

LIVE PROJECT REPORT

on

“Event Recommendation System”

BY

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Under the guidance of

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Jayanth G S**

**Supervisor
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Cloud Counselage Pvt. Ltd.

**Machine Learning Internship Live project
(June 2020 – July 2020)**

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Acknowledgement

I have taken efforts in this Event Recommender Machine Learning Project. However, it would not have been possible without the kind support and help of many individuals and organizations

Firstly, I would like to express my indebtedness appreciation to my Project Team Lead Mr. Aarya Bodhankar. His constant guidance and advice played very important role in successful completion of the report.

I would like to express my gratitude towards Project Manager Mr. Jayanth G S for his kind co-operation and encouragement which helped me during the completion of this report.

Also, I wish to thank Mr. Tushar Topale, Mr. Nirbhey Singh Pahwa and all members of Cloud Counselage Pvt. Ltd. for their whole hearted co-operation during this internship.

I would like to say that it has indeed been a fulfilling experience for working out this project.

**Ajinkya Chavan
(Machine Learning Intern)**

Chapter 1. PROBLEM STATEMENT & OBJECTIVES

PROBLEM STATEMENT

One often misses events of interest sheerly due to a lack of awareness at the right time. Cloud Counselage also receives invites for events in multiple domains that need to be forwarded to people with relevant interests.

The aim is to create a Recommender System that recommends only relevant events to each employee and intern based on their preferences, whenever the company receives invites for said events. The system should read new events and autonomously classify them into various domains. It should then match the event with all of those in the company database who have given said domains as a preference. Finally, for each event, the system should output the list of people whose preferences match with the event's detected domain. Create a report documenting your approach and methodology followed.

OBJECTIVES

- To read a set of events as input.
- To classify each event into one or more domains.
- To fetch the employee database with domain and event preferences.
- To match each event with all interested employees.
- To output the list of matching employees per event.

Chapter 2. CONSTRAINTS & POINTS FOR THE OUTPUT

CONSTRAINTS –

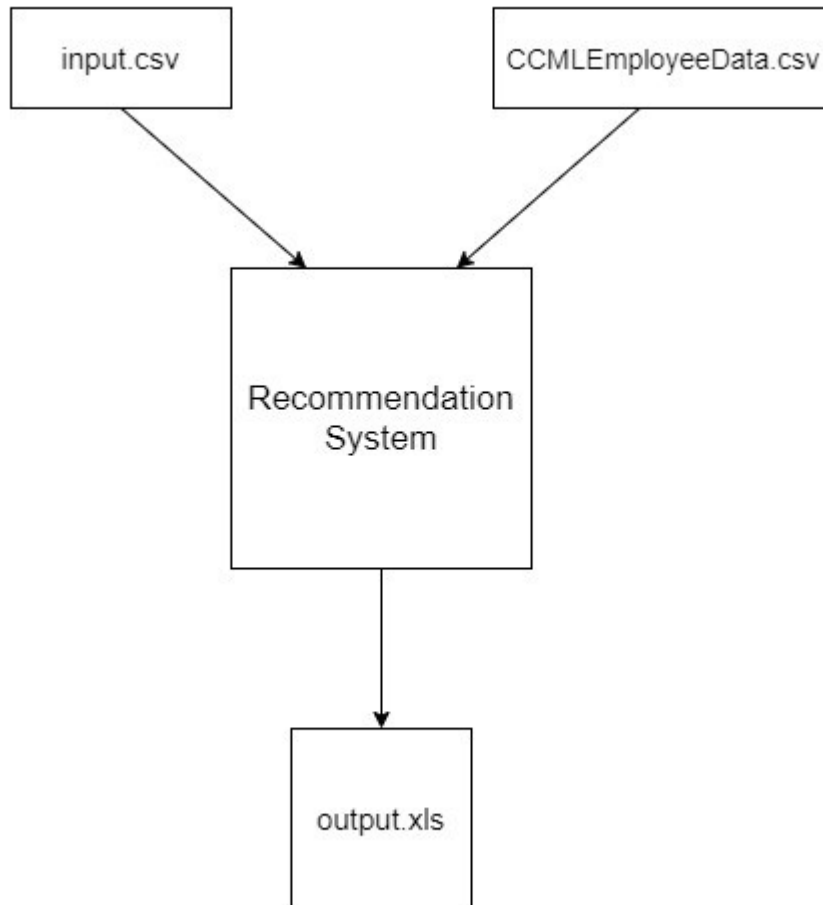
- The system is to be created in Python 3.6 or above.
- The events and employee list to be read shall be provided as a [csv] with 1 event per row.
- You are allowed to use any ML approach, publicly available resources, and additional training data, but the final output should be on the provided list.
- The output shall be in the form of a spreadsheet [xls] having a column for event name and another for the names of people to recommend said event to.
- The output spreadsheet should be auto-generated by the system you create.

