

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

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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

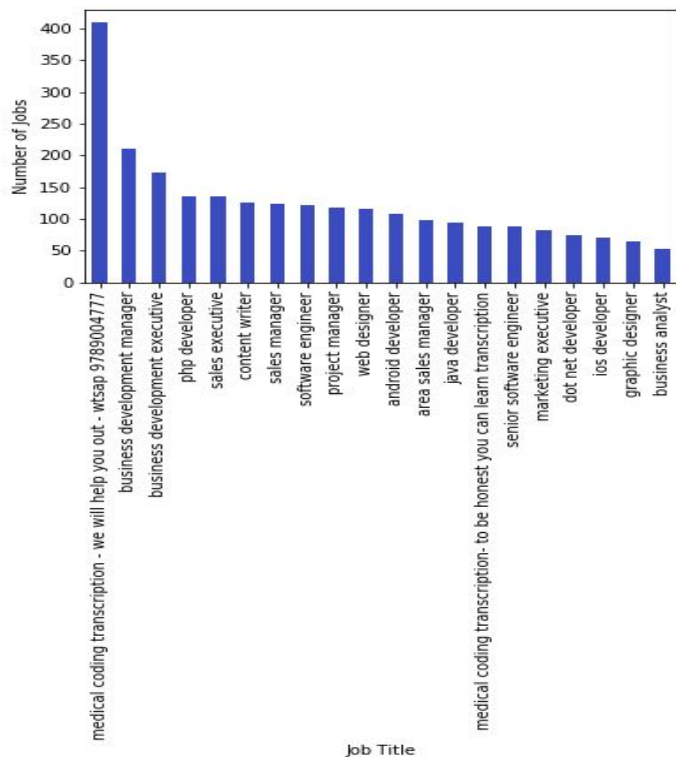
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- **Adaptability:** NLP techniques understand resume and job description nuances, while multi-arm bandits optimize decision-making through continuous learning.
- **Efficiency:** NLP streamlines data processing, and multi-arm bandits optimize resource 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

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index	Resume_title	City	location	Description	work_experiences	Educations	Skills
0	java developer	Tirur	kerala	To prove myself dedicated, worthy and energeti...	{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

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- Concatenated 'job_title', 'job_description', '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 **TfidfVectorizer** 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 Tfidfvectorization 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

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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

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- 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

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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 Desig...	1	1.0
7	Oracle India Pvt. Ltd.	software developer 3	Job Description Send me Jobs like this Desig...	1	1.0
8	Oracle India Pvt. Ltd.	software developer 3	Job Description Send me Jobs like this Desig...	1	1.0
5	Oracle India Pvt. Ltd.	software developer 3	Job Description Send me Jobs like this Desig...	1	1.0
10	Oracle India Pvt. Ltd.	software developer 3	Job Description Send me Jobs like this Desig...	1	1.0
2	Oracle India Pvt. Ltd.	software developer 3	Job Description Send me Jobs like this Desig...	2	1.0
3	Oracle India Pvt. Ltd.	software developer 4	Job Description Send me Jobs like this Desig...	2	1.0
4	Oracle India Pvt. Ltd.	software developer 3	Job Description Send me Jobs like this Desig...	1	1.0
11	Oracle India Pvt. Ltd.	software developer 3	Job Description Send me Jobs like this Desig...	1	1.0
9	Oracle India Pvt. Ltd.	software developer 4	Job Description Send me Jobs like this Desig...	2	1.0
14	SYMENTRICS 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 Desig...	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	TQanta 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	17	php developer	â™Œ more than 3.5+ years of experience in deve...	{0: [{'wtitle': 'php developer'}, {'wcompany:...
1	1	1	php developer		{0: [{'wtitle': 'php developer'}, {'wcompany:...
3	3	3	php developer		{0: [{'wtitle': 'php developer'}, {'wcompany:...
266	266	266	php developer	â€¢ 1 year of experience in developing web bas...	{0: [{'wtitle': 'php developer'}, {'wcompany:...
8	8	8	php developer	to secure a challenging position where i can e...	{0: [{'wtitle': 'php developer'}, {'wcompany:...
31	31	31	php developer	to secure a challenging position that utilizes...	{0: [{'wtitle': 'php developer'}, {'wcompany:...
134	134	134	php developer		{0: [{'wtitle': 'php developer'}, {'wcompany:...
9	9	9	php developer	i want to utilize my skills and potential to a...	{0: [{'wtitle': 'php developer'}, {'wcompany:...
187	187	187	php developer	â€¢ i have extensive knowledge in website deve...	{0: [{'wtitle': 'php developer'}, {'wcompany:...
336	336	336	php developer	â€¢ 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	1	java developer	looking for a challenging career which demands...	{0: [{'wtitle': 'java developer'}, {'wcompany:...
13	13	13	java developer	teamwork goal oriented interpersonal skills am...	{0: [{'wtitle': 'java developer'}, {'wcompany:...
2	2	2	java developer		{0: [{'wtitle': 'java developer'}, {'wcompany:...
5	5	5	java developer	attain the position of 'java developer' in fas...	{0: [{'wtitle': 'java developer'}, {'wcompany:...
7	7	7	java developer	â€¢ knowledgeable with core java implementatio...	{0: [{'wtitle': 'java developer'}, {'wcompany:...
19	19	19	java developer		{0: [{'wtitle': 'java developer'}, {'wcompany:...
16	16	16	java developer		{0: [{'wtitle': 'java developer'}, {'wcompany:...
17	17	17	java developer	my recent objective is to work with the compan...	{0: [{'wtitle': 'java developer,angular devel...
11	11	11	java developer		{0: [{'wtitle': 'java developer'}, {'wcompany:...
0	0	0	java developer	to prove myself dedicated, worthy and energeti...	{0: [{'wtitle': 'java developer'}, {'wcompany:...

