

Bidirectional job recommendation system

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Problem Statement

Implementing a bidirectional resume and job recommendation system.

Our algorithm recommends the best resume for a job and best job for a resume.

In order to achieve this we have combined the NLP techniques along the multi-arm bandits.

Novelty

The bi-directional aspect implies that our system considers not only the job requirements but also the candidate's qualification and preferences.

The novelty also lies in combining NLP techniques along with the multi-arm bandits.

Datasets

Jobs dataset: <https://www.kaggle.com/PromptCloudHQ/jobs-on-naukricom>

This dataset contains company, education, experience, industry, job-description, joblocation, job-title, pay-rate, postdate, skills as the attributes.

Resume dataset: Found from a github repo

This dataset contains resume_id, city, state, work_experiences, educations, skills, resume_title as the attributes.

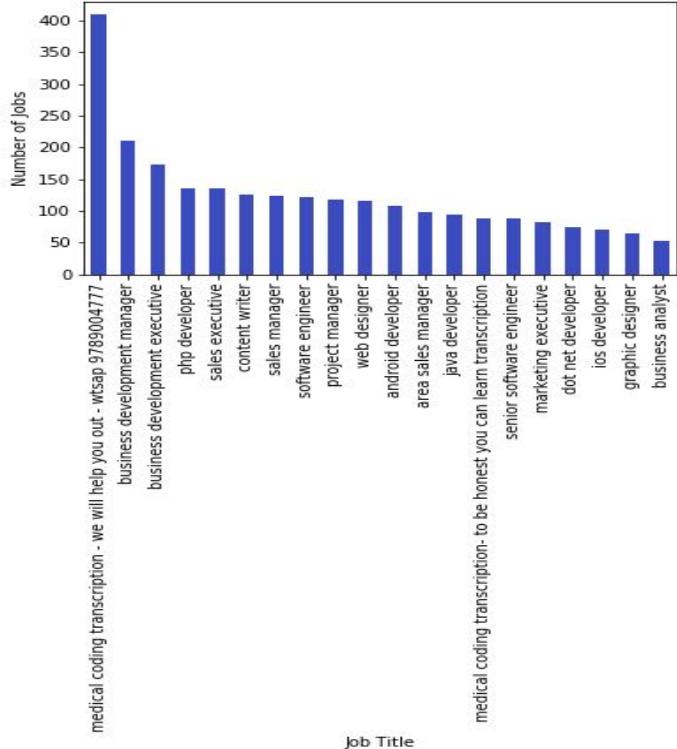
Philosophy behind selecting the algorithm

- **Adaptability:** NLP techniques understand resume and job description nuances, while multi-arm bandits optimize decision-making through continuous learning.
- **Efficiency:** NLP streamlines data processing, and multi-arm bandits optimize resource allocation for quicker, more effective recommendations.
- **Personalization:** NLP identifies individual preferences, and multi-arm bandits refine recommendations based on user interactions, ensuring tailored suggestions.

Job dataset EDA

- **job-description:** Deleted nan values as it is mandatory
- **experience:** Filled the null values with 0.
- **industry:** Filled the null values with most repeated value.
- **skills:** Filled null values with ‘others’.
- **payrate:** Replaced null values with ‘Not disclosed’.
Determined the salary range and removed alpha-numeric values.

Job dataset EDA



- **Job location:** Brought a common notion of India-state-city and filled nulls with 'India'. Used another dataset india-city-state to achieve this.
- **education:** Replaced nulls with 'any graduate'
- We added columns `is_grad`, `is_postgrad` and `is_doc` in both the datasets for better recommendation purpose.

Resume dataset EDA

- **Work_experiences:** It extracts details like job title, company name, city, state, duration and description from the json format. If there is the word ‘PRESENT’ then the total_experience is calculated as present date. Else it calculates the duration between start and end dates.
- As the experience is varying a lot we have binned the experience into 4 categories.(0-1, 1-5, 5-10, 10+).

Resume dataset EDA

index	Resume_title	City	location	Description	work_experiences	Educations	Skills
0	java developer	Tirur	kerala	To prove myself dedicated, worthy and energetic...	{0: [{"wtitle": "Java Developer"}, {"wcompany..."}]}	{0: [{"e_title": "Bachelor's in Bachelor of C..."}]}	['java (less than 1 year)', 'jsp (less than 1...']
1	software developer	Bengaluru	karnataka	Working as Software Developer at IngrolInfo Sof...	{0: [{"wtitle": "JAVA DEVELOPER"}, {"wcompany..."}]}	{0: [{"e_title": "MCA in Master of Computer A..."}]}	['programming languages: core java', 'j2ee \n...']
2	java developer	Pune	maharashtra	Looking for a challenging career which demands...	{0: [{"wtitle": "Java Developer"}, {"wcompany..."}]}	{0: [{"e_title": "Bachelor's in Electrical En..."}]}	['eclipse (1 year)', 'hibernate', 'spring (l...']
3	seeking innovative and challenging career assi...	Pune	maharashtra	NONE	{0: [{"wtitle": "Java Developer"}, {"wcompany..."}]}	{0: [{"e_title": "BE in Computer"}, {"e_schoo..."}]}	['git', 'angular 7', 'maven', 'java', 'jen...']
4	java developer	Pune	maharashtra	NONE	{0: [{"wtitle": "Java Developer"}, {"wcompany..."}]}	{0: [{"e_title": "Bachelor of Engineering in ..."}]}	['project: hr payroll systems role: java devel...']

