Importing basic libraries:

In [1]:
```
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
```

Data reading and exploration:

In [2]:
```
data = pd.read_csv(r"C:\Users\LENOVO\OneDrive\Desktop\jobs_in_data.csv")
data
```

Out[2]:

	work_year	job_title	job_category	salary_currency	salary	salary_in_usd	employee_residence	experien
0	2023	Data DevOps Engineer	Data Engineering	EUR	88000	95012	Germany	
1	2023	Data Architect	Data Architecture and Modeling	USD	186000	186000	United States	
2	2023	Data Architect	Data Architecture and Modeling	USD	81800	81800	United States	
3	2023	Data Scientist	Data Science and Research	USD	212000	212000	United States	
4	2023	Data Scientist	Data Science and Research	USD	93300	93300	United States	
...	...	...	...	...	...	...	...	
9350	2021	Data Specialist	Data Management and Strategy	USD	165000	165000	United States	
9351	2020	Data Scientist	Data Science and Research	USD	412000	412000	United States	
9352	2021	Principal Data Scientist	Data Science and Research	USD	151000	151000	United States	
9353	2020	Data Scientist	Data Science and Research	USD	105000	105000	United States	Er
9354	2020	Business Data Analyst	Data Analysis	USD	100000	100000	United States	Er

9355 rows × 12 columns

In [13]:
```
print(f"The number of rows in the dataset is {data.shape[0]}\nThe number of columns in t
```

```
The number of rows in the dataset is 9355
The number of columns in the data set is 12
```

In [3]:
```
data.describe()
```

Out[3]:

	work_year	salary	salary_in_usd
count	9355.000000	9355.000000	9355.000000
mean	2022.760449	149927.981293	150299.495564
std	0.519470	63608.835387	63177.372024
min	2020.000000	14000.000000	15000.000000
25%	2023.000000	105200.000000	105700.000000
50%	2023.000000	143860.000000	143000.000000
75%	2023.000000	187000.000000	186723.000000
max	2023.000000	450000.000000	450000.000000

In [17]:
```
#checking the description of the non-numeric features as well

data.describe(include='object')
```

Out[17]:

	job_title	job_category	salary_currency	employee_residence	experience_level	employment_type	work_
count	9355	9355	9355	9355	9355	9355	
unique	125	10	11	83	4	4	
top	Data Engineer	Data Science and Research	USD	United States	Senior	Full-time	In
freq	2195	3014	8591	8086	6709	9310	

In [4]:
```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 9355 entries, 0 to 9354
Data columns (total 12 columns):
 #   Column              Non-Null Count  Dtype 
---  ------              --------------  ----- 
 0   work_year           9355 non-null   int64 
 1   job_title           9355 non-null   object
 2   job_category        9355 non-null   object
 3   salary_currency     9355 non-null   object
 4   salary              9355 non-null   int64 
 5   salary_in_usd       9355 non-null   int64 
 6   employee_residence  9355 non-null   object
 7   experience_level    9355 non-null   object
 8   employment_type     9355 non-null   object
 9   work_setting        9355 non-null   object
 10  company_location    9355 non-null   object
 11  company_size        9355 non-null   object
dtypes: int64(3), object(9)
memory usage: 877.2+ KB
```

In [5]:
```
data.isnull().sum()
```

Out[5]:
```
work_year             0
job_title             0
job_category          0
salary_currency       0
salary                0
salary_in_usd         0
employee_residence    0
experience_level      0
employment_type       0
work_setting          0
company_location      0
company_size          0
dtype: int64
```

In [22]:
```
# summarizing the data description in the form of DataFrame

pd.DataFrame({'Count':data.shape[0], 'Null':data.isnull().sum(),'Diversity':data.nunique
```

Out[22]:

	Count	Null	Diversity
work_year	9355	0	4
job_title	9355	0	125
job_category	9355	0	10
salary_currency	9355	0	11
salary	9355	0	1507
salary_in_usd	9355	0	1786
employee_residence	9355	0	83
experience_level	9355	0	4
employment_type	9355	0	4
work_setting	9355	0	3
company_location	9355	0	70
company_size	9355	0	3

In [20]:
```
data.duplicated().sum()
```

Out[20]:
```
4014
```

In [29]:
```
percentage_duplication = (data.duplicated().sum() / data.shape[0]) *100
print("Percentage duplication in the data is", percentage_duplication)
```

```
Percentage duplication in the data is 42.90753607696419
```

The duplication percentage in the data is quite high, so we can not remove the duplicated data. The percentage is quite considerable because a specific position/role might have the same work setting and salary in a certain country. So we can conclude that the percentage do not represent duplicated values but different entries from the survey which had the same responses.

Data Visualization and analysis:

