Pre-processing

Importing the necessary libraries and the dataset

In [1]:

```
# from google.colab import drive
# drive.mount('/content/drive', force_remount=True)
```

In [1]:

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
%matplotlib inline
```

In [2]:

```
df = pd.read_csv('combined.csv')
df.head()
```

Out[2]:

	Date	Profile URL	First Name	Last Name	Full Name	
0	29/03/2021, 19:22:46	https://www.linkedin.com/in/karteek-pallerla	Karteek	Pallerla (KP)	Karteek Pallerla (KP)	
1	29/03/2021, 19:22:47	https://www.linkedin.com/in/ravitejadupuguntla	Ravi Teja	Dupuguntla	Ravi Teja Dupuguntla	
2	29/03/2021, 19:22:48	https://www.linkedin.com/in/aroonmathai	Aroon	Mathai	Aroon Mathai	
3	29/03/2021, 19:22:48	https://www.linkedin.com/in/shubhanjan-chakrab...	Shubhanjan	Chakrabarty	Shubhanjan Chakrabarty	E
4	29/03/2021, 19:22:49	https://www.linkedin.com/in/varsha-agarwal-8a7...	Varsha	Agarwal	Varsha Agarwal	

5 rows × 28 columns

In [3]:

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 4910 entries, 0 to 4909
Data columns (total 28 columns):
 #   Column                Non-Null Count  Dtype  
---  ------                --------------  -----  
 0   Date                  4910 non-null   object 
 1   Profile URL           4910 non-null   object 
 2   First Name            4834 non-null   object 
 3   Last Name             4833 non-null   object 
 4   Full Name             4834 non-null   object 
 5   Location              3476 non-null   object 
 6   Job Title             4898 non-null   object 
 7   Company Name          4892 non-null   object 
 8   Industry              4900 non-null   object 
 9   Company Location      4910 non-null   object 
 10  Social Handle         326 non-null    object 
 11  Social Network        326 non-null    object 
 12  Websites              676 non-null    object 
 13  New Job (90 Days)     4760 non-null   object 
 14  Current Position      4898 non-null   object 
 15  Job Description       1259 non-null   object 
 16  Month Started         4760 non-null   float64
 17  Year Started          4816 non-null   float64
 18  Profile Headline      4892 non-null   object 
 19  Profile Summary       3465 non-null   object 
 20  School                4658 non-null   object 
 21  Degree                4716 non-null   object 
 22  Education Start       4680 non-null   float64
 23  Education End         4672 non-null   float64
 24  Field of Study        4532 non-null   object 
 25  Shared Connections    4910 non-null   int64  
 26  Degree of Connection  4910 non-null   int64  
 27  Domain                4910 non-null   object 
dtypes: float64(4), int64(2), object(22)
memory usage: 1.0+ MB
```

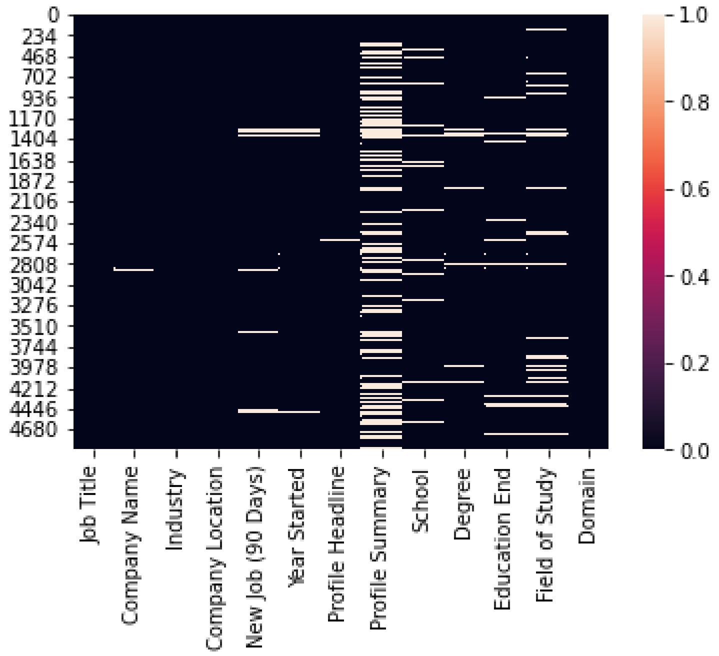
In [4]:

```
df1 = df.drop(['Date','Location','Current Position','Job Description','Education Start
# df1.head()
```

In [5]:

```
sns.heatmap(df1.isnull())
print(df1.isnull().sum())
```

```
Job Title              12
Company Name           18
Industry               10
Company Location        0
New Job (90 Days)     150
Year Started           94
Profile Headline       18
Profile Summary      1445
School                252
Degree                194
Education End         238
Field of Study        378
Domain                  0
dtype: int64
```

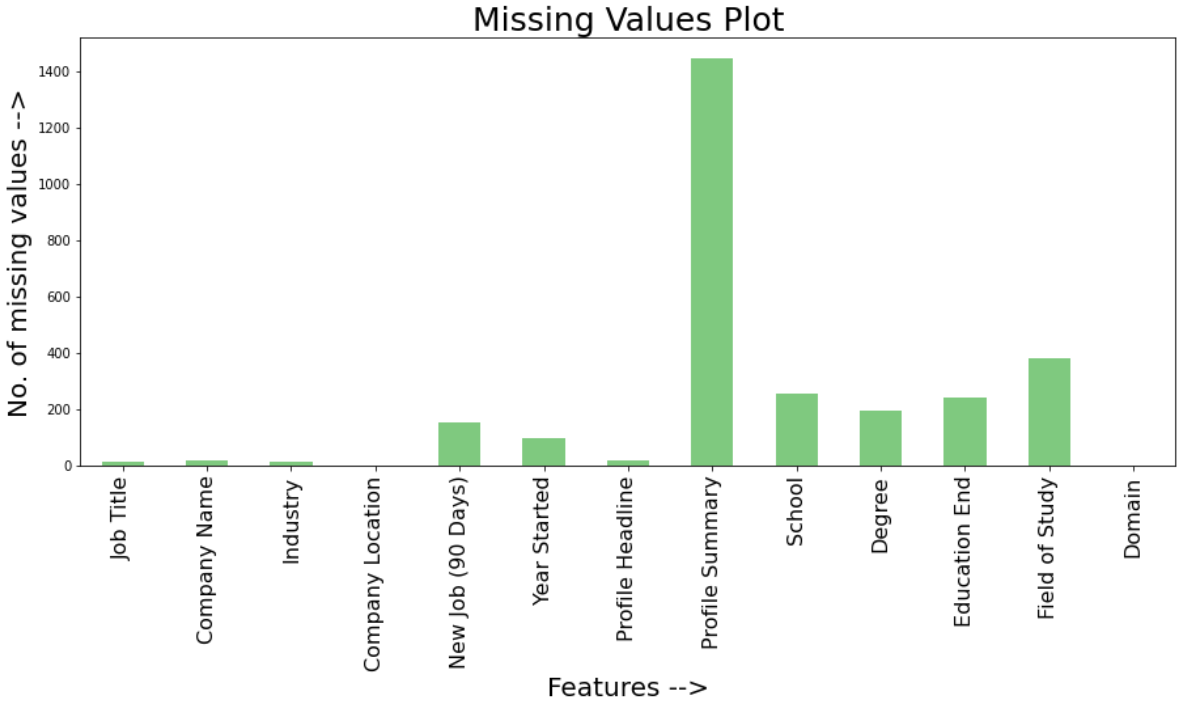


Checking the number of missing values in each coloum before Pre-processing

In [6]:

```
print('Percentage of missing values :')
print(df1.isnull().sum()*100/(df1.notnull().sum()+df1.isnull().sum()))

plt.figure(figsize=(15,6))
df1.isnull().sum().plot(kind='bar', colormap='Accent')
plt.title('Missing Values Plot', fontsize = 25)
plt.xlabel('Features -->', fontsize = 20)
plt.ylabel('No. of missing values -->', fontsize = 20)
plt.xticks(fontsize=16)
plt.show()
```

```
Percentage of missing values :
Job Title               0.244399
Company Name            0.366599
Industry                0.203666
Company Location        0.000000
New Job (90 Days)       3.054990
Year Started            1.914460
Profile Headline        0.366599
Profile Summary        29.429735
School                  5.132383
Degree                  3.951120
Education End           4.847251
Field of Study          7.698574
Domain                  0.000000
dtype: float64
```



Plotting a TreeMap to understand the hierarchy of jobs in the companies

In [7]:

```
import plotly.express as px
import numpy as np
import plotly as plt
import ipywidgets as widgets

plt.offline.init_notebook_mode(connected=True)
```

In [8]:

```
df1['CompanyName']=df1['Company Name']
df1['JobTitle']=df1['Job Title']
df1.JobTitle = df1['JobTitle'].fillna('not_given')
df1.CompanyName = df1['CompanyName'].fillna('not_given')
df1.Industry = df1.Industry.fillna('not_given')
df1['My Network']='network'
```

In [9]:

```
#!pip install --upgrade plotly
```

In [10]:

```
# fig1 = px.treemap(df1, path=['My Network', 'Domain', 'Industry'], width=1000, height
# fig1.show()
# # renderer = "colab"
```

In [11]:

```
# fig2 = px.treemap(df1, path=['My Network', 'Domain', 'JobTitle'], width=1000, height
# fig2.show()
```

In [12]:

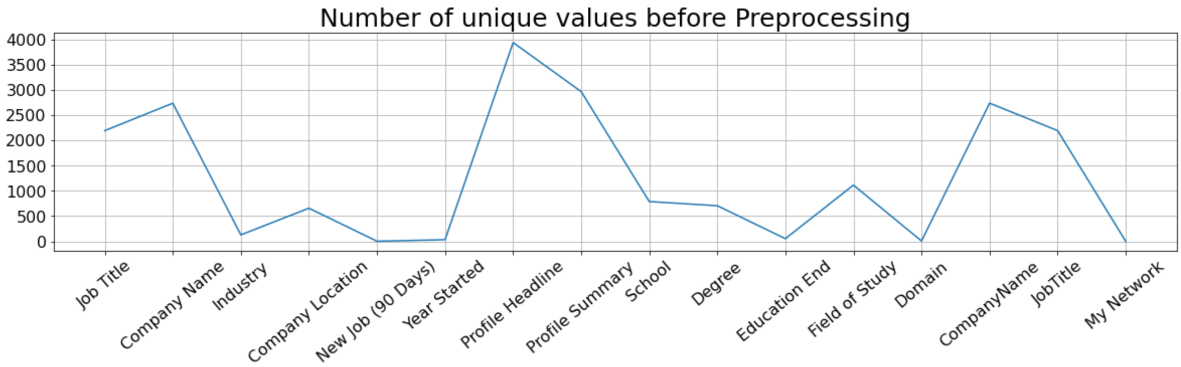
```
# fig2 = px.treemap(df1, path=['My Network', 'Domain', 'JobTitle'], width=1000, height
# fig2.show()

# fig3 = px.treemap(df1, path=['My Network', 'Domain', 'CompanyName'], width=1000, heig
# fig3.show()
```

Checking the number of unique values in each coloum before Pre-processing

In [13]:

```
import matplotlib.pyplot as plt

print(df1.nunique())
plt.figure(figsize=(20,4))
plt.plot(df1.nunique())
plt.grid()
plt.title('Number of unique values before Preprocessing', fontsize = 25)
plt.xticks(fontsize=16, rotation=40)
plt.yticks(fontsize=16)
plt.show()
```

```
Job Title             2194
Company Name          2738
Industry               128
Company Location       657
New Job (90 Days)        2
Year Started            32
Profile Headline      3941
Profile Summary       2968
School                 789
Degree                 706
Education End           53
Field of Study        1115
Domain                   7
CompanyName           2739
JobTitle              2195
My Network               1
dtype: int64
```



Preprocessing the Company Locations column

Two steps:

1. Adding a country column using the location column
2. Adding a continent column using the country column created above

STEP - 1

In [14]:

```
df1['Country'] = df1['Company Location']
```

In [15]:

```
df1['Country'].replace({'Bengaluru, Karnataka' : 'Bengaluru, India',
              'Greater Bengaluru Area' : 'Greater Bengaluru Area, India',
             'Canada | Netherlands' : 'Canada',
             'Mumbai, Maharashtra' : 'Mumbai, Maharashtra, India',
             'Pune': 'Pune, India',
            'Woburn,MA' : 'Woburn, MA, United States',
            'New York City Metropolitan Area': 'New York, United States',
            'Greater Paris Metropolitan Region' : 'Greater Paris Metropolitan Region,
            'Vellore' : 'Vellore, India',
            'Near Kakinada, A.P.': 'Near Kakinada, A.P, India',
            'Greater Leicester Area': 'Greater Leicester Area, England',
            'VIT Vellore' : 'VIT Vellore, India',
           'Greater San Diego Area' : 'Greater San Diego Area, India',
            'Jaipur' : 'Jaipur, India',
            'CHENNAI' : 'CHENNAI, India',
            'Houston, Texas Area' : 'Houston, Texas Area, United States',
            'Raleigh-Durham, North Carolina Area' : 'Raleigh-Durham, North Carolina Ar
            'Vellore, Tamil Nadu' : 'Vellore, Tamil Nadu, India',
            'Bangalore - India' : 'Bangalore, India',
            'pune' : 'pune, India',
            'Ottawa, Canada Area' : 'Ottawa, Canada',
            'Bangalore' : 'Bangalore, India',
            'Chennai, Tamil Nadu' : 'Chennai, Tamil Nadu, India',
            'Russelsheim' : 'Russelsheim, Germany',
            'Seattle, Washington' : 'Seattle, Washington, United States',
           'Tamil Nadu, India and Doha, Qatar' : 'Doha, Qatar',
            'Kochi,India' : 'Kochi, India',
           'Ghandhinagar' : 'Ghandhinagar, India',
            'Raipur' : 'Raipur, India',
            'Tamilnadu' : 'Tamilnadu, India',
            'VIT Vellore ' : 'VIT Vellore , India',
            'Hyderabad ': 'Hyderabad , India',
            'Hosur' : 'Hosur, India',
            'Greater New York City Area' : 'Greater New York City Area, United States'
            'New Delhi, Delhi' : 'New Delhi, Delhi, India',
            'Chennai' : 'Chennai, India',
            'Hyderabad' : 'Hyderabad, India',
            'Greater Noida' : 'Greater Noida, India',
            'Richardson,Texas' : 'Richardson, Texas, United States',
            'Chittoor, Andhra Pradesh' : 'Chittoor, Andhra Pradesh, India',
            'MN,Minnesota' : 'MN, Minnesota, United States',
            'Pantnagar, Uttarakhand' : 'Pantnagar, Uttarakhand, India',
            'Mumbai' : 'Mumbai, India',
            'Lyndhurst new jersey': 'Lyndhurst new jersey, United States',
           'Kalpakkam, Chennai' : 'Kalpakkam, Chennai, India',
           'Surajpur noida' : 'Surajpur noida, India',
            'Wixom, MI' : 'Wixom, MI, United States',
            'Jacksonville, Florida Area' : 'Jacksonville, Florida Area, United States'
            'San Francisco Bay Area' : 'San Francisco Bay Area, United States',
            'Greater Seattle Area' : 'Greater Seattle Area, United States',
            'Greater Sydney Area' : 'Greater Sydney Area, United States',
            'Greater Houston' : 'Greater Houston, United States',
            'Greater Chicago Area' : 'Greater Chicago Area, United States',
            'Dallas-Fort Worth Metroplex' : 'Dallas-Fort Worth Metroplex, United State
            'Charlotte Metro' : 'Charlotte Metro, United States',
            'Greater Cambridge Area' : 'Greater Cambridge Area, England',
            'Other' : 'India',
            'Greater Delhi Area' : 'Greater Delhi Area, India',
            'Greater Chennai Area' : 'Greater Chennai Area, India',
            'Greater Hyderabad Area' : 'Greater Hyderabad Area, India',
            'San Francisco Bay Area' : 'San Francisco Bay Area, United States',
            'Greater Reading Area' : 'Greater Reading Area, United Kingdom',
            'Boise Metropolitan Area' : 'Boise Metropolitan Area, United States',
            'Berlin Metropolitan Area' : 'Berlin Metropolitan Area, Germany',
            'Brabantine City Row' : 'Brabantine City Row, Netherlands',
            'Pune/Pimpri-Chinchwad Area' : 'Pune/Pimpri-Chinchwad Area, India',
            'Greater Coventry Area' : 'Greater Coventry Area, England',
            'Greater Sacramento' : 'Greater Sacramento, United States',
            'Hong Kong SAR' : 'Hong Kong',
            'Geneva Metropolitan Area' : 'Geneva Metropolitan Area, Switzerland',
            'Greater Boston' : 'Greater Boston, United States',
            'Greater Indore Area' : 'Greater Indore Area, India',
            'Detroit Metropolitan Area' : 'Detroit Metropolitan Area, United States',
            'Greater Montreal Metropolitan Area' : 'Greater Montreal Metropolitan Area
            'Greater Tuscaloosa Area' : 'Greater Tuscaloosa Area, United States',
            'Greater Melbourne Area' : 'Greater Melbourne Area, Australia',
            'Gothenburg Metropolitan Area' : 'Gothenburg Metropolitan Area, Sweden',
            'Greater Brisbane Area' : 'Greater Brisbane Area, Australia',
            'Greater Dublin' : 'Greater Dublin, Ireland',
            'Greater Allahabad Area' : 'Greater Allahabad Area, India',
            'Greater Perth Area' : 'Greater Perth Area, Australia',
            'Greater Hamburg Area' : 'Greater Hamburg Area, Germany',
            'Mumbai Metropolitan Region' : 'Mumbai Metropolitan Region, India',
            'Los Angeles Metropolitan Area' : 'Los Angeles Metropolitan Area, India',
            'Greater Vancouver Metropolitan Area' : 'Greater Vancouver Metropolitan Ar
            'Greater Adelaide Area' : 'Greater Adelaide Area, Australia',
            'Greater Kassel Area' : 'Greater Kassel Area, Germany',
            'Greater Barcelona Metropolitan Area' : 'Greater Barcelona Metropolitan Ar
            'Da Nang Metropolitan Area' : 'Da Nang Metropolitan Area, Central Vietnam'
            'Greater Lille Metropolitan Area' : 'Greater Lille Metropolitan Area, Fran
            'Texas Metropolitan Area' : ' Texas Metropolitan Area, United States',
            'Greater Toulouse Metropolitan Area' : 'Greater Toulouse Metropolitan Area
            'Johannesburg Metropolitan Area' : 'Johannesburg Metropolitan Area, South
            'Cincinnati Metropolitan Area' : 'Cincinnati Metropolitan Area, United Sta
            ' South Carolina Area' : 'South Carolina Area, United states',
            'Stockholm Metropolitan Area' : 'Stockholm Metropolitan Area, Sweden',
            'Oregon Metropolitan Area' : ' Oregon Metropolitan Area, United States',
            'Greater Kolkata Area' : 'Greater Kolkata Area, India',
            'Greater Syracuse-Auburn Area' : 'Greater Syracuse-Auburn Area, United Sta
            'Greater Madrid Metropolitan Area' : 'Greater Madrid Metropolitan Area, Sp
            'Greater Newcastle Area' : 'Greater Newcastle Area, England',
            'Cork Metropolitan Area' : 'Cork Metropolitan Area, Ireland',
            'Helsinki Metropolitan Area' : 'Helsinki Metropolitan Area, Finland',
            'Atlanta Metropolitan Area' : 'Atlanta Metropolitan Area, United States',
            'Ghent Metropolitan Area' : 'Ghent Metropolitan Area, Belgium',
            'Washington DC-Baltimore Area' : 'Washington DC-Baltimore Area, United Sta
            'Greater Tampa Bay Area' : 'Greater Tampa Bay Area, United States',
            'New York Metropolitan Area' : ' New York Metropolitan Area, United States
            'Greater Orlando' : 'Greater Orlando, Florida',
            'Greater Minneapolis-St. Paul Area' : 'Greater Minneapolis-St. Paul Area,
           'Greater Munich Metropolitan Area' : 'Greater Munich Metropolitan Area, Ger
            'Stuttgart Region' : 'Stuttgart Region, Germany',
            'Brussels Metropolitan Area' : 'Brussels Metropolitan Area, Belgium',
           'Greater St. Louis' : 'Greater St. Louis, United States',
            'Greater Hartford' : 'Greater Hartford, United States',
            'Greater Edmonton Metropolitan Area' : 'Greater Edmonton Metropolitan Area
            'Frankfurt Rhine-Main Metropolitan Area' : 'Frankfurt Rhine-Main Metropoli
           'Greater Indianapolis' : 'Greater Indianapolis, United States',
            'Denver Metropolitan Area' : 'Denver Metropolitan Area, United States',
            'Greater Bordeaux Metropolitan Area' : 'Greater Bordeaux Metropolitan Area
            'Congo (DRC)' : 'Republic of the Congo',
          'Greater Milwaukee' : 'Greater Milwaukee, United States',
          'Austin, Texas Metropolitan Area' : 'Austin, Texas Metropolitan Area, United
          'Greater Pittsburgh Region' : 'Greater Pittsburgh Region, United States',
          'Antwerp Metropolitan Area' : 'Belgium',
          'Urbana-Champaign Area' : 'Urbana-Champaign Area, United States',
          'Rochester, New York Metropolitan Area' : 'Rochester, New York Metropolitan
          'Greenville-Spartanburg-Anderson, South Carolina Area' : 'Greenville-Spartan
          'Portland, Oregon Metropolitan Area' : 'Portland, Oregon Metropolitan Area,
          'San Antonio, Texas Metropolitan Area' : 'San Antonio, Texas Metropolitan Ar
         'kanchipuram': 'kanchipuram, India'}, inplace = True)
```