For java developer job

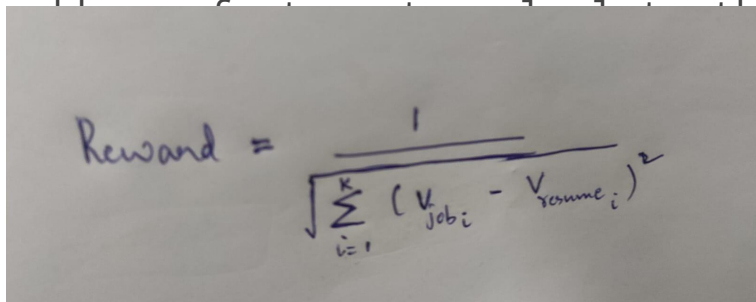
Multi-arm bandits

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 $20 \times (\text{number of arms})$ times. In each iteration we



A photograph of a piece of paper with a handwritten formula for the reward function. The formula is:

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

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
27027 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
27027 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
27027 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 In 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
27027 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	php developer	Bengaluru	16	
3	1442	php developer	NONE	1	
4	1570	sr php developer	Bhopal	19	
5	5306	php developer	Pune	20	
6	6063	php developer	Pune	20	
7	9294	sr php developer	Ahmedabad	11	
8	9673	sr. php developer	Pune	20	
9	10270	php developer	Bengaluru	16	
10	10443	php developer	NONE	1	
11	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	1570	to work in an organization, where innovation a...			
17	5306				
18	6063				
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					work_experiences \
25					
26	1269	{0: [{'wtitle': 'php developer'}, {'wcompany':...			
27	1442	{0: [{'wtitle': 'php developer'}, {'wcompany':...			
28	1570	{0: [{'wtitle': 'sr php developer'}, {'wcompa...			
29	5306	{0: [{'wtitle': 'php developer'}, {'wcompany':...			
30	6063	{0: [{'wtitle': 'php developer'}, {'wcompany':...			\9294 {0: [{'wtitle': 'sr php developer'}, {'wcompa...
31	9673	{0: [{'wtitle': 'sr. php developer'}, {'wcomp...			
32	10270	{0: [{'wtitle': 'php developer'}, {'wcompany':...			
33	10443	{0: [{'wtitle': 'php developer'}, {'wcompany':...			
34	10571	{0: [{'wtitle': 'sr php developer'}, {'wcompa...			
35					Educations \
36					
37	1269	{0: [{'e_title': 'B.Tech'}, {'e_schoolname':...			
38	1442	{0: [{'e_title': 'M.Tech in NOORUL ISLAM'}, {...			
39	1570	{0: [{'e_title': 'B.E. in Computer Science'},...			
40	5306	{0: [{'e_title': 'MCA in Business Administrat...			
41	6063	{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	1570	['html', 'php', 'laravel', 'java', 'jquery']			
52	5306	['css', 'php', 'codeigniter', 'jquery', 'a...			
53	6063	['css', 'php', 'codeigniter', 'jquery', 'a...			
54	9294	['', 'laravel', 'kernal', '']			