POINTS FOR THE OUTPUT –

- The system should handle I/O only as mentioned in order to be evaluated correctly.
- Submission of the complete working code of the designed system to be done.
- Report:
 - Methodology of the overall system.
 - Tools & libraries used for the system.
 - ML approach utilized.
 - Recommended future improvements.

Chapter 3. Design of System

Design Overview

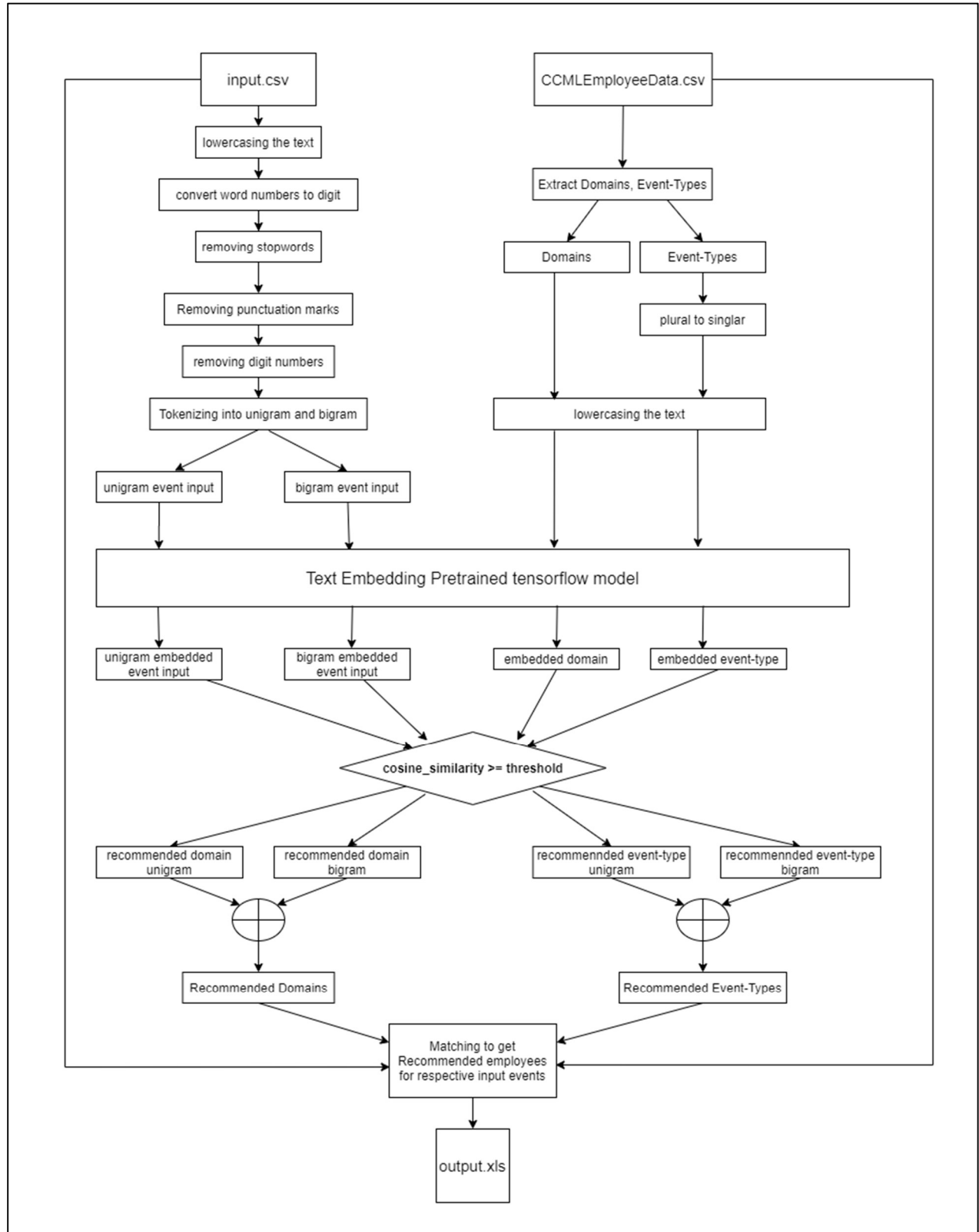


input.csv – csv file consisting of invites of input events in text format with single event invite per row

CCMLEmployeeData.csv – csv file consisting of details of Employee like Name, Domain and Preferred Events (Event1, Event2)

output.xls - output spreadsheet with the first column for input event invites and the second column containing recommended employee names as comma-separated

Project Design Flow Chart



Input1: input.csv

[illegible]

Input2: CCMLEmployeeData.csv

[illegible]

code.ipynb

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```
[6] 1 #importing libraries
2 import pandas as pd
3 import numpy as np
4 import nltk #module for text preprocessing
5 import wordngrams
6 import inflect #module to convert plural text into singular
7 import tensorflow_hub as hub #module to get pretrained tensorflow model
8 from sklearn.metrics.pairwise import cosine_similarity
```

Employee Preference Data Analysis