In [16]:

```
countries = []
for index, loc in enumerate(df1['Country']):
    if type(loc) != float:
        country = loc.strip().split(',')[-1]
        country = country.rstrip().lstrip()
        countries.append(country)
    else:
        countries.append("not-given")

df1['Country'] = countries
```

In [17]:

```
df1['Country'].unique()
```

Out[17]:

```
array(['United States', 'India', 'Denmark', 'England', 'France',
       'United Arab Emirates', 'United Kingdom', 'Switzerland', 'Germany',
       'Australia', 'Nepal', 'Netherlands', 'Canada', 'Bangladesh',
       'Taiwan', 'Kuwait', 'Singapore', 'Ireland', 'Sweden', 'China',
       'Saudi Arabia', 'Brazil', 'Fiji', 'Hong Kong', 'Uganda',
       'Indonesia', 'Qatar', 'Finland', 'Oman', 'Nigeria', 'New Zealand',
       'Bahrain', 'Belgium', 'Italy', 'Spain', 'Central Vietnam', 'Japan',
       'Malaysia', 'Kenya', 'Thailand', 'South Africa', 'Florida',
       'Norway', 'Luxembourg', 'Mexico', 'Unknown',
       'Republic of the Congo'], dtype=object)
```

In [18]:

```
print("Number of unique countries of country locations: ", df1['Country'].nunique())
```

```
Number of unique countries of country locations:  47
```

In [19]:

```
df1['Country'].value_counts(dropna = False)
```

Out[19]:

```
India                       3913
United States                420
Canada                        77
United Arab Emirates          75
Australia                     75
Germany                       46
United Kingdom                46
France                        26
Netherlands                   25
China                         23
Singapore                     22
Sweden                        17
Qatar                         15
Saudi Arabia                  13
New Zealand                   10
Ireland                       10
Nepal                          8
Belgium                        7
Oman                           6
Denmark                        5
Malaysia                       5
Finland                        5
Kuwait                         5
Spain                          5
England                        4
Switzerland                    4
Bahrain                        4
Taiwan                         3
Italy                          3
Japan                          3
Hong Kong                      3
Norway                         3
Central Vietnam                3
Fiji                           2
Republic of the Congo          2
Nigeria                        2
South Africa                   2
Luxembourg                     2
Bangladesh                     2
Thailand                       2
Mexico                         1
Brazil                         1
Kenya                          1
Florida                        1
Uganda                         1
Indonesia                      1
Unknown                        1
Name: Country, dtype: int64
```

STEP - 2

In [20]:

```
df1['Continent'] = df1['Country']
```

In [21]:

```
# !pip install pycountry_convert
```

In [22]:

```
import pycountry_convert as pc
import pycountry

input_countries = df1['Country'].tolist()
```

In [23]:

```
countries = {}
for country in pycountry.countries:
    countries[country.name] = country.alpha_2
continents = []
codes = [countries.get(country, 'Unknown code') for country in input_countries]
for code in codes:
    if code != 'Unknown code':
        continents.append(pc.country_alpha2_to_continent_code(code))
    else:
        continents.append('unknown')

# print(continents)
df1['Continent'] = continents
```

In [24]:

```
df1['Continent'].unique()
```

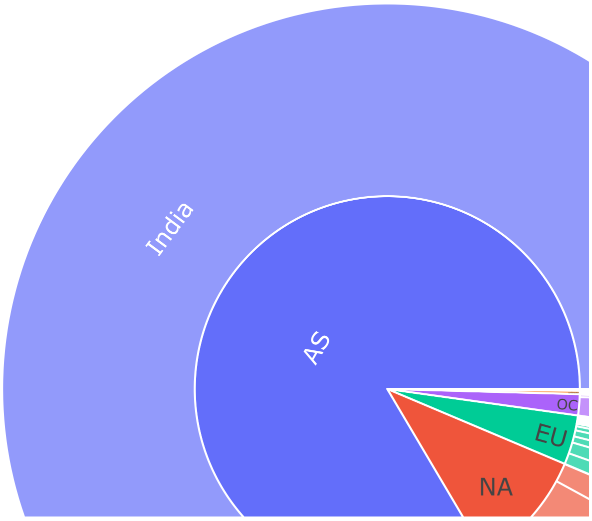
Out[24]:

```
array(['NA', 'AS', 'EU', 'unknown', 'OC', 'SA', 'AF'], dtype=object)
```

Plotting sunbursts to visualise the distribution of companies distributed over continents

In [25]:

```
fig4 = px.sunburst(df1, path=['Continent', 'Country'])
fig4.show()
```



Pre-processing the Job Title coloum

In [26]:

```
df1['Job Title'].value_counts(dropna=False)
```

Out[26]:

```
Project Manager                    348
Product Manager                    217
Analyst                            213
Program Manager                    113
Account Manager                     66
                                  ... 
Trainee decision scientist           1
entertainers and event management    1
Internet of Things Intern            1
Operations Executive                 1
Associate Video Producer             1
Name: Job Title, Length: 2195, dtype: int64
```

In [27]:

```
df['Job Title'].describe()
```

Out[27]:

```
count                4898
unique               2194
top       Project Manager
freq                  348
Name: Job Title, dtype: object
```

In [28]:

```
df['Job Title'].value_counts()
```

Out[28]:

```
Project Manager                      348
Product Manager                      217
Analyst                              213
Program Manager                      113
Account Manager                       66
                                    ...
Trainee decision scientist             1
entertainers and event management      1
Internet of Things Intern              1
Operations Executive                   1
Junior Analyst 2                       1
Name: Job Title, Length: 2194, dtype: int64
```

In [29]:

```
df1['Job Title'].unique()
```

Out[29]:

```
array(['Battery Designer', 'Digital DevOps Engineer', 'Product Designer',
       ..., 'Product Manager Haematology', 'Principal Product Manager',
       'Product Technical Manager at Infosys'], dtype=object)
```

In [30]:

```
df1['JobTitle']=df1['Job Title']
df1['JobTitle'] = df1['JobTitle'].str.replace('[^\w\s]','')
df1['JobTitle']=df1['JobTitle'].str.lower()
df1['JobTitle']=df1['JobTitle'].str.replace(' ','')

df1.JobTitle = df1.JobTitle.fillna('not_given')
```

