Uncover Terrorist Network Communities and Predictions

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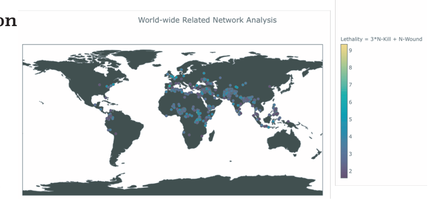
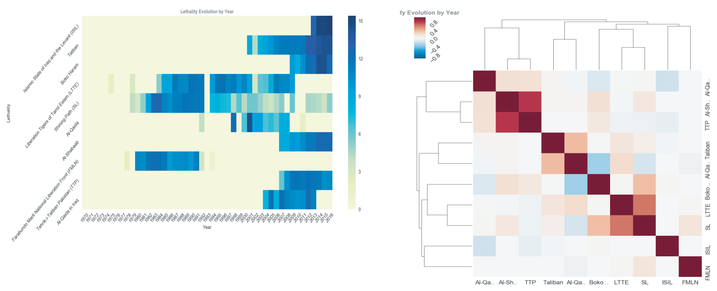
Overview

- Terrorist community detection
- Hidden Network Inference
- Event Prediction

- Global Terrorism Database:
  [170350 x 135]
- Features:
  related events, attack type, target type ...



Temporal Evolution

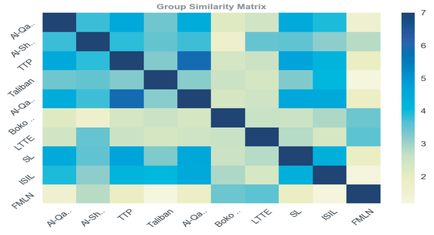


Similarity Network

Terrorist Events → Group Vectors → Similarity Matrix → Similarity Network → Community Detection

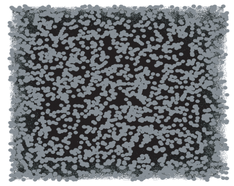
Algorithm 1 Similarity Network Construction

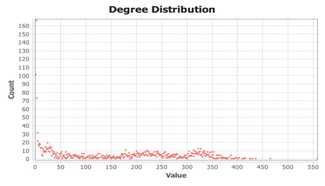
procedure SIMILARITYSCORE(v_1, v_2)
  $score \leftarrow 0$
  for $i = 1 : VectorDimension$ **do**
    if i^{th} feature is unbounded numeric value **then**
      $curr = min(v_1[i], v_2[i])/max(v_1[i], v_2[i])$
    if i^{th} feature is bounded numeric value **then**
      $curr = exp(-abs(v_1[i] - v_2[i])$
    if i^{th} feature is categorical value **then**
      $curr = 1[v_1[i] == v_2[i]]$
    if i^{th} feature is longitude/latitude **then**
      $distance$ = geographic distance by lon/lat
      $curr = exp^{-distance}$
    $score += curr$
  return $score$



Hidden Network Inference

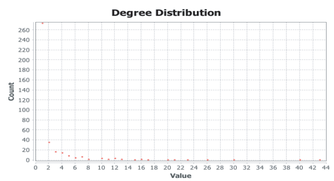
- **Similarity Graph**





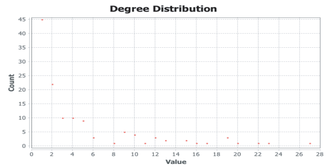
Significantly Denser Graph
(even with high threshold of similarity)

- ***NetInf*** **Graph**



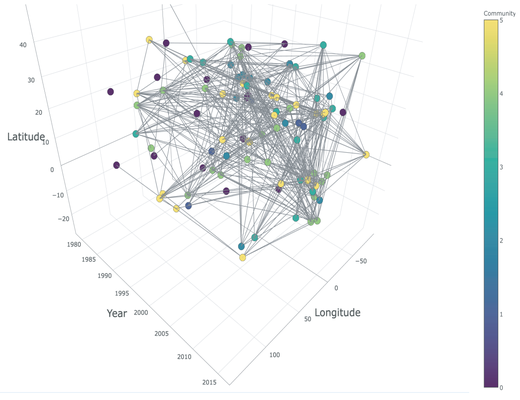
Extremely Low Average Degree
(Very few nodes marked as influential, certain nodes exhibit high influence)

- ***FastInf*** **Graph**



Degree Distribution much more even than NetInf Implementation
(Still, most nodes exhibit no influence)

3D Terrorist Group Community Detection



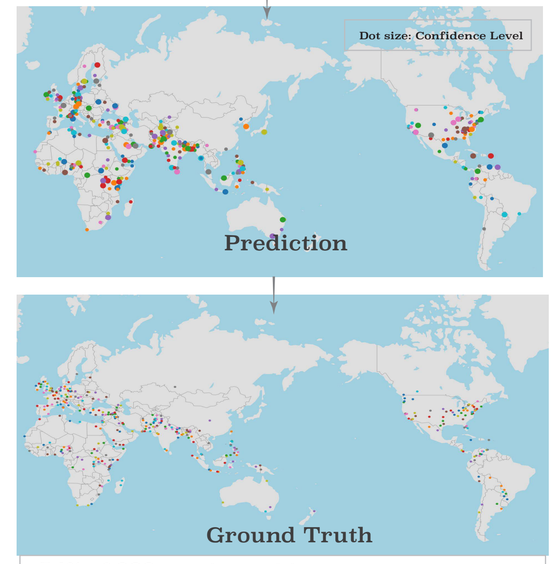
Community	Groups
1	**FARC, Ansar Allah, ISI**, FARC
2	**Boko ..**, Hutu .., Fulan.., MNR, CPI-Maoist
3	**Al-Sh..**, AQAP, Al-Nu.., Chech.., Donet..
4	**FMLN**, FDN, PKK, NPA, ARDE
5	**Taliban**, Khora.., South Africa, Narco..

SIS - Event Geographical Prediction

- Terrorism as Susceptible-Infected-Susceptible Model

Graph-based FeatureVector: [*degree, betweenness, farness ...*]

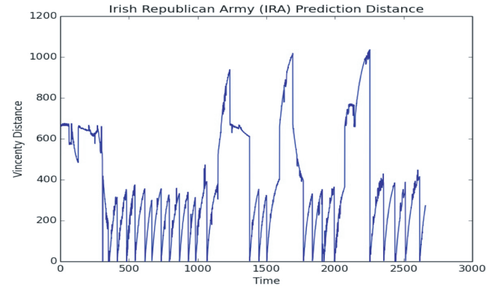
Two small neural networks to classify on S->I and I->S respectively



54% of 332 predicted cities actually had attacks (2016)

SIS with Neural Net Model successfully predicted major attacks in
London, Berlin, Montreal, Hamburg, Dublin, Copenhagen, Stockholm, Madrid, Paris, Milan, Istanbul, Florencia, Moscow, Bankok, Richmond, Washington D.C., San Jose and Toronto.

Particle Filter to Track Group Movement



Github Code Repo

https://github.com/dengl11/CS224W-Project