- **Resume_title:** This is an important column for recommendation. There are titles with same meaning but different title. We need to bring consistency over here.
- skills, description, certificates, links, additional info are left the same.

Job dataset preprocessing

- Concatenated ‘job_title’, ‘job_descrition’, ‘jobdescription’, ‘skills’ for creating the job feature vectors.

NLP–NLTK techniques:

- Tokenizing: Splits at whitespaces, removes punctuation, removes stopwords and lemmatizes (divides words based on verb, noun and adjective).

Job dataset processing

- Used **TfidVectorizer** to create vectors where a word is represented as a value using formulae

$$\text{TF-IDF}(t, d, D) = \frac{\text{Number of times term } t \text{ appears in document } d}{\text{Total number of terms in document } d} \times \log \left(\frac{\text{Total number of documents in the corpus } D}{\text{Number of documents containing term } t+1} \right)$$

- Added custom stop words using the TfIdvectorization output.
- Doc2Vec model has been trained using the tagged data and saved. Feature vectors for each job has been created.
- Each vector contains 20 features for each resume.

Resume dataset preprocessing

To match resume with jobs, I need to have similar 20 vectors, that I created to train my Doc2Vec model for jobs.

For training my jobs model, I picked text data from :

- job title
- job description
- skills
- industry

So for training my resume model, I need similar text, thus picking:

- Resume_title
- Resume description
- skills
- Experience description

```
#####
```

Resume dataset preprocessing

- First, we have extracted experience description information for each row from the column ‘work_experiences’
- After that we converted all the required columns into lower case and replaced null values with empty strings

Resume dataset preprocessing

- Similar to what we did in job - preprocessing ,applied Tokenizing for the new column that was obtained by concatenating the fields Resume_title,Resume description,skills,Experience description. And then applied **TFID vectorization** and got custom stop words.
- Now, the **Doc2Vec** model that was trained previously in job preprocessing has been used to generate feature vectors for resume data as well.

Algorithms implemented

- 1) Cosine similarity between the feature vectors
- 2) Multi-arm bandits

Matching-Similarity

Abstract: With the 20 vectors that we obtained after performing DocToVec model, along with few other factors like experience range, location, etc., we try to find the similarity between them and recommend accordingly.

Implementation:

To recommend jobs:

- Choose a resume.
- Using fuzzywuzzy algorithm we will sort the jobtitles and obtain the jobs that are relevant to the resume_title.
- Now we iterate through each relevant_jobs and compute similarity with the resume
- Now we sort in descending order and report top 5 or top 10 best job recommendations.

Similar implementation is done for resume recommendations.

id	company	job_title	jobdescription	experience_range	is_grad
0	Varite India Pvt. Ltd. hiring for TOP MNCs	software developer	Job Description Send me Jobs like this Hi, T...	2	1.0
1	Oracle India Pvt. Ltd.	software developer 3	Job Description Send me Jobs like this Design...	1	1.0
7	Oracle India Pvt. Ltd.	software developer 3	Job Description Send me Jobs like this Design...	1	1.0
8	Oracle India Pvt. Ltd.	software developer 3	Job Description Send me Jobs like this Design...	1	1.0
5	Oracle India Pvt. Ltd.	software developer 3	Job Description Send me Jobs like this Design...	1	1.0
10	Oracle India Pvt. Ltd.	software developer 3	Job Description Send me Jobs like this Design...	1	1.0
2	Oracle India Pvt. Ltd.	software developer 3	Job Description Send me Jobs like this Design...	2	1.0
3	Oracle India Pvt. Ltd.	software developer 4	Job Description Send me Jobs like this Design...	2	1.0
4	Oracle India Pvt. Ltd.	software developer 3	Job Description Send me Jobs like this Design...	1	1.0
11	Oracle India Pvt. Ltd.	software developer 3	Job Description Send me Jobs like this Design...	1	1.0
9	Oracle India Pvt. Ltd.	software developer 4	Job Description Send me Jobs like this Design...	2	1.0
14	SYNEMTRICS SOLUTIONS	software developer	Job Description Send me Jobs like this We ar...	1	1.0
12	WeMakeScholars Edtech Pvt. Ltd	software developer	Job Description Send me Jobs like this Requi...	1	1.0
15	Global Professional Services	software developer	Job Description Send me Jobs like this Must...	1	1.0
13	Oracle India Pvt. Ltd.	software developer 4	Job Description Send me Jobs like this Design...	2	1.0
18	Waveaxis	software developer	Job Description Send me Jobs like this Job d...	1	1.0
19	Waveaxis	software developer	Job Description Send me Jobs like this Job d...	1	1.0
16	NavSemi Technologies Pvt Ltd	software developer	Job Description Send me Jobs like this Job D...	1	1.0
17	NavSemi Technologies Pvt Ltd	software developer	Job Description Send me Jobs like this Job D...	1	1.0
20	EXALT CONSULTING PVT. LTD	software developer	Job Description Send me Jobs like this 1 to ...	0	1.0