In [31]:

```
df1.loc[df1.JobTitle.str.contains('manage'), 'JobTitle'] = 'Manager'
df1.loc[df1.JobTitle.str.contains('analys'), 'JobTitle'] = 'Analyst'
df1.loc[df1.JobTitle.str.contains('developer'), 'JobTitle'] = 'Developer'
df1.loc[df1.JobTitle.str.contains('web'), 'JobTitle'] = 'Developer'
df1.loc[df1.JobTitle.str.contains('designer'), 'JobTitle'] = 'Designer'
df1.loc[df1.JobTitle.str.contains('dev'), 'JobTitle'] = 'developer'
df1.loc[df1.JobTitle.str.contains('founder'), 'JobTitle'] = 'Founder'
df1.loc[df1.JobTitle.str.contains('owner'), 'JobTitle'] = 'Founder'
df1.loc[df1.JobTitle.str.contains('intern'), 'JobTitle'] = 'Intern'
df1.loc[df1.JobTitle.str.contains('freelance'), 'JobTitle'] = 'freelancer'
df1.loc[df1.JobTitle.str.contains('associate'), 'JobTitle'] = 'Associate'
df1.loc[df1.JobTitle.str.contains('president'), 'JobTitle'] = 'Board Member'
df1.loc[df1.JobTitle.str.contains('vice'), 'JobTitle'] = 'Board Member'
df1.loc[df1.JobTitle.str.contains('ceo'), 'JobTitle'] = 'Board Member'
df1.loc[df1.JobTitle.str.contains('director'), 'JobTitle'] = 'Board Member'
df1.loc[df1.JobTitle.str.contains('board'), 'JobTitle'] = 'Board Member'
df1.loc[df1.JobTitle.str.contains('engineer'), 'JobTitle'] = 'Engineer'
df1.loc[df1.JobTitle.str.contains('chair'), 'JobTitle'] = 'Board Member'
df1.loc[df1.JobTitle.str.contains('professor'), 'JobTitle'] = 'Professor'
df1.loc[df1.JobTitle.str.contains('officer'), 'JobTitle'] = 'Officer'
df1.loc[df1.JobTitle.str.contains('blogger'), 'JobTitle'] = 'Blogger'
df1.loc[df1.JobTitle.str.contains('scientist'), 'JobTitle'] = 'Research Scientist'
df1.loc[df1.JobTitle.str.contains('research'), 'JobTitle'] = 'PhD Student'
df1.loc[df1.JobTitle.str.contains('phd'), 'JobTitle'] = 'PhD Student'
df1.loc[df1.JobTitle.str.contains('thesis'), 'JobTitle'] = 'PhD Student'
df1.loc[df1.JobTitle.str.contains('core'), 'JobTitle'] = 'Commitee Member'
df1.loc[df1.JobTitle.str.contains('member'), 'JobTitle'] = 'Commitee Member'
df1.loc[df1.JobTitle.str.contains('head'), 'JobTitle'] = 'Team Leader'
df1.loc[df1.JobTitle.str.contains('lead'), 'JobTitle'] = 'Team Leader'
df1.loc[df1.JobTitle.str.contains('admin'), 'JobTitle'] = 'Team Leader'
df1.loc[df1.JobTitle.str.contains('sales'), 'JobTitle'] = 'Sales Representative'
df1.loc[df1.JobTitle.str.contains('market'), 'JobTitle'] = 'Marketing'
df1.loc[df1.JobTitle.str.contains('specialist'), 'JobTitle'] = 'Specialist'
df1.loc[df1.JobTitle.str.contains('edit'), 'JobTitle'] = 'Editor'
df1.loc[df1.JobTitle.str.contains('ambassador'), 'JobTitle'] = 'Product ambassador'
df1.loc[df1.JobTitle.str.contains('campus'), 'JobTitle'] = 'Product ambassador'
df1.loc[df1.JobTitle.str.contains('grapher'), 'JobTitle'] = 'Photographer'
df1.loc[df1.JobTitle.str.contains('assistant'), 'JobTitle'] = 'Assistant'
df1.loc[df1.JobTitle.str.contains('archi'), 'JobTitle'] = 'Architect'
df1.loc[df1.JobTitle.str.contains('creator'), 'JobTitle'] = 'Content Creator'
df1.loc[df1.JobTitle.str.contains('content'), 'JobTitle'] = 'Content Creator'
df1.loc[df1.JobTitle.str.contains('desi'), 'JobTitle'] = 'Product Designer'
df1.loc[df1.JobTitle.str.contains('test'), 'JobTitle'] = 'Sofware tester'
df1.loc[df1.JobTitle.str.contains('rep'), 'JobTitle'] = 'Product Representative'
df1.loc[df1.JobTitle.str.contains('art'), 'JobTitle'] = 'Artist'
df1.loc[df1.JobTitle.str.contains('volunteer'), 'JobTitle'] = 'Volunteer'
df1.loc[df1.JobTitle.str.contains('coordinator'), 'JobTitle'] = 'Coordinator'
df1.loc[df1.JobTitle.str.contains('consult'), 'JobTitle'] = 'Consultant'
df1.loc[df1.JobTitle.str.contains('advi'), 'JobTitle'] = 'Advisor'
df1.loc[df1.JobTitle.str.contains('writ'), 'JobTitle'] = 'Writer'
df1.loc[df1.JobTitle.str.contains('read'), 'JobTitle'] = 'Writer'
df1.loc[df1.JobTitle.str.contains('grow'), 'JobTitle'] = 'Growth Hacker'
df1.loc[df1.JobTitle.str.contains('youtube'), 'JobTitle'] = 'Youtuber'
df1.loc[df1.JobTitle.str.contains('compos'), 'JobTitle'] = 'Composer'
df1.loc[df1.JobTitle.str.contains('executive'), 'JobTitle'] = 'Executive'
df1.loc[df1.JobTitle.str.contains('solution'), 'JobTitle'] = 'Solution Expert'
df1.loc[df1.JobTitle.str.contains('expert'), 'JobTitle'] = 'Product Expert'
df1.loc[df1.JobTitle.str.contains('actor'), 'JobTitle'] = 'Actor'
df1.loc[df1.JobTitle.str.contains('review'), 'JobTitle'] = 'Reviewer'
```

```
df1.loc[df1.JobTitle.str.contains('organize'), 'JobTitle'] = 'Organizer'
df1.loc[df1.JobTitle.str.contains('agent'), 'JobTitle'] = 'Product Agent'
df1.loc[df1.JobTitle.str.contains('promot'), 'JobTitle'] = 'Promoter'
df1.loc[df1.JobTitle.str.contains('student'), 'JobTitle'] = 'Student'
df1.loc[df1.JobTitle.str.contains('communicat'), 'JobTitle'] = 'Communicator'
df1.loc[df1.JobTitle.str.contains('business'), 'JobTitle'] = 'Business Stratergy'
df1.loc[df1.JobTitle.str.contains('retail'), 'JobTitle'] = 'Retailer'
df1.loc[df1.JobTitle.str.contains('public'), 'JobTitle'] = 'Public Relations'
df1.loc[df1.JobTitle.str.contains('secret'), 'JobTitle'] = 'Secretary'
df1.loc[df1.JobTitle.str.contains('trainee'), 'JobTitle'] = 'Trainee'
df1.loc[df1.JobTitle.str.contains('control'), 'JobTitle'] = 'Project Control'
df1.loc[df1.JobTitle.str.contains('project'), 'JobTitle'] = 'Project Control'
df1.loc[df1.JobTitle.str.contains('operat'), 'JobTitle'] = 'Operations'
df1.loc[df1.JobTitle.str.contains('transla'), 'JobTitle'] = 'Translator'
df1.loc[df1.JobTitle.str.contains('tutor'), 'JobTitle'] = 'Tutor'
df1.loc[df1.JobTitle.str.contains('tutor'), 'JobTitle'] = 'Trainer'
df1.loc[df1.JobTitle.str.contains('instruct'), 'JobTitle'] = 'Trainer'
df1.loc[df1.JobTitle.str.contains('media'), 'JobTitle'] = 'Media'
```

In [32]:

```
print("Number of unique Job Titles: ", df1['JobTitle'].nunique())
```

```
Number of unique Job Titles:  177
```

Pre-processing the Industry coloum

In [33]:

```
df1['Industry'].value_counts(dropna=False)
```

Out[33]:

```
Information Technology and Services    785
Computer Software                      554
Internet                               181
Financial Services                     179
Management Consulting                  178
                                      ... 
Fine Art                                 1
Wireless                                 1
Executive Office                         1
Wine and Spirits                         1
Warehousing                              1
Name: Industry, Length: 128, dtype: int64
```

In [34]:

```
df1['Industry'].replace({'Higher Education':'Primary/Secondary Education',
                         'Medical Practice':'Hospital & Health Care',
                         'Mental Health Care':'Hospital & Health Care',
                         'Health, Wellness and Fitness':'Hospital & Health Care',
                         'Medical Devices':'Hospital & Health Care',
                         'Pharmaceuticals':'Hospital & Health Care',
                         'Veterinary':'Hospital & Health Care',
                         'Computer Software':'Information Technology and Services',
                         'Wireless':'Information Technology and Services',
                         'Computer Games':'Information Technology and Services',
                         'Information Services':'Information Technology and Services',
                         'Computer & Network Security':'Information Technology and Serv
                         'Computer Networking':'Information Technology and Services',
                         'Internet':'Information Technology and Services',
                         'Automotive':'Mechanical or Industrial Engineering',
                         'Construction':'Civil Engineering',
                         'Building Materials':'Civil Engineering',
                         'Railroad Manufacture':'Civil Engineering',
                         'Investment Banking':'Banking',
                         'Online Media':'Media Production',
                         'Broadcast Media':'Media Production',
                         'Food & Beverages':'Consumer Goods',
                         'Restaurants':'Consumer Goods',
                         'Wine and Spirits':'Consumer Goods',
                         'Oil & Energy':'Consumer Goods',
                         'Chemicals':'Consumer Goods',
                         'Insurance':'Consumer Services',
                         'Hospitality':'Consumer Services',
                         'Telecommunications':'Consumer Services',
                         'Arts and Crafts':'Consumer Goods',
                         'Newspapers':'Consumer Goods',
                         'Plastics':'Consumer Goods',
                         'Fine Art':'Consumer Goods',
                         'Wholesale':'Consumer Goods',
                         'Paper & Forest Products':'Consumer Goods',
                         'Textiles':'Consumer Goods',
                         'Food Production':'Consumer Goods',
                         'Luxury Goods & Jewelry':'Consumer Goods',
                         'Consumer Electronics':'Consumer Goods',
                         'Staffing and Recruiting':'Consumer Services',
                         'Environmental Services':'Consumer Services',
                         'Financial Services':'Consumer Services',
                         'Events Services':'Consumer Services',
                         'Legal Services':'Consumer Services',
                         'Individual & Family Services':'Consumer Services',
                         'Facilities Services':'Consumer Services',
                         'Supermarkets':'Consumer Goods',
                         'Retail':'Consumer Goods',
                         'Package/Freight Delivery':'Consumer Services',
                         'Import and Export':'International Trade and Development',
                         'International Affairs':'International Trade and Development',
                         'Outsourcing/Offshoring':'International Trade and Development
                         'Transportation/Trucking/Railroad':'Logistics and Supply Chai
                         'Leisure, Travel & Tourism':'Logistics and Supply Chain',
                         'Writing and Editing':'Publishing',
                         'Music':'Entertainment',
                         'Animation':'Entertainment',
                         'Media Production':'Entertainment',
                         'Photography':'Entertainment',
                         'Philanthropy':'Nonprofit Organization Management',
                         'Market Research':'Research',
                         'Think Tanks':'Research',
                         'Computer Hardware':'Consumer Goods',
                         'Apparel & Fashion':'Consumer Goods',
                         'Semiconductors':'Consumer Goods',
                         'Cosmetics':'Consumer Goods',
                         'Packaging and Containers':'Consumer Services',
                         'Public Relations and Communications':'Consumer Services',
                         'Printing':'Consumer Services',
                         'Glass, Ceramics & Concrete':'Consumer Goods',
                         'Machinery':'Consumer Goods',
                         'Utilities':'Consumer Goods',
                         'Shipbuilding':'Consumer Services',
                         'Banking':'Consumer Services',
                         'Motion Pictures and Film':'Entertainment',
                         'Accounting':'Consumer Services',
                         'Human Resources':'Consumer Services',
                         'Translation and Localization':'Consumer Services',
                         'Publishing':'Consumer Services',
                         'Professional Training & Coaching':'Consumer Services',
                         'Program Development':'Consumer Services'

                        },inplace = True)
```

