

Detection of Small Covert Networks Embedded in Large Networks

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TODO FUNDING INFORMATION

Overview

- ▶ Definitions,
- ▶ A Model to Reflect Those,
- ▶ Implementation for a Particular Case: Salafi Jihadi Network,
- ▶ Detecting Groups in this Model,
- ▶ Some Detection Results for that Implementation, and
- ▶ Flaws, Extensions, and Outlook

What is *Covert*?

a *covert network* is a sub graph where interaction information is some combination of unavailable, unreliable, or (mostly) indistinguishable from the enclosing graph structure

...or Operationally

A relatively small, organized group of conspirators, masking their existence via communication discipline and taking advantage of a noisy background.

For this particular talk: Salafi Jihadi network.

Note: not the bottom-up cells of Sageman, et al's current work

TODO graphics about Salafi

A General Model

Salient Features

- ▶ isolated, but highly interconnected subordinate groups, and
- ▶ bridging middle managers,
- ▶ with some tradecraft,
- ▶ “lost” among myriad public communications

Our Implementation addressing Salafi Jihadi Network

- For our simple model of a bomber group in Salafi Jihadi Network
- population** many small cliques, which are recursively cliqued into single graph
 - covert leader** stochastically added to cliques, outgoing connections to a random member of each of the covert groups
 - subordinates** few, medium size cliques with connections between clusters
 - communications** simple message content *Good* vs. *Bad*

... or Symbolically

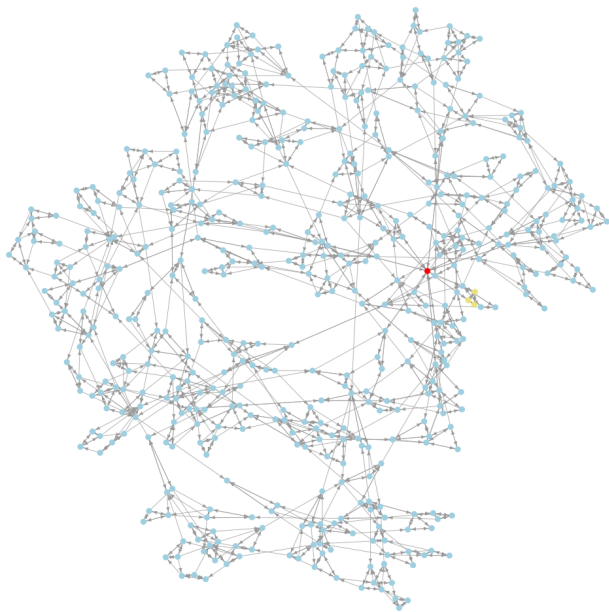
- ▶ a structured population, P ,
- ▶ covert leader(s), H ,
- ▶ subordinate covert group(s), $\{C_i\}$,
- ▶ stochastic behavior model for intra- and inter-group messages

Aside: Sales Pitch

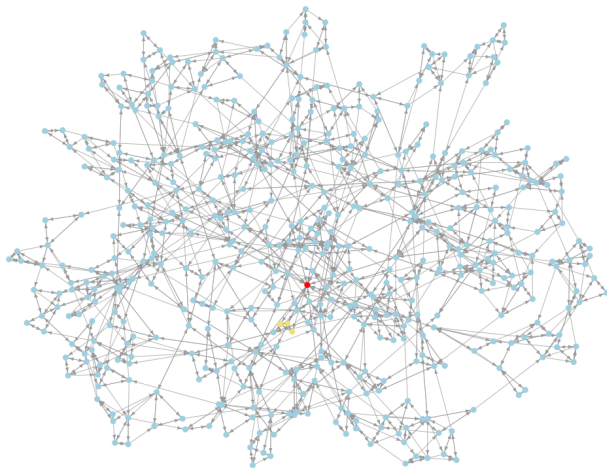
Scala-based Implementation available for remix:

<https://github.com/pearsonca/scala-commsim>

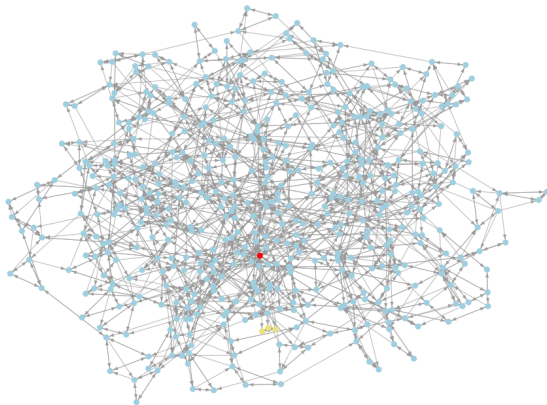
We're actively moving features from a closed, non-Scala implementation to this repository. Feel free to request changes, point out bugs, etc.



