thus, the more central a node is the smaller its sum of distance to all other nodes [7,8]. Thus, the more central a node is the lower its total distance to all other nodes. Closeness can be regarded as a measure of how long it will take to spread information from s to all other nodes sequentially [9,6]. Mathematically, it can be written as [6]

$$C_c(k) = \sum_{\substack{i=1 \\ i\neq k}}^{n} l(i, k), \tag{3}$$

where n is the number of nodes and $l(i, k)$ is the length of the shortest path connecting nodes i and k.

(3) Betweenness centrality. Betweenness is a centrality measure of a vertex within a graph. It is equal to the number of shortest paths from all vertices to all others that pass through that node. It was introduced as a measure for quantifying the control of a node on the communication between other nodes in a social network by Linton Freeman [10]. This index identifies the node which has most links in a terrorist network. The individual with high betweenness is a gatekeeper of information flow from a group to another. The betweenness of a node k is defined as the number of geodesics (short paths between two nodes) [6] as follows.

$$C_B(k) = \sum_{i}^{n} \sum_{j}^{n} g_{ij}(k), \tag{4}$$

where n is the total number of nodes in a network, and $g_{ij}(k)$ is a binary variable indicating whether a link exists between nodes i and k.

(4) K-core. The K-core is the remaining part of a network after the nodes with degree $d \leq k$ are cut out. K-core decomposition is used to visualize large-scale complex networks in two dimensions [10,7]. This decomposition, based on a recursive pruning of the least connected vertices, disentangles the hierarchical structure of a terrorist network by progressively focusing on their central cores. In this paper, we also select this index to analyze the East Turkistan terrorist network.

2.2. Application of SNA in terrorism network

Currently, SNA is applied more for prosecution, and not for the prevention of criminal activities [11]. SNA has a long history of application to both fraud and criminal conspiracy cases. It is also noted in the analysis of the terrorist network [12,13].