Top 10 resumes for a job with job title 'php developer'

Multi arm bandits outputs:

```

6220 3424 Unitforce technologies Pvt. Ltd.
7803 4237 Tridentssa
13722 7506 Ravinderkhurana.com
16339 9089 Allure medspa
16618 9288 Entrepreneurs Institute
20472 11716 CStone Software Solutions Pvt. Ltd.
22881 13520 Hari Krishna Exports Pvt Ltd
27185 15995 Maharaja Games
27307 16053 Encoders
28371 16605 Arav Infotech
28757 16014 Creative Virtual Ltd
29413 17124 WATMedia Pvt Ltd
29414 17124 WATMedia 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

6218 UG: Any Graduate - Any Specialization PG:Any P... experience \
6219 UG: Any Graduate - Any Specialization PG:Any P... 3
6220 UG: Any Graduate - Any Specialization PG:Any P... 3
7803 UG: B.Tech/B.E. - Any Specialization PG:Any P... 3
13722 UG: Any Graduate - Any Specialization, Graduat... 2
16339 UG: B.Tech/B.E. PG:Post Graduation Not Required 2
16618 UG: B.Tech/B.E. PG:Post Graduation Not Required 2
20472 UG: B.Tech/B.E. PG:M.Tech Doctorate:Any Doctor... 2
22881 UG: Any Graduate - Any Specialization PG:Any P... 0
27185 UG: B.Tech/B.E. PG:Post Graduation Not Require... 2
27307 UG: B.Tech/B.E. PG:Post Graduation Not Require... 2
28371 UG: Any Graduate PG:Any Postgraduate Doctorate... 3
28757 UG: B.Tech/B.E. PG:Any Postgraduate Doctorate:... 2
29413 UG: B.Tech/B.E. PG:MCA Doctorate:Any Doctorate... 2
29414 UG: B.Tech/B.E. PG:MCA Doctorate:Any Doctorate... 2
34282 UG: Diploma PG:MCA Doctorate:Any Doctorate - A... 3
34283 UG: Diploma PG:MCA Doctorate:Any Doctorate - A... 2
35253 UG: B.Tech/B.E. PG:M.Tech Doctorate:Any Doctor... 2
35254 UG: B.Tech/B.E. PG:M.Tech Doctorate:Any Doctor... 2
36200 UG: Any Graduate - Any Specialization PG:Post ... 2

6218 IT-Software / Software Services industry \
6219 IT-Software / Software Services
6220 IT-Software / Software Services
7803 IT-Software / Software Services
13722 IT-Software / Software Services
16339 Medical / Healthcare / Hospitals
16618 Education / Teaching / Training
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
29413 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

6218 Job Description Send me Jobs like this WMB d... jobtitle \
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 a... sr. web developer
13722 Job Description Send me Jobs like this Php ... php web developer
16339 Job Description Send me Jobs like this Desig... web developer
