The Rise of Prompt Engineering Jobs: A Review of the Nature of the Job, Qualifications, and Compensations

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1

Abstract

The evolution of large language models such as GPT-3 and GPT-4 from OpenAI, LLaMA from Meta, and PaLM2 from Google has revolutionized how the works are performed and created new opportunities. Among the new opportunities is the prompt engineering jobs that are emerging in various sectors. Researchers and the public need a better understanding of the various aspects of the prompt engineering jobs in order to take advantage of them. However, scarce research is available that documented those aspects therefore, this study explored the nature of the job, qualifications, and compensations of prompt engineers. The study applied a text-mining approach to over 100 job advertisements for prompt engineering jobs. It was found that experience and skills in natural language processing, machine learning, and large language models are the key qualifications for prompt engineering jobs. The job description shows that in addition to working in large language models, prompt engineers are expected to work in cross-functional teams. Further, although education level is relatively less emphasized in the qualifications, people with a background in computer science are in better positions to be hired. In addition to the normal benefits and compensations of the full-time employees, the average salary for prompt engineers is relatively higher than other workers with similar educational backgrounds. Colleges and vocational institutions can use the study findings to provide skills needed in the market.

Keywords: Prompt engineering jobs, large language models, CHATGPT, Open AI

1 Background

Large language models (LLM), which gained their popularity at the end of 2022, have revolutionized the way people work, thus, producing a new direction in the labor market (Clavié et al., 2023). The origins of prompt engineering can be traced back to the early days of AI, but it was only with the advent of sophisticated LLMs that it emerged as a distinct field. According to Zarifhonarvar, (2023), these emerging generative Arificial Intelligence (AI) models, like ChatGPT, can have both positive and negative impacts on the job market. On the positive side, AI technology has created new job opportunities in high-skilled occupations such as prompt engineering. Prompt engineering involves designing and fine-tuning prompts, which are pieces of text used to guide or initiate AI/ML models to generate specific outputs or responses (Liu et al., 2023), to optimize LLMs for specific tasks (White et al., 2023).

Since its inception, various studies have evaluated the applications of prompt engineering in various aspects, such as art education, Automated Software Engineering (ASE), image generation, and medical education, among others (Arvidsson & Axell, 2023; Heston & Khun, 2023; Hutson & Cotroneo, 2023; Kutela, Li, et al., 2023; Kutela, Msechu, Das, et al., 2023; Kutela, Msechu, Novat, et al., 2023; Oppenlaender et al., 2023; Shin et al., 2023; Yamada, 2023). A study by Cotroneo & Hutson, (2023) explored how prompt engineering could elevate creativity in art education through the utilization of AI tools. Their mixed-methods study used student surveys, instructor feedback, and artifacts, including AI-generated content and final projects. The research uncovered that prompt engineering techniques facilitated the gradual refinement of students' ideas and encouraged them to experiment and explore creative concepts. However, the study noted challenges, like ethical concerns such as copyright issues and the possibility of artists facing job displacement, and the need for ongoing curriculum updates to match evolving AI technology in art and design. Another study by Oppenlaender et al., (2023) assessed the application of prompt engineering on image generation. Specifically, the study wanted to understand if novice participants could evaluate the quality of prompts and the resulting images generated. Participants demonstrated creativity in writing descriptive prompts but lacked specialized AI art vocabulary. The study revealed that participants found prompt modifiers less intuitive, suggesting that prompt engineering may require expertise. The assessment of the strengths and limitations of prompt engineering and fine-tuning for Automated Software Engineering (ASE) tasks was performed by (Shin et al., 2023). The study focuses on using GPT-4 in software engineering and compares its performance with fine-tuned models. The study found that GPT-4 excelled in comment generation and C# to Java translation with basic prompts, but not in Java to C# translation. Task-specific prompts improved performance, while in-context learning had mixed effects. Furthermore, prompt engineering has also been explored in medical education (Heston & Khun, 2023). The study delves into the role of prompt engineering in effectively communicating with generative language models (GLMs) to achieve desired outcomes in medical education by enhancing understanding, retention, and patient interviewing skills. Another study by Yamada, (2023) evaluated prompt engineering for language translation. The translated scripts by ChatGPT were evaluated through practicing translators. The study found that incorporating "purpose" and "target audience" into prompts significantly altered

3

translations, improving quality, especially for content like marketing materials and culturally dependent idioms.

