The Utility of Social Media in Understanding the Future of Work

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ABSTRACT

There is a growing body of research that leverages online social networks to study users' interests and behaviors for reasons such as personalization and recommendation. However, the utility of online social platforms in understanding and predicting the labor market has not received the attention that it deserves in the literature. Therefore, this Ph.D. research will explore the temporal and causal relationships between online social topics and the changes in the job market from several complementary aspects. More specifically, this research will be focused on addressing three main problems: (1) investigating whether social content is an effective indicator of future job requirements; (2) analyzing if any meaningful causal relationship could be found between work-related emotions expressed on online social platforms and their social demographics; and, (3) identifying potential causal impacts of community support on the online users' well-being in the future job market. The findings of my doctoral dissertation will assist learners and job seekers to gain insight into important job-related skill trends, which can help them in their career-long learning process to stay in demand and remain employable. Also, the outcomes of this thesis can help governments and policymakers understand workforce challenges and design programs and solutions that can support workers in the knowledge economy and enhance their well-being.

CCS CONCEPTS

• **Human-centered computing → Empirical studies in HCI**; **Empirical studies in collaborative and social computing**.

KEYWORDS

Future of work, Social media, Causality, Professional development, Social support, Online community, Lifelong learning, Well-being

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1 INTRODUCTION

The advancement of technology, such as artificial intelligence, has created new occupations, which impose ever-evolving skills on employees [7]. In such a fast-evolving labor market, learning the skills that are immediately in-demand by employers, searching for new careers, and losing jobs can lead to anxiety and exhaustion [17, 22, 27]. As such, it is imperative to systematically understand the dynamics of the labor market and develop evidence-based methods that would proactively assist the workforce with their occupational needs. Supporting the workers in the evolving labor market is a problem that has received increasing attention from CSCW and HCI scholars in recent years [3, 4, 6]. These researchers investigate the emerging labor market from a variety of perspectives such as employment, crowdsourcing [2], emergent skill relationships [14], professional development [17, 19], future workplace [5, 15], and cognitive-based workstations [25], to name a few. Although the majority of existing works employ qualitative methodologies, such as survey or interview analysis, there is a growing body of literature that leverages online communities to quantitatively model the labor market. For example, Kou and Gray [16] explore the role of online communities in skill development, and Ganesh and Lazar [11] show how users discuss the invisible health conditions that cause them pain in the workplace on Reddit. However, existing literature does not study the role of online communities in understanding job market movements and the possible reflection of the workforce's well-being on such online communities. This is while prior work shows that content from online social communities has the potential to garner an understanding of in-demand skills [17, 19], job satisfaction [24], and job burnout [29], to name a few.

One of the reasons that online social communities are important in understanding different social phenomena is the type of connections that can form between users. For example, on social platforms such as Twitter and Reddit, users form virtual communities based on weak ties in which they share common goals and willingness to communicate with one another and even strangers [30]. In these communities, users from different ethnic backgrounds, diverse levels of societal power, and knowledge expertise have the chance to connect to others with superior knowledge, resources, and expertise. Such weak ties allow the users to freely share their personal experiences and knowledge on a variety of topics, including technological trends, potentially in-demand skills, and the evolution of the needs of certain market segments [20]. Additionally, individuals might also utilize social media to express emotions and challenges that they experience while unemployed or looking for a job, which they may not freely share with close ties, such as friends and family members [12]. This inexpensive, large-scale, and naturalist social data has already shown its utility in prior CSCW and HCI work to study different social phenomena regarding finance [21, 26], mental health [10, 23], and the labor market [24, 29], to name a few.

However, there has not been much research that leverages user-generated social data to gain actionable insight into the changes in the labor market, e.g., future in-demand skills, or determinants of negative emotions related to career development and learning in the evolving job market.

To bridge the gap in the literature, this Ph.D. research will adopt qualitative and quantitative methods to understand the shift in the job market and the mental challenges of information workers. Using quasi-experimental methods on observational data from social networks, I will study how social content may reflect different aspects of the labor market, such as career requirements represented in job postings. The results of this work will help to systematically plan for workforce skill development to harness the future of work. More specifically, this research will endeavor to provide the following contributions:

- **Introducing a new lens for analyzing the job market**: instead of studying the future of the job market in isolation by only relying on historical trends, this research thesis will study this phenomenon through a large scale, and near real-time data source, i.e., online social data, which has been overlooked in the literature in this space;
- **Providing novel insights into information workers' well-being**: to the best of my knowledge, this is the first study that examines the factors that impact the well-being of workers and their relationship with users' demographics;
- **Designing a causal inference framework**: Formulating the problem of estimating the effect of community support on workers' well-being within a causal inference framework.

2 RESEARCH FRAMEWORK

This Ph.D. research intends to shed light on the utility of online content in understanding the labor market. To do so, I define three complementary and synergistic research components. The first component will study how user-generated content can be utilized to understand future skill demands of the labor market. The second component will focus on exploring the demographic differences between workers based on the emotions that they expressed on social content. Further, I determine whether differences in the underlying concerns and challenges that may affect workers' wellbeing can be explained by linguistic differences within each demographic group. The third component investigates the possible support mechanisms that workers can receive from online social networks, which may enhance their well-being and minimize the psychological impacts that they experience in the labor market. These above components are formulated in the form of the following research objectives and the synergy between them is shown in Figure 1:

- **RO1**: Can meaningful variables be mined from social content that could serve as sufficient indicators for skill demand in the future of work?
- **RO2**: How do workers express their challenges toward different aspects of the labor market on social media and how are these challenges related to workers' emotions and demographics?
- **RO3**: How can possible relationships between support from online communities and information workers' well-being be modeled within a causal framework?

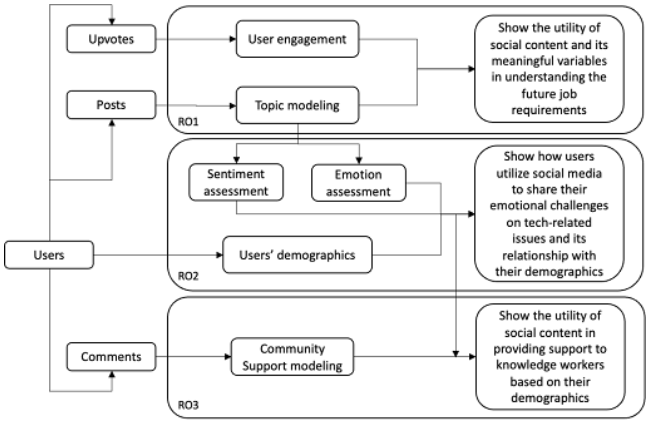

Figure 1: The overview of the proposed research framework for this Ph.D. thesis. The framework consists of three interacting and synergistic components, shown as rectangles. The top rectangle shows the principal aim of this study, which is to explore the utility of online communities for understanding the IT job market. The middle rectangle shows the utility of online communities in understanding information workers. The last rectangle shows the utility of online communities in supporting information workers with their emotional challenges.

In RO1, the goal is to discover the existence of relationships (causal or correlational) between social content and labor market skill demand. The goal is to identify social content types and characteristics that help the most in understanding the trends in future in-demand skills that will expose themselves to future job requirements. The findings of this research objective will provide data-driven insights for workers to systematically acquire new skills and maximize their employability. Also, learning institutions will be able to reflect on the in-demand skills when designing their program curricula via high scale and near real-time data that is freely available in online communities.

The main objective of RO2 is to model the relationship between workers' demographics, such as age, gender, and education, and their emotions expressed on social content in regards to different topics related to the labor market, such as job search, skill development, and job complaints. The findings of this task will help human resource policymakers of academic and industrial organizations to identify the mental challenges that their workers experience in the knowledge economy. Therefore, they can develop policies that increase their workers' well-being and enhance their job performance. Additionally, this research objective aims to provide insight into the possible support mechanisms that information workers can receive, which would enhance their mental health and minimize the psychological impacts that they experience in the fast-changing knowledge economy.

In the last research objective, RO3, the focus will be on the concept of self-disclosure of emotions related to topics, such as job search, skill development, and work-related well-being. In this context, I will examine how online support can lead to a change in the user's mental health. By identifying the effective types of

support from the community, human resource policymakers can select the most powerful solutions to assist their workforce in their professional development journey that will maximize individuals' job performance and well-being.

The following sections will provide more information on each research aim and the proposed approach.

3 METHODOLOGY

The methodology that I will adopt for investigating the utility of social network content in understanding the labor market is a combination of qualitative and quantitative methods. To study the effectiveness of social network content in the labor market, posts and comments shared on a community-based online platform, such as Reddit, posted on technology-related subreddits will be collected. In addition to the collected social data, IT job postings will be gathered. Based on this data, qualitative methods such as the Grounded theory [28], will be applied to model users' interests.

To address **RO1**, and to explore the existence of relationships between workers and the future labor market skill requirements, causal inference frameworks such as Granger causality [13] will be employed. Granger's concept is a simple yet robust causality technique that embeds precedence via time series. To identify the relationship between social content and job market movements, workers' topical interests and in-demand skills based on historical job postings will be modeled through time series. Granger causality can be adopted to explore any possible relationships between the two time series.

In regards to **RO2**, and to estimate the effect of users' demographics on their emotions, a Propensity Score Matching (PSM) method will be conducted while adjusting for the influences of the confounding variables [1]. To detect workers' emotions, similar to the exisitng work [9, 23], deep learning-based text classifiers will be trained to retrieve anxiety, sadness, depression, or anger expressed in social content. Additionally, a set of Named Entity Recognition (NER) tools will be developed to extract workers' demographics, such as their age, gender, race, education level, employment status, and job category based on social data which will be used within the matching process of PSM. This approach may identify challenges that workers and learners experience in the fast-changing knowledge economy.

Finally, to address **RO3**, I investigate the causal effect of online community support (the treatment) on workers' well-being (the outcome). To tackle this objective, by employing the machine learning techniques developed for RO2, I will obtain a list of users who have publicly shared negative emotions towards at least one labor market topic, such as learning or job search. Then, by leveraging topic modeling techniques, the type of support that is offered to such users from online communities will be modeled. Note that in this study, community support is identified through likes and comments. Then, two groups will be compared: those who received help from the community to cope with labor market issues and challenges and a matched control group. Finally, to find the causal relationship between the user's well-being and social support, a causal inference model will be developed [8].

4 WORK TO DATE

This first research objective has already been completed and the results are published and presented at CSCW 2021 [18]. The first important finding with regard to RO1 suggests a strong temporal alignment between user-generated data and future requirements of IT occupations. Hence, social content posted on community-based platforms, such as Reddit, can serve as strong indicators of the future in-demand skills represented in job postings. Further findings indicate that the Granger-causality framework is beneficial for capturing the linear functional connectivity between Reddit content and job postings. In other words, online social content Granger causes future changes in the labor market and can predict future job requirements better than just using historical job demands. Furthermore, results show that by using historical data, I can predict the lag at which the maximum correlation between Reddit and job posting time series occurs.

In addition to detecting a Granger-causation relationship between social content and future job demands, I have reported important findings that indicate the utility of IT-related social content in understanding the future of in-demand skills is highly dependent on the topic they cover. For example, among the detected topics related to "recruitment", "project/mentor/team search", "learning", "career advice", and "technical advice", our results showed that social content discussing "recruitment" and "technical topics" have the highest indictiveness for future in-demand skills. Further, I have also explored to what extent content with certain user engagement characteristics is more appropriate for determining future in-demand skills. I showed that in addition to the content topic, high engaging posts in online social content, i.e., those that have received the highest number of likes, detect future trendy skills stronger than low engaging posts. Also, I found that social content originating from job seekers and learners who received higher support from the community are better indicators of future in-demand skills compared to those posted by hiring managers and recruiters. **These findings are published in a second paper at CSCW2022**.

In future work, we will address the second and third research objectives to investigate the utility of online social networks in the job market from two new perspectives: 1) workers' usage of social media and emotions associated with workers' content under different circumstances, and 2) the type of support that the online community provides and its relationship to workers' well-being.

5 CURRENT AND EXPECTED CONTRIBUTIONS

By incorporating the growing literature within the CSCW and HCI communities in developing tools that help industries gain insight into the recent changes in the labor market, my dissertation comprises an important line of research for future researchers. This work will help scholars leverage suitable sources of information to study the labor market more systematically and promptly. Additionally, this research has multiple implications for job seekers, learners, educational institutes, and policymakers. For example, by showing what types of user-generated content have the most impact on the future in-demand skills, job seekers and lifelong learners can systematically explore the shift in skill demands in

the IT job market promptly to stay in demand and employed. Similarly, the findings of this work help educational institutes develop tools based on indicative content on online communities to help new graduates, jobseekers, and lifelong learners systematically get informed of the changes in the job market by getting some insight into these changes. This research will also assist human resource policymakers to identify the factors that impact the well-being of their workforce. Hence, policymakers can design effective planning and strategy that helps employees not only be skillful in the knowledge economy but also have adequate mental health that helps them with personal and professional growth.

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