For Software Developer resume.

id	company	job_title	jobdescription	experience_range	is_grad
4	Kinesis Management Consultant Pvt. Ltd	java developers	Job Description Send me Jobs like this Core ...	1	1.0
0	Kinesis Management Consultant Pvt. Ltd	java developers	Job Description Send me Jobs like this Core ...	1	1.0
1	Kinesis Management Consultant Pvt. Ltd	java developers	Job Description Send me Jobs like this Core ...	1	1.0
2	Kinesis Management Consultant Pvt. Ltd	java developers	Job Description Send me Jobs like this Core ...	1	1.0
3	Kinesis Management Consultant Pvt. Ltd	java developers	Job Description Send me Jobs like this Core ...	1	1.0
6	Confidential	sr.java developer	Job Description Send me Jobs like this 3 - 5...	1	1.0
10	Technosoft Global Services Pvt Ltd	java developer	Job Description Send me Jobs like this 5+ ye...	1	1.0
8	executive-teams.com	java developers	Job Description Send me Jobs like this knowl...	0	1.0
9	executive-teams.com	java developers	Job Description Send me Jobs like this knowl...	0	1.0
7	executive-teams.com	java developers	Job Description Send me Jobs like this knowl...	0	1.0
13	TQuanta Technologies Pvt. Ltd.	java developer	Job Description Send me Jobs like this compa...	1	1.0
11	Melstar Information Technologies Ltd	java developer	Job Description Send me Jobs like this Job D...	1	1.0
12	Melstar Information Technologies Ltd	java developer	Job Description Send me Jobs like this Job D...	1	1.0
19	Exadata Consulting Pvt Ltd	java developers	Job Description Send me Jobs like this Job D...	1	1.0
15	RA Info	java developer	Job Description Send me Jobs like this Job D...	1	1.0
14	Ankit Bhatnagar Consultant	java developer	Job Description Send me Jobs like this java ...	0	1.0
24	Unitforce technologies Pvt. Ltd.	java developer	Job Description Send me Jobs like this J2EE ...	1	1.0
22	Unitforce technologies Pvt. Ltd.	java developer	Job Description Send me Jobs like this J2EE ...	1	1.0
23	Unitforce technologies Pvt. Ltd.	java developer	Job Description Send me Jobs like this J2EE ...	1	1.0
25	Clematis Technology Solutions India Pvt Ltd	java developer	Job Description Send me Jobs like this Job D...	1	1.0

For java developer resume

index	Resume_title	description	work_experiences
17	17	php developer more than 3.5+ years of experience in deve...	{0: [{"wtitle': 'php developer'}, {'wcompany':...
1	1	php developer	{0: [{"wtitle': 'php developer'}, {'wcompany':...
3	3	php developer	{0: [{"wtitle': 'php developer'}, {'wcompany':...
266	266	php developer 1 year of experience in developing web bas...	{0: [{"wtitle': 'php developer'}, {'wcompany':...
8	8	php developer to secure a challenging position where i can e...	{0: [{"wtitle': 'php developer'}, {'wcompany':...
31	31	php developer to secure a challenging position that utilizes...	{0: [{"wtitle': 'php developer'}, {'wcompany':...
134	134	php developer	{0: [{"wtitle': 'php developer'}, {'wcompany':...
9	9	php developer i want to utilize my skills and potential to a...	{0: [{"wtitle': 'php developer'}, {'wcompany':...
187	187	php developer i have extensive knowledge in website deve...	{0: [{"wtitle': 'php developer'}, {'wcompany':...
336	336	php developer 1.9+ year of experience as web developer. ...	{0: [{"wtitle': 'php developer'}, {'wcompany':...