In addition to prompt engineering as a skill, prompt engineering jobs have been a topic of interest to various stakeholders focusing on the benefits, skills needed, and skepticism, among others. However, most of these articles are more personal thoughts, which are not backed up with scientific or statistical evidence. For instance, the article by Nguyen, (2023), highlights the opportunities in the field of prompt engineering, the high salaries it can offer, and the growing demand for individuals who can effectively interact with generative AI tools. Similarly, (Telefonica, 2023) delves deeper into the in-demand role of a prompt engineer, elucidating the responsibilities and the distinctive skill set necessary for this profession. The article showed that prompt engineers need to possess an in-depth knowledge of the specific language models they work with and the ability to collaborate effectively within multidisciplinary teams. Additionally, an article by Ivey, (2023), explains further the skills needed to land a job as an AI prompt engineer. The article emphasizes proficiency in natural language processing (NLP) and language modeling. Secondly, Expertise in programming languages like Python and familiarity with machine learning frameworks such as TensorFlow or PyTorch. On the other hand, Luansing, (2023) presents a contrasting perspective, emphasizing the skepticism surrounding the validity of a career in prompt engineering. The article emphasized that the job's stability hinges on how employers perceive it as a long-term investment. Further, the study highlighted that, without universally recognized educational programs, assembling an effective, prompt portfolio carries greater appeal to potential employers than possessing course certificates. Lastly, Marr, (2023) provides insights into the job markets and benefits for prompt engineers. The study showed that various companies, from digital advertising agencies to healthcare providers and utility companies, are actively hiring prompt engineers. The article further underscores that job listings in this field have surged by 51% from 2021 to 2022, offering competitive salaries ranging from $280,000 to $375,000.

Although the studies highlighted above have evaluated prompt engineering and prompt engineering jobs, several aspects have not been explored to a great extent. Most of these studies that explored prompt engineering jobs are based on personal views without strong scientific or statistical evidence and did not cover a wide range of points of interest. Therefore, the objective of this study is to provide a deeper understanding of the qualifications, responsibilities, and compensations of prompt engineers by backing up with statistical evidence. The findings from this study would inform the aspiring prompt engineers of the needed qualifications, the expected responsibilities, and the possible benefits and compensations. In addition to the aspiring prompt engineers, the vocational schools and colleges would use the findings of this study to understand the types of materials and the key focus of the courses to produce prompt engineers needed in the job market. As AI models become more sophisticated, the role of the prompt engineer might evolve, emphasizing more on ethics, user experience, or some other aspect.

The rest of the paper is organized as follows; the next section presents the materials and methods whereby the data collection and analysis approaches are discussed. The results and discussion section is then presented, followed by the conclusion and future studies.

2   Materials and Methods

This section presents the materials and methods. It covers the data collection and description as well as the data analysis approach.

2.1   Data Description

This study utilized prompt engineering job advertisements posted on various outlets between August and November 2023. Such outlets include Indeed, LinkedIn, Glassdoor, Google for Jobs, CareerBuilder, Upwork, and Monster, among others. Several keywords were used to search for the prompt engineering jobs. Such keywords include Prompt Engineer, Prompt Engineering Job, Generative AI Engineering Job, and ChatGPT Engineer, among others. For each job found, the qualifications, responsibilities, job description, and benefits/compensations were extracted and saved in the Excel sheet for further consideration. A total of 213 jobs were obtained from such sources. Upon further review and removal of the repeating jobs that were either posted in multiple outlets or posted multiple times in the same outlet, 106 unique jobs were available for further analysis.

Table 1 shows the distribution of the advertised jobs by mode. It can be observed that most of the advertised jobs are full-time (43). However, there is a significant number of job posts that did not indicate the mode.

**Table 1. Distribution of Advertised Jobs by Mode**

Mode	Number of jobs
Full time	43
Part-time	2
Contract	3
Internship	3
Unknown/not mentioned	55

Additionally, about 16 job posts indicated the minimum and maximum yearly salary, while almost every post showed the benefits and other compensations. Further, 83 job posts were from companies, 16 were from on-demand sources such as Upwork, and six did not indicate the company. The next section presents the data analysis approach.

2.2   Data Analysis Approach

The keywords were analyzed using the text network method (TNA) to find key themes. This method makes use of nodes and links to display key information from text data (Kutela, Magehema, et al., 2022; Kutela, Novat, et al., 2022; Lee & Hong, 2020; Yoon & Park, 2004). Nodes in the network (**Figure 1**) stand for keywords, while links denote co-occurred keywords. In the narratives, the gap between keywords matches the distance between two nodes. keywords that are close to one another are referred to

5

as collocated keywords and offer a more straightforward interpretation compared to co-occurring or single keywords. A community is formed by grouping keywords with comparable concepts (Kutela, Langa, et al., 2021; Kutela, Novat, et al., 2021; Paranyushkin, 2012).
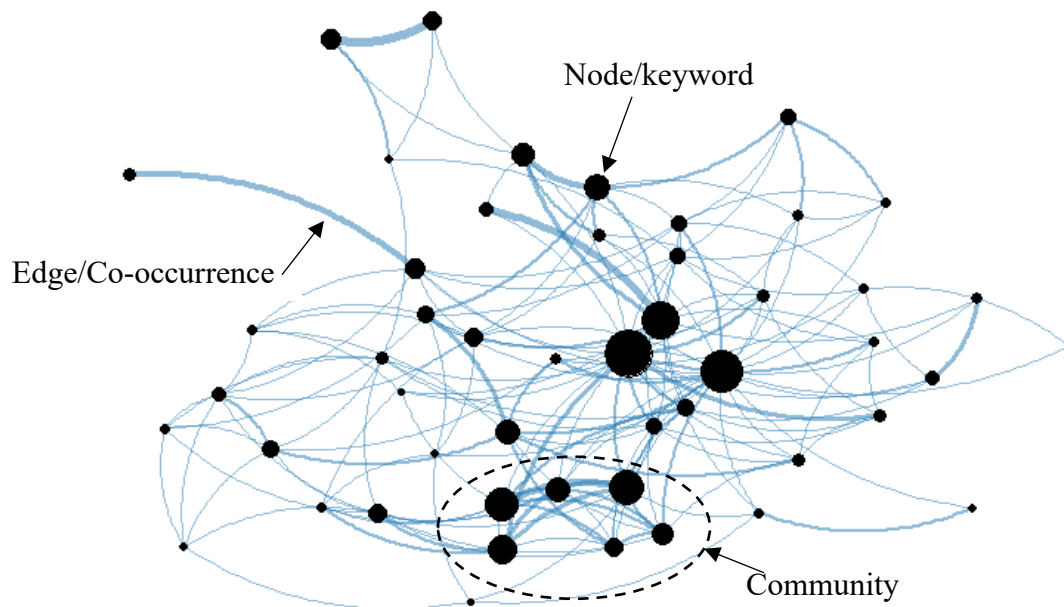
Figure 1. A Typical Text Network

There are three main processes involved in creating a text network. Initially, text cleaning and formatting methods, including converting the text to lowercase and eliminating signs, symbols, and punctuation, are applied. The next step involves generating a matrix of keywords and plotting them as a network of keywords based on how frequently they appeared in the corpus. The thickness of the edges/links in this network indicated the frequency of the co-occurrence of keywords, whereas the size of a node indicated the frequency of a keyword (Das et al., 2023; Kim & Jang, 2018; Kutela, Das, et al., 2021; Paranyushkin, 2012).

The text data can be interpreted using a variety of measures, including node size, link size, co-occurrences, and network topology (Kutela, Novat, et al., 2022; Kutela & Mwekh'iga, 2023; Yoon & Park, 2004). Due to the magnitude of the dataset, only the top 50 most common terms were considered while attempting to make sense of the network. References to the original raw text are normally preferred to improve the interpretability of the networks. Stemming and lemmatization techniques were not used in the data pre-processing to guarantee that actual keywords were collected.

6

3   Results and Discussions

This section presents the results and discussion. It covers the discussion on the qualifications, responsibilities, job descriptions, and benefits and compensations. The findings from this study are compared to other studies to broaden the context and increase the understanding of the presented findings.

3.1   Prompt Engineering Job Descriptions

Figure 2 and **Table 2** present the text-network and associated metrics for the job description. **Figure 2** displays the relationships between various key job-related terms in the field of prompt engineering. The dense node cluster of large, language, models, team, and role represent the primary focus of the field. In fact, prompt engineers are expected to work on large language models. This aligns with the findings of Clavié et al. (2023), who emphasized the importance of accurately matching job posts to skill taxonomies using large language models. The job description also shows the type of work and the role that the prompt engineer will play in the team. This is indicated by the keyword's role, work, and team in the keyword frequency.
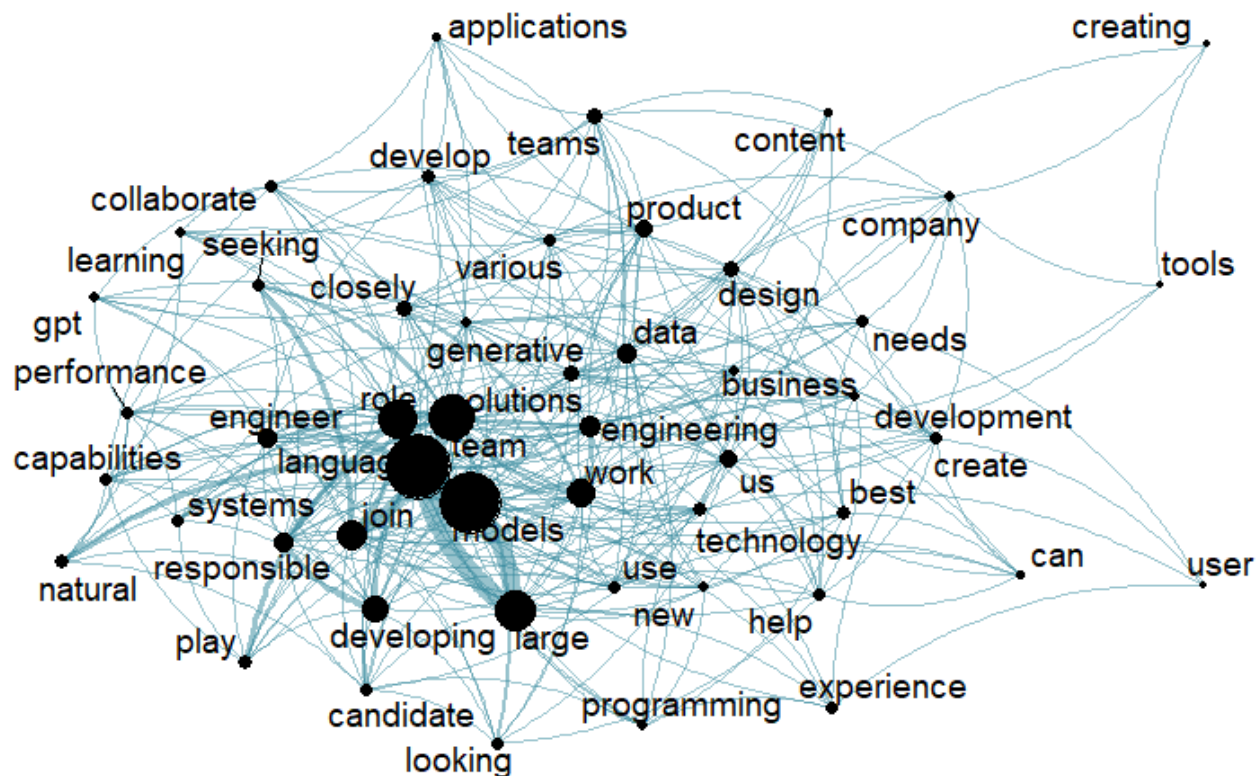
Figure 2. Prompt Engineering Job Descriptions

7

Table 2. Top Keywords and Collocated Keywords for Prompt Engineering Job Descriptions

	Keywords			Collocated keywords			
Rank	feature	frequency	docfreq	collocation	count	lambda	z-score
1	team	59	50	language models	40	5.32	17.35
2	language	69	41	large language	38	9.25	6.45
3	models	68	41	join team	19	4.85	13.07
4	role	42	37	natural language	15	6.69	7.73
5	work	41	35	work closely	13	6.74	9.43
6	join	35	34	responsible developing	12	5.94	11.89
7	developing	25	25	language processing	12	7.52	5.20
8	looking	26	24	team role	11	3.53	9.40
9	large	38	23	ideal candidate	11	8.90	9.01
10	engineering	32	23	machine learning	10	9.06	8.85
11	seeking	23	23	cross-functional teams	10	9.06	6.12
12	solutions	27	22	help us	9	5.84	10.83
13	engineer	23	22	seeking talented	9	6.69	9.86
14	data	31	21	role shaping	7	5.58	8.34
15	responsible	22	21	language model	7	4.53	7.87
16	us	21	18	engineer play	6	5.18	9.16
17	create	22	17	engineer responsible	6	4.69	8.88
18	company	20	17	highly skilled	6	7.82	8.01
19	teams	20	17	crucial role	6	5.72	7.50
20	technology	19	17	data science	6	6.59	7.11

One of the job advertisements stated that *"We are currently seeking a talented and experienced Prompt/Embedding Engineer to join our technology team. In this role, you will work on developing and enhancing AI language models, with a focus on GPT-3.5-turbo and GPT-4. Experience with LangChain and Auto-GPT is a plus."* This reflects the skills, such as the development of SkillGPT for skill extraction from job descriptions using LLMs, highlighted by Li et al. (2023).

Further, the job description shows the responsibility of the prompt engineer as indicated by the word "responsible." A typical example of such a job advertisement is, "We are looking for an experienced AI engineer to join our team and help us develop customized AI solutions for our business. As an AI engineer, you will be responsible for developing, testing, and implementing AI algorithms and models that meet our business needs."

The co-located keywords in **Table 2** present a similar pattern of keywords. For instance, the words team role, role shaping, engineer play, and crucial role show the role of prompt engineer in the team. For example, one of the job advertisements stated, "We are seeking a talented and motivated Prompt Engineer to join our dynamic team and play a pivotal role in shaping the future of AI." The words responsible and developing show the actual responsibilities of the prospective hire. Additionally, the job description shows the qualifications of the ideal candidate and the levels of skills needed using keywords such as data science, highly skilled, etc.

8

Although the job description in **Figure 2** and **Table 2** provided information related to the job, a deep understanding of the qualifications of the prompt engineer is needed to provide information to the universities and vocational colleges on the needed skills for prompt engineers. Thus, the next section presents the qualifications and responsibilities.

3.2   Qualifications of Prompt Engineering Jobs

Figure 3 and **Table 3** present the text network and associated keywords for the qualification of prompt engineering jobs. Both **Figure 3** and **Table 3** show that *experience* is among the keywords that appear more frequently in job advertisements for job qualifications. Using the network in **Figure 3**, distinct clusters that represent the different qualifications that are important for this role can be deduced from the network. This network suggests that the qualifications range from technical skills to creativity and innovation. The central cluster of the network is centered on the largest key nodes of experience, language, and skill. This cluster is indicative of the broad range of qualifications that are required for prompt engineering jobs. This cluster highlights the importance of having a strong skill set and experience in large language models to be a qualified candidate for this role.