In [35]:

```
df1['Industry'].unique()
```

Out[35]:

```
array(['Mechanical or Industrial Engineering',
       'Information Technology and Services', 'Consumer Goods',
       'Consumer Services', 'Hospital & Health Care', 'Design',
       'Management Consulting', 'Entertainment',
       'Electrical/Electronic Manufacturing', 'Civil Engineering',
       'Education Management', 'Industrial Automation',
       'Primary/Secondary Education', 'Aviation & Aerospace', 'Research',
       'Nonprofit Organization Management', 'Publishing',
       'Marketing and Advertising', 'Real Estate', 'Graphic Design',
       'International Trade and Development', 'Renewables & Environment',
       'Law Practice', 'Biotechnology', 'E-Learning',
       'Architecture & Planning', 'Sports',
       'Venture Capital & Private Equity', 'Logistics and Supply Chain',
       'not_given', 'Public Safety', 'Mining & Metals',
       'Civic & Social Organization', 'Airlines/Aviation',
       'Security and Investigations', 'Media Production',
       'Business Supplies and Equipment', 'Capital Markets',
       'Commercial Real Estate', '-1', 'Warehousing', 'Defense & Space',
       'Investment Management', 'Judiciary', 'Public Policy',
       'Government Administration', 'Farming', 'Banking',
       'Executive Office', 'Nanotechnology'], dtype=object)
```

In [36]:

```
df1['Industry'].value_counts()[0:50]
```

Out[36]:

```
Information Technology and Services     1617
Consumer Services                        481
Consumer Goods                           433
Mechanical or Industrial Engineering     296
Management Consulting                    178
Nonprofit Organization Management        178
Marketing and Advertising                175
Hospital & Health Care                   159
Electrical/Electronic Manufacturing      136
Entertainment                            124
Civil Engineering                        124
Education Management                     122
Biotechnology                            102
E-Learning                                93
Research                                  92
Design                                    85
Primary/Secondary Education               74
Publishing                                57
Logistics and Supply Chain                54
Aviation & Aerospace                      41
Industrial Automation                     36
Media Production                          28
Graphic Design                            26
Renewables & Environment                  24
International Trade and Development       20
Real Estate                               17
Venture Capital & Private Equity          15
Sports                                    13
Business Supplies and Equipment           12
Architecture & Planning                   12
Capital Markets                           11
not_given                                 10
Mining & Metals                            9
-1                                         9
Civic & Social Organization                7
Airlines/Aviation                          7
Investment Management                      6
Commercial Real Estate                     3
Public Safety                              3
Security and Investigations                3
Banking                                    3
Defense & Space                            3
Nanotechnology                             3
Law Practice                               2
Government Administration                  2
Public Policy                              1
Judiciary                                  1
Farming                                    1
Executive Office                           1
Warehousing                                1
Name: Industry, dtype: int64
```

In [37]:

```
df1['Industry'].describe()
```

Out[37]:

```
count                                     4910
unique                                      50
top       Information Technology and Services
freq                                      1617
Name: Industry, dtype: object
```

In [38]:

```
print("Number of unique Industries: ", df1['Industry'].nunique())
```

```
Number of unique Industries:  50
```

Preprocessing the Degree Column

In [39]:

```
df1['Degree'] = df1['Degree'].str.replace('[^\w\s]','')
df1['Degree']=df1['Degree'].str.lower()
df1['Degree']=df1['Degree'].str.replace(' ','')

df1.Degree = df1.Degree.fillna('not_given')
```

In [40]:

```
df1.loc[df1.Degree.str.contains('null'), 'Degree'] = 'null'
df1.loc[df1.Degree.str.contains('bachelor'), 'Degree'] = 'ug'
df1.loc[df1.Degree.str.contains('under'), 'Degree'] = 'ug'
df1.loc[df1.Degree.str.contains('be'), 'Degree'] = 'ug'
df1.loc[df1.Degree.str.contains('btec'), 'Degree'] = 'ug'
df1.loc[df1.Degree.str.contains('bachlors'), 'Degree'] = 'ug'
df1.loc[df1.Degree.str.contains('engineer'), 'Degree'] = 'ug'
df1.loc[df1.Degree.str.contains('bc'), 'Degree'] = 'ug'
df1.loc[df1.Degree.str.contains('mtech'), 'Degree'] = 'pg'
df1.loc[df1.Degree.str.contains('master'), 'Degree'] = 'pg'
df1.loc[df1.Degree.str.contains('mca'), 'Degree'] = 'pg'
df1.loc[df1.Degree.str.contains('mba'), 'Degree'] = 'pg'
df1.loc[df1.Degree.str.contains('business'), 'Degree'] = 'pg'
df1.loc[df1.Degree.str.contains('management'), 'Degree'] = 'pg'
df1.loc[df1.Degree.str.contains('post'), 'Degree'] = 'pg'
df1.loc[df1.Degree.str.contains('ms'), 'Degree'] = 'pg'
df1.loc[df1.Degree.str.contains('ma'), 'Degree'] = 'pg'
df1.loc[df1.Degree.str.contains('pg'), 'Degree'] = 'pg'
df1.loc[df1.Degree.str.contains('mdes'), 'Degree'] = 'pg'
df1.loc[df1.Degree.str.contains('doctor'), 'Degree'] = 'phd'
df1.loc[df1.Degree.str.contains('research'), 'Degree'] = 'phd'
df1.loc[df1.Degree.str.contains('phd'), 'Degree'] = 'phd'
df1.loc[df1.Degree.str.contains('bs'), 'Degree'] = 'ug'
df1.loc[df1.Degree.str.contains('school'), 'Degree'] = 'school'
df1.loc[df1.Degree.str.contains('high'), 'Degree'] = 'school'
df1.loc[df1.Degree.str.contains('ba'), 'Degree'] = 'ug'
df1.loc[df1.Degree.str.contains('graduate'), 'Degree'] = 'ug'
df1.loc[df1.Degree.str.contains('cs'), 'Degree'] = 'ug'
df1.loc[df1.Degree.str.contains('mechanical'), 'Degree'] = 'ug'

df1['Degree'] = df1['Degree'].str.replace('ugprofessionalyearug', 'ug')

df1['Degree'].replace({'byech':'ug','executiveeducation':'pg','me':'pg','sslc':'school
                       'preuniversity':'school','10thboards':'school','intermediate':'
                       'student':'school','12th':'school','preuniversitycource':'schoo
                       'ece':'ug','grduate':'ug','thesis':'phd','llicenciatura':'other
                       'pncandkrdegreecollege':'ug', 'arts':'ug',
       'onlinesaleinindia':'other',
       'certificateprogramme':'other',
       'financialmodellingandvaluation':'other',
       '2styear':'other', 'vitvellore':'ug',
       'professionaldegreecertificate':'other',
        'valuenagotiation':'other', 'idp':'other',
       'contractlaw':'ug', 'projectstudent':'other',
       'projectplanninganalysisandcontrol':'other',
        'ee':'other', 'dme':'other', 'pmpusa':'other', 'aws':'other',
       'ocw':'other', 'accountingfundamental':'other', 'extensionstudies':'other', 'mi
       'gniit':'ug', '学士':'other',
        'bt':'other', 'dece':'ug', 'diplomo':'ug', 'amie':'other', 'biotech':'ug', 'de
       'presidencycollegeofchennai':'ug', 'commerce':'ug', 'fellowshipprogram':'phd',
       'innovationandentrepreneurship':'other', 'onlinecourse':'other', 'no':'other',
       'associateofscienceas':'ug', 'inprocess':'other',
       'mobileapplicationdevelopment':'other',
       'chineseenglishtranslatorinchennai09910713101':'other', 'grandeécole':'other',
       'craftingcreativecommunication':'other', 'documentaryproduction':'other',
       'computerscience':'ug', 'nanodegree':'pg', 'diplômeetudiantentrepreneur':'ug'
        'professionalyear''ug',
       'advancedjavaframeworks':'other', 'chefdeprojetmultimedia':'other',
       'intermediatescience':'pg', 'mphil':'pg', 'cqfcertification':'other', 'dhmct':'
```

```
        'certificationingamedesigining':'other', 'licencedinsuranceagent':'other','aecp
                         'professionalyear':'pg','ugprofessionalyearug':'ug'},inplace=Tr
```

In [41]:

```
df1['Degree'].unique()
```

Out[41]:

```
array(['pg', 'ug', 'not_given', 'phd', 'other', 'school',
       'ugprofessionalyearug'], dtype=object)
```

In [42]:

```
df1['Degree'].value_counts(dropna=False)
```

Out[42]:

```
ug                      2660
pg                      1918
not_given                194
phd                       78
other                     39
school                    20
ugprofessionalyearug       1
Name: Degree, dtype: int64
```

