ABSTRACT

Terrorism is considered to be a violent act which in the name of religion creates fear among the innocent people. Terrorist networks are amorphous, invisible, resilient, dispersed, in other words difficult to visualize their real structure. This community is seen as a social network with a lot of secrecy and influence. Social Network Analysis has a wide spread range of uses from semantic analysis to disrupting clandestine organizations.

Social Network Analysis primarily focuses on judging the importance or status of the actors in the social network. The actors could be characterized based on their capacity to either maximally influence the network called as pivot tellers or maximally fragment the network called as pivot isolators. The attribute of an actor depend on the interestingness, the knowledge set the actor posses and the various roles assigned to them. The network analysis strongly believes that actors are dependent on one another based on the relationship they share among themselves. But, the strength of relationships between actors in social networks need not be always equal as it varies from strong familial like relationships to weak casual relationships.

The research proposed in this thesis does behavioral analysis of the actors based on their profiles of activities. It also uses the relational analysis methodology to tag the pivot actors for disrupting the information flow and
gradually ceasing the covert social network. The change detection based on the removal of actors lead to the analysis about emergent leaders for the various residual networks. The probability of any future attack is analyzed and the findings are presented in a layman understandable way using simple language processing technique.

The proposed SpyNetMiner system describes about various methodologies to tag the pivot teller. These are the spreader actors which behave as a hub of information interaction. The analysis is performed by simulating profiles for the various actors based on their interestingness. The actor involvement is presented precisely using the selection strategies. The pivot tellers are tagged by characterizing the actors as $S_{Node}$, $R_{Node}$ or $N_{Node}$. The outlier actors are pruned from other actors using the distance based algorithms. The predominant behaviors are extracted using the class and feature based correlation factors. This Gladio module has contributed to profile generation by providing more of randomness. The huge feature set is being filtered using relevancy and redundancy based on correlation values rather than the rule based algorithms.

The EKIA module has tagged the pivot isolators as it enumerates on how the various interpersonal relations, among the actors could be used to study the nature of covert organizations. It extends the problem of Key Player Problem to Weighted Key Player Problem, by including the actor and
relationship weights. The question of including relational and actor weights in network analysis has been solved and proved to be more effective in tagging the isolators who could reduce the information flow within the social graph. The proposed methodology, overcomes the state-of-art distance metric issues. The actor significance is analyzed by the role assigned to them, and the relational significance is based on the time order and the repeatability of its occurrence. The efficiency of the newly defined relationship centrality is compared with the existing centralities. The top N ranked actors are further used to perform efficient fragmentation of the covert organization.

The fragmentation module tags the predominant actor set for breaking the network. It is discovered from the pivot teller and pivot isolator cutsets. This identified cutset is analyzed, based on the degree of fragmentation and the probability of the future attacks that could happen. The proper combinations of pivot actors could lead to an effective network disruption. This is presented to the crime analyst, such that, the finding is in an easily understandable pattern. The behaviors of the actors are fetched from the generated profile and using rule converter the system achieves a human understandable explanation. The fragmentation analysis is further extended to spot the emergent leaders, who become the central actors when the pivot leads are removed. The system uses two suite strategies to find the emergent leader. Initially, it recomputes the \( C_R \) measure for the fragmented network and the top N ranked actors are called as second leaders. Secondly, the various group
fragmenter algorithms are used to extract the present groups in the fragmented network. The actors controlling the components are determined. Such actors could lead the covert network in future.

The proposed system has been analyzed based on the real world terrorist activity deployed by Al-Qaeda on United States of America in 2001. The complete information about the September 9th terrorist attack has been collected from the 9/11 commission report presented by the National Commission on Terrorist Attacks Upon the United States created by Congress and the President of United States (Public Law 107-306, November 27, 2002). This dataset is studied to recognize the pivot tellers and pivot isolators. The degree of fragmentation on the removal of the predominant actors presents the distortion of the Al-Qaeda network in USA soil. The profiles detailing the various behaviors of the actors involved directly and indirectly in this attack are analyzed using the expert annotation system.