Similarly, **Table 3** shows that the top keyword in 74 job advertisements is a *skill*, while *experience* appeared in 73 job advertisements, although it appeared more frequently for each job advertisement. Almost every job advertisement had the word experience appear three times. The observation indicates that for prompt engineering jobs, specific skills and experience are the most important criteria that need to be met. Up-to-date skills and experience have been ranked among the top employee qualities considered by organizations when hiring.

Other keywords that appear more frequently include *communication, excellent, python, strong,* and *AI*. The observation suggests that, in addition to the experience and skills, prompt engineers need to have strong communication skills. Similar skills were highlighted in the article by (Alam, 2023) when describing the qualifications needed for prompt engineers. Further, the result in **Table 3** shows that education level was not among the top keywords but is still relevant. In fact, the education-related keyword *degree* appears as the ninth top keyword, and it was mentioned in 49 job advertisements.

In addition to the individual keywords, the collocated keywords provided more information regarding the skills needed. According to the ranking of the collocated keywords, the keywords related to natural language processing, such as *natural language, language processing, language modes*, and *large language,* are among the top-ranked ones. The observation suggests prompt engineers must have natural language processing skills and experience to qualify for the jobs. Other skills mentioned in the job advertisement include communication skills and problem-solving skills.

The collocated keywords also show the education level needed and are indicated by the keywords' *degree computer, master's degree*, and *bachelor's degree*. In fact, 20 job advertisements required a bachelor's degree in computer science, while 13 job advertisements required a master's degree in the same field. Typically, software developers usually require a bachelor's degree, although having a master's degree in the field is often favored. Similarly, computer systems analysts typically hold a bachelor's degree, but when it comes to technically intricate roles within this field, a master's degree is frequently preferred (Harr,

9

2021). This observation aligns with the one presented in the ai-job.net article (ai-jobs.net, 2023), which indicated that having a degree is beneficial, but a person may become a prompt engineer without one.
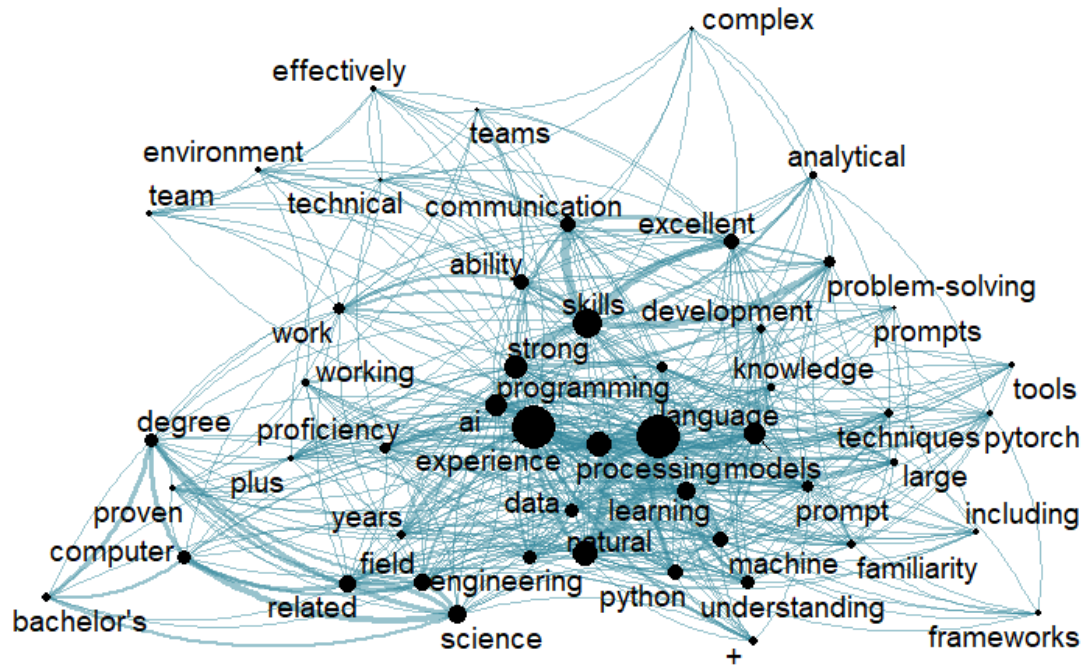
Figure 3. Qualifications of Prompt Engineering Jobs

Table 3. Top Keywords and Collocated Keywords for Qualifications of Prompt Engineering Jobs

	Keywords			Collocated keywords			
Rank	feature	frequency	docfreq	collocation	count	lambda	z-score
1	skills	136	74	natural language	75	9.37	6.58
2	experience	209	73	language processing	74	7.77	11.89
3	language	153	72	machine learning	51	10.76	7.44
4	strong	95	60	computer science	49	9.19	12.99
5	communication	67	60	related field	44	9.40	13.83
6	python	59	55	communication skills	36	4.26	16.16
7	excellent	61	54	language models	34	3.53	14.80
8	ai	89	50	skills ability	30	3.80	14.73
9	degree	58	49	problem-solving skills	30	4.50	14.70
10	models	86	47	degree computer	29	5.65	16.75
11	ability	73	46	large language	26	6.22	9.32
12	science	61	46	bachelor's degree	25	5.65	15.68
13	problem-solving	49	46	excellent communication	24	4.52	15.02
14	natural	75	45	ability work	23	4.61	14.74
15	learning	64	45	programming language	23	4.08	12.62
16	computer	51	45	experience working	23	5.14	9.88
17	field	50	45	prompt engineering	22	5.11	15.14
18	processing	76	44	master's degree	19	7.11	10.29
19	related	47	43	years experience	18	3.32	10.28
20	bachelor's	41	41	excellent problem-solving	17	4.31	12.95

10

3.3 Benefits and Compensations

Figure 4 presents the summary of the benefits that prompt engineers would get when hired. It can be observed that most of the job advertisements provided information about insurance and dental insurance as indicated by the keyword *insurance* and the surrounding keywords *vision, health,* and *dental*. Additionally, the keywords *paid*, *medical,* and *leave* are among the highly frequent keywords, which implies that a number of job advertisements mentioned the provision of such benefits (paid medical leaves). *Salary* and *compensation* appear in the network, although their frequency is relatively lower.

Figure 4. Compensations and benefits

Other keywords that show the benefits offered to prompt engineers include *parental leave*, *personal development*, *supporting environment*, *401k*, *life insurance*, and *training*. One of the job advertisements stated these as benefits *"Dental insurance, Flexible schedule, Health insurance, Comprehensive health, dental, and vision insurance for you and all your dependents. 401(k) plan with 4% matching, 21 weeks of paid parental leave, Unlimited PTO – most staff take between 4-6 weeks each year, sometimes more! Stipends for education, home office improvements, commuting, and wellness, Fertility benefits via Carrot. Daily lunches and snacks in our office, Relocation support for those moving to the Bay Area, Unlimited paid time off, Visa sponsorship, and Vision insurance."* The presence of these keywords, which are similar to the keywords found in other jobs, signifies that prompt engineering jobs are considered as significant as other traditional jobs in terms of benefits (Indeed Editorial Team, 2023).

11

Figure 5 presents the salary range for a selected 16 job advertisement that has the salary information. It can be observed that the majority of the advertisements had a minimum salary ranging between $100,000-$200,000 per year and a maximum salary of over $200,000 per year. The lowest yearly salary listed in the advertisement was $72,000, while the maximum was $520,000. A review of the job advertisements shows that 67.19% of the prompt engineering jobs are full-time with full benefits, while 3.13% are part-time. For the full-time jobs, the salary ranged between $60000 –$375000 per year, which is about 300% higher than similar jobs of the graduate of computer science (*Salary: Computer Science Graduate in Florida (Oct, 2023)*, 2023). One article (Nguyen, 2023) hinted at such a high salary, although it focused on one job post. Overall, the compensation and benefits indicate that prompt engineering, which the revolution of large language models has brought about, is among the highly-paying jobs. However, as (Pearl, 2023) discussed earlier, some of the prompt engineering job salaries are not as lucrative as they have been hyped, especially when the job description is relatively loose.
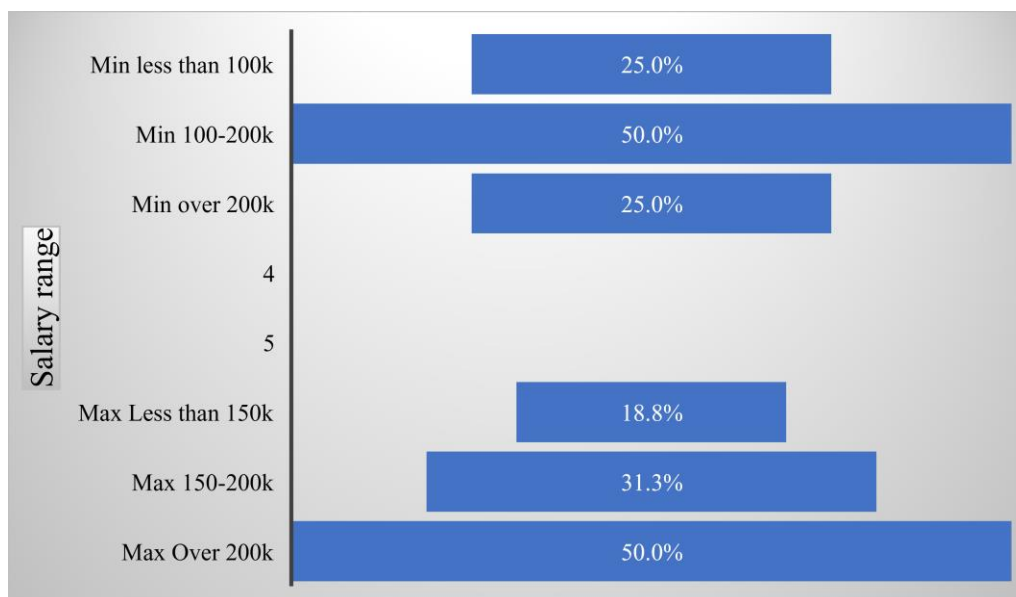
Figure 5. Salary range

4   Conclusions and Future Studies

The rise of large language models, particularly those developed by OpenAI, has undeniably reshaped the landscape of artificial intelligence and its applications in various sectors. One of the most notable outcomes of this evolution is the emergence of prompt engineering as a specialized field, offering a plethora of job opportunities. However, despite its growing significance, there exists a noticeable gap in the literature concerning the qualifications, responsibilities, and benefits associated with these roles. This study aimed to bridge this gap by employing text-mining techniques to analyze job advertisements related to prompt engineering. The findings of this study lead to several key conclusions:

12

Experience with Large Language Models: Mastery over large language models, encompassing their development, design, and performance evaluation, stands out as a paramount qualification for aspiring prompt engineers. This underscores the importance of hands-on experience and practical knowledge in this domain.

Educational Credentials: While the emphasis on specific educational qualifications in job advertisements was relatively subdued, possessing a bachelor's degree in computer science or related disciplines evidently offers a competitive edge in the job market for prompt engineering roles.

Comparable Benefits with Enhanced Compensation: The benefits package for prompt engineers, including insurance, paid leaves, and professional development opportunities, aligns with industry standards. However, when it comes to remuneration, prompt engineers appear to command a premium, reflecting the specialized nature of their expertise.

Curriculum Revisions for Educational Institutions: The skills and qualifications highlighted in the job advertisements serve as a valuable guide for educational institutions. Universities, colleges, and vocational training centers should consider revising curricula to incorporate relevant skills, such as prompt engineering techniques, machine learning, and more. This would ensure graduates are well-equipped to navigate the evolving job landscape and capitalize on emerging opportunities.

Future Directions: As the field of prompt engineering continues to evolve, it would be beneficial to conduct longitudinal studies to track changes in job requirements and compensation over time. Additionally, exploring the ethical implications and challenges associated with prompt engineering, as well as the broader impact of large language models on the job market, would provide a more comprehensive understanding of this burgeoning domain.

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14

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