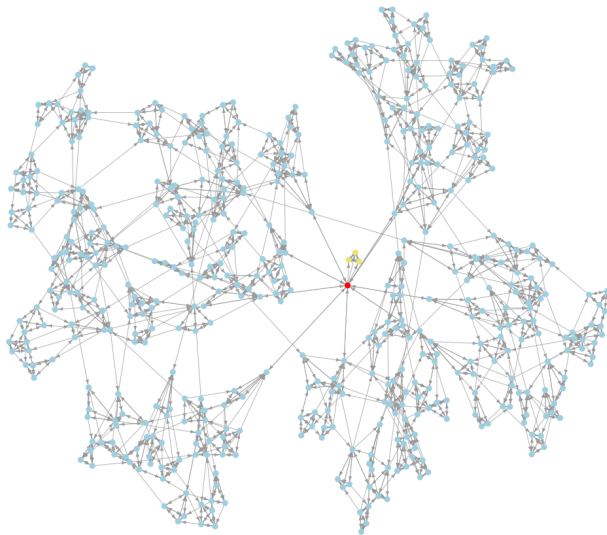
3 clique, 1% remix



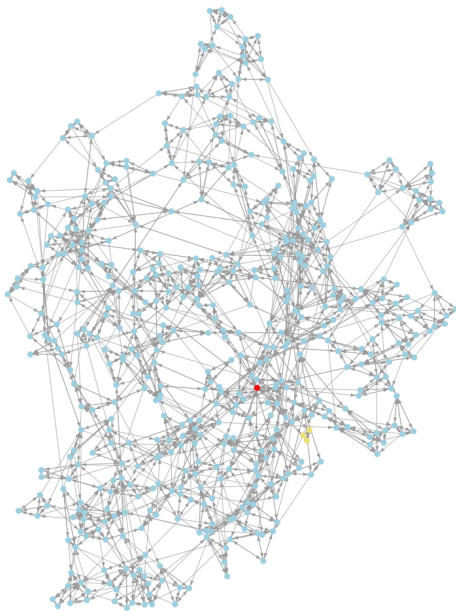
3 clique, 10% remix



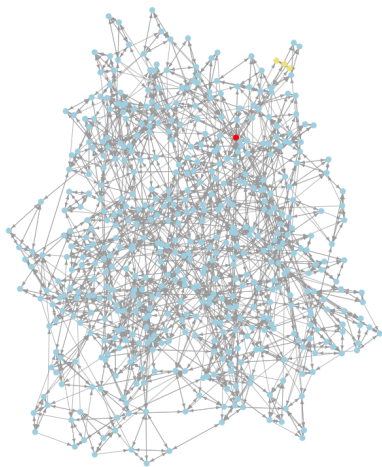
3 clique, 30% remix



4 clique, 1% remix



4 clique, 10% remix



4 clique, 30% remix

Real Time Challenges to Detection

- ▶ population vs. covert group communication network initially unknown,
- ▶ potentially limited resources for monitoring those communications,
- ▶ thus gathered information unreliable / incomplete,
- ▶ and risk trade-offs: FPR & TPR vs. action by group

Our Model: The Observer

An algorithmic description of

- ▶ the data limitations (e.g., random suppression or transformation of signals), and
- ▶ detection strategy(ies)

Some Simple Strategies

- ▶ pure content: pick up everyone that has sent and received a *Bad* message
- ▶ pure structural: pick up highest degree person and all people below median
- ▶ mixed structural and content

Appropriate Measures?

Assume that any given plot has some critical amount of planning-related communication.

But what else?

- ▶ true positive rate,
- ▶ false positive rate,
- ▶ resource investment

Results For These Modes

TODO series of plots

Flaws, Extensions, and Outlook

- ▶ limited vocabulary – add message diversity, require content detection as well,
- ▶ unsophisticated Observer model and strategies – add resource model, shifting strategies
- ▶ background / foreground structural generations – new generators, fitting to live traffic