In [43]:

```
print("Number of unique Degree: ", df1['Degree'].nunique())
```

```
Number of unique Degree:  7
```

Preprocessing the Field of Study Column

In [44]:

```
df1['FieldOfStudy']=df1['Field of Study']
df1['FieldOfStudy'].value_counts()
```

Out[44]:

```
Computer Science
661
Mechanical Engineering
371
Information Technology
206
Electrical, Electronics and Communications Engineering
193
Electrical and Electronics Engineering
180

...
Digital Game Design
1
Mechanical engineering with specialization in energy engineering
1
Computer Science Engineering with Specialization in Information Security
1
Electronics and Communication with specialisation in IOT and Sensors
1
Applied Biology
1
Name: FieldOfStudy, Length: 1115, dtype: int64
```

In [45]:

```
df1['FieldOfStudy'] = df1['FieldOfStudy'].str.replace('[^\w\s]','')
df1['FieldOfStudy']=df1['FieldOfStudy'].str.lower()
df1['FieldOfStudy']=df1['FieldOfStudy'].str.replace(' ','')

df1.FieldOfStudy = df1.FieldOfStudy.fillna('not_given')
```

In [46]:

```
df1.loc[df1.FieldOfStudy.str.contains('computer'), 'FieldOfStudy'] = 'Computer Science
df1.loc[df1.FieldOfStudy.str.contains('security'), 'FieldOfStudy'] = 'Computer Science
df1.loc[df1.FieldOfStudy.str.contains('data'), 'FieldOfStudy'] = 'Computer Science'
df1.loc[df1.FieldOfStudy.str.contains('artificial'), 'FieldOfStudy'] = 'Computer Scien
df1.loc[df1.FieldOfStudy.str.contains('cse'), 'FieldOfStudy'] = 'Computer Science'
df1.loc[df1.FieldOfStudy.str.contains('information'), 'FieldOfStudy'] = 'Computer Scie
df1.loc[df1.FieldOfStudy.str.contains('network'), 'FieldOfStudy'] = 'Computer Science'
df1.loc[df1.FieldOfStudy.str.contains('electric'), 'FieldOfStudy'] = 'Electrical, Elec
df1.loc[df1.FieldOfStudy.str.contains('software'), 'FieldOfStudy'] = 'Computer Science
df1.loc[df1.FieldOfStudy.str.contains('electronics'), 'FieldOfStudy'] = 'Electrical, E
df1.loc[df1.FieldOfStudy.str.contains('communica'), 'FieldOfStudy'] = 'Electrical, Ele
df1.loc[df1.FieldOfStudy.str.contains('ece'), 'FieldOfStudy'] = 'Electrical, Electroni
df1.loc[df1.FieldOfStudy.str.contains('instrument'), 'FieldOfStudy'] = 'Electrical, El
df1.loc[df1.FieldOfStudy.str.contains('sensor'), 'FieldOfStudy'] = 'Electrical, Electr
df1.loc[df1.FieldOfStudy.str.contains('biotech'), 'FieldOfStudy'] = 'Biotechnology'
df1.loc[df1.FieldOfStudy.str.contains('mech'), 'FieldOfStudy'] = 'Mechanical Engineeri
df1.loc[df1.FieldOfStudy.str.contains('auto'), 'FieldOfStudy'] = 'Mechanical Engineeri
df1.loc[df1.FieldOfStudy.str.contains('market'), 'FieldOfStudy'] = 'Marketing and Fina
df1.loc[df1.FieldOfStudy.str.contains('financ'), 'FieldOfStudy'] = 'Marketing and Fina
df1.loc[df1.FieldOfStudy.str.contains('manage'), 'FieldOfStudy'] = 'Management'
df1.loc[df1.FieldOfStudy.str.contains('chem'), 'FieldOfStudy'] = 'Chemical Engineering
df1.loc[df1.FieldOfStudy.str.contains('civil'), 'FieldOfStudy'] = 'Civil Engineering'
df1.loc[df1.FieldOfStudy.str.contains('material'), 'FieldOfStudy'] = 'Civil Engineerin
df1.loc[df1.FieldOfStudy.str.contains('struct'), 'FieldOfStudy'] = 'Civil Engineering'
df1.loc[df1.FieldOfStudy.str.contains('busines'), 'FieldOfStudy'] = 'Business Studies'
df1.loc[df1.FieldOfStudy.str.contains('innovat'), 'FieldOfStudy'] = 'Business Studies'
df1.loc[df1.FieldOfStudy.str.contains('entrep'), 'FieldOfStudy'] = 'Business Studies'
df1.loc[df1.FieldOfStudy.str.contains('mba'), 'FieldOfStudy'] = 'Business Studies'
df1.loc[df1.FieldOfStudy.str.contains('media'), 'FieldOfStudy'] = 'Media'
df1.loc[df1.FieldOfStudy.str.contains('manufact'), 'FieldOfStudy'] = 'Manufacturing an
df1.loc[df1.FieldOfStudy.str.contains('production'), 'FieldOfStudy'] = 'Manufacturing
df1.loc[df1.FieldOfStudy.str.contains('design'), 'FieldOfStudy'] = 'Design'
df1.loc[df1.FieldOfStudy.str.contains('commerce'), 'FieldOfStudy'] = 'Commerce'
df1.loc[df1.FieldOfStudy.str.contains('arts'), 'FieldOfStudy'] = 'Arts'
df1.loc[df1.FieldOfStudy.str.contains('english'), 'FieldOfStudy'] = 'Arts'
df1.loc[df1.FieldOfStudy.str.contains('operat'), 'FieldOfStudy'] = 'Operations'
df1.loc[df1.FieldOfStudy.str.contains('research'), 'FieldOfStudy'] = 'Research'
df1.loc[df1.FieldOfStudy.str.contains('energy'), 'FieldOfStudy'] = 'Energy Engineering
df1.loc[df1.FieldOfStudy.str.contains('visual'), 'FieldOfStudy'] = 'Visual Communicati
df1.loc[df1.FieldOfStudy.str.contains('system'), 'FieldOfStudy'] = 'System Engineering
df1.loc[df1.FieldOfStudy.str.contains('envi'), 'FieldOfStudy'] = 'Environmental Enginee
df1.loc[df1.FieldOfStudy.str.contains('food'), 'FieldOfStudy'] = 'Food Science'
df1.loc[df1.FieldOfStudy.str.contains('archi'), 'FieldOfStudy'] = 'Architecture'
df1.loc[df1.FieldOfStudy.str.contains('psycho'), 'FieldOfStudy'] = 'Psychology'
df1.loc[df1.FieldOfStudy.str.contains('math'), 'FieldOfStudy'] = 'Mathematics'
df1.loc[df1.FieldOfStudy.str.contains('econo'), 'FieldOfStudy'] = 'Economics'
df1.loc[df1.FieldOfStudy.str.contains('journal'), 'FieldOfStudy'] = 'Journalism'
df1.loc[df1.FieldOfStudy.str.contains('literat'), 'FieldOfStudy'] = 'Arts'
```

In [47]:

```
df1['FieldOfStudy'].replace({'backendwebdevelopment':'Computer Science','compter':'Comp
                             'imageprocessing':'Computer Science', 'urbanplanning':'Ci
                             'remotesensing':'Electrical, Electronics and Communicatio
       'hr':'Management',
       'entrepreneurshipandnewventurecreation':'Business Studies', 'generalmangement':
       'executiveeducation':'Business Studies', 'socialwork':'not_given', 'strategylea
       'liberalstudies':'Law', 'bomedicalengneering':'Biotechnology', 'bkfs':'not_give
       'strategyandorganization':'Business Studies', 'masteroftechnologymtechcadcam':'
       'departmentofhaematologyhaemostasisoncologyandstemcelltransplantation':'Biotech
       'foundationfielbus':'not_given',
       'robotics':'Mechanical Engineering','animationinteractivetechnologyvideographic
        'bba':'Law','law':'Law','basiclaw':'Law','highschoolsecondarycertificateprogra
       'technologyandpolicy':'not_given', 'smartcities':'not_given', 'leanengineering'
       'prourementinventory':'not_given','petroleumengineering':'Energy Engineering',
        'semiconductordevicefabrication':'Electrical, Electronics and Communication En
        'strategyandleadership':'Business Studies','strategy':'Business Studies','':'n
        'cs':'Computer Science','broadcastengineering':'Media','pcmb':'School','mca':'
        'bachelorofengineeringbe':'not_given','btech':'not_given', 'cloudcomputing':'C
                            }, inplace=True)
```

In [48]:

```
df1['FieldOfStudy'].value_counts()
```

Out[48]:

```
Computer Science                                        1731
Electrical, Electronics and Communication Engineering    525
Mechanical Engineering                                   492
not_given                                                393
Marketing and Finance                                    350
                                                        ... 
technical                                                  1
pcminformatics                                             1
cellbiology                                                1
ecm                                                        1
regulatoryaffairsofdrugsbiologicsandmedicaldevices         1
Name: FieldOfStudy, Length: 157, dtype: int64
```

Preprocessing the New Job Column

1. Filling Missing Values

In [49]:

```
print("Number of unique values: ", df1['New Job (90 Days)'].nunique())
print("Number of rows: ", df1['New Job (90 Days)'].shape[0])
print("Number of null values: ", df1['New Job (90 Days)'].isnull().sum())
```

```
Number of unique values:  2
Number of rows:  4910
Number of null values:  150
```

In [50]:

```
print(df['New Job (90 Days)'].describe())
```

```
count      4760
unique        2
top       False
freq       3984
Name: New Job (90 Days), dtype: object
```

In [51]:

```
print(df1.index[(df1['Year Started'] == 2021) & (df1['New Job (90 Days)'] != True)].to
print(df1.index[(df1['Year Started'] == 2021) & (df1['New Job (90 Days)'] == False)].t
```

```
[830, 1527, 2184]
[]
```