```
[7] 1 Employee_Preference_Data = pd.read_csv('CCMLEmployeeData.csv')
2 Employee_Preference_Data
```

| | Name | Domain | Event1 | Event2 |
|-----|--------------------|-----------------------|----------------|----------------|
| 0 | Bryan Brock | Management | Jobs | Hackathons |
| 1 | Joseph Sullivan | Coding | Certifications | Webinars |
| 2 | Sherri Dawson | Security | Internships | Fests |
| 3 | Dustin Ferguson | Hardware | Competitions | Webinars |
| 4 | Kayla Young | Web Development | Expos | Certifications |
| ... | ... | ... | ... | ... |
| 178 | Katelyn Barnes | Coding | Courses | Webinars |
| 179 | Gabriel Cruz | Other | Talks | Fests |
| 180 | Christina Williams | Software Architecture | Talks | Fests |
| 181 | William Turner | Development Processes | Trainings | Seminars |
| 182 | Damon Lane | C | Seminars | Internships |

183 rows x 4 columns

code.ipynb

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```
1 Domain = sorted(Employee_Preference_Data.Domain.unique())
2 #print(str(len(Domain)) + ' Total Domains')
3 Domain
```

```
['Artificial Intelligence',
 'Blockchain',
 'C',
 'C++',
 'Cloud Computing',
 'Coding',
 'Data Science',
 'Development Processes',
 'Finance',
 'Hardware',
 'Higher Education',
 'IoT',
 'Java',
 'JavaScript',
 'Machine Learning',
 'Management',
 'Mobile Applications',
 'Networking',
 'Other',
 'Python',
 'Security',
 'Software Architecture',
 'Web Development']
```

```
[9] 1 Event1 = Employee_Preference_Data.Event1.unique()
2 Event1
```

```
array(['Jobs', 'Certifications', 'Internships', 'Competitions', 'Expos', 'Workshops', 'Trainings', 'Seminars', 'Hackathons', 'Fests', 'Talks', 'Webinars', 'Courses'], dtype=object)
```

```
[10] 1 Event2 = Employee_Preference_Data.Event2.unique()
2 Event2
```

```
array(['Hackathons', 'Webinars', 'Fests', 'Certifications', 'Seminars', 'Courses', 'Expos', 'Jobs', 'Trainings', 'Internships', 'Competitions', 'Talks', 'Workshops'], dtype=object)
```

```
[11] 1 Events = set(Event1) | set(Event2)
2 Events = sorted(list(Events))
3 #print(str(len(Events))+ ' Total Events')
4 Events
```

code.ipynb

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Preprocessing Input Events

```
1 input = pd.read_csv('input.csv')
2 input
```

| | input_events |
|----|--|
| 0 | Get a System Administration certification from PurpleHat today. |
| 1 | Lockdown special courses on Ydemi. 22 hours left! |
| 2 | CodeBoost codeathon is live now! |
| 3 | Attend the Computer Vision and Deep Learning Summit tomorrow |
| 4 | AI & Big Data Expo in 36 hours |
| 5 | Book Online Tickets for workshops on C programming |
| 6 | Spoonshot is hiring a Work From Home - Data Science Internship for 6 months in Bengaluru |
| 7 | Java Training in Electronic city Bangalore |
| 8 | Ted Talk in the field of Security |
| 9 | Arrange a Machine Learning Workshop and Internship |
| 10 | Digital Marketing Workshop and Webinar |
| 11 | Advanced Certification in Open Banking from July 2020 |
| 12 | Software development conference is designed for developers, team leads, architects, and project managers |
| 13 | Don't miss the Web Development Course in Pune |
| 14 | Bolt IoT and ML Innovation Training in August |
| 15 | Tech Savvy contest 2020 - The IoT Academy |
| 16 | Talk on the Role of Data analytics and Cloud Computing in Internet of Things 2020 |
| 17 | Four days of hands-on security training followed by the two-day main conference covering the information security research |
| 18 | We are happy to invite you to the much anticipated AngularJS Hackathon! |

code.ipynb

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[13] 17 Four days of hands-on security training followed by the two-day main conference covering the information security research

18 We are happy to invite you to the much anticipated AngularJS Hackathon!

```
1 preprocess = pd.DataFrame(columns=['input'])
2 preprocess['input'] = input.iloc[:,0] #df.iloc[rows,columns] (: means selecting all values of that dimension)
3 #Lower Casing
4 preprocess['input'] = preprocess['input'].str.lower()
5 preprocess
```

| | input |
|----|--|
| 0 | get a system administration certification from purplehat today. |
| 1 | lockdown special courses on ydemi. 22 hours left! |
| 2 | codeboost codeathon is live now! |
| 3 | attend the computer vision and deep learning summit tomorrow |
| 4 | ai & big data expo in 36 hours |
| 5 | book online tickets for workshops on c programming |
| 6 | spoonshot is hiring a work from home - data science internship for 6 months in bengaluru |
| 7 | java training in electronic city bangalore |
| 8 | ted talk in the field of security |
| 9 | arrange a machine learning workshop and internship |
| 10 | digital marketing workshop and webinar |
| 11 | advanced certification in open banking from july 2020 |
| 12 | software development conference is designed for developers, team leads, architects, and project managers |
| 13 | don't miss the web development course in pune |
| 14 | bolt iot and ml innovation training in august |
| 15 | tech savvy contest 2020 - the iot academy |
| 16 | talk on the role of data analytics and cloud computing in internet of things 2020 |
| 17 | four days of hands-on security training followed by the two-day main conference covering the information security research |

code.ipynb

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we are happy to invite you to the much anticipated angularjs hackathon!