16618 Job Description Send me Jobs like this Requi... php web developer
20472 Job Description Send me Jobs like this Job D... web developer
22881 Job Description Send me Jobs like this HVC 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
3220	3220	android developer	Delhi	9
3288	3288	android developer	Karnal	12
3459	3459	android developer	Surat	11
3517	3517	android developer	Surat	11
5462	5462	android developer	Bilaspur	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	Bilaspur	6
13586	13586	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

Top 20 resume recommendations for a job having title 'android developer'

	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	ã€¢ to achieve success in competitive environm...
8124	over 1.6 years of expertise in java developmen...
8129	ã€¢ good knowledge object oriented programming...
8262	a pioneering, security oriented, open source e...
13499	
13514	seeking a challenging and rewarding opportunit...
13553	
13586	
13592	ã€¢ good knowledge object oriented programming...
13610	i seek challenging opportunities where i can f...
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...
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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...

Metric for Multi-arm bandits (Regret curve)

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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:

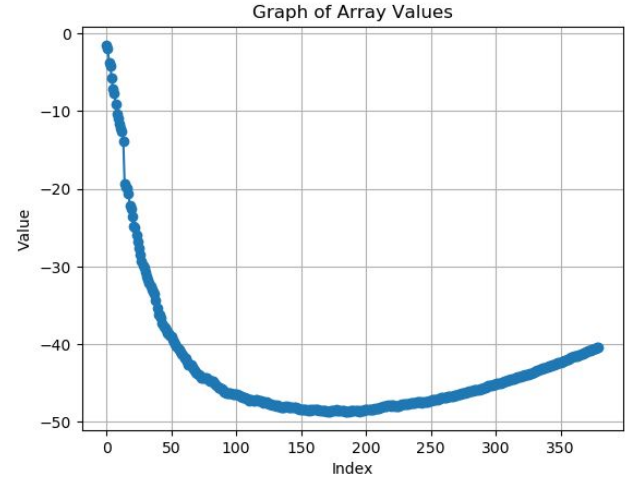
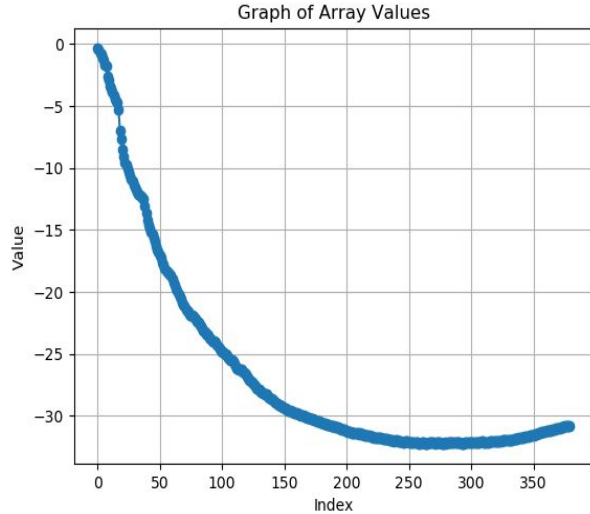
- Calculate the cumulative reward by summing up all rewards seen so far.
- Append this cumulative reward to the list of cumulative rewards.
- Calculate the cumulative optimal reward by multiplying the index of the reward by the optimal reward.
- Append this cumulative optimal reward to the list of cumulative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

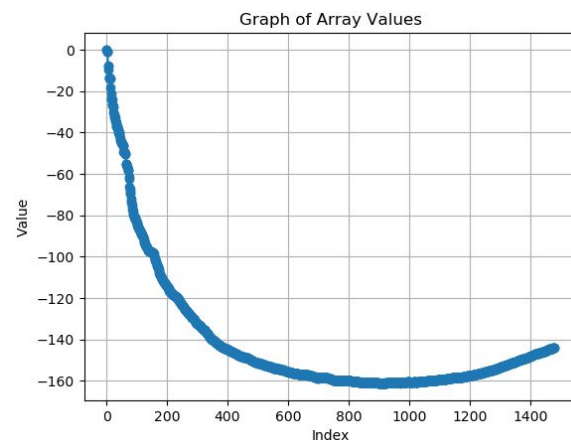
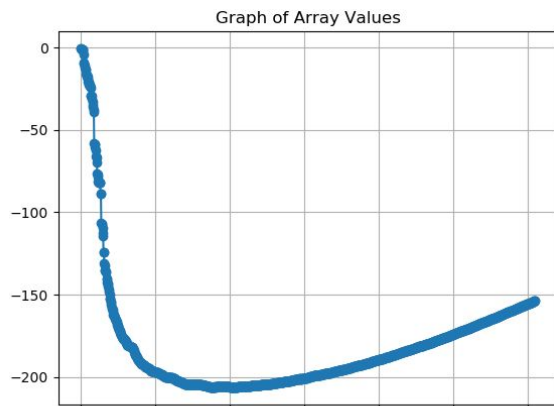
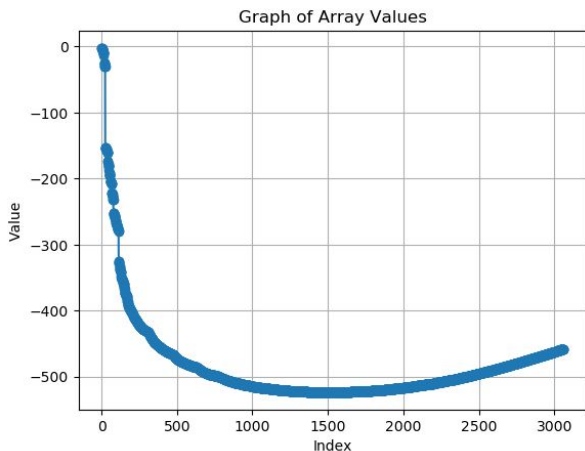
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Regret curves for sales manager, and sales executive

Metric for Multi-arm bandits (Regret curve)

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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)

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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