In [52]:

```
df1['New Job (90 Days)'].fillna(False, inplace = True)
```

In [53]:

```
df1['New Job (90 Days)'].isnull().sum()
```

Out[53]:

```
0
```

Preprocessing the Profile Headline column

1. Removing Null Values

In [54]:

```
print("Number of unique values: ", df1['Profile Headline'].nunique())
print("Number of rows: ", df1['Profile Headline'].shape[0])
print("Number of null values: ", df1['Profile Headline'].isnull().sum())
```

```
Number of unique values:  3941
Number of rows:  4910
Number of null values:  18
```

In [55]:

```
nan_profileheadline = df1.index[df1['Profile Headline'].isnull()].tolist()
nan_profileheadline
```

Out[55]:

```
[66,
 275,
 552,
 710,
 904,
 1653,
 1876,
 1878,
 1908,
 2146,
 2334,
 2551,
 2628,
 2647,
 2699,
 2999,
 3175,
 3676]
```

In [56]:

```
df1.at[66, 'Profile Headline'] = 'Computer Science and Engineering Student'
df1.at[275, 'Profile Headline'] = 'Electrical, Electronics and Communications Engineeri
df1.at[66, 'Profile Headline'] = 'Computer Science and Engineering Student'
df1.at[552, 'Profile Headline'] = 'Mechanical  Engineering Student'
df1.at[710, 'Profile Headline'] = 'Mechanical  Engineering Student'
df1.at[904, 'Profile Headline'] = 'Computer Science and Engineering Student'
df1.at[1653, 'Profile Headline'] = 'Computer Science and Engineering Student'
df1.at[1876, 'Profile Headline'] = 'Computer Science and Engineering Student'
df1.at[1878, 'Profile Headline'] = 'Mechanical Engineering Student | Business Developme
df1.at[1908, 'Profile Headline'] = 'Automotive Engineering Student'
df1.at[2146, 'Profile Headline'] = 'Computer Science and Engineering Student | Cyber Se
df1.at[2334, 'Profile Headline'] = 'Computer Science and Engineering Student | Web Deve
df1.at[2551, 'Profile Headline'] = 'Mechanical Engineering Student'
df1.at[2551, 'Education End'] = 2021.0
df1.at[2628, 'Profile Headline'] = 'Computer Science and Engineering Student'
df1.at[2647, 'Profile Headline'] = 'Computer Science and Engineering Student'
df1.at[2699, 'Profile Headline'] = 'Automotive Engineering student'
df1.at[2999, 'Profile Headline'] = 'Electrical and Electronics Engineering Student | Ae
df1.at[2999, 'Education End'] = 2022.0
df1.at[3175, 'Profile Headline'] = 'Automotive Engineering Student'
df1.at[3676, 'Profile Headline'] = 'Electrical, Electronics and Communications Engineer
```

In [57]:

```
i = nan_profileheadline[15]
print(i)
df1.iloc[i]
# df1.iloc[i]['Profile Summary']
# df1.iloc[i]['Company Name']
```

```
2999
```

Out[57]:

```
Job Title                                        Java developer intern
Company Name                                 Tata Consultancy Services
Industry                           Electrical/Electronic Manufacturing
Company Location                             Faridabad, Haryana, India
New Job (90 Days)                                                 True
Year Started                                                      2021
Profile Headline     Electrical and Electronics Engineering Student...
Profile Summary      Aerial robotics enthusiast with a keen interes...
School                                 Vellore Institute of Technology
Degree                                                              ug
Education End                                                     2022
Field of Study                  Electrical and Electronics Engineering
Domain                                           Business Development 
CompanyName                                  Tata Consultancy Services
JobTitle                                                     Developer
My Network                                                     network
Country                                                          India
Continent                                                           AS
FieldOfStudy                                          Computer Science
Name: 2999, dtype: object
```

In [58]:

```
df1['Profile Headline'].isnull().sum()
```

Out[58]:

```
0
```

2. Named Entity Recognition

Preprocessing the Education End column

In [59]:

```
df1['Education End'].value_counts(dropna = False)
```

Out[59]:

```
2022.0    533
2020.0    479
2021.0    448
2023.0    422
2019.0    408
2018.0    367
2017.0    299
2016.0    259
2015.0    246
NaN       236
2014.0    155
2013.0    129
2024.0    106
2012.0    101
2011.0     96
2010.0     85
2008.0     72
2009.0     69
2005.0     67
2007.0     59
2006.0     49
2003.0     33
2004.0     31
1999.0     21
1997.0     17
2000.0     14
2025.0     12
2002.0     12
1993.0     11
1998.0      9
2001.0      9
1996.0      7
1995.0      4
1988.0      4
1994.0      4
1989.0      3
1981.0      3
1992.0      3
1990.0      3
1980.0      3
1987.0      3
1977.0      3
1985.0      2
1969.0      2
1976.0      2
1979.0      2
1973.0      1
1966.0      1
1982.0      1
1986.0      1
1972.0      1
1965.0      1
1960.0      1
1991.0      1
Name: Education End, dtype: int64
```

In [60]:

```
# df1['Education End'].fillna(0, inplace = True)
```

In [61]:

```
arr = df1['Education End'].unique()
arr = np.sort(arr)[::-1]
```

In [62]:

```
arr
```

Out[62]:

```
array([  nan, 2025., 2024., 2023., 2022., 2021., 2020., 2019., 2018.,
       2017., 2016., 2015., 2014., 2013., 2012., 2011., 2010., 2009.,
       2008., 2007., 2006., 2005., 2004., 2003., 2002., 2001., 2000.,
       1999., 1998., 1997., 1996., 1995., 1994., 1993., 1992., 1991.,
       1990., 1989., 1988., 1987., 1986., 1985., 1982., 1981., 1980.,
       1979., 1977., 1976., 1973., 1972., 1969., 1966., 1965., 1960.])
```

In [63]:

```
df1['Education End'].replace({2025 : 'group1', 2024 : 'group1', 2023 : 'group1', 2022
                               2020 : 'group2', 2019 : 'group2', 2018 : 'group2', 2017
                               2014 : 'group3', 2013 : 'group3', 2012 : 'group3', 2011
                               2009 : 'group3', 2008 : 'group3', 2007 : 'group3', 2006
                               2004 : 'group3', 2003 : 'group3', 2002 : 'group3', 2001
                               1999 : 'group4', 1998 : 'group4', 1997 : 'group4', 1996
                               1994 : 'group4', 1993 : 'group4', 1992 : 'group4', 1991
                               1989 : 'group4', 1988 : 'group4', 1987 : 'group4', 1986
                               1982 : 'group4', 1981 : 'group4', 1980 : 'group4', 1979
                               1976 : 'group4', 1973 : 'group4', 1972 : 'group4', 1969
                               1965 : 'group4', 1960 : 'group4', np.nan: 'not-given'}, 

"""
group 1: 2021 - 2015
group 2: 2020 - 2015
group 3: 2000 - 2015
group 4: before 2000
"""
```

Out[63]:

```
'\ngroup 1: 2021 - 2015\ngroup 2: 2020 - 2015\ngroup 3: 2000 - 2015\ngroup
4: before 2000\n'
```

In [64]:

```
df1['Education End'].value_counts(dropna = False)
```

Out[64]:

```
group2       1812
group1       1521
group3       1227
not-given     236
group4        114
Name: Education End, dtype: int64
```

Final Preprocessing before applying BERT and converting to Embeddings

In [65]:

```
df1.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 4910 entries, 0 to 4909
Data columns (total 19 columns):
 #   Column             Non-Null Count  Dtype  
---  ------             --------------  -----  
 0   Job Title          4898 non-null   object 
 1   Company Name       4892 non-null   object 
 2   Industry           4910 non-null   object 
 3   Company Location   4910 non-null   object 
 4   New Job (90 Days)  4910 non-null   bool   
 5   Year Started       4816 non-null   float64
 6   Profile Headline   4910 non-null   object 
 7   Profile Summary    3465 non-null   object 
 8   School             4658 non-null   object 
 9   Degree             4910 non-null   object 
 10  Education End      4910 non-null   object 
 11  Field of Study     4532 non-null   object 
 12  Domain             4910 non-null   object 
 13  CompanyName        4910 non-null   object 
 14  JobTitle           4910 non-null   object 
 15  My Network         4910 non-null   object 
 16  Country            4910 non-null   object 
 17  Continent          4910 non-null   object 
 18  FieldOfStudy       4910 non-null   object 
dtypes: bool(1), float64(1), object(17)
memory usage: 695.4+ KB
```

In [66]:

```
df1.isnull().count()
```

Out[66]:

```
Job Title            4910
Company Name         4910
Industry             4910
Company Location     4910
New Job (90 Days)    4910
Year Started         4910
Profile Headline     4910
Profile Summary      4910
School               4910
Degree               4910
Education End        4910
Field of Study       4910
Domain               4910
CompanyName          4910
JobTitle             4910
My Network           4910
Country              4910
Continent            4910
FieldOfStudy         4910
dtype: int64
```

In [67]:

```
# df1['Job Title'].fillna("", inplace = True)
# df1['Company Name'].fillna("", inplace = True)
# df1['Industry'].fillna("", inplace = True)
# df1['Year Started'].fillna(0, inplace = True)
# df1['Profile Summary'].fillna("", inplace = True)
# df1['School'].fillna("", inplace = True)
# df1['Degree'].fillna("", inplace = True)
# df1['Education End'].fillna(0, inplace = True)
# df1['Field of Study'].fillna("", inplace = True)
```