1 #Convert word numbers to digit

2 preprocess['input'] = preprocess['input'].apply(lambda row: wordtodigits.convert(row))

3 preprocess

input

0 get a system administration certification from purplehat today.

1 lockdown special courses on ydemi. 22 hours left!

2 codeboost codeathon is live now!

3 attend the computer vision and deep learning summit tomorrow

4 ai & big data expo in 36 hours

5 book online tickets for workshops on c programming

6 spoonshot is hiring a work from home - data science internship for 6 months in bengaluru

7 java training in electronic city bangalore

8 ted talk in the field of security

9 arrange a machine learning workshop and internship

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12 software development conference is designed for developers, team leads, architects, and project managers

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14 bolt iot and ml innovation training in august

15 tech savvy contest 2020 - the iot academy

16 talk on the role of data analytics and cloud computing in internet of things 2020

17 4 days of hands-on security training followed by the two-day main conference covering the information security research

18 we are happy to invite you to the much anticipated angularjs hackathon!

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1 #removing stopwords

2 nltk.download('stopwords')

3 from nltk.corpus import stopwords

4 stop_words = stopwords.words('english')

5 newStopWords = ["day","hour","month","days","months","hours"] #adding more stopwords

6 stop_words.extend(newStopWords)

7 preprocess['input'] = preprocess['input'].apply(lambda x: ' '.join([word for word in x.split() if word not in (stop_words)]))

8 preprocess

[nltk_data] Downloading package stopwords to /root/nltk_data...

[nltk_data] Package stopwords is already up-to-date!

input

0 get system administration certification purplehat today.

1 lockdown special courses ydemi. 22 left!

2 codeboost codeathon live now!

3 attend computer vision deep learning summit tomorrow

4 ai & big data expo 36

5 book online tickets workshops c programming

6 spoonshot hiring work home - data science internship 6 bengaluru

7 java training electronic city bangalore

8 ted talk field security

9 arrange machine learning workshop internship

10 digital marketing workshop webinar

11 advanced certification open banking july 2020

12 software development conference designed developers, team leads, architects, project managers

13 miss web development course pune

14 bolt iot ml innovation training august

15 tech savvy contest 2020 - iot academy

16 talk role data analytics cloud computing internet things 2020

Comment

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1 #Removing punctuation marks with python RegEx(Regular Expression)

2 # [] - A set of characters

3 # \w - Returns a match where the string contains any word characters (characters from a to Z, digits from 0-9, and the underscore _ character)

4 # \s - Returns a match where the string contains a white space character

5 preprocess['input'] = preprocess['input'].str.replace('[^\w\s]','')

6 preprocess

input

0 get system administration certification purplehat today

1 lockdown special courses ydemi 22 left

2 codeboost codeathon live now

3 attend computer vision deep learning summit tomorrow

4 ai big data expo 36

5 book online tickets workshops c programming

6 spoonshot hiring work home data science internship 6 bengaluru

7 java training electronic city bangalore

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14 bolt iot ml innovation training august

15 tech savvy contest 2020 iot academy

16 talk role data analytics cloud computing internet things 2020

17 4 handson security training followed twoday main conference covering information security research

18 happy invite much anticipated angularjs hackathon

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[17] 17 4 handson security training followed twoday main conference covering information security research

18 happy invite much anticipated angularjs hackathon

1 #removing numbers

2 preprocess['input'] = preprocess['input'].str.replace(n'\d+', '')

3 preprocess

input

0 get system administration certification purplehat today

1 lockdown special courses ydemi left

2 codeboost codeathon live now

3 attend computer vision deep learning summit tomorrow

4 ai big data expo

5 book online tickets workshops c programming

6 spoonshot hiring work home data science internship bengaluru

7 java training electronic city bangalore

8 ted talk field security

9 arrange machine learning workshop internship

10 digital marketing workshop webinar

11 advanced certification open banking july

12 software development conference designed developers team leads architects project managers

13 miss web development course pune

14 bolt iot ml innovation training august

15 tech savvy contest 2020 iot academy

16 talk role data analytics cloud computing internet things

17 handson security training followed twoday main conference covering information security research

18 happy invite much anticipated angularjs hackathon

17

18

code.ipynb

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Editing

```
[19] 1 nltk.download('punkt') #module required for ngrams tokenizer
```