For php developer job

index	Resume_title	description	work_experiences
1	1	java developer looking for a challenging career which demands...	{0: [{"wtitle': 'java developer'}, {'wcompany':...
13	13	java developer teamwork goal oriented interpersonal skills am...	{0: [{"wtitle': 'java developer'}, {'wcompany':...
2	2	java developer	{0: [{"wtitle': 'java developer'}, {'wcompany':...
5	5	java developer attain the position of 'java developer' in fas...	{0: [{"wtitle': 'java developer'}, {'wcompany':...
7	7	java developer knowledgeable with core java implementatio...	{0: [{"wtitle': 'java developer'}, {'wcompany':...
19	19	java developer	{0: [{"wtitle': 'java developer'}, {'wcompany':...
16	16	java developer	{0: [{"wtitle': 'java developer'}, {'wcompany':...
17	17	java developer my recent objective is to work with the compan...	{0: [{"wtitle': 'java developer,angular devel...', 'wcompany':...}
11	11	java developer	{0: [{"wtitle': 'java developer'}, {'wcompany':...
0	0	java developer to prove myself dedicated, worthy and energeti...	{0: [{"wtitle': 'java developer'}, {'wcompany':...

For java developer job

Multi-arm bandits

Reward function:

First, for a given job/resume using fuzzy-wuzzy library we filtered out the resumes/jobs having resume/job title similar to the given job/resume title.

And then, we considered those obtained filtered resumes/jobs as arms.

The algorithm is going to run for $20 * (\text{number of arms})$ times. In each iteration we will calculate the new reward.

$$\text{Reward} = \frac{1}{\sqrt{\sum_{i=1}^k (v_{\text{job}_i} - v_{\text{resume}_i})^2}}$$

Multi-arm bandits

UCBMultiArmedBandit Class:

Initialize the UCBMultiArmedBandit class:

- Define a class `UCBMultiArmedBandit` with an `__init__` method that initializes the bandit with arms.
- Initialize attributes like `arms`, `num_arms`, `num_iterations`, `action_counts`, `total_rewards`, and `Q_values`.

Select Arm Method:

- Create a method `select_arm(iteration)` that implements the Upper Confidence Bound (UCB) algorithm to select an arm.
- Calculate UCB values for each arm based on exploration terms and Q values.
- Return the arm with the highest UCB value.

Update Method:

- Create a method `update(chosen_arm, reward)` to update the bandit's state based on the chosen arm and received reward.
- Increment the action count for the chosen arm, update total rewards, and calculate new Q values.

Multi-arm bandits outputs (job recommendation)

```
-----  
3690 2092      Ankit Bhatnagar Consultant  
5086 2789      Ankit Bhatnagar Consultant  
5194 2855      New Era India Consultancy Pvt. Ltd.  
6155 3392      CRAVAKA Info Systems Pvt Ltd  
19350 10929     Larsen & Toubro Limited  
20623 11827     Ankit Bhatnagar Consultant  
27827 15903     SA Technologies  
27881 16334     Avenues India Pvt. Ltd.  
32891 18843     Genx Info Technologies Pvt. Ltd  
32892 18843     Genx Info Technologies Pvt. Ltd  
  
                           education experience \  
3690 UG: Any Graduate - Any Specialization PG:Any P... 0  
5086 UG: Any Graduate - Any Specialization PG:Any P... 0  
5194 UG: Any Graduate - Any Specialization, Graduat... 7  
6155 UG: Any Graduate PG:Any Postgraduate Doctorate... 1  
19350 UG: Any Graduate - Any Specialization, B.Tech/... 3  
20623 UG: Any Graduate - Any Specialization PG:Any P... 2  
27827 UG: Any Graduate - Any Specialization, Graduat... 3  
27881 UG: Any Graduate PG:Any Postgraduate Doctorate... 2  
32891 UG: B.Tech/B.E. PG:M.Tech Doctorate:Any Doctor... 2  
32892 UG: B.Tech/B.E. PG:M.Tech Doctorate:Any Doctor... 2  
  
                           industry \  
3690 IT-Software / Software Services  
5086 Automobile / Auto Ancillary / Auto Components  
5194 BPO / Call Centre / ITES  
6155 IT-Software / Software Services  
19350 IT-Software / Software Services  
20623 Textiles / Garments / Accessories  
27827 IT-Software / Software Services  
27881 Recruitment / Staffing  
32891 IT-Software / Software Services  
32892 IT-Software / Software Services  
  
                           jobdescription          jobtitle \  
3690 Job Description Send me Jobs like this java ...  java developer  
5086 Job Description Send me Jobs like this java ...  java developer  
5194 Job Description Send me Jobs like this Job D... sr. java developer  
6155 Job Description Send me Jobs like this Id de...  java developers  
19350 Job Description Send me Jobs like this We ha...  java developer  
20623 Job Description Send me Jobs like this java ...  java developers  
27827 Job Description Send me Jobs like this SA Te...  java developer  
27881 Job Description Send me Jobs like this Respo...  java developer  
32891 Job Description Send me Jobs like this Excel...  java developer  
32892 Job Description Send me Jobs like this Excel...  java developer
```