In [68]:

```
# sns.heatmap(df1.isnull())
```

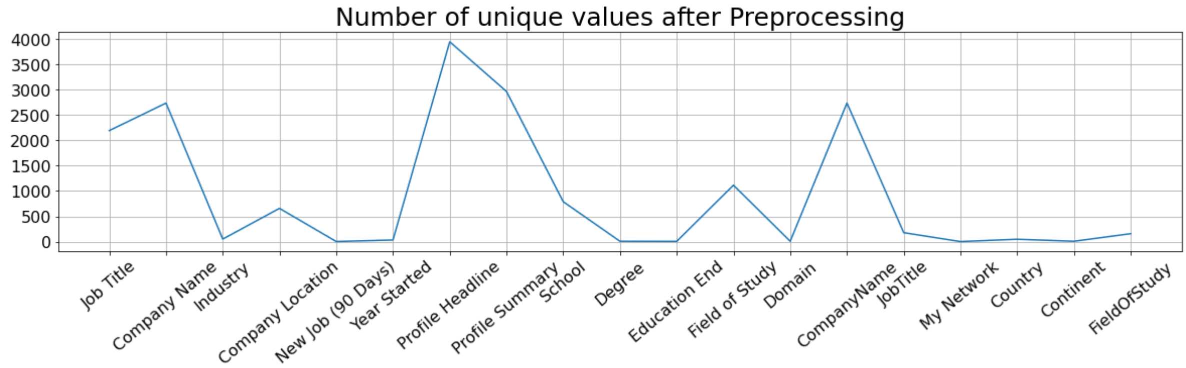
In [69]:

```
# df1.to_csv('Before_BERT.csv')
```

In [70]:

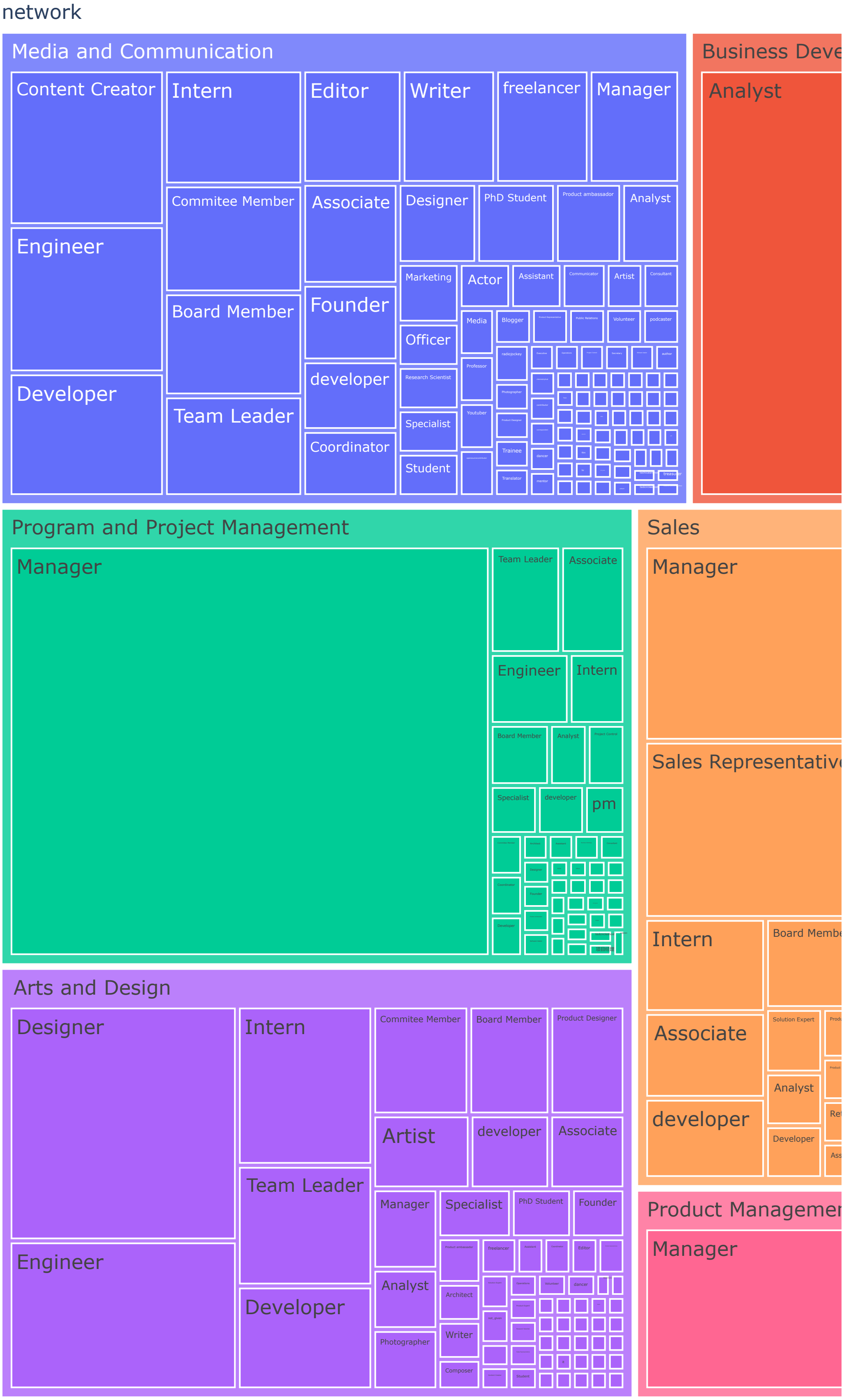
```
import matplotlib.pyplot as plt

print(df1.nunique())
plt.figure(figsize=(20,4))
plt.plot(df1.nunique())
plt.grid()
plt.title('Number of unique values after Preprocessing', fontsize = 25)
plt.xticks(fontsize=16, rotation=40)
plt.yticks(fontsize=16)
plt.show()
```

```
Job Title              2194
Company Name           2738
Industry                 50
Company Location        657
New Job (90 Days)         2
Year Started             32
Profile Headline       3950
Profile Summary        2968
School                  789
Degree                    7
Education End             5
Field of Study         1115
Domain                    7
CompanyName            2739
JobTitle                177
My Network                1
Country                  47
Continent                 7
FieldOfStudy            157
dtype: int64
```



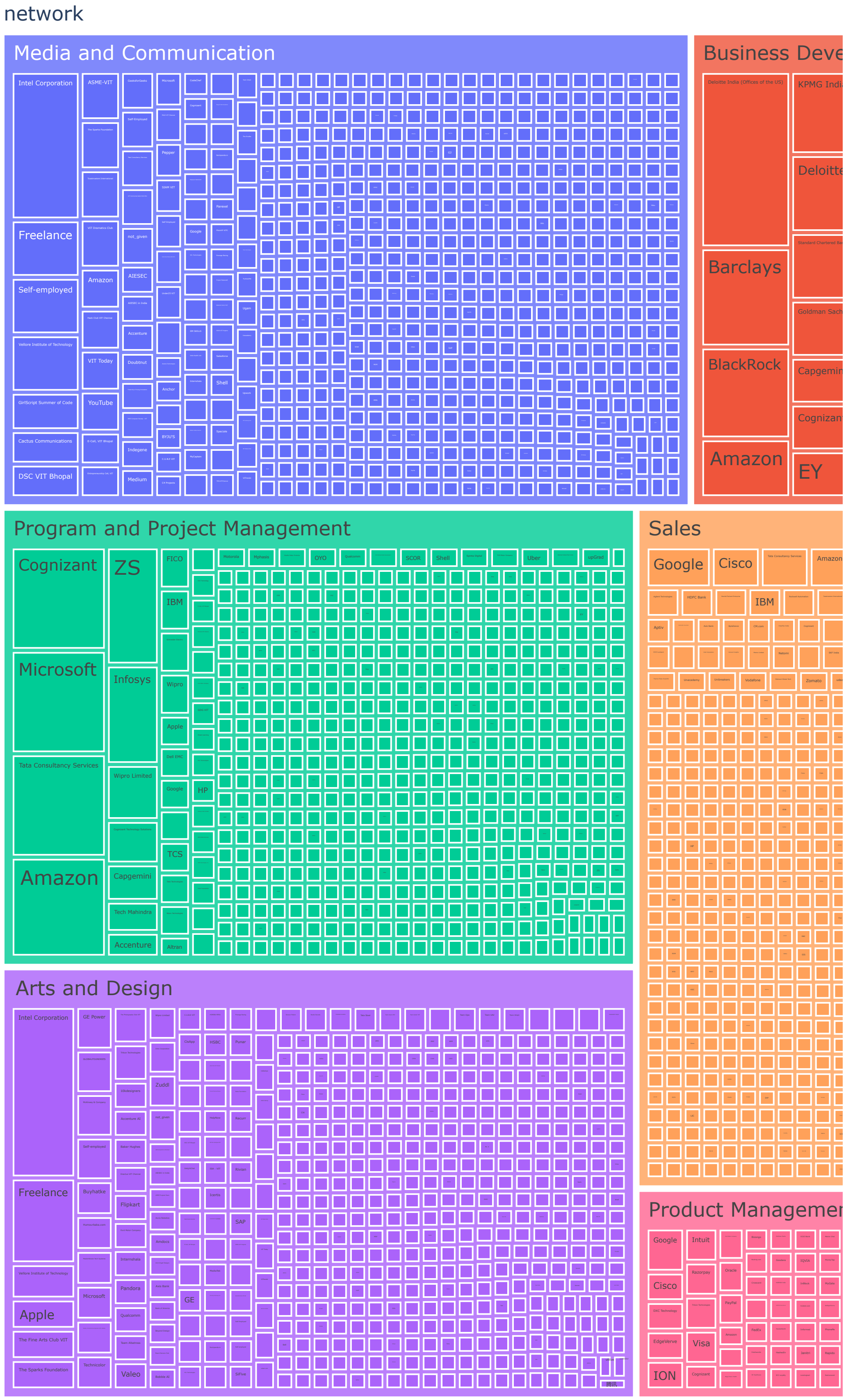
In [72]:

```
fig2 = px.treemap(df1, path=['My Network', 'Domain', 'JobTitle'], width=1000, height=1
fig2.show()
```



In [73]:

```
fig3 = px.treemap(df1, path=['My Network', 'Domain', 'CompanyName'], width=1000, heigh
fig3.show()
```



In [ ]:

In [ ]:

In [ ]:

In [ ]: