Analyzing Latent Topics in Student Confessions Communities on Facebook

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Abstract
Confessions pages have grown popular on social media sites such as Facebook and Twitter, particularly within college communities. Such pages allow users to anonymously submit confessions related to collegiate experience that are subsequently broadcast on a public forum. Because of the anonymous nature of disclosure, we believe that confessions pages are novel data sources from which to discover trends and issues in a collegiate community. Aggregating data from more than 20,000 entries posted to one such space, we analyze natural language characteristics of the originating community with LDA, pointwise mutual information and sentiment analysis. Using a Markov topic model, we identify the latent topics in our corpus and find that loneliness is a highly regular pattern. Our findings on student confession communities support previous sociological research, contextualizing student loneliness in the age of social networks.

Introduction
In the age of Social Network Sites (SNS), university students often utilize anonymous confessions pages on Facebook to vocalize issues and topics they otherwise would not share under their true identity. Acquired through an externally linked survey, confessional messages are filtered by page administrators and then anonymously posted on a public Facebook community page, where page followers can comment and respond (Simon 2015). One student anonymously writes to a confessions page:

“I honestly feel like a failure. I spent all semester looking for an internship, applied to dozens of places, got interviewed at only one and did not get it. If I cannot get even one, how will I be able to find a real job senior year?”

Another student writes on the campus page for University of Colorado, Boulder:

“I think I’m a Republican now, and I can’t tell any of my friends or anyone else in Boulder, really.”

Through personal anecdotes, these pages offer insight into “true” campus culture as well as student sociological and political sentiment. Moreover, they propagate unprecedented volumes of such textual data - between 2011 and 2013, some community pages have individually posted more than 17,000 anonymous messages (Simon 2015). A university campus’s confessions page is a novel corpus from which we can begin to infer trends within a collegiate cohort that would otherwise be difficult to detect through unsolicited and official surveys (Wang, Burke, and Kraut 2013). To further motivate this study, patterns in such student discourse could inform administrators about their respective student bodies and draw general attention to prominent issues or topics in such communities. Confessions pages have already recently raised awareness from campus administrators about specific incidents necessitating institutional intervention (Simon 2015). In this paper, we employ a textual approach to analyze information disclosed by users of confessions pages. Full anonymity is known to have a positive effect on this process of self-disclosure (Keipi, Oksanen, and Räsänen 2015).

One recent study examined how SNS users access emotional support by broadcasting requests for advice/resources via status updates to their entire network (Ellison et al. 2013). However, users are unlikely to use such a public channel to share embarrassing or graphic experiences and issues - English-speaking users mostly tend to publicly post positive updates (Kramer and Chung 2011). Prior research also suggests that anonymous social media sharing is more likely with controversial content (Zhang and Kizilcec 2014). Therefore, an anonymous campus confessions page may be a more socially acceptable forum for university students to discreetly share negative campus experiences. Perhaps, these posts are framed as ‘cries for help’ instead of simply ‘calls for support’. In addition, users have access to a broader audience of their campus peers, instead of their immediate social network.

Given the advantages of anonymous confessions pages as a novel data source for monitoring issues, in this paper, we aimed to answer a general research question: What does a particular student community talk about on a confessions page?

Proposed Method
Dataset
We collected approximately 24,000 anonymous posts published on the Facebook page, “Tufts Confessions”, from late
Table I: Top trigrams ranked by frequency.

| Phrase           | freq |
|------------------|------|
| I want to        | 732  |
| I feel like      | 694  |
| I just want      | 314  |
| I wish I         | 306  |
| the fact that    | 261  |
| all the time     | 230  |
| in love with     | 216  |
| every time I     | 189  |

Table II: Top trigrams ranked by PMI.

| Phrase                                      | PMI  |
|---------------------------------------------|------|
| socio economic background                   | 28.21|
| spectrum bi curiosity                       | 28.01|
| prescription ADD medication                 | 27.87|
| fossil fuel companies                       | 27.69|
| Israeli Palestinian conflict                | 26.53|
| competent natural ability                   | 26.78|
| beginning anti depressant                   | 24.93|
| false rape accusation                       | 24.57|
| segregated culture house                    | 24.08|
| binge eating disorder                       | 23.98|
| struggle struggle struggle                  | 23.52|
| social justice warrior                      | 22.71|

2013 to early 2015. For this study, using a single campus page allowed for coordination with individual page administrators. Focusing on a particular ‘community sample’ we can link our analysis back to a single, known student community. Moreover, this particular page offered a much larger corpus than other sparser pages.

This dataset consisted of publicly visible messages as posted by the page administrators. All messages were filtered by the administrators to confirm their origin from and relevance to the Tufts University community.

To preprocess the data, we removed all non-essential stopwords (e.g. “the”, “of”) from each post according to the Natural Language Toolkit. URL syntax (e.g. “http”, “youtube”) was also removed. After pre-processing, we retained 245,260 of the original 991,297 tokens, with a vocabulary set of 25,055 unique words.

Natural language processing tools

To explore some general characteristics about our corpus, we employed Pointwise Mutual Information (PMI). PMI is an information theoretic metric that can be used to discover high entropy bigrams (word pairs) and trigrams (triplets) in a text corpus (Tomokiy and Hurst 2003). Phrases with high PMI are often very specific and frequently occurring vernacular or linguistic constructions across a set of documents.

In order to understand the topics discussed in “Tufts Confessions”, we used Latent Dirichlet Allocation (LDA), a machine learning algorithm to segment a text corpus into discrete topics (Blei, Ng, and Jordan 2003). The fundamental assumption of the LDA model is that a document is an orderless “bag of words,” from which clusters of frequently co-occurring words across all documents give meaning to “topics”.

We are not only interested in the separate topics in our corpus, but also the relationships between the topics themselves and the distribution of topics in one post. To model topic transitions within a post, we turned to the Hidden Markov model which augments the LDA “bag of words” assumption by suggesting that post topics form a Markov chain (Seymore, McCallum, and Rosenfeld 1999). The Hidden Markov model is suitable for discovering sequential syntactic structure in language (Seymore, McCallum, and Rosenfeld 1999). The average post in our corpus is 35 words (including stopwords), so it is likely that a single post explores a sequence of multiple topics. This assumption allows us to thematically categorize keywords, and recognize global topic patterns.

Experimental Results

First, we report the top trigrams in “Tufts Confessions” ranked by raw frequency alone in Table I. These phrases serve to illustrate the egocentric syntactic construction of Internet confessions. Confession posts typically express personal desire or sentiment, and notably often recount repeated experiences (e.g. “every time I”, “all the time”).

In comparison, to find popular phrases that were also likely distinct to the Tufts student community, we extracted the top trigrams across all documents according to PMI (Table II). We only reported trigrams that met a minimum frequency of occurrence in our corpus as to ensure that our trigrams didn’t measure high in PMI just because of the rare overall occurrence of word triplets (e.g. nonsense phrases, proper nouns, non-English phrases). Our resulting set of phrases were relatively frequent, and less generic word segments.

We can observe that phrases in this latter group resemble political, economic and racial discourse. These include “fossil fuel companies,” “Israeli Palestinian conflict,” and “segregated culture houses.” For our cohort, such phrases are consistent with the Tufts University’s vocal emphasis on active citizenship and social entrepreneurship (Fortunato). Our anonymous social media discourse evidently reflects university culture. Other phrases suggest recurring mental health behavior - “beginning anti depressants,” “binge eating disorder,” “prescription ADD medication” - as well as sexual health, that are perhaps not as publicly known or detailed. These may include ‘trigger words,’ phrases that may cause emotional reactions in victims of traumatic experience.

Table III presents the results of our LDA discovery. We set the number of topics to be discovered (T = 17) by iteratively running LDA until we found the most ‘interpretable’ topic distribution. Because of the subjectivity of topic interpretability, human judges must be experts of the textual
Table III: LDA topics in order of likelihood.