Top 10 jobs for a resume having the resume title as ‘java developer’

Multi-arm bandits outputs (resume recommendation)

```
1 index      Resume_title      City   location \
2 1269    1269    php developer Bengaluru 16
3 1442    1442    php developer NONE   1
4 1578    1570    sr php developer Bhopal 19
5 5386    5386    php developer Pune   20
6 6603    6603    php developer Pune   20
7 9294    9294    sr php developer Ahmedabad 11
8 9673    9673    sr. php developer Pune   20
9 10270   10270   php developer Bengaluru 16
10 10443   10443   php developer NONE   1
11 10571   10571   sr php developer Bhopal 19
12
13             Description \
14 1269    job title: php developer, .net developer \
15 1442    to be associated with an organization that pro...
16 1578    to work in an organization, where innovation a...
17 5386
18 6603
19 9294    7 year experience as php developer good in wor...
20 9673    having 2.2 years of experience as nodejs, php...
21 10270   job title: php developer, .net developer
22 10443   to be associated with an organization that pro...
23 10571   to work in an organization, where innovation a...
24
25             work_experiences \
26 1269   {0: [{"wtitle": "php developer"}, {"wcompany": ...
27 1442   {0: [{"wtitle": "php developer"}, {"wcompany": ...
28 1578   {0: [{"wtitle": "sr php developer"}, {"wcompany": ...
29 5386   {0: [{"wtitle": "php developer"}, {"wcompany": ...
30 6603   {0: [{"wtitle": "php developer"}, {"wcompany": ...
31 9673   {0: [{"wtitle": "sr. php developer"}, {"wcompany": ...
32 10270   {0: [{"wtitle": "php developer"}, {"wcompany": ...
33 10443   {0: [{"wtitle": "php developer"}, {"wcompany": ...
34 10571   {0: [{"wtitle": "sr php developer"}, {"wcompany": ...
35
36             Educations \
37 1269   {0: [{"e_title": "B.Tech"}, {"e_schoolname": "...",
38 1442   {0: [{"e_title": "M.Tech in NOORUL ISLAM"}, {...,
39 1578   {0: [{"e_title": "B.E. in Computer Science"}, ...,
40 5386   {0: [{"e_title": "MCA in Business Administrat...},
41 6603   {0: [{"e_title": "MCA in Business Administrat...},
42 9294   {0: [{"e_title": "PGDCA(Postgraduate diploma...},
43 9673   {0: [{"e_title": "Masters in Computer Science...},
44 10270   {0: [{"e_title": "B.Tech"}, {"e_schoolname": "...,
45 10443   {0: [{"e_title": "M.Tech in NOORUL ISLAM"}, {...,
46 10571   {0: [{"e_title": "B.E. in Computer Science"}, ...,
47
48             Skills \
49 1269   ['php', 'bootstrap', 'javascript', 'jquery...', ...
50 1442   ['html', 'php', 'codeigniter', 'python', '...', ...
51 1578   ['html', 'php', 'laravel', 'java', 'jquery', 'a...', ...
52 5386   ['css', 'php', 'codeigniter', 'jquery', 'a...', ...
53 6603   ['css', 'php', 'codeigniter', 'jquery', 'a...', ...
54 9294   ['html', 'laravel', 'tuvar', 'l', 'rifluvar', '...', ...
```

Top 10 resumes for a job with
job title ‘php developer’

Multi arm bandits outputs:

6220	3424	Unitforce technologies Pvt. Ltd.	
7803	4237	RTridentsqa	
13722	7506	Ravinderkhanana.com	
16218	9399	Allroundadsspa	
16218	9288	Entrepreneurs Institute	
20472	11716	Cstone Software Solutions Pvt. Ltd.	
22881	13520	Hari Krishna Exports Pvt Ltd	
27185	15095	Maharaj Games	
27185	16085	Manedas	
28371	16685	Aarav Infotech	
28757	16814	Creative Virtual Ltd	
29413	17124	WebMedia Pvt Ltd	
29413	17124	WebMedia Pvt Ltd	
34282	19573	Savvyonweb Pvt. Ltd.	
34283	19573	Savvyonweb Pvt. Ltd.	
35253	20081	RS IT Services	
35254	20081	RS IT Services	
36200	20514	infiniti techlabs LLP	
		education	experience \
6218	UG: Any Graduate - Any Specialization PG:Any P...	PG: Any P...	3
6218	UG: Any Graduate - Any Specialization PG: Any Po...	PG: Any P...	3
6220	UG: Any Graduate - Any Specialization PG: Any Po...	PG: Any P...	3
7803	UG: B.Tech/B.E. - Any Specialization PG: Any Po...	PG: Any P...	5
13722	UG: Any Graduate - Any Specialization, Graduat...	Graduat...	2
16339	UG: B.Tech/B.E., PG:Post Graduation Not Required	PG: Post Graduation Not Required	2
16339	UG: B.Tech/B.E., PG:Post Graduation Not Required	PG: Post Graduation Not Required	2
20472	UG: B.Tech/B.E., PG:M.Tech Doctorate: Any Doctor...	M.Tech Doctorate: Any Doctor...	2
22881	UG: Any Graduate - Any Specialization PG: Any P...	PG: Any P...	0
27185	UG: B.Tech/B.E., PG:Post Graduation Not Required...	Post Graduation Not Required...	2
27185	UG: B.Tech/B.E., PG:Post Graduation Not Required...	Post Graduation Not Required...	2
28371	UG: Any Graduate PG: Any Postgraduate Doctorate...	Postgraduate Doctorate...	5
28757	UG: B.Tech/B.E., PG: Any Postgraduate Doctorate...	Postgraduate Doctorate...	5
29413	UG: B.Tech/B.E., PG:MCA Doctorate: Any Doctorate...	MCA Doctorate: Any Doctorate...	2
29414	UG: B.Tech/B.E., PG:MCA Doctorate: Any Doctorate...	MCA Doctorate: Any Doctorate...	2
34282	UG: Diploma PG:MCA Doctorate: Any Doctorate - A...	Diploma PG:MCA Doctorate: Any Doctorate - A...	3
34283	UG: Diploma PG:MCA Doctorate: Any Doctorate - A...	Diploma PG:MCA Doctorate: Any Doctorate - A...	3
35253	UG: B.Tech/B.E., PG:M.Tech Doctorate: Any Doctor...	M.Tech Doctorate: Any Doctor...	2
35254	UG: B.Tech/B.E., PG:M.Tech Doctorate: Any Doctor...	M.Tech Doctorate: Any Doctor...	2
36200	UG: Any Graduate - Any Specialization PG:Post ...	Post ...	2
		industry	\
6218	IT-Software / Software Services		
6219	IT-Software / Software Services		
6220	IT-Software / Software Services		
7803	IT-Software / Software Services		
13722	IT-Software / Software Services		
16339	Medical / Healthcare / Hospitals		
16339	Education / Teaching / Training		
16339	Gems / Jewellery		
20472	IT-Software / Software Services		
22881	Gems / Jewellery		
27185	IT-Software / Software Services		
27307	IT-Software / Software Services		
28371	IT-Software / Software Services		
28757	Internet / Ecommerce		
29414	Internet / Ecommerce		
34282	IT-Software / Software Services		
34283	IT-Software / Software Services		
35253	IT-Software / Software Services		
35254	IT-Software / Software Services		
36200	IT-Software / Software Services		
		jobdescription	\
6218	Job Description Send me Jobs like this WMB d...	wmb	developer
6219	Job Description Send me Jobs like this WMB d...	wmb	developer
6220	Job Description Send me Jobs like this WMB d...	wmb	developer
7803	Job Description Send me Jobs like this Web d...	sr. web	developer
13722	Job Description Send me Jobs like this Php d...	php	web developer
16339	Job Description Send me Jobs like this Desig...	web	developer
16618	Job Description Send me Jobs like this Requir...	php	web developer
20472	Job Description Send me Jobs like this Job D...	web	ui developer
22881	Job Description Send me Jobs like this MVC S...	web	developer
27185	Job Description Send me Jobs like this Job D...	web ui	developer
27307	Job Description Send me Jobs like this Job D...	php	web developer

Top 20 jobs recommendation for a resume having title ‘web developer’

