

A Topical Crawler for Uncovering Hidden Communities of Extremist Micro-Bloggers on Tumblr

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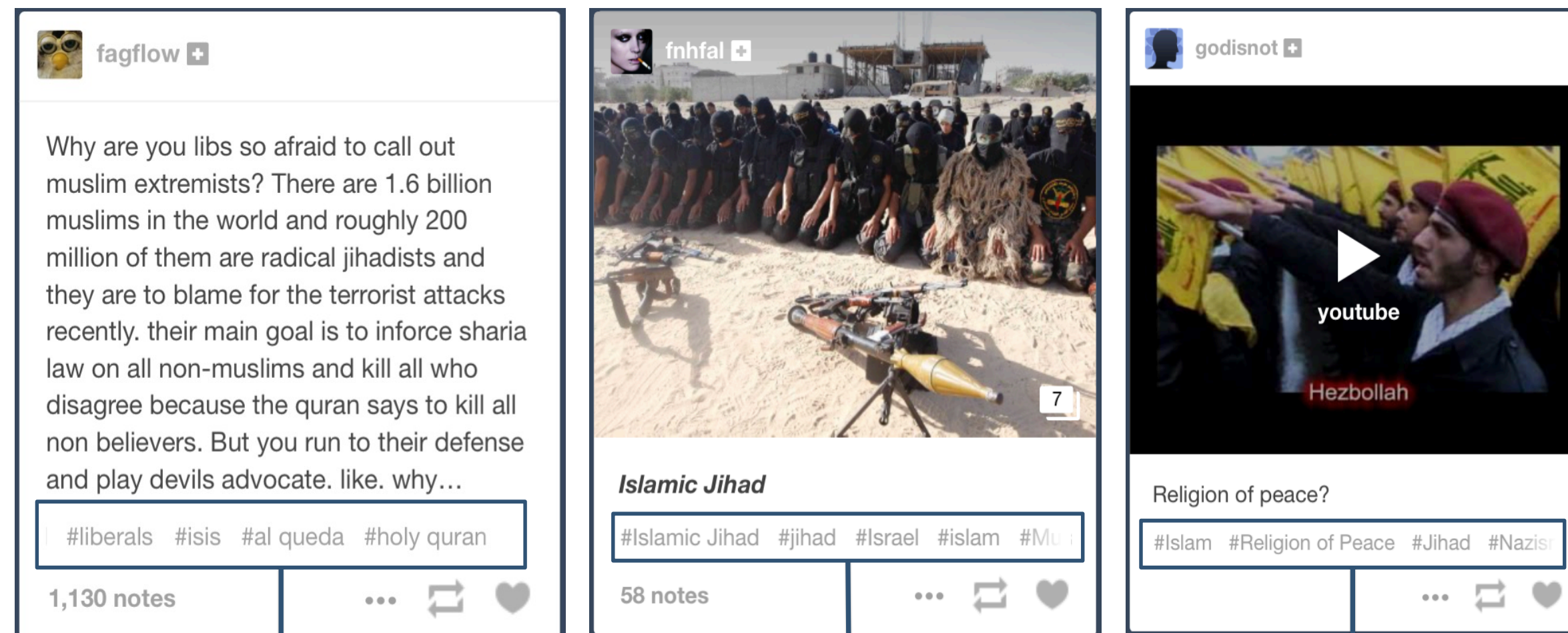


Research Motivation

Tumblr- 2nd most popular and widely used micro-blogging website. (#blogs: 234.2million, #posts: 109.9 billion- May 1, 2015 statistics)

- Simplicity of Navigation • High reachability across wide range of viewers • Low publication barriers • Social networking • Anonymity

- ✓ Tumblr being used as a platform for disseminating hate and extremism
- ✓ Issues raised by **law enforcement agencies** and website moderators- Need of investigating solutions to counter and combat online extremism on Tumblr
- ✓ Automatic identification of extremist content/blogger is a technically challenging problem
 - Tumblr- A large repository of Text, Image Audio, Video- **Impractical to use keyword based flagging** for filtering/classification
 - Large volume of data, Dynamic nature of website, free-form text and noisy content



boko haram, islam, muslim, radical islam, terrorist, jihad, isis, liberals, al queda, holy quran, je suis charlie, Islamic Jihad, Israel, ak47, guns, rifle, hate, anti-American, violence, battle, weapon, religion of peace

Tags/Keywords associated with the post

Research Aim

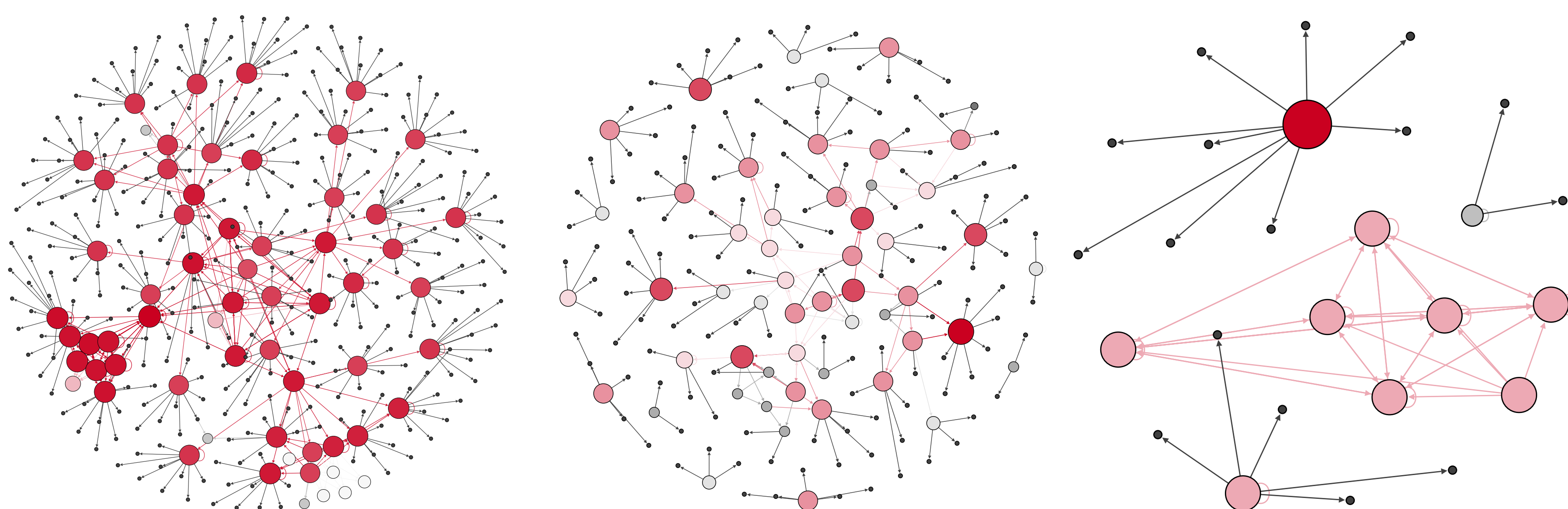
- ✓ To investigate the application of a **topical crawling** based algorithm for retrieving hate promoting bloggers on Tumblr
- ✓ To examine the effectiveness of a **random-walk** based approach in social network graph traversal
- ✓ To examine the effectiveness of **re-blogging** and **like** on a post as the links between two bloggers and conduct experiments on large real world dataset to demonstrate the effectiveness of our approach

Related Work

| | |
|--------------------------|--|
| Agarwal et. al. 2014 | A one-class classification model (KNN and SVM) to identify hate and extremism promoting tweets |
| O'Callaghan et. al. 2013 | Identification of extremist communities on various social media websites (Twitter- as a possible gateway, Facebook, YouTube) |
| Morcelli et. Al 2011 | Keyword based search to locate several criminal organizations and gangs on Twitter and Facebook |
| Mahmood S. 2010 | describes several mechanisms that can be useful in order to detect presence of terrorists on social networking websites by analyzing their activity feeds. |

Social Network Analysis

Cluster Representation of Social Network: "All links" (Left), "Posts Liked by" (Center), "Re-blogged by" (Right)



| | Nodes | Edges | Dia | #SCC | #ACC | #Mod | IBC | ICC |
|-----|-------|-------|-----|------|-------|-------|-------|------|
| ALL | 382 | 275 | 4 | 137 | 0.026 | 12.00 | 11.36 | 0.20 |
| PLB | 27 | 60 | 1 | 21 | 0.023 | 1.30 | 0.00 | 0.38 |
| PRB | 355 | 215 | 6 | 185 | 0.021 | 7.01 | 6.28 | 0.40 |

Size of node N is directly proportional to its out-degree (unique number of blogger who liked and re-blogged the post P made by Node N)

Network Level Measurements for the Topical Crawler. Notes as Links Between Bloggers: ALL (PRB+PLB), PLB: Posts Liked By, PRB: Posts Re-Blogged By

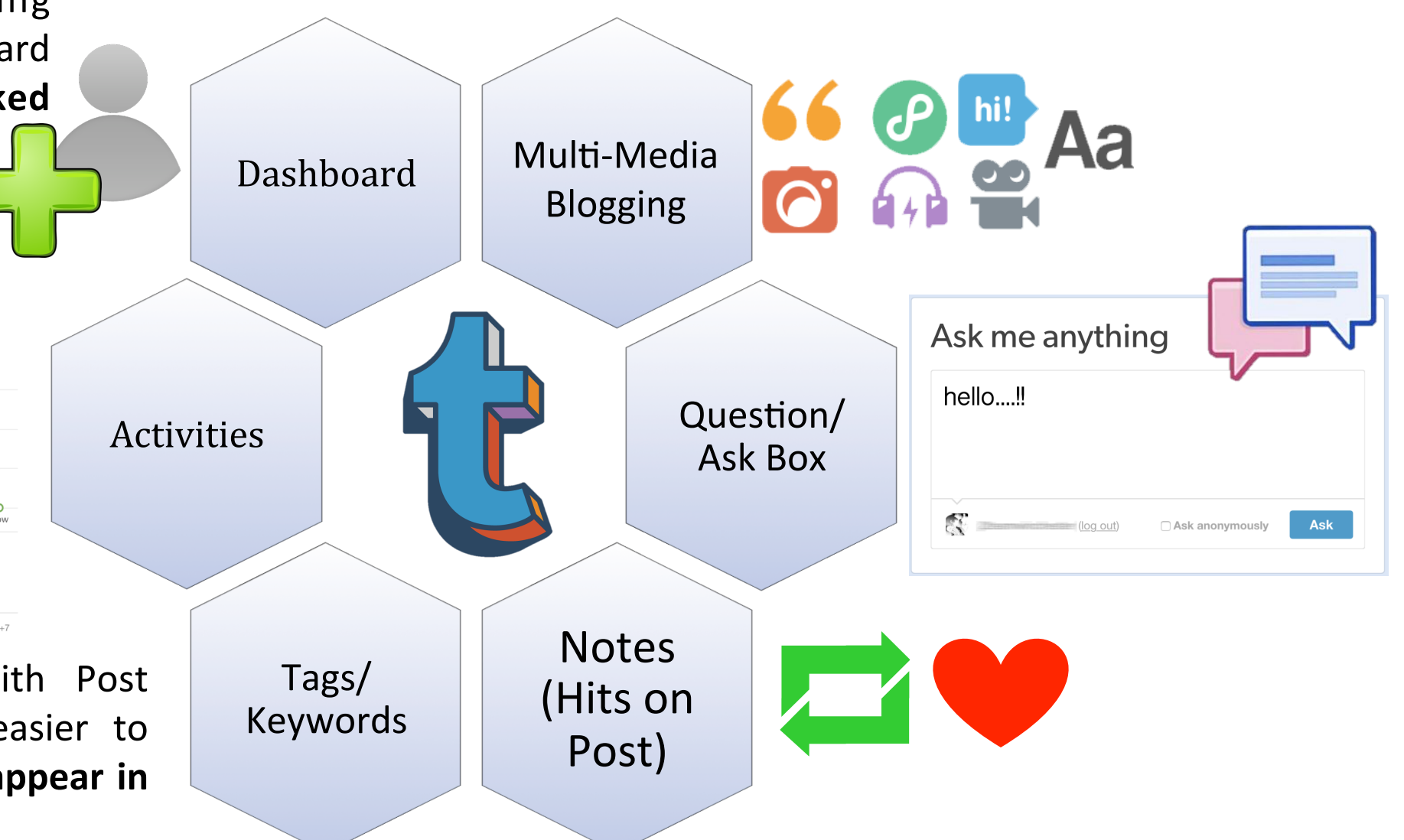
Dia: Diameter, SCC: Strongly Connected Components, ACC: Average Clustering Coefficient, IBC: In-Betweenness Centrality, ICC: In-Closeness Centrality

Tumblr

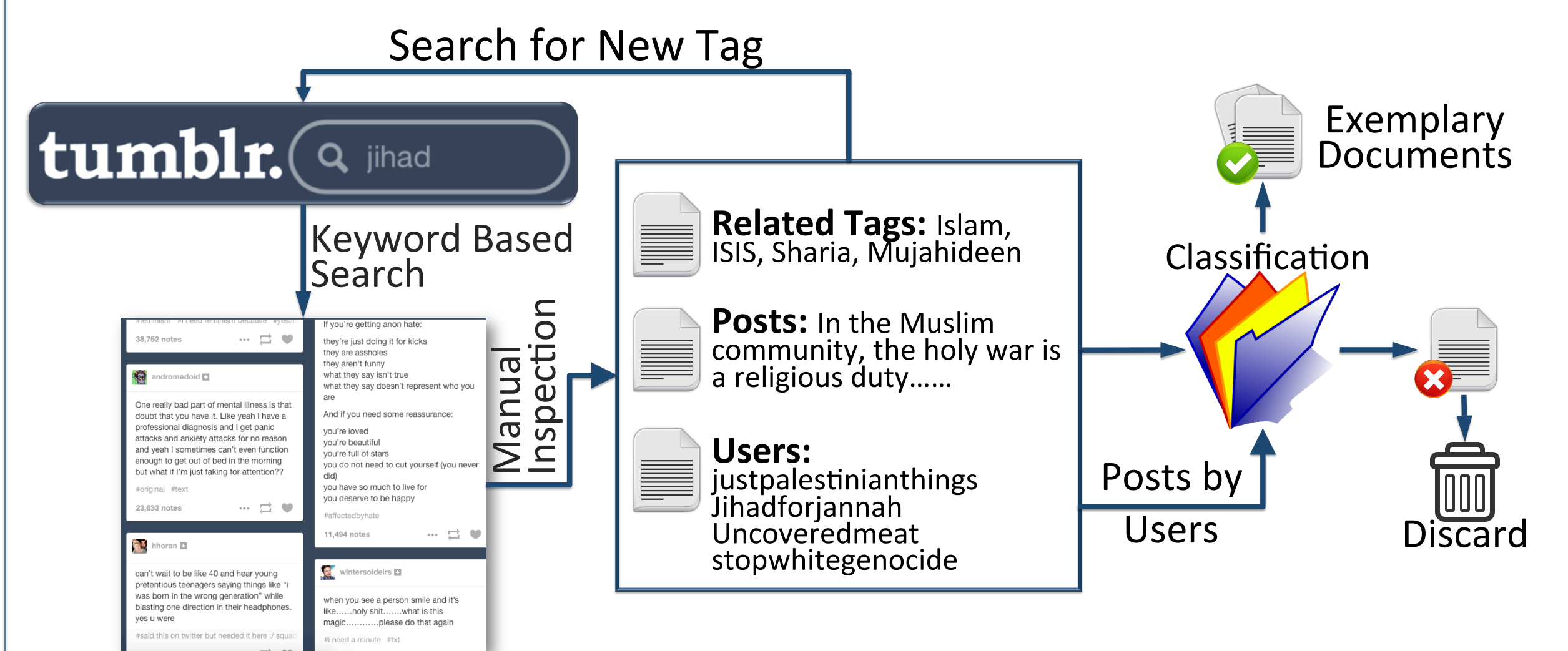
Public posts of following bloggers appear on Dashboard + Posts containing tracked tags

Summary of recent activity feeds- Notes (who liked/re-blogged which post), new followers, Top post/Fan of week

#keyword: Associated with Post (optional): Makes a post easier to search, High probability to appear in search results

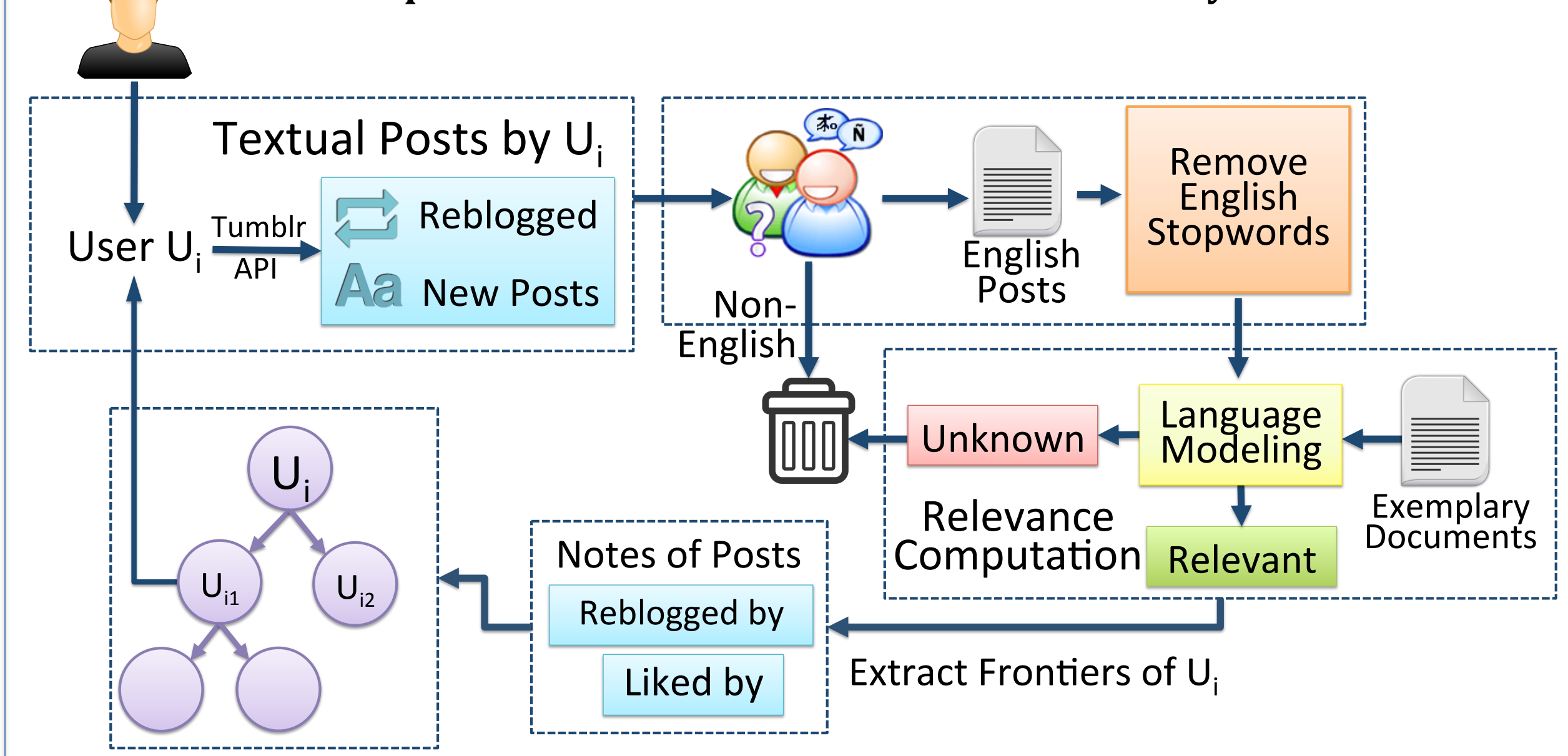


Solution Approach



1. Flow Sequence of Exemplary Data Collection Process

2. Proposed Architecture for Extremist Community Detection



Accuracy Results

| | | Predicted | | Precision | Recall |
|--------|------------|-----------|------------|-----------|--------|
| | | Relevant | Irrelevant | | |
| Actual | Relevant | 290 | 45 | 0.75 | 0.86 |
| | Irrelevant | 92 | 173 | 0.80 | 0.77 |

| | TPR | TNR | PPV | NPV | F1-Score | Accuracy |
|-----|------|------|------|------|----------|----------|
| BFS | 0.75 | 0.35 | 0.88 | 0.18 | 0.81 | 0.69 |
| SSA | 0.77 | 0.35 | 0.95 | 0.09 | 0.85 | 0.74 |

Conclusions

- ✓ We execute our topical crawler for a given seed blogger and traverse through Tumblr network using random walk algorithm
- ✓ Results shows that the precision, recall and f1-score are reasonably high and we are able to predict hate promoting bloggers with an accuracy of 77%
- ✓ Our experimental analysis reveals that **re-blogging** is a good indicator of connection between two extremist bloggers
- ✓ We locate users who are central and influential among all and play major role in the discovered communities

References:

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