| Topic label                  | likelihood | keywords                                                                 |
|------------------------------|------------|--------------------------------------------------------------------------|
| LONELINESS                   | 0.229      | want, people, care, sometimes, wish, alone, body, someone, talk, stop     |
| SOCIAL DYNAMIC               | 0.147      | people, white, black, privilege, think, race, social, gay, world          |
| TIME                         | 0.146      | year, time, freshman, first, week, every, still, last, yet, day, job      |
| SOCIAL ISSUES                | 0.099      | many, social, isn’t, still, trying, others, issues, racism, without, understand |
| PARTY                        | 0.073      | room, dance, floor, door, stop, walk, around, smoke, weed, finals         |
| HOOK-UP                      | 0.066      | attractive, hooked, interested, hooking, anyone, best, sexually, campus   |
| ATTRACTIVE INDIVIDUAL        | 0.046      | sexy, next, sitting, man, name, hair, gym, naked, dark, dining, ATO, tisch |
| DOMESTIC                     | 0.045      | money, kid, rich, sorority, grade, family, huge, enough, parent, bad, poor |
| BATHROOM                     | 0.0401     | penis, bathroom, toilet, poop, paper, clean, seat, put, house, step, take, pee |
| BODY                         | 0.0337     | pants, body, free, fat, drink, eat, obsessed, thin, skinny, social, marriage |
| SEXUAL ASSAULT               | 0.0301     | rape, hate, sexual, culture, trigger, assault, ate, ATO                  |
| ACADEMIC EXPERIENCE          | 0.021      | liberal, major, conservative, absolutely, cry, turn, easy, homework, gotta, power |
| SEXUAL ENCOUNTER             | 0.020      | dick, frat, gave, public, cum, laid, guilty, stranger                    |

Thus, we identified and labelled the topics with the help of the page administrators who were familiar with the style and content of the particular confessions page and could categorize each grouping of words as a ‘talked-about’ subject. For each such subject, Table III reports the most relevant keywords.

Figure 1: Topic transition probability matrix for all posts in “Tufts Confessions”.

Discussion and Future Work

Loneliness: a dominant theme

With more than 22% overall likelihood of occurrence by keyword, Loneliness is the most recurring topic in our corpus - more than Sexual assault, Academic experience and Party combined. The resulting probability matrix of our Markov model as shown in Figure 1 further corroborates this. Loneliness dominates in the global topic network as the most likely non-cyclic out-topic across the entire matrix.

Using the power method to approximate the stationary topic distribution of a ‘random topic walk’, Loneliness in the dominant eigenvector has a convergent transition probability of 0.752 and Social issues has the next highest value of 0.481. Under the assumption of multi-topic posts, a confession is most likely to steer towards these two topics. This may be interpreted as the most likely ‘direction’ of discourse from an anonymous confessor from this community.

User behavior

Is an online confessions community innately biased towards expressions of social distress such as Loneliness? Using sentiment analysis (Pang and Lee 2008), we scored each post in our corpus with a polarity measuring the weighted average sentiment of its keywords. Figure 2 shows the resulting distribution plot with an average sentiment of 0.403, indicating that the average confessor is likely to express negative sentiment. In particular, the presence of topics such as Sexual assault and Body suggest that this online space may be popular for individuals who’ve undergone personal trauma to relate their negative experiences in the safety of anonymity. However, research on social network well-being by Burke et al. (Burke, Marlow, and Lento 2010) found that direct communication with online friends correlate with decreased...
feelings of loneliness. Despite the benefits of anonymous self-disclosure to a campus network, the removal of direct engagement may only worsen feelings of distress. It is difficult to establish a causal relationship between the social medium and confessional behavior without further study to understand the role of anonymity.

It is worth noting the overlap between Loneliness keywords and top scoring trigrams in Table I e.g. “want,” “wish”. Our students’ confession posts, in the majority, are egocentric requests centering on the personal, particularly on the complications of Loneliness. Even for specific political or social subject matter as suggested in Table II, they cater towards personal desire or experience. This may suggest that SNS users transmit uncontroversial, positive egocentric expressions through status updates, while relaying contentious, negative egocentric expressions as nameless ‘confessions’.

Social utility

Sociological research finds that behavioral transitions during early college experiences are coupled with feelings of loneliness and isolation [Shaver, Furman, and Buhrmester 1985]. The thematic prevalence of Loneliness in our corpus extends this notion to the Facebook age; university students now use a common social media platform to report these feelings. Within undergraduate communities, first-year students are the most common cohort to express such isolation and loneliness based on studies of collegiate Facebook behavior [Kalpidou, Costin, and Morris 2011].

