Human agency in automated futures

Mapping worker's discourse on adaptation to labor market automation

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Introduction

This study explores how worker narratives about automation, as seen on Reddit, reflect emergent adaptation strategies in the face of systemic shifts. Automation isn't a change that happens in a vacuum. It unfolds as a force reshaping labor in layers, each with its own adaptations that ripple through the system. Workers are not isolated in their responses; they exercise their agency within a multi-level ecosystem where individual actions, task adjustments, and collective shifts interact and amplify each other. By analyzing Reddit posts about labor market automation from 2022 to 2024 and breaking them into three levels—tasks, workers, and the workforce—we expect to identify adaptation patterns at the individual, task, and collective scales.

Research questions: How do worker narratives on automation, as shared in Reddit interactions, reflect emergent adaptation strategies? How do these strategies manifest differently at individual, task, and collective levels?

Through the lens of complex systems theory, we see human adaptation to automation as a constant, interwoven change process. At the individual level, workers face automation head-on, potentially choosing to adapt by upskilling, reframing their roles, or even forging symbiotic relationships with technology to stay relevant. Personal adaptations do not stay isolated—they cascade downward and upward, reconfiguring tasks and workflows. Just as simple rules in biological systems lead to complex behaviors, simple interactions with automation (e.g., using AI tools or introducing automation to perform certain tasks in an organization) can result in complex new labor structures. This study uses Reddit discussions about work automation, where posters share raw, unfiltered experiences, to trace individual narratives to reveal emergent patterns across scales.

This study hypothesizes that each level—task/work, individual/worker, collective/workforce—reflects distinct yet connected trends in adaptation narratives:

H1 Hybrid workflows emerge. At the task level, workflow reconfiguration leads to workers developing either a cooperative or extractive approach to technology. Reddit narratives are

expected to highlight cooperative and extractive patterns, especially in sectors and task groups where repetitive processes can be partially automated with accessible tools.

H2 Adaptive skill acquisition amid fear of obsolescence. At the worker level, individuals who encounter automation are expected to adapt by acquiring new skills. This skill-building may correlate with workers' perceptions of job security and professional identity, suggesting that the more workers perceive their role as vulnerable to automation, the more likely they are to engage in proactive upskilling or reskilling.

H3 Emerging collective identities and responses to workforce adaptation. At the workforce level, automation drives collective adaptation not just in terms of functions but also in forming a shared identity and shaping collective agency among workers who face automation challenges. This collective response serves as a strategic way to adapt to automation-driven disruption, allowing workers to negotiate and navigate their roles in the larger, automated economy. Here, references to economic alternatives to the current labor system, such as Universal Basic Income (UBI), are expected.

Background

Tools that enhance communication, coordination, and productivity have continually driven societal changes and economic shifts. However, Artificial Intelligence (AI) represents more than just a new tool—it is a technology that can carry out whole processes with unprecedented speed and precision, with limited human oversight. Unlike prior advancements, AI operates on both physical and cognitive levels, impacting virtually any existing industry. For the labor market, this may end up having multiple implications, including the emergence of hybrid systems in the co-evolution of machine and human behavior, which may end up producing new dynamics in work environments (Rahwan 2019).

Historically, technological shifts have brought both disruption and opportunity. The printing press, for instance, in transforming information distribution gave rise to new roles in education and media, but displaced other professions, such as scribes. Today, the disruptions caused by AI systems blur the lines between manual and cognitive work. Robots in manufacturing, for instance, are performing complex assembly tasks, while AI in white-collar professions increasingly handles tasks once exclusive to human judgment. Generative AI, which can analyze data, produce content, and solve problems, has already impacted sectors like legal services, content creation, and customer support, challenging assumptions about the safety of high-skilled jobs. Industry research suggests that up to 87% of blue-collar jobs and 45% of white-collar jobs could be automated by existing technologies, marking a significant expansion of automation’s reach (Goldman Sachs, 2023; Eloundou et al., 2023). Educated white-collar workers, especially in information processing roles, may face the highest risks of job displacement, while agriculture and manufacturing jobs remain less exposed (Eloundou et al., 2023). AI adoption could exacerbate income inequality by increasing demand for high-wage earners, despite overall productivity gains (IMF 2024).

Understanding worker's agency in the current automation wave remains a developing field. For instance, Presbitero and Teng-Calleja (2023) found that workers experiencing job insecurity due to AI often explore new careers as a self-protective strategy. Complementary studies highlight public sentiment shifts, noting an initial skepticism toward AI on social platforms like Reddit, which became more positive by mid-2023 (Talafidaryani and Moro 2024). However, ethical concerns, including job loss, skill decline, and over-reliance on AI, remain prominent.

Methods

This study draws on insights from prior research examining AI-related socio-economic effects, using Reddit as a source of unfiltered worker narratives on adaptation strategies. Reddit provides a valuable source of rich, unfiltered narratives that capture real-time reflections on socio-economic changes, making it ideal for studying adaptation to automation. This approach draws inspiration from recent studies, such as Del Río Chanona et al. (2023), who analyzed mental health themes in worker narratives during The Great Resignation. Their work, alongside other research mapping socio-economic phenomena on Reddit—ranging from market trends (Lucchini et al. 2023) to political polarization (Waller and Anderson 2021)—proves Reddit's capacity to reveal nuanced shifts in public sentiment and behaviors. However, it is essential to note that Reddit's user base primarily consists of younger, educated individuals from the Global North, with a strong representation in the United States, Canada, and Western Europe. This demographic profile means that while the findings provide valuable insights, they may not fully represent the perspectives of the global population but rather hint at trends among digitally connected, higher-educated communities, which are, in turn, predicted to be the most affected by AI-driven labor market automation.

The methods for this study involved an extensive data collection effort from Reddit, capturing 7,616,585 posts from key subreddits spanning the period of July 2022 to July 2024. The 10 subreddits selected for their relevance to discussions on work and technology included: *anti-work, AskReddit, careerguidance, changemyview, Economics, Futurology, jobs, NoStupidQuestions, Showerthoughts,* and *technology.* Following data collection, we implemented a double validation process: first, filtering posts using a targeted query (see below) to identify those discussing AI and job impact, and second, employing Llama 3.1 7B to automatically validate whether the posts specifically addressed AI's role in transforming or influencing the job market.

```
(("ai " OR " ai" OR "artificial intelligence" OR chatgpt) AND (job OR jobs OR work OR career OR employment OR profession OR worker OR workers OR employee OR replace OR replaced OR replaces OR replacement OR affected OR affect OR affecting OR disappear OR disappearing OR disappeared OR fired OR hiring OR hire OR lose OR lost OR losing OR eliminate OR eliminates OR eliminating OR redundant OR safe OR obsolete))
```

After applying the query and LLM validation, 18,159 Reddit posts were identified as relevant. From this subset, the highest-performing posts (those with a score above 10) were classified into three levels—C1 Work, C2 Worker, and C3 Workforce—using multilabel classification to

capture narratives focused on task-specific changes, individual worker experiences, and broader workforce impacts. A total of 555 posts were manually labeled to ensure accuracy.

- C1 Work/Task (67 posts): Posts reflecting reactions to task-level changes, where automation tools handle discrete functions within broader job roles. Examples include workers sharing their experiences using AI to streamline repetitive tasks or expressing concerns over AI's potential to handle specific functions.
- C2 Worker/Individual (192 posts): Posts on how AI affects specific roles (including the user's). For instance, posts tagged as C2 might include stories of workers exploring new skills to stay relevant or sharing anxieties about being replaced by AI in their specific professions, such as creative fields.
- C3 Workforce/Labor market (80 posts): This category captures posts that reflect broader, systemic impacts on entire job sectors or industries. Posts in this category can include posters contemplating the future of entire fields and the implications for the workforce as a whole beyond individual experiences.

This classification approach allows the study to explore how worker narratives evolve from individual tasks to larger industry trends, providing a structured perspective on adaptation strategies at each level of impact.

A combination of manual labeling and Machine Learning classification provided the foundation for Exploratory Data Analysis and Topic Modeling. To categorize unlabeled Reddit data, two ML models, a Random Forest Classifier and a Support Vector Machine (SVM), were trained using multilabel classification. Random Forest, an ensemble method that builds multiple decision trees to produce a robust classification, was configured with 100 estimators and a random seed to ensure reproducibility. It excelled in classifying the *C2 Worker* category, delivering high F1 scores. On the other hand, SVM, which constructs hyperplanes for classification in a high-dimensional space, employs a linear kernel and probability estimates to manage multilabel outputs. Although SVM performed comparably to Random Forest in some cases, both models struggled with class imbalances and low observations in the *C1 Work* and *C3 Workforce* categories. Ultimately, Random Forest was selected for its relative efficacy in predicting only *C2 Worker* posts.

The text preprocessing pipeline was crucial for preparing data for these models. It involved converting text to lowercase, removing URLs, punctuation, numbers, and stopwords, followed by lemmatization. The cleaned text was then transformed into numerical features using TF-IDF vectorization. The data was split into 80% training and 20% validation sets, and model performance was evaluated through precision, recall, and F1-score.

In addition to classification, Topic Modeling was conducted using Latent Dirichlet Allocation (LDA) to uncover themes within the *C2 Worker* category. LDA was applied to both manually labeled and predicted data. The process involved further preprocessing, including tokenization and stopword removal, and creating a dictionary and corpus using Gensim's tools. The LDA model was configured to generate five topics for the manually labeled posts and ten topics for the predicted ones, with hyperparameters such as automatic alpha adjustment to optimize topic distribution and multiple passes over the data to improve coherence. This allowed for a detailed exploration of the adaptation themes across the

dataset, with stronger results for the predicted C2 Worker data. A detailed account of the methodology used can be found in the Annex.

Results

The analysis of worker narratives on Reddit from July 2022 to July 2024 offers some preliminary insights into how individuals, tasks, and the workforce as a whole adapt to automation. By categorizing Reddit posts into three levels—C1 Work (task-level), C2 Worker (individual level), and C3 Workforce (collective level)—the findings shed light on distinct yet interconnected strategies that workers employ as they navigate an increasingly automated labor market.

ML model performance revealed challenges with imbalances across categories, but insights from EDA and TM provided preliminary support for the hypothesized adaptations. Key themes such as the need for skill acquisition, cooperative dynamics with AI in daily tasks, and collective movements toward alternative economic policies illustrate how worker adaptations to automation materialize at multiple levels, showing hints of interconnectedness.

Although the analysis needs to be strengthened, the multilayered approach seems promising for illuminating the nuances of workers' strategies for navigating an AI-driven automation landscape.

C1 Topic Modeling. Collaboration and extraction

Analysis of the C1 Work category yielded loosely defined topics, largely due to limitations in labeled data and the need for refined lemmatization. Nonetheless, some recurring themes emerged, albeit without strong alignment with the hypothesized dynamics of task reconfiguration.

Topics within C1 included AI’s potential applications in specific tasks, debates over AI’s role in augmenting versus replacing human work, and speculative conversations about AI in travel and language services. For example, some posts discussed the potential uses of AI in managerial roles and data summarization, suggesting a cooperative dynamic where AI supports workers.

The ambiguity in these topics highlights the limitations of the approach adopted for C1 TM. A more granular analysis with better lemmatization and tokenization is needed to capture the nuances of task reconfiguration within this category accurately. Furthermore, the limited number of posts labeled as C1 contributed to a lack of representational clarity, suggesting that any conclusions about task reconfiguration remain tentative.

C2 Topic Modeling. Adaptive skill acquisition and obsolescence

Our hypothesis suggested that at the worker level, individuals facing automation will likely adapt by acquiring new, automation-specific skills. The C2 Worker category, which contained the majority of relevant posts, showed hints of support for this hypothesis, albeit only partially.

Key topics included AI's role in the art world (e.g., discussions on AI-generated art and its impact on human creativity), personal concerns over job replacement (workers reflecting on AI's implications for job security), and career planning in the context of AI (conversations about the need to adapt or retrain to remain competitive). Other conversations tackled the personal strategies of workers directly:

> **Date**: 08/04/2023
> **Score**: 59
> **Title**: How do you prepare for AI's Impact on White-Collar Jobs: Personal Strategies
>
> "There is a lot of talk going on in this subreddit and beyond about the current AI boom. One aspect that both interests and concerns me is the potential impact on white-collar jobs. Predictions vary widely on when and how fast jobs might disappear. Some people predict that AI will yield more productive people (we see that already), but that it would not necessarily lead to unemployment, while others predict scenarios where large numbers of white-collar jobs will vanish on short notice. Personally, I find it difficult to predict the future, I am uncertain about how it will unfold. I have no idea what will happen to my job (at the intersection of Sales & Engineering) and if the end would come, how long this would take. This uncertainty causes me a bit of anxiety to be frank. In this post I would like to discuss and gather insight on how we individuals can brace themselves for the potential rocky road to come.
> Don't get me wrong; I am not necessarily pessimistic about the distant future. Rather, I would like to start a discussion about how individuals can prepare for the impact of AI on their jobs, even when the impact and its timing are uncertain. So, my question is, what can we do in this great uncertainty to prepare for the future, while not knowing what that future will hold? In other words: what are strategies that will likely benefit us in as many situations as possible?
> Personally, I am taking some steps that I believe might be helpful:
>
> - Practicing mindfulness to avoid focusing too much on negative scenarios.
> - Focusing on soft skills at work to complement my technical skills. I think that, in the short term, the need for interpersonal connections with other humans will remain important.
> - Embracing minimalism at a personal level, which allows me to set aside some savings each month that could help me get through difficult times.
>
> I have no idea if these steps will be sufficient. However, even temporary solutions can be just enough to make the transition smoother.
> I am very interested in which practical steps you are taking and how you believe they might be beneficial. For instance, what practical or interpersonal skills are you learning? Are you considering a career change to a field with more longevity? Or do you have a different approach?"

While these topics align with the hypothesis that individuals are seeking new skills to adapt, they also reveal a seemingly more prevailing element: significant apprehension about obsolescence, particularly in creative fields. The qualitative depth and emotional range within these posts suggest that while some workers view skill-building as a means of survival, others feel uncertain about whether these adaptations will be sufficient to safeguard their place in the labor market.

Despite these insights, model performance challenges present a caveat: while the data shows evidence of adaptive skill acquisition at the individual level, further refinement of classification models and expanded datasets could provide a clearer picture of this behavior.

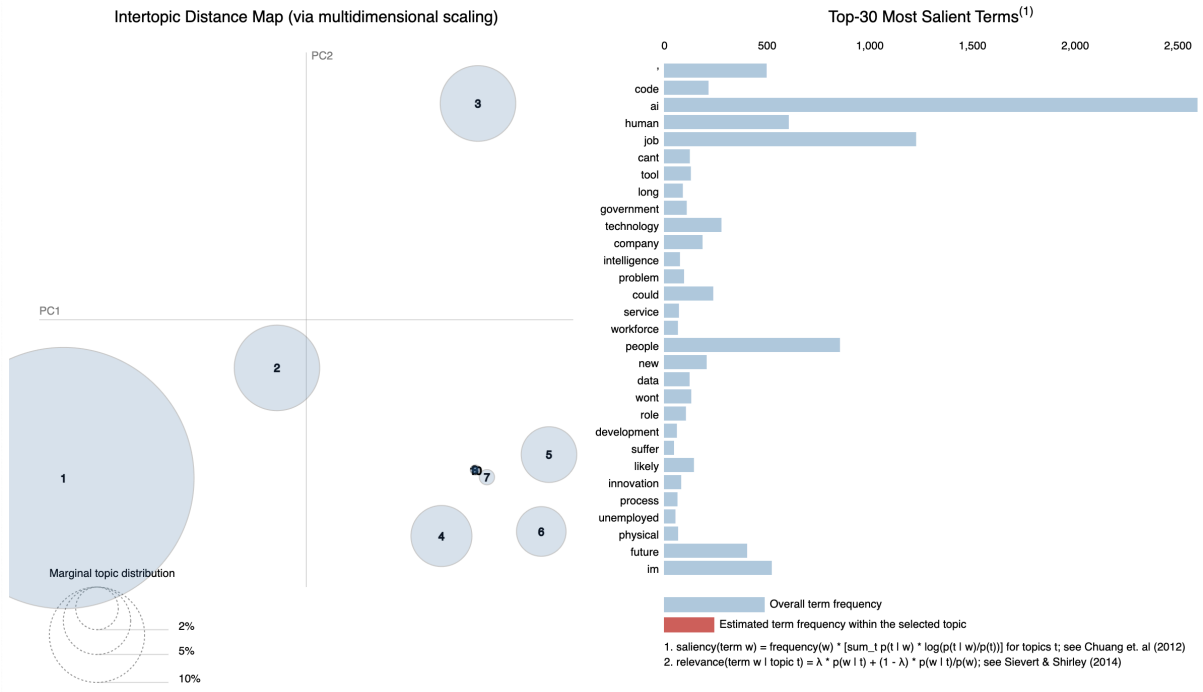
C2 Topic Modeling. Predicted dataset

For this category, we utilized predictive data, which expands the original dataset by adding posts predicted by ML models based on the manually labeled training set. This approach yields more refined results, which capture broader patterns of adaptation within worker narratives. By incorporating both manually labeled and predicted posts, we can explore thematic trends with greater depth, offering insights that may have been limited by the initial dataset alone.

The **top words for Topics 1 to 5** reveal distinct themes:

1. **Topic 1**: Terms like “long,” “term,” and “suffer” reflect discussions about the prolonged impacts of automation.
2. **Topic 2**: Words such as “code,” “ethical,” and “tool” suggest a focus on the ethical considerations surrounding AI development and deployment, touching on questions of responsible AI usage and potential impacts on job integrity.
3. **Topic 3**: The term “Chinese” appears here, which may indicate that North American workers are connecting current automation trends to past waves of job offshoring to China. This parallel suggests that workers see automation as another force driving job loss and economic instability, similar to the effects of outsourcing industries to lower-cost labor markets.
4. **Topic 4**: Words like “planning” and “viable” suggest that workers are actively considering career planning and adaptation strategies to remain viable in the AI-dominated labor market. The word “success” points to a focus on pathways to thrive amidst these changes.
5. **Topic 5**: Terms like “pace,” “eliminate,” and “warning” highlight the rapid acceleration of AI’s role in the workforce. Discourses here express concern over the pace at which AI advances, indicating a sense of urgency about the need to adapt to avoid obsolescence.

These predicted topics shed some light on how workers are grappling with the AI-driven transformation in nuanced ways, reflecting both immediate and long-term anxieties. Additionally, the connection between “Chinese” and automation suggests that some workers view AI as part of a broader continuum of economic threats to job stability, drawing historical parallels to offshoring. While some focus on ethical or career planning concerns, others view AI as another chapter in a longstanding economic struggle.



Predicted C2 Worker LDA

Topic 1	Topic 2	Topic 3	Topic 4	Topic 5
long (0.033)	code (0.024)	scientist (0.046)	andor (0.029)	pace (0.059)

suffer (0.021)	ethical (0.012)	chinese (0.013)	planning (0.027)	sooner (0.016)
term (0.017)	vast (0.012)	jumping (0.004)	viable (0.008)	eliminate (0.010)
replacing (0.016)	intelligence (0.011)	escape (0.002)	success (0.005)	administrative (0.001)
fathom (0.015)	tool (0.010)	monitoring (0.001)	progression (0.002)	warning (0.001)

Top words for Topics 1 to 5

C3 Topic Modeling. Collective identities and response

This study's hypothesis suggested that automation drives collective adaptation at the workforce level, fostering shared identities and collective responses among workers who face similar challenges. Analytical readings of the C3 Workforce category provided substantial support for this hypothesis, though topics within C3 were also relatively loosely defined due to imbalanced data and categorization challenges.
Identified themes within C3 included discussions on AI's impact on white-collar jobs, concerns over general societal implications of Artificial General Intelligence (AGI), and conversations about collective economic responses, such as Universal Basic Income (UBI). For example, some posts expressed concerns about AI's growing impact on professional roles, highlighting the need for collective workforce adaptations to counter potential mass displacement:

> **Date:** 14/03/2024
> **Score:** 274
> **Title:** CMV: Companies that replace large percentages of workers with AI should be required to contribute to a Universal Basic Income system.
>
> As AI systems gear up to march forward and replace large amounts of human workers, we have an important opportunity to ensure the good of the people is placed first.
> This is an excellent time to put the well-being of the citizens ahead of the bottom line and take a percentage of revenue from companies profiting via AI that replaced human jobs.
> As AI becomes more widespread in the workforce, it will become increasingly difficult for people to find jobs that will pay them well, thus the need for UBI.
> I believe this is one of the best outcomes as the reality of job replacement is quickly approaching.

In numerous C3 posts, workers recognize automation's threat to employment stability and discuss policy solutions such as UBI to safeguard public well-being. This discourse showcases the speculative and theoretical nature of many C3 discussions. In the example above, advocating for AI-driven companies to fund UBI, we glimpse both the collective consequences of automation's long-term effects and a desire for policy-level adaptation. However, the model's limited performance in categorizing C3 posts, compounded by an insufficient volume of labeled data, contributes to an overall lack of robustness in conclusions at the workforce level.

Additional findings and methodological caveats

This exercise has shed some preliminary findings, one of which is that some narratives on Reddit encompass all three levels of adaptation, demonstrating emerging multi-level reflections:

Date: 10/06/2024
Score: 226
Title: AI is already taking jobs!

"Hey everyone, I wanted to share my thoughts on a topic that I think is affecting all of us, whether we realize it or not: AI taking jobs. Now, before you write me off as a boomer, doomer, or decel, hear me out. I'm neither pessimistic nor resistant to technological progress, but I do believe that AI is already chipping away at the job market in ways that are subtle but significant. Here's what I mean: AI might not be outright replacing entire jobs yet, but it's definitely taking over portions of various jobs. As these portions add up, they result in less demand for those roles, eventually leading to job losses. For instance, I recently cancelled my appointment with my nutritionist after having a conversation with an AI. The AI provided me with detailed and personalized dietary advice, which made me feel confident enough to skip seeing a human professional. This might seem like a small thing, but imagine this happening across different industries and professions. If AI can handle parts of our jobs—whether it's providing customer service, managing schedules, or offering health advice—then the cumulative effect could be fewer people needed in those roles. Over time, this leads to fewer full-time positions and potentially more job losses. It's a bit of a domino effect: each small piece taken over by AI contributes to a larger shift in the job market. We need to think about how to adapt to these changes, whether it's through new skills, different career paths, or finding ways to work alongside AI rather than being replaced by it. And here's another example of how AI is taking over portions of jobs: AI wrote this article. By using AI to generate content, I saved time and effort that would normally be spent crafting this post myself. While this is convenient, it also highlights how AI is capable of performing tasks traditionally done by humans, further demonstrating the shift in job dynamics. What are your thoughts? Have you experienced anything similar with AI affecting your job or services you use? What strategies are you using to mitigate the coming changes? Let's discuss! TL;DR: AI isn't just a future threat to jobs—it's already taking over portions of various roles, leading to fewer full-time positions. I canceled my nutritionist appointment after getting advice from an AI, and AI also wrote this article. Let's discuss how AI is affecting our jobs and what we can do about it."

The post details AI's incremental impact on specific tasks, such as dietary advice, illustrating task-level (C1) reconfiguration. At the individual level (C2), the user adapts by choosing AI-driven options and utilizing AI for writing, reflecting personal strategies to navigate automation's effects on productivity and job security. Finally, the poster anticipates workforce-level (C3) changes, suggesting a collective concern that AI's gradual integration across roles may reduce full-time employment. This post exemplifies how narratives are starting to show adaptation strategies across levels, reinforcing this study's hypothesis that AI's impact unfolds as a multilevel, interdependent system. The analysis across all categories suggests an overarching theme of mixed sentiment, where discussions on automation evoke both cautious optimism and apprehensive adaptation.

However, several limitations necessitate a careful interpretation of these findings. The relatively low clarity of topics in C1 and C3 highlights the need for refined lemmatization and more balanced data labeling across categories. This also points to an opportunity for improved tokenization techniques, such as bigrams, and the incorporation of an industry-specific lexicon to enhance the semantic accuracy of TM.

Next steps

Several improvements to methodology could be made to enhance the depth, reliability and accuracy of the analysis performed so far. Expanding manual labeling to a larger number of posts in categories C1 and C3, combined with data augmentation techniques such as predicting similar posts (as applied with C2), could help address dataset imbalance. Rebalancing through selective sampling within Reddit data archives—for instance, by applying manual labeling to all posts with scores above 5—could further strengthen the training set, particularly for these two underrepresented categories. Additionally, refining text preprocessing by enhancing the lemmatization process to capture industry-specific terms relevant to automation better and AI would ensure that important terms retain their context

and meaning, ultimately improving the quality of TM and classification. To capture contextual nuances better, bigram tokenization should replace unigrams in the preprocessing phase, allowing models to recognize common phrases like “job loss” or “mental health” that single words might not convey as effectively.

In addition to improving the current analysis, exploring alternative methods and expanding the dataset could provide new dimensions of insight. For example, applying framing analysis to a subset of high-engagement Reddit posts from each category (C1, C2, and C3) would allow for a deeper qualitative exploration of specific narratives, uncovering subtle themes that may not be detected by ML methods.

Expanding the dataset to capture responses from a representative sample of Reddit users who engage with the original posts would also deepen the study. This expansion would make it possible to apply Emotional Contagion Theory (Kramer et al., 2014) through network analysis to examine how narratives spread and influence sentiments across the platform. This would address the interconnectedness of adaptation narratives at the three levels—an aspect that TM alone can not fully capture.

Additionally, incorporating Causal Layered Analysis (CLA), a method used widely in futures studies, could offer a layered understanding of worker agency as expressed in the data by mapping it across multiple levels—from surface-level issues to deep-seated ideologies. CLA allows for the deconstruction of complex social phenomena across four layers: litany (surface issues), systemic causes (institutional and economic structures), worldview (shared cultural beliefs), and myth/metaphor (deep-rooted narratives and symbols) (Inayatullah, 1998). Applying CLA could clarify why certain adaptation trends emerge and how they are intertwined with cultural and ideological drivers.

Finally, employing temporal network analysis could further enhance the study by layering discussions over time, and examining changes in topic prevalence, structure, and connections. Each post and its keywords could be treated as part of a conceptual network, allowing the study to visualize how themes like “job replacement” initially appear independently but later connect with concepts such as “upskilling” or “UBI” as the narrative matures. This approach would reveal not only shifts in topic prevalence but also evolving relationships between key concepts, highlighting how worker narratives adapt in response to broader cultural and temporal shifts.

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Annex. Expanded methodology

Data Collection and Preprocessing

Data Extraction

Due to limitations with Reddit's API, we utilized the Reddit data archive, which is accessible via torrents. The data spans 2005 to 2023, but we focused on posts from July 2022 to July 2024. The data was downloaded using academic torrents, processed using scripts from the PushshiftDumps repository, and filtered within ten subreddits and a query with key terms.
Subreddits: anti-work, AskReddit, careerguidance, changemyview, Economics, Futurology, jobs, NoStupidQuestions, Showerthoughts, technology

Query

```
(("ai " OR " ai" OR "artificial intelligence" OR chatgpt) AND (job OR jobs OR work OR career OR employment OR profession OR worker OR workers OR employee OR replace OR replaced OR replaces OR replacement OR affected OR affect OR affecting OR disappear OR disappearing OR disappeared OR fired OR hiring OR hire OR lose OR lost OR losing OR eliminate OR eliminates OR eliminating OR redundant OR safe OR obsolete))
```

For the two years, we gathered **7,616,585** Reddit posts within the ten subreddits. After that, we performed a double validation process. First, we used the query above to filter only relevant Reddit posts, and second, we used Llama 3.1 7B to automatically validate whether they were talking about AI taking over jobs or affecting the job market. The number of Reddit posts filtered with the query and labeled by the LLM was around **18,159**.
To narrow down the topic of the post, we assigned it to 3 levels (below). We manually labeled **555** Reddit posts validated by the LLM using multilabel classification. We selected the posts from 10 to the highest score.

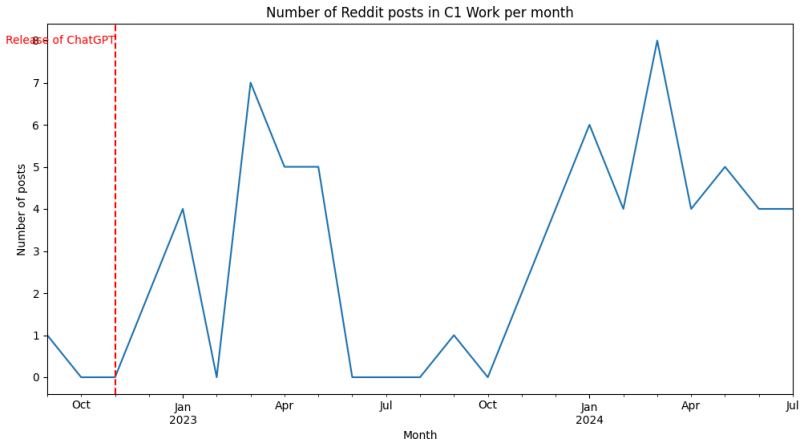
Label Distribution

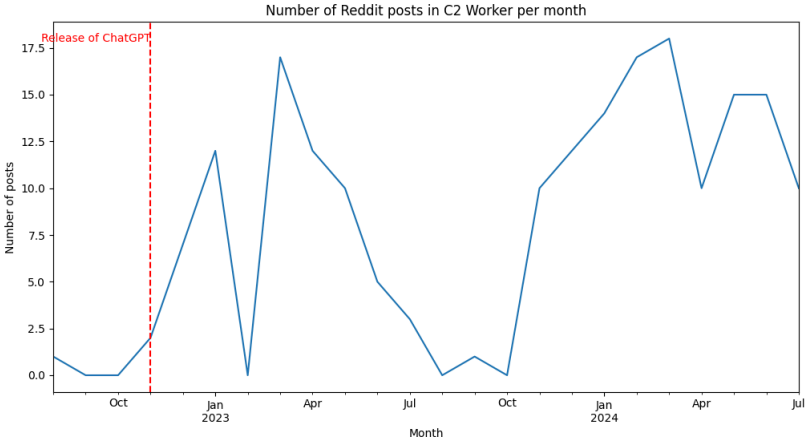
Category	**Number of Posts**
C1 Work	67
C2 Worker	192
C3 Workforce	80

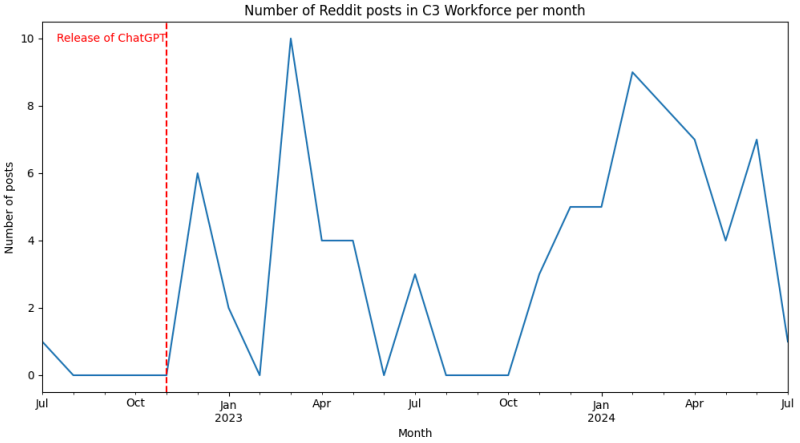
Exploratory Data Analysis (EDA)

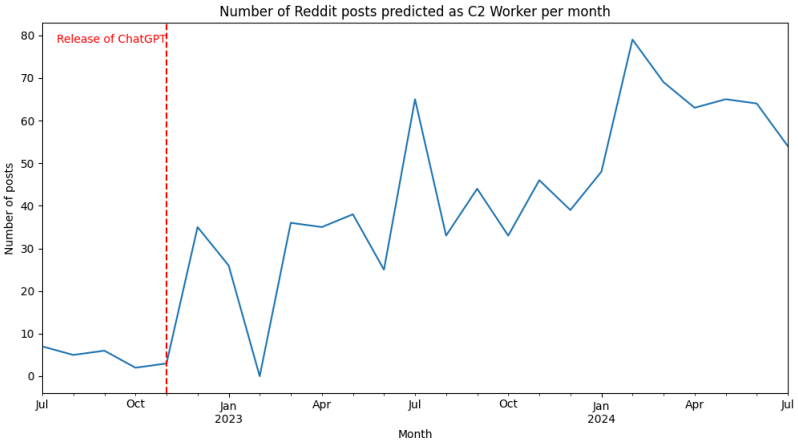
EDA was conducted on the manually labeled and predicted data (classified by the ML model into Category 2, about the Worker) to understand trends and patterns.

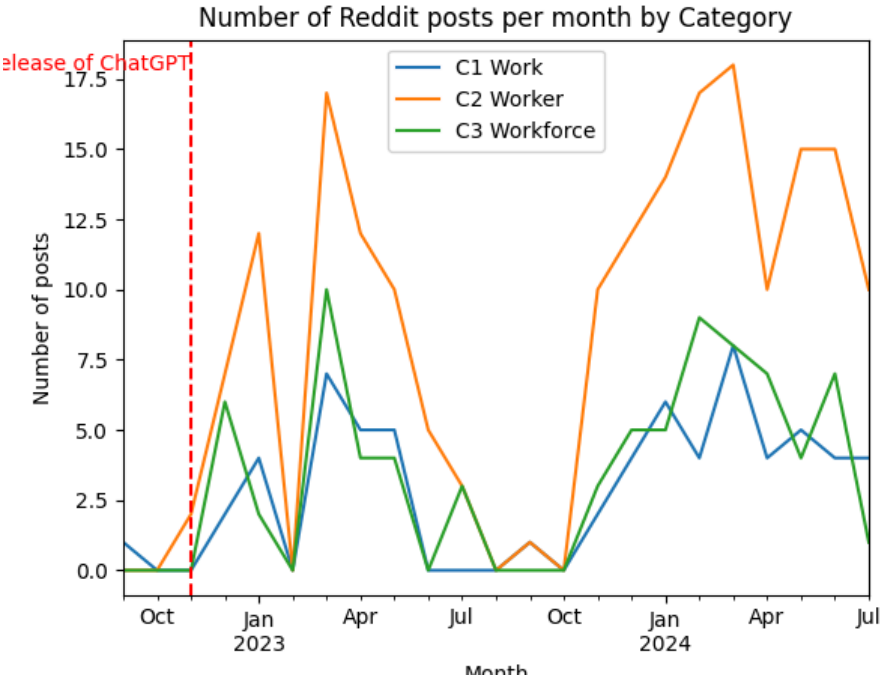
1. **Time Series Analysis**: Plots showing the number of monthly Reddit posts were created to identify trends over time.



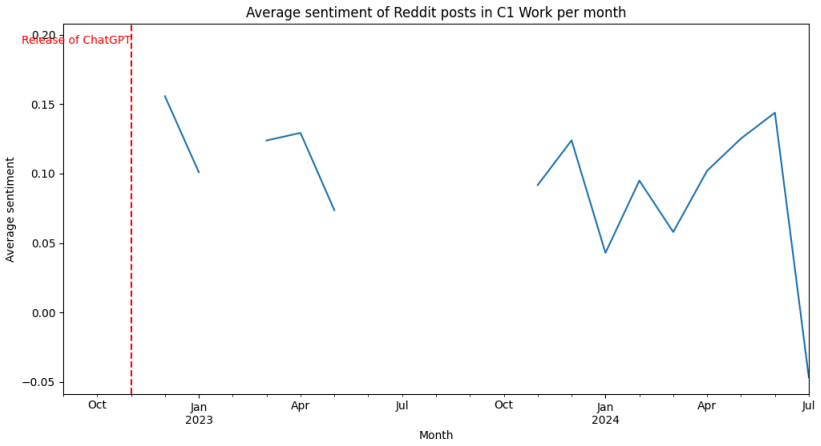


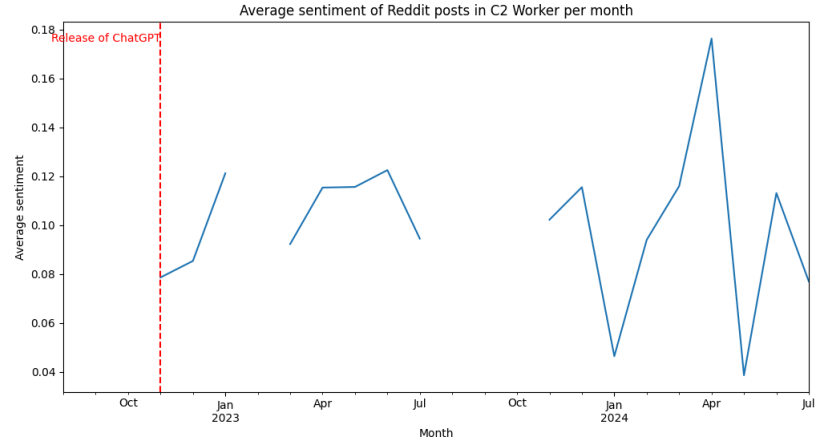


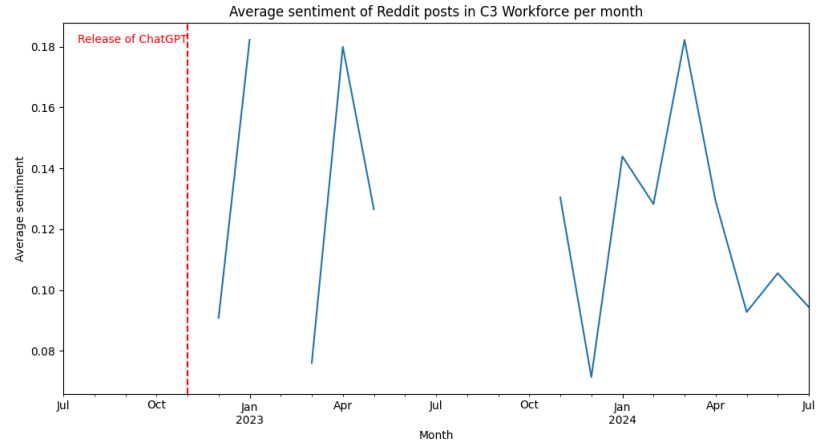

Number of Reddit posts predicted as C2 Worker per month
Release of ChatGPT
Number of posts
Month
Jul
Oct
Jan
2023
Apr
Jul
Oct
Jan
2024
Apr
Jul

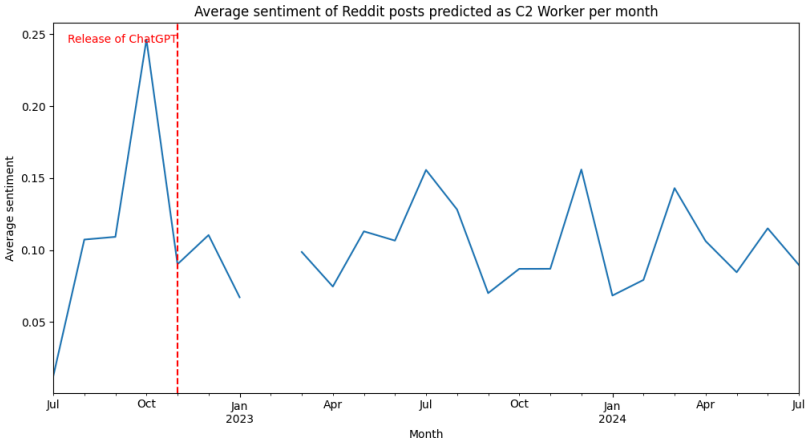

Number of Reddit posts per month by Category
elease of ChatGPT
C1 Work
C2 Worker
C3 Workforce
Number of posts
Month
Oct
Jan
2023
Apr
Jul
Oct
Jan
2024
Apr
Jul

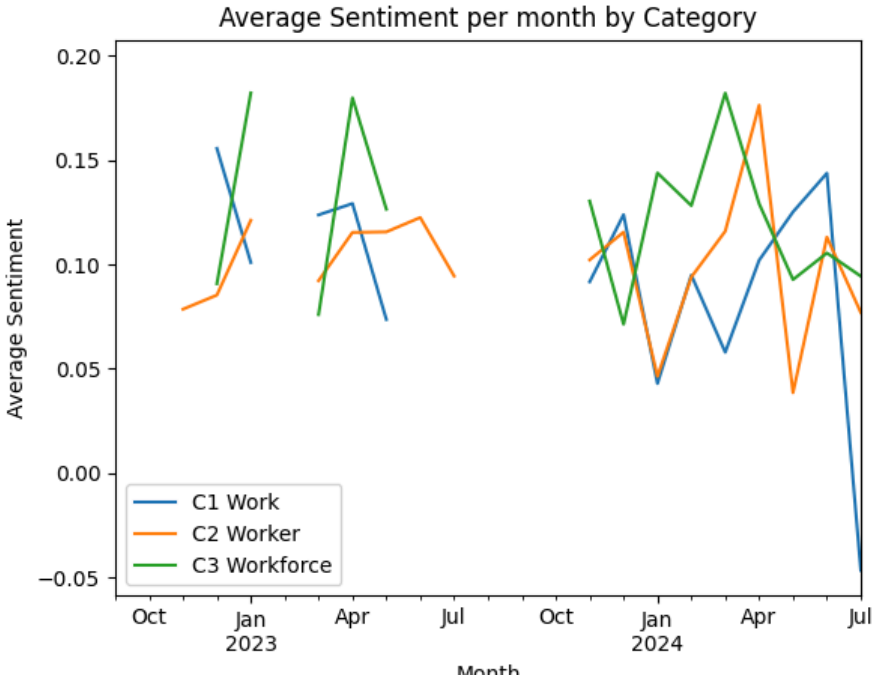
2. **Sentiment Analysis**: The average sentiment per month was calculated using TextBlob's sentiment analyzer to assess the emotional tone of the discussions.











Analysis

ML Models

We trained two ML models to predict the categories of unlabeled data:

1. Random Forest Classifier
2. Support Vector Machine (SVM)

Data Preprocessing

- Text data was cleaned by converting it to lowercase and removing URLs, punctuation, numbers, and stop words.
- Lemmatization was applied to reduce words to their base forms.

- The cleaned text was transformed into numerical features using TF-IDF vectorization.

Model Training

- The models were trained using the manually labeled data through multilabel classification (the categories are not mutually exclusive)
- The data was split into training and validation sets using an 80/20 split.
- We used the following evaluation metrics: Precision, Recall, F1-Score, and Support (number of occurrences of each class in the validation set)

Model Performance

Random Forest:

Category	Precision	Recall	F1-Score	Support
C1 Work	1.00	0.10	0.18	10
C2 Worker	0.61	0.33	0.43	33
C3 Workforce	0.00	0.00	0.00	16

SVM

Category	Precision	Recall	F1-Score	Support
C1 Work	0.00	0.00	0.00	10
C2 Worker	0.69	0.27	0.39	33
C3 Workforce	0.50	0.12	0.20	16

Predicted Posts per Category and Model

Category	*Random Forest*	*SVM*
C1 Work	0	10
C2 Worker	920	942
C3 Workforce	7	61

Model Selection

- Both models struggled with predicting C1 Work and C3 Workforce due to low support and class imbalance.
- The Random Forest model had a higher F1-Score for C2 Worker, so it was selected for further analysis.

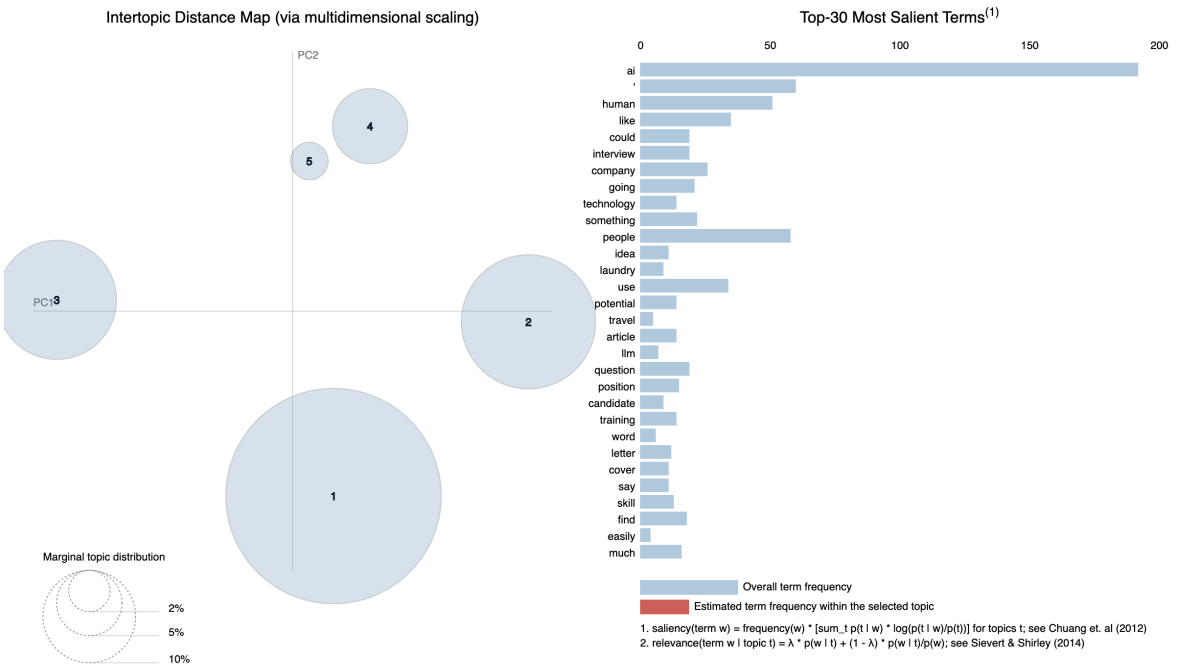
Topic Modeling

TM was performed using Latent Dirichlet Allocation (LDA) on four datasets:

1. Manually Labeled Data for All 3 Categories:
    1. C1 Work
    2. C2 Worker
    3. C3 Workforce
2. Predicted Data for C2 Worker

Table 1: Top Words for C1 Work Topics

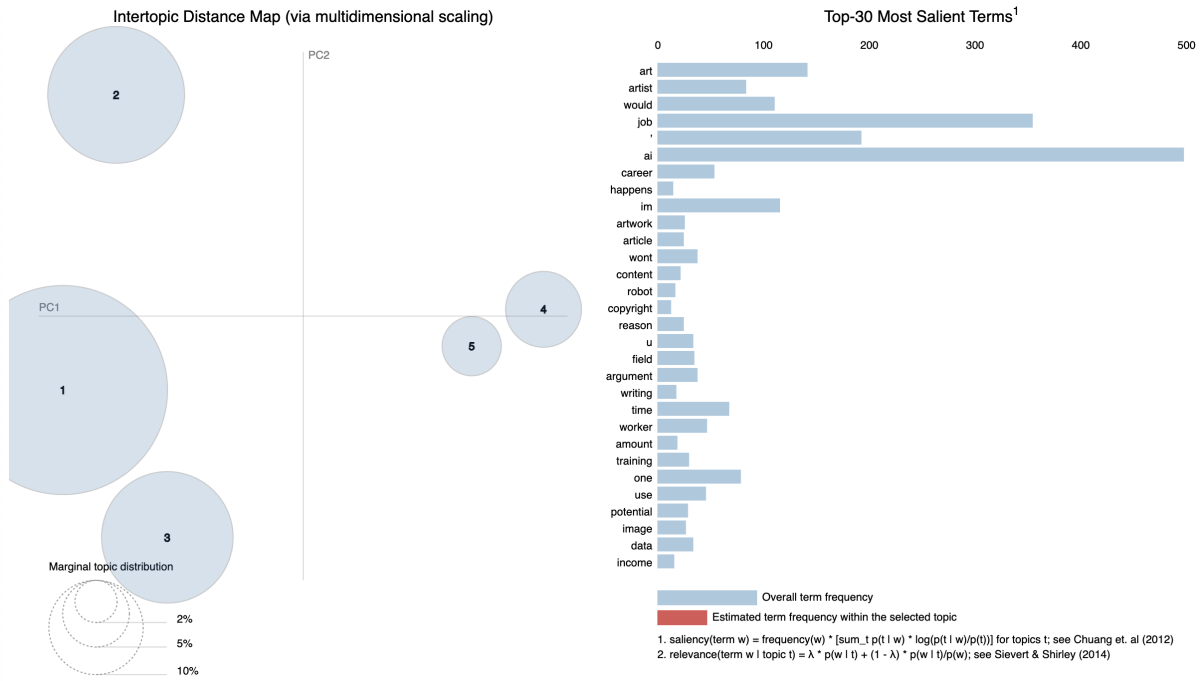
Topic 1	**Topic 2**	**Topic 3**	**Topic 4**	**Topic 5**
ai (0.008)	ai (0.024)	job (0.013)	ai (0.011)	ai (0.028)
could (0.005)	job (0.012)	human (0.011)	’ (0.011)	job (0.017)
people (0.003)	potential (0.006)	ai (0.011)	human (0.008)	people (0.010)
use (0.003)	article (0.006)	company (0.007)	travel (0.008)	’ (0.009)
going (0.003)	human (0.006)	laundry (0.006)	like (0.008)	new (0.007)



C1 Work LDA

Table 2: Top Words for C2 Worker Topics

Topic 1	Topic 2	Topic 3	Topic 4	Topic 5
ai (0.025)	ai (0.027)	ai (0.021)	would (0.013)	happens (0.011)
art (0.025)	job (0.025)	job (0.017)	copyright (0.006)	ai (0.007)
artist (0.017)	people (0.016)	’ (0.010)	bootcamps (0.005)	art (0.006)
’ (0.014)	like (0.009)	career (0.008)	won't (0.005)	would (0.005)
like (0.009)	human (0.009)	I'm (0.007)	robot (0.004)	I'm (0.005)

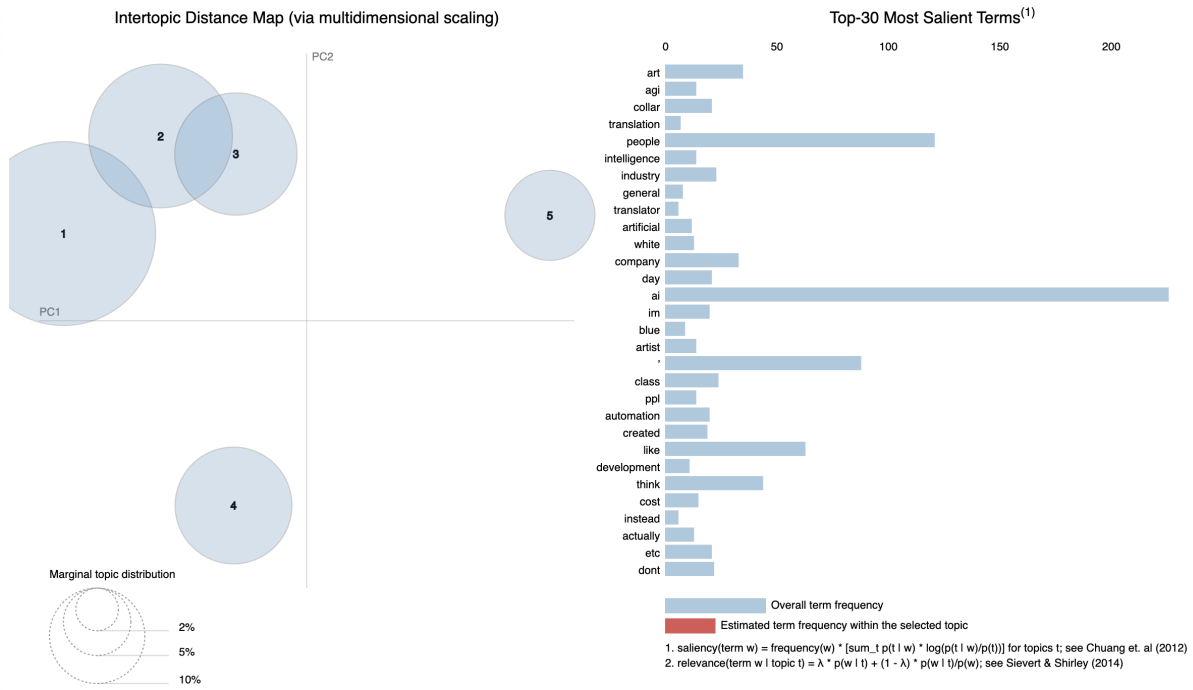


C2 Worker LDA

C3 Workforce

Table 3: Top Words for C3 Workforce Topics

Topic 1	Topic 2	Topic 3	Topic 4	Topic 5
ai (0.024)	ai (0.027)	ai (0.020)	agi (0.011)	people (0.015)
job (0.021)	job (0.017)	job (0.015)	ai (0.008)	work (0.009)
’ (0.016)	people (0.013)	art (0.013)	translation (0.007)	ai (0.009)
would (0.014)	human (0.007)	people (0.012)	general (0.006)	collar (0.009)
people (0.009)	even (0.007)	human (0.008)	translator (0.006)	job (0.007)



C3 Workforce LDA

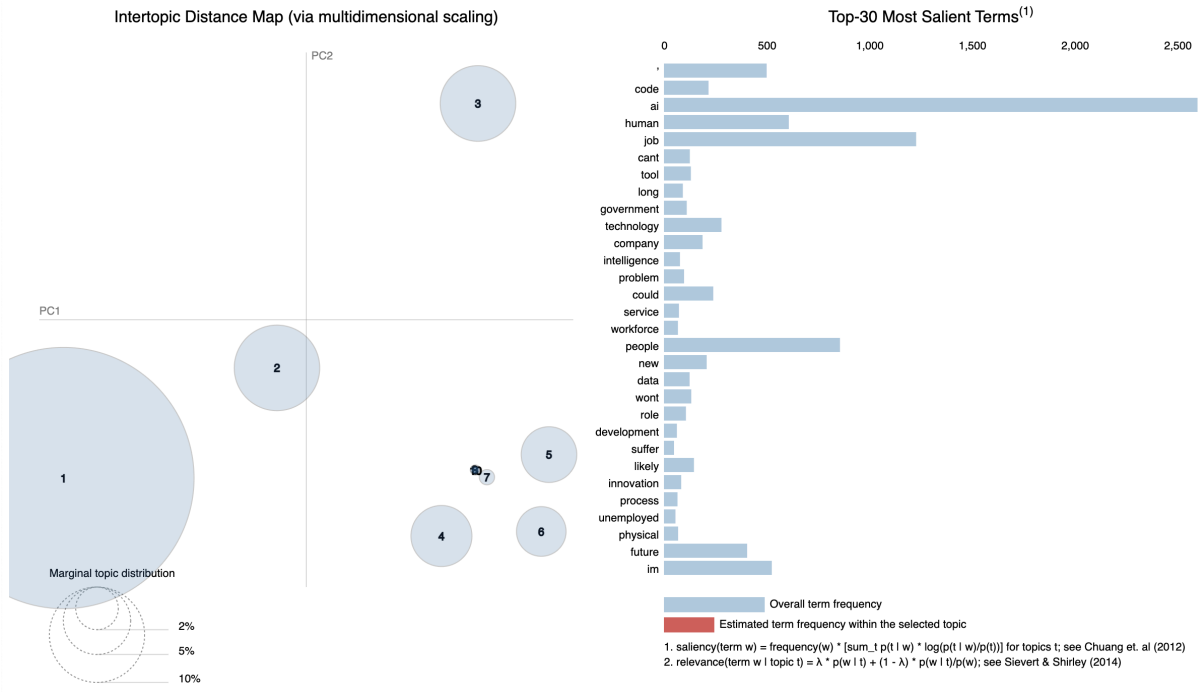
Table 4: Top Words for Topics 1 to 5

Topic 1	Topic 2	Topic 3	Topic 4	Topic 5
long (0.033)	code (0.024)	scientist (0.046)	andor (0.029)	pace (0.059)
suffer (0.021)	ethical (0.012)	chinese (0.013)	planning (0.027)	sooner (0.016)
term (0.017)	vast (0.012)	jumping (0.004)	viable (0.008)	eliminate (0.010)
replacing (0.016)	intelligence (0.011)	escape (0.002)	success (0.005)	administrative (0.001)
fathom (0.015)	tool (0.010)	monitoring (0.001)	progression (0.002)	warning (0.001)

Table 5: Top Words for Topics 6 to 10

Topic 6	Topic 7	Topic 8	Topic 9	Topic 10
problem (0.011)	service (0.017)	’ (0.273)	suffering (0.041)	ai (0.051)
position (0.010)	government (0.015)	“ (0.023)	ipad (0.016)	job (0.023)
created (0.010)	unemployed (0.013)	” (0.022)	ideally (0.014)	people (0.017)

collar (0.010)	population (0.013)	stop (0.016)	device (0.011)	like (0.012)
massive (0.009)	physical (0.012)	dentist (0.013)	random (0.008)	human (0.012)



Predicted C2 Worker LDA

Findings from C1 Work

The C1 Work category delves into discussions focused on task-oriented aspects of AI, particularly how new technologies and models influence specific work-related activities.

1. **Topic 1**
   This topic centers on the potential applications of AI in various contexts. The frequent mention of words like "could," "use," "going," "interview," "technology," and "manager" suggests conversations about how AI might be integrated into managerial tasks and interviews. People are contemplating the future trajectory of AI technology and its practical implications in the workplace.
2. **Topic 2**
   Here, the discussion shifts towards the potential impact of AI on jobs and human labor. With words like "job," "potential," "article," "human," "work," and "use," the topic likely includes debates spurred by articles about AI's capabilities. There's a focus on whether AI will replace or augment human workers and how it's being utilized in different industries.
3. **Topic 3**
   This topic appears to address specific jobs or tasks susceptible to AI automation.

Words such as "company," "laundry," "software," and "writing" indicate discussions about industries like software development and laundry services. People are exploring how companies are adopting AI to automate these roles and the consequences for employees who currently perform these tasks.

4. **Topic 4**
   The emphasis here is on AI's role in areas like travel and language processing. The presence of words like "travel," "llm" (large language model), "idea," and "question" suggests speculative conversations about how AI could revolutionize travel experiences or language-related services. There's a sense of curiosity and exploration of innovative possibilities enabled by AI advancements.
5. **Topic 5**
   This topic captures people's reflections on new developments in AI and their effects on jobs and work practices. Words like "new," "think," "like," "way," and "even" indicate a general contemplation about the evolving landscape due to AI innovations. Discussions may involve opinions on recent AI technologies and their potential to transform traditional work methods

Findings from C2 Worker

The C2 Worker category focuses on the individual worker's perspective, examining how AI impacts personal job security, career paths, and day-to-day work experiences.

1. **Topic 1**
   This topic is heavily centered on the intersection of AI and the art world. Words like "art," "artist," "artwork," and "human" suggest discussions about AI-generated art and the challenges it poses to human artists. There's an exploration of creativity, originality, and the value of human input in artistic endeavors when AI can produce art.
2. **Topic 2**
   Here, the emphasis is on personal concerns regarding AI replacing human jobs. The frequent use of words like "job," "people," "human," "work," "new," and "I'm" indicates that individuals are reflecting on how AI advancements are affecting their employment and considering new types of work emerging from technological progress.
3. **Topic 3**
   This topic delves into career-related anxieties and considerations. Words like "career," "work," "year," "article," and "time" suggest that workers are discussing the influence of AI on their career trajectories. There may be conversations about the need to adapt, retrain, or make timely decisions in response to AI developments.
4. **Topic 4**
   Legal and financial concerns are prominent in this topic. The presence of words like "copyright," "bootcamps," "income," "industry," and "robot" points to

discussions about the implications of AI on intellectual property rights, income stability, and the necessity of education programs to help workers adapt to technological changes.

5. **Topic 5**
   This topic reflects uncertainty and questions about the future impact of AI on specific fields, particularly in the arts. Words like "happens," "would," "field," "content," and "question" indicate that individuals are pondering the fate of their professions and expressing apprehension about how AI might alter their work landscapes.

Findings from C3 Workforce

The C3 Workforce category examines the broader implications of AI on large groups of workers and entire industries, emphasizing systemic changes rather than individual experiences.

1. **Topic 1**
   This topic discusses the need for adaptation as AI reshapes job markets and company operations. Words like "would," "people," "human," "work," "company," "new," and "need" suggest conversations about how organizations and the workforce must evolve. There's likely a focus on acquiring new skills and the restructuring required to stay relevant in an AI-driven economy.
2. **Topic 2**
   The focus here is on the displacement of human labor by AI and the societal challenges that arise. With words like "even," "like," "work," "would," and "make," discussions may involve debates about the extent to which AI can or should replace human workers, the ethical considerations, and the potential consequences for employment rates.
3. **Topic 3**
   This topic addresses automation's impact on jobs, including in creative sectors such as art. Words like "art," "think," "automation," and "going" indicate reflections on the direction of technological advancement and its effects on employment opportunities. There's an acknowledgment of the accelerating pace of automation across various industries.
4. **Topic 4**
   The emergence of Artificial General Intelligence (AGI) is the central theme here. Words like "agi," "translation," "general," "translator," "intelligence," and "artificial" suggest discussions about AI reaching a level of general cognitive abilities. Concerns may revolve around the future of professions like translation and the broader implications of AGI on the job market.
5. **Topic 5**

This topic focuses on the impact of AI on white-collar jobs. Words like "collar," "white," "work," "day," and "lot" imply that everyday professional work is changing due to AI technologies. There's a contemplation of how AI affects routine tasks and the potential need for workers in professional settings to adapt to new tools and processes.

Findings from Predicted C2 - Worker

1. **Topic 1: Long-Term Impacts of AI on the Workforce**
   This topic revolves around discussions about the long-term effects of AI on employment. Words like "long," "suffer," "term," "replacing," and "workforce" suggest that individuals are contemplating how AI might replace human labor over extended periods. There's a concern about the potential suffering or hardship that could result from AI-driven job displacement. The mention of "fathom" and "it'll" indicates the difficulty in fully understanding or accepting these future changes.
2. **Topic 2: Ethical Considerations and AI Tools**
   This topic focuses on ethical issues surrounding AI and its applications. Words such as "code," "ethical," "intelligence," "tool," and "development" highlight discussions about responsible AI development and the importance of ethics in coding and deploying AI technologies. The term "vast" suggests the expansive nature of AI's capabilities, and "potential" points to the opportunities and risks involved.
3. **Topic 3: Scientists and International Perspectives**
   This topic appears to center on scientists and possibly international collaborations or competitions in AI. The prominent words are "scientist" and "Chinese," indicating discussions about scientists from different countries and their contributions or roles in AI development. Other words like "jumping," "escape," and "monitoring" could suggest topics related to movement or shifts in scientific communities or concerns about surveillance.
4. **Topic 4: Career Planning and Success in the AI Era**
   This topic focuses on personal career trajectories in the context of AI advancements. Words like "planning," "viable," "success," and "progression" suggest that individuals are considering how to plan their careers to remain relevant and successful. The mention of "and/or" might indicate weighing different options or paths. There's an emphasis on embracing change and seeking opportunities in the evolving job market.
5. **Topic 5: Accelerating Pace of Automation**
   This topic addresses the rapid acceleration of AI and automation. The word "pace" stands out significantly, indicating a focus on the speed at which changes are occurring. Words like "sooner," "eliminate," and "warning" suggest that automation may eliminate certain jobs faster than anticipated, raising concerns

and prompting calls for caution. There may be discussions about administrative roles being affected.

6. **Topic 6: Employment Challenges and Economic Policies**
   This topic delves into problems related to employment and economic policies in the face of AI advancements. Words like "problem," "position," "created," "collar," "massive," "policy," and "job" indicate discussions about the challenges workers face, particularly in blue-collar positions. There's mention of "massive" changes and the need for policies to address job displacement.
7. **Topic 7: Government Services and Automation**
   This topic focuses on the government's role in addressing unemployment and the impact of automation on services. Words like "service," "government," "unemployed," "population," "physical," "system," and "automated" suggest discussions about how government services can support unemployed populations and how automation affects public services. "UBI" (Universal Basic Income) appears to be a point of discussion as a potential solution.
8. **Topic 8: Communication and Expression Challenges**
   This topic seems to highlight issues related to communication and expression. The high frequency of punctuation marks like "’," "“," and "”" suggests textual elements or perhaps quoting and dialogues in discussions. Words like "stop," "voice," "concerned," "affected," and "negative" indicate conversations about being heard, expressing concerns, or negative impacts on communication.
9. **Topic 9: Technological Devices and User Experience**
   This topic revolves around technology devices and user experiences. Words like "suffering," "ipad," "ideally," "device," "ipados," "macos," "remove," and "cyber" suggest discussions about issues with devices, perhaps frustrations with technology or software updates. "Suffering" in this context may refer to user dissatisfaction or challenges with adapting to new technologies.
10. **Topic 10: General Discussions on AI and Employment**
    This topic captures general conversations about AI's impact on jobs and the future. Words like "ai," "job," "people," "like," "human," "I'm," "art," "work," "future," and "think" indicate broad discussions about how AI affects employment, human roles, and thoughts about the future. There's a mix of personal reflections and general observations.

Summary

EDA Findings

- Trends Over Time: There was an observable increase in discussions on AI and employment following the release of ChatGPT.
- Sentiment Analysis: The average sentiment fluctuated over time, indicating varying emotional responses to AI developments.
- Word Frequencies: Common words included “ai,” “job,” “people,” “work,” and “human,” highlighting the central themes of employment and human-AI interaction.

Model Performance

- Random Forest Model: Demonstrated better performance for the C2 Worker category but failed to effectively predict C1 Work and C3 Workforce.
- SVM Model: Showed limited effectiveness across all categories.
- Challenges: The models struggled due to class imbalance and the complexity of the multilabel classification task.

TM Insights

Across all datasets, several common themes emerge:

1. **AI's Impact on Employment:** There's a pervasive concern about how AI will affect jobs, both at the individual and industry levels. Workers are contemplating the potential for job displacement and the need to adapt to new technologies.
2. **Human vs. AI Creativity:** Particularly in the art sector, there's significant discourse on the differences between human-created and AI-generated content. The value of human creativity is being examined in light of AI's capabilities.
3. **Future Uncertainty:** Many discussions express uncertainty about the future. Questions about how AI will reshape careers, industries, and society are prevalent, reflecting both anxiety and curiosity.
4. **Ethical and Societal Considerations:** Ethical issues, such as the implications of AGI and the societal impact of widespread automation, are important topics. There's an awareness of the need for responsible AI development and consideration of its effects on humanity.
5. **Need for Adaptation:** Workers recognize the necessity of adapting to the changing landscape, whether through upskilling, retraining, or shifting to roles less susceptible to automation.