[nltk_data] Downloading package punkt to /root/nltk_data...
[nltk_data] Package punkt is already up-to-date!
True

```
1 #FUNCTION to generate n-grams from sentences.  
2 def extract_ngrams(data, num):  
3     n_grams = nltk.ngrams(nltk.word_tokenize(data), num)  
4     return ' '.join(grams for grams in n_grams)
```

```
[71] 1 preprocessUnigram = pd.DataFrame(columns=['input'])  
2 preprocessUnigram['input'] = preprocess['input'].apply(lambda row: extract_ngrams(row, 1))  
3 preprocessUnigram
```

input

| | |
|----|---|
| 0 | [get, system, administration, certification, purplehat, today] |
| 1 | [lockdown, special, courses, ydemi, left] |
| 2 | [codeboost, codeathon, live, now] |
| 3 | [attend, computer, vision, deep, learning, summit, tomorrow] |
| 4 | [ai, big, data, expo] |
| 5 | [book, online, tickets, workshops, c, programming] |
| 6 | [spoonshot, hiring, work, home, data, science, internship, bengaluru] |
| 7 | [java, training, electronic, city, bangalore] |
| 8 | [ted, talk, field, security] |
| 9 | [arrange, machine, learning, workshop, internship] |
| 10 | [digital, marketing, workshop, webinar] |
| 11 | [advanced, certification, open, banking, july] |
| 12 | [software, development, conference, designed, developers, team, leads, architects, project, managers] |
| 13 | [miss, web, development, course, pune] |

code.ipynb

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Editing

```
[71] 17 [handson, security, training, followed, twoday, main, conference, covering, information, security, research]
```

```
18 [happy, invite, much, anticipated, angularjs, hackathon]
```

```
1 preprocessBigram = pd.DataFrame(columns=['input'])  
2 preprocessBigram['input'] = preprocess['input'].apply(lambda row: extract_ngrams(row, 2))  
3 preprocessBigram
```

input

| | |
|----|---|
| 0 | [get system, system administration, administration certification, certification purplehat, purplehat today] |
| 1 | [lockdown special, special courses, courses ydemi, ydemi left] |
| 2 | [codeboost codeathon, codeathon live, live now] |
| 3 | [attend computer, computer vision, vision deep, deep learning, learning summit, summit tomorrow] |
| 4 | [ai big, big data, data expo] |
| 5 | [book online, online tickets, tickets workshops, workshops c, c programming] |
| 6 | [spoonshot hiring, hiring work, work home, home data, data science, science internship, internship bengaluru] |
| 7 | [java training, training electronic, electronic city, city bangalore] |
| 8 | [ted talk, talk field, field security] |
| 9 | [arrange machine, machine learning, learning workshop, workshop internship] |
| 10 | [digital marketing, marketing workshop, workshop webinar] |
| 11 | [advanced certification, certification open, open banking, banking july] |
| 12 | [software development, development conference, conference designed, designed developers, developers team, team leads, leads architects, architects project, project managers] |
| 13 | [miss web, web development, development course, course pune] |
| 14 | [bolt iot, iot ml, ml innovation, innovation training, training august] |
| 15 | [tech savvy, savvy contest, contest iot, iot academy] |
| 16 | [talk role, role data, data analytics, analytics cloud, cloud computing, computing internet, internet things] |
| 17 | [handson security, security training, training followed, followed twoday, twoday main, main conference, conference covering, covering information, information security, security research] |
| 18 | [happy invite, invite much, much anticipated, anticipated angularjs, angularjs hackathon] |

```
code.ipynb
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+ Code + Text
Embedding of Preprocessed Input Events

[73] 1 #Loading Trained Text Embedding Model from TensorFlow
2 embed = hub.load("https://tfhub.dev/google/nlm-en-dim128-with-normalization/2")

[74] 1 #FUNCTION to convert strings in list to lowercase
2 def list_to_lowercase(lst):
3     lst = list(map(lambda x: x.lower(), lst))
4     return lst

1 #smaller case domains
2 domain = list_to_lowercase(Domain)
3 domain

['artificial intelligence',
'blockchain',
'c',
'c++',
'cloud computing',
'coding',
'data science',
'development processes',
'finance',
'hardware',
'higher education',
'iot',
'java',
'javascript',
'machine learning',
'management',
'mobile applications',
'networking',
'other',
'python',
'security',
'software architecture',
'web development']

[76] 1 p = inflect.engine()
```

```
code.ipynb
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1 # Domain names(lowercase) to vector
2 Domain_embedding = Lst_embed(Domain,domain_array)
3 Domain_embedding

{'Artificial Intelligence': array([-0.02381875,  0.05594338, -0.07246269, -0.04354268, -0.04750569, -0.04718925, -0.00347527, -0.24177687, -0.03963751,  0.10682512,  0.06793644, -0.04864619,
'Blockchain': array([-0.2386947, -0.13033912, -0.02230424,  0.16754964,  0.17086451,  0.01366061, -0.05464397, -0.14844342,  0.11602819,  0.06536724,  0.20635279,  0.01682108,  0.07446451,
'c': array([[ 0.10897093,  0.24288498, -0.06894178, -0.06749935,  0.03836131, -0.06195106, -0.05958307,  0.09137953, -0.04330692,  0.0840671, -0.07800891, -0.03113263,  0.17979045, -0.220394
'c++': array([[ 0.1501945, -0.17133737, -0.12377484,  0.10878668, -0.10280805,  0.0079645, -0.24713837, -0.02780441, -0.01580326, -0.0443612, -0.02635937,  0.10729197,  0.16912086, -0.0121
'Cloud Computing': array([[ 0.06871764, -0.04849996,  0.05959907, -0.3425448, -0.05774344, -0.00950237, -0.03983269, -0.01648588,  0.00427261,  0.1026902, -0.03445328, -0.16574496,  0.065666
'Coding': array([[ 0.05052524,  0.00105788, -0.00631633, -0.18456332,  0.01820162,  0.10001083,  0.04069703,  0.06751374, -0.03401529,  0.20247184,  0.02922501, -0.07980989,  0.04662366,  0.1
'Data Science': array([[ 3.47763523e-02, -1.08352964e-04,  2.96027064e-02, -3.32662314e-01, -5.56508554e-02, -0.90822765e-02,  3.04790470e-03, -7.74908544e-02, -3.53782028e-02,  2.90843517e-0
'Development Processes': array([[ 0.05149219,  0.02869743,  0.09930836, -0.21505864, -0.13038935, -0.02573121,  0.07702205,  0.05487201, -0.02785086,  0.09723774,  0.1289215, -0.04856856,  0
'Finance': array([[ 0.04539598,  0.07742774, -0.01175204, -0.17427427, -0.03038105, -0.01174759,  0.06376271, -0.170462, -0.06080452,  0.11998758, -0.05895284,  0.03737804,  0.00129953,  0
'Hardware': array([[ 0.01102832, -0.02941512, -0.03412564, -0.06860974, -0.10581117,  0.10507981,  0.02522494, -0.04470011, -0.0440468, -0.17613949, -0.01948674, -0.15521024,  0.0031336,  0
'Higher Education': array([[ 0.05273758,  0.0472428,  0.20405395, -0.14195247,  0.12265966, -0.11418379,  0.06220371,  0.06696637,  0.01071637,  0.19446593,  0.00716926, -0.0280109, -0.0863
'Iot': array([[ 0.02007552,  0.00136903, -0.13110945, -0.0050544,  0.18150344, -0.06800186,  0.01038195, -0.06715024, -0.07278329,  0.05227078,  0.0098061, -0.02461346,  0.15393789,  0.0543
'Java': array([[ 0.12210694, -0.09560563, -0.12665346, -0.10194721,  0.05897449, -0.00052948, -0.18564516, -0.03979788, -0.05308848,  0.14025599, -0.02661561, -0.07824424, -0.02931463,  0.029
'JavaScript': array([[ 2.26013202e-04,  7.49183744e-02,  0.24948121e-03, -6.26126602e-02, -0.55755915e-03, -4.53226501e-03, -1.44275427e-01, -1.63773566e-01, -2.51334682e-02,  1.08984374e-01,
'Machine Learning': array([[ 0.028289,  0.04589714,  0.0226074, -0.15559003, -0.02903215, -0.03614638, -0.00700366, -0.08412965, -0.03474244,  0.19986655,  0.12232368, -0.05199844, -0.0424
'Management': array([[ 0.03525186, -0.00024544, -0.09721833, -0.06670903, -0.14539151,  0.02092699,  0.03531968, -0.04403616,  0.09930138,  0.14607456,  0.04428484,  0.0485478, -0.00139515,
'Mobile Applications': array([[ 2.81758141e-02,  7.37135932e-02,  4.29924221e-05, -2.34760804e-01, -1.42506155e-01, -4.25182432e-02,  2.02752743e-02,  1.76174880e-03, -1.29719630e-01,  8.4574
'Networking': array([[ 0.04057057,  0.00830478, -0.07303292, -0.07318593,  0.0021667,  0.00430497, -0.06123386, -0.0221544,  0.05537353,  0.00453993, -0.02926414, -0.07956603, -0.12045782,
'Other': array([[ 0.23540272,  0.01913304,  0.25682324,  0.01058906,  0.01344088,  0.12033708,  0.02162254, -0.02594936, -0.12162223,  0.16841303, -0.08068004, -0.01976215, -0.15194267, -0.06
'Python': array([[ -1.06131658e-01, -7.7094718e-02, -6.90717921e-02, -1.35485092e-02, -2.2235175e-01,  3.97003517e-02,  1.41466195e-02, -1.84834227e-02, -8.77462476e-02,  2.51306538e-02, -7.
'Security': array([[ 0.02420446,  0.09803227, -0.05078882, -0.03408561, -0.0392679, -0.00227255,  0.08977084, -0.10719674, -0.00812071, -0.1089246,  0.12251689, -0.00493341, -0.00070756,  0
'Software Architecture': array([[ -3.29292342e-02,  3.46402600e-02,  4.60801832e-02, -1.60350263e-01, -0.86081931e-02,  9.14529935e-02,  3.43196355e-02, -1.56675205e-01, -8.72316360e-02,  2.36
'Web Development': array([[ -1.90230943e-02,  8.94087106e-02,  3.52216847e-02, -1.55942708e-01, -0.48749594e-02,  7.09295185e-02,  1.20227179e-02, -1.23092897e-01, -5.38444985e-03,  2.40777148

[84] 1 Event_embedding = Lst_embed(Events, event_array)
2 Event_embedding

{'Certifications': array([[ 0.02622697,  0.1323314, -0.07933656, -0.05958174,  0.02174166,  0.01774574,  0.00393504,  0.15573442,  0.03231861,  0.15558924, -0.02180332,  0.05177488,  0.033965
'Competitions': array([[ 5.07774644e-03, -2.60172356e-02,  0.13311243e-02, -1.68486670e-01, -1.26420725e-02,  6.26014471e-02,  4.83030374e-02,  3.35360502e-02,  5.70703559e-02,  7.81265125e-0
'Courses': array([[ 0.15790348, -0.03566315,  0.1411371, -0.12078588,  0.03002203, -0.00804193,  0.08087523, -0.14295134,  0.00901446,  0.00285627,  0.0041627, -0.1469041, -0.00234847,  0
'Expos': array([[ 0.06797885,  0.10213025,  0.03200351, -0.14943305, -0.04276524,  0.09340724, -0.10232039, -0.08708917,  0.03128403,  0.0146784,  0.07446124,  0.00846831, -0.0197182,  0.04
'Fests': array([[ -2.9851250e-03,  1.70845087e-04, -3.69398668e-03, -1.47656098e-01,  7.08518997e-02,  1.54436782e-01,  0.09863117e-03, -1.21358879e-02,  7.08217472e-02, -4.47226502e-02,  1.0
'Hackathons': array([[ 0.08448447, -0.08690038,  0.01737547, -0.13063666,  0.0365156,  0.1924467, -0.1033833, -0.1312469,  0.09400202,  0.03682772, -0.02903782, -0.19567889,  0.07069533,
'Internships': array([[ 0.04921836,  0.16230248,  0.00969581, -0.10275519, -0.00562412,  0.01912666, -0.03246333,  0.01558187, -0.04663841,  0.13207826, -0.01355816, -0.10491442, -0.02707182,
'Jobs': array([[ 0.070966279,  0.2121143,  0.06845286, -0.12294513, -0.08577138, -0.0419548,  0.10367058, -0.01499175, -0.10232183,  0.13510251,  0.05105727, -0.05052175,  0.0182952,  0.072
'Seminars': array([[ 0.02815981,  0.04580925, -0.00156279, -0.22709666, -0.00210201,  0.01355546, -0.0597565, -0.1233171,  0.0621466,  0.11842612,  0.03241133,  0.08708085,  0.0087204,  0
'Talks': array([[ 0.02636901,  0.07348055, -0.15026888, -0.13660114, -0.11458269, -0.12084925,  0.05603733, -0.07961853,  0.03841748,  0.11091319,  0.02230105, -0.08384051,  0.10176273, -0.03
'Trainings': array([[ 0.02284346,  0.07746359,  0.05419392, -0.110233, -0.06078361, -0.01021589, -0.05705453, -0.11558412, -0.14439464,  0.08361904,  0.08060478, -0.06132473, -0.02996759,
'Webinars': array([[ 0.03103358,  0.00826895, -0.026003, -0.20490265, -0.1443621,  0.08002424, -0.01145732, -0.07125022,  0.01770204,  0.11549333, -0.1429255, -0.05159695, -0.01171616,  0
```


code.ipynb

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```

1 #Mapping Recommendations with Employees and their preference
2 Recommendations = pd.DataFrame(columns=['input','Recommended_Employees'], index=Input.index) #Empty dataframe with same no. of rows as no. of input events
3 for i in range(len(Input)):
4     Recommendations['input'][i] = Input.iloc[i,0]
5     recommended_domains = Domain_Recommendation[Input.iloc[i,0]] # iloc[rows,columns]
6     recommended_events = Event_Recommendation[Input.iloc[i,0]]
7     if (recommended_domains == ['Other']): #condition when no domain detected
8         Recommendations['Recommended_Employees'][i] = pandas_to_string(find_employees_event(recommended_events)) #direct recommendation with event names
9     else:
10         DomainMatchedIndex = find_employees_domain(recommended_domains).index # Getting index of employees with recommended domains
11         EventsMatchedIndex = find_employees_event(recommended_events).index #Getting index of employees with recommended domains
12         RecommendationIndex = DomainMatchedIndex.intersection(EventsMatchedIndex) #Intersection to get Respective Domain Employees with their Preferred events
13         Recommendations['Recommended_Employees'][i] = pandas_to_string(Employee_Preference_Data['Name'][RecommendationIndex])

```

1 Recommendations

| | input | Recommended_Employees |
|---|--|--|
| 0 | Get a System Administration certification from PurpleHat today. | Joshua Miller, Virginia Lucas |
| 1 | Lockdown special courses on Ydemi. 22 hours left! | David Foster, Jennifer Merritt, Robert Ramirez |
| 2 | CodeBoost codeathon is live now! | |
| 3 | Attend the Computer Vision and Deep Learning Summit tomorrow | David Davis, Philip Woods, Jessica Lee, Rebecca Kelley, Melissa Diaz |
| 4 | AI & Big Data Expo in 36 hours | Jessica Terrell |
| 5 | Book Online Tickets for workshops on C programming | Melinda West, Christopher Hernandez, Allison Robinson, Beverly Hayes, Teresa Riley, Gina Diaz, Damon Lane |
| 6 | Spoonshot is hiring a Work From Home - Data Science Internship for 6 months in Bengaluru | Adam Richards, Michael Smith, Daniel Johnson |
| 7 | Java Training in Electronic city Bangalore | Russell Vargas, Corey Beck, Edward Hampton, James Raymond, Melissa Diaz |
| 8 | Ted Talk in the field of Security | Kevin Robbins, Ernest Pierce, Marissa Dawson |
| 9 | Arrange a Machine Learning Workshop and Internship | Dustin Ferguson, David Davis, Philip Woods, Christian Odom, Brian Patterson, Matthew Martinez, Jessica Lee, Tanya Armstrong, Jasmine Brown, Rebecca Kelley, Sharon Mitchell, Stacy Jones, Melissa Diaz |

Output: output.xls

output.xls [Compatibility Mode] - Excel

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| | A | B |
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| | input | Recommended Employees |
| 1 | Get a System Administration certification from PurpleHat today. | Joshua Miller, Virginia Lucas |
| 2 | Lockdown special courses on Ydemi. 22 hours left! | David Foster, Jennifer Merritt, Robert Ramirez |
| 3 | CodeBoost codeathon is live now! | |
| 4 | Attend the Computer Vision and Deep Learning Summit tomorrow | David Davis, Philip Woods, Jessica Lee, Rebecca Kelley, Melissa Diaz |
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| 10 | Arrange a Machine Learning Workshop and Internship | Dustin Ferguson, David Davis, Philip Woods, Christian Odom, Brian Patterson, Matthew Martinez, Jessica Lee, Tanya Armstrong, Jasmine Brown, Rebecca Kelley, Sharon Mitchell, Stacy Jones |
| 11 | Digital Marketing Workshop and Webinar | Kayla Young, Ann Morris, Jacqueline Houston, Donna Hansen, Janice Leonard, Matthew Graham, Micheal Brown, Robert Sanchez |
| 12 | Advanced Certification in Open Banking from July 2020 | Lisa Roberts, Kenneth Martinez, Mrs. Brenda Scott, Todd Smith |
| 13 | Software development conference is designed for developers, team leads. | Joseph Sullivan, Dustin Ferguson, Kayla Young, Ann Morris, David Davis, Jacqueline Houston, Erika Ross, Donna Hansen, Philip Woods, Diana Thomas, Christian Odom, Joshua Calhoun, Peter |
| 14 | Don't miss the Web Development Course in Pune | Edwin Bowman, Michael West, Katherine Gonzalez, Jason Anthony |
| 15 | Boh IoT and ML Innovation Training in August | Curtis Ortega, David Davis, Glenn Martinez, Virginia Lucas, Sharon Buckley, Lisa Thomas, Jennifer Thompson, William Turner |
| 16 | Tech Savvy contest 2020 - The IoT Academy | Dustin Ferguson, David Davis, Tanya Armstrong |
| 17 | Talk on the Role of Data analytics and Cloud Computing in Internet of Things | Diana Thomas, Anthony Williams, Kathryn Odom, Kenneth Diaz, Matthew Graham, Susan Bailey, Michael Smith, Alyssa Davis, Jennifer Walker, Christina Williams |
| 18 | Four days of hands-on security training followed by the two-day main conference | Kayla Young, Deborah Young, Ann Morris, Corey Beck, David Davis, Jacqueline Houston, Donna Hansen, Kevin Robbins, Michelle Miller, Janice Leonard, Michael West, Mrs. Marissa Dixon, Jes |
| 19 | We are happy to invite you to the much anticipated AngularJS Hackathon! | Bryan Brock, David Cox, Julian Sanders, Javier LeBlanc, Angela Hall, Christopher Jones, Jonathan Fowler, Laura Hurst, Valene Peterson, Virginia Lucas, Adam Richards, Matthew Martinez, Tere |
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Sheet1

Chapter 5. CONCLUSION

Thus I have successfully implemented the Event Recommendation System and generated the output as output.xls which contains events names along with the names of employees recommended using Machine Learning, NLP, word2vec, etc.

Recommender systems are a powerful new technology for extracting additional value for a business from its user databases. These systems help users find items they want to buy from a business. Recommender systems benefit users by enabling them to find items they like