Multi arm bandits outputs:

```
index      Resume_title      City   location \
2796      2796  android developer  Bengaluru  16
2802      2802  android developer  Bengaluru  16
3200      3200  android developer  Delhi     9
3288      3288  android developer  Kernal    12
3459      3459  android developer  Surat     11
3517      3517  android developer  Surat     11
5462      5462  android developer  Billaspur 6
7636      7636  android developer  Pune     20
8124      8124  android developer  Pune     20
8129      8129  android developer  Mangalore 16
8262      8262  android developer  Gurgaon  12
13499     13499 android developer  NONE     1
13514     13514 android developer  New Delhi 9
13553     13553 android developer  Billaspur 6
13561     13561 android developer  Pune     20
13592     13592 android developer  Mangalore 16
13610     13610 android developer  Narippatta 17
13641     13641 android developer  Narippatta 17
13721     13721 android developer  Noida     31
13762     13762 android developer  Fatehabad 12
```

```
                                Description \
2796  c o m \nto pursue a highly rewarding career by...
2802  c o m \nto pursue a highly rewarding career by...
3220  i seek a job as an android developer in an it ...
3288  to become a part of a challenging environment ...
3459  to secure a challenging position where, i can ...
3517  to secure a challenging position where, i can ...
5462
7636  á€¢ to achieve success in competitive environm...
8124  over 1.6 years of expertise in java developmen...
8129  á¢ good knowledge object oriented programmin...
8262  a pioneering, security oriented, open source e...
8299
13514 seeking a challenging and rewarding opportunit...
13553
13586  á¢ good knowledge object oriented programmin...
13616  i seek challenging opportunities where i can ...
13641  i seek challenging opportunities where i can f...
13721  to obtain a position that challenges me and pr...
13762  i would like to be a part of an organization w...
```

```
                                work_experiences \
2796  {0: [{"wtitle": "developer"}, {"wcompany": "..."}], ...
2802  {0: {"wtitle": "developer"}, {"wcompany": "..."}}, ...
3220  {0: {"wtitle": "android developer"}, {"wcomp..."}}, ...
3288  {0: {"wtitle": "android developer"}, {"wcomp..."}}, ...
3459  {0: {"wtitle": "android developer"}, {"wcomp..."}}, ...
3517  {0: {"wtitle": "android developer"}, {"wcomp..."}}, ...
5462  {0: {"wtitle": "android developer"}, {"wcomp..."}}, ...
7636  {0: {"wtitle": "android developer"}, {"wcomp..."}}, ...
8124  {0: {"wtitle": "android developer"}, {"wcomp..."}}, ...
8129  {0: {"wtitle": "android developer"}, {"wcomp..."}}, ...
8262  {0: {"wtitle": "android developer"}, {"wcomp..."}}, ...
13499  {0: {"wtitle": "android developer"}, {"wcomp..."}}, ...
13514  {0: {"wtitle": "android developer"}, {"wcomp..."}}, ...
13553  {0: {"wtitle": "android developer"}, {"wcomp..."}}, ...
13586  {0: {"wtitle": "android developer"}, {"wcomp..."}}, ...
13592  {0: {"wtitle": "android developer"}, {"wcomp..."}}, ...
13610  {0: {"wtitle": "android developer"}, {"wcomp..."}}, ...
13641  {0: {"wtitle": "android developer"}, {"wcomp..."}}, ...
13721  {0: {"wtitle": "android developer"}, {"wcomp..."}}, ...
13762  {0: {"wtitle": "android developer"}, {"wcomp..."}}, ...}
```

```
                                Educations \
2796  {0: [{"e_title": "BACHELOR in TECHNOLOGY"}, {"..."}], ...
2802  {0: {"e_title": "BACHELOR in TECHNOLOGY"}, {"..."}}, ...
3220  {0: {"e_title": "B.Tech in Technology and Ma..."}, ...
3288  {0: {"e_title": "B.Tech in Computer Science"}, ...
3459  {0: {"e_title": "BE in Information Technolog..."}, ...
3517  {0: {"e_title": "BE in Information Technolog..."}, ...}
```

Top 20 resume recommendations for a job having title ‘android developer’

Metric for Multi-arm bandits (Regret curve)

Calculation of regret (pseudo code):

Initialize an empty list to store the cumulative rewards.

Initialize an empty list to store the cumulative optimal rewards.

Initialize a variable to store the total regret.

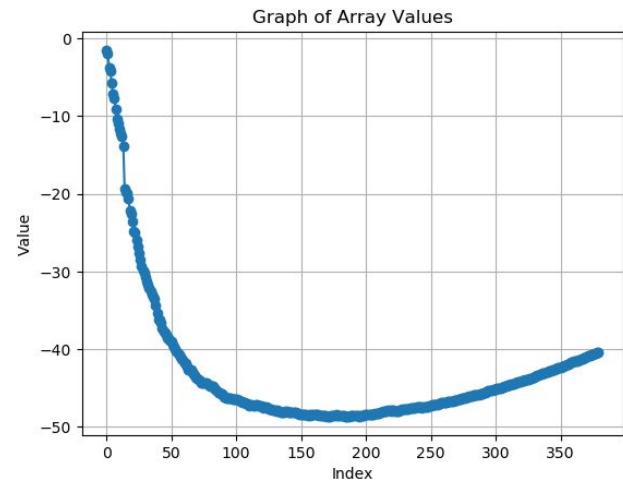
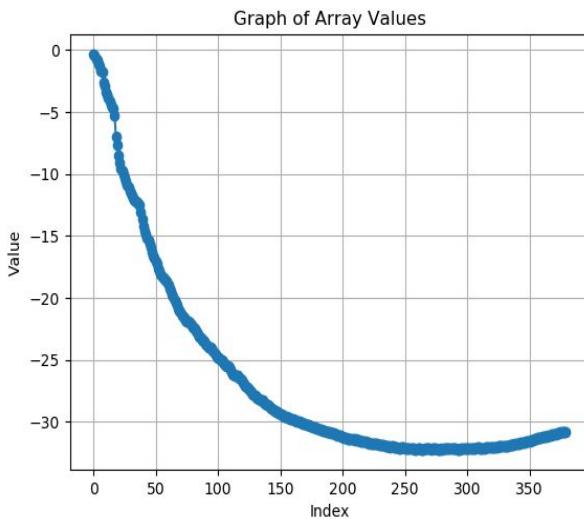
Loop through each reward in the rewards list:

- o Calculate the cumulative reward by summing up all rewards seen so far.
- o Append this cumulative reward to the list of cumulative rewards.
- o Calculate the cumulative optimal reward by multiplying the index of the reward by the optimal reward.
- o Append this cumulative optimal reward to the list of cumulative optimal rewards.

Calculate the regret by subtracting the cumulative rewards from the cumulative optimal rewards.

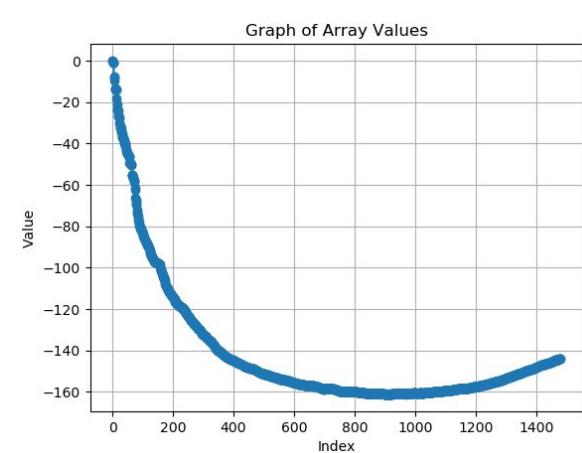
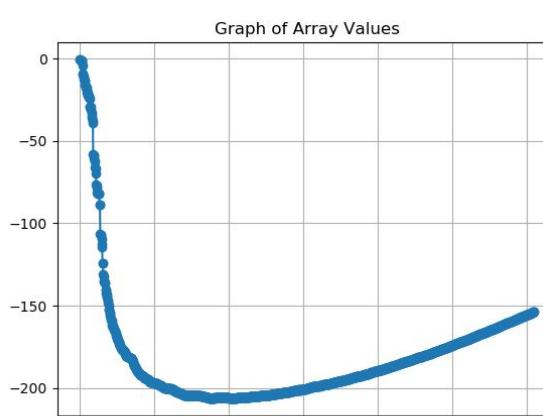
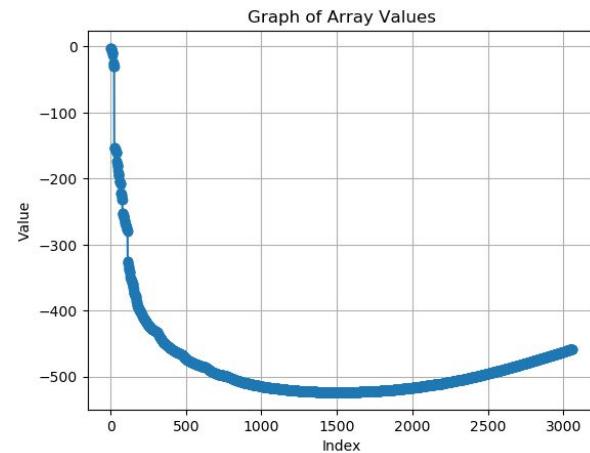
Return the total regret.

Metric for Multi-arm bandits (Regret curve)



Regret curves for sales manager, and sales executive

Metric for Multi-arm bandits (Regret curve)



Regret curves for full stack developer, software developer, web developer

Metric for Multi-arm bandits (Metric using similarity)

We have divided the resumes based upon the resume title and found the recommendations.

We then calculated it's similarity with the input job vector.

The mean of the similarities between the job and the set of recommended resumes of a particular job title is taken as a metric

Metric for Multi-arm bandits (Regret curve)

Job title	Mean similarity
php developer	0.854
software developer	0.711
senior web developer	0.724
Java developer	0.835
Full stack developer	0.787
android developer	0.848
buisiness development executive	0.636
sales manager	0.542
product manager	0.624

Similarity means for each job title

Thank you