Compounded with the social and psychological benefits of confessional behavior, platforms that encourage honest personal disclosure can contribute to the ultimate well-being of users such as students transitioning into university life [Weiner et al. 1991]. With comparison and cross-validation between different pages, we hope to make findings - with geographic, temporal, and institutional dimensions - about university students across campuses.

Conclusion

In this paper, we examined “Tufts Confessions,” a sample of popular university campus confessions pages. We describe some characteristics of 24,000 anonymously authored posts, revealing both expected syntactic trends and unique phrases that provide “cultural” context. To examine topic patterns in this novel corpus, we utilized Markov topic models to examine our text corpora as a network of topic-word distributions. The discovery of Loneliness as a dominant topic of confession supports and extends the sociology of loneliness in university student life. Future work includes compiling a larger dataset of student confessions across different campus pages for further comparisons.

References

[Blei, Ng, and Jordan 2003] Blei, D. M.; Ng, A. Y.; and Jordan, M. I. 2003. Latent Dirichlet Allocation. Journal of Machine Learning Research 3:993–1022.

[Burke, Marlow, and Lento 2010] Burke, M.; Marlow, C.; and Lento, T. 2010. Social network activity and social well-being. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, 1909–1912. ACM.

[Ellison et al. 2013] Ellison, N. B.; Gray, R.; Vitak, J.; Lampe, C.; and Fiore, A. T. 2013. Calling All Facebook Friends: Exploring Requests for Help on Facebook. In Proceedings of the International Conference on Weblogs and Social Media (ICWSM).

[Fortunato 2013] Fortunato, M. 2013. Citizen You: How Social Entrepreneurs are Changing the World. Journal of Higher Education Outreach and Engagement 17(4):315–320.

[Kalpidou, Costin, and Morris 2011] Kalpidou, M.; Costin, D.; and Morris, J. 2011. The relationship between Facebook and the well-being of undergraduate college students. Cyberpsychology, Behavior, and Social networking 14(4):183–189.

[Keipi, Oksanen, and Räsänen 2015] Keipi, T.; Oksanen, A.; and Räsänen, P. 2015. Who prefers anonymous self-expression online? a survey-based study of Finns aged 15 to 30 years. Information, Communication & Society 18(6):717–732.

[Kramer and Chung 2011] Kramer, A. D., and Chung, C. K. 2011. Dimensions of Self-Expression in Facebook Status Updates. In Proceedings of the International Conference on Weblogs and Social Media (ICWSM).

[Pang and Lee 2008] Pang, B., and Lee, L. 2008. Opinion mining and sentiment analysis. Foundations and Trends in Information Retrieval 2(1-2):1–135.

[Seymore, McCallum, and Rosenfeld 1999] Seymore, K.; McCallum, A.; and Rosenfeld, R. 1999. Learning hidden Markov model structure for information extraction. In AAAI Workshop on Machine Learning for Information Extraction, 37–42.

[Shaver, Furman, and Buhrmester 1985] Shaver, P.; Furman, W.; and Buhrmester, D. 1985. Transition to college: Network changes, social skills, and loneliness. Sage Publications, Inc.

[Simon 2015] Simon, S. 2015. Students bare souls, and more, on Facebook “confession” pages. Reuters. http://www.reuters.com/article/2013/03/18/us-usa-facebook-confess-idUSBRE92H0X720130318.

[Tomokiyo and Hurst 2003] Tomokiyo, T., and Hurst, M. 2003. A Language Model Approach to Keyphrase Extraction. In Proceedings of the ACL Workshop on Multiword Expressions: Analysis, Acquisition and Treatment - Volume 18, MWE ’03, 33–40. Association for Computational Linguistics.

[Wang, Burke, and Kraut 2013] Wang, Y.-C.; Burke, M.; and Kraut, R. E. 2013. Gender, Topic, and Audience Response: An Analysis of User-Generated Content on Facebook. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, 31–34. ACM.

[Weiner et al. 1991] Weiner, B.; Graham, S.; Peter, O.; and Zmuidinas, M. 1991. Public confession and forgiveness. Journal of Personality 59(2):281–312.
Zhang, K., and Kizilcec, R. F. 2014. Anonymity in social media: Effects of content controversy and social endorsement on sharing behavior. In Proceedings of the International Conference on Weblogs and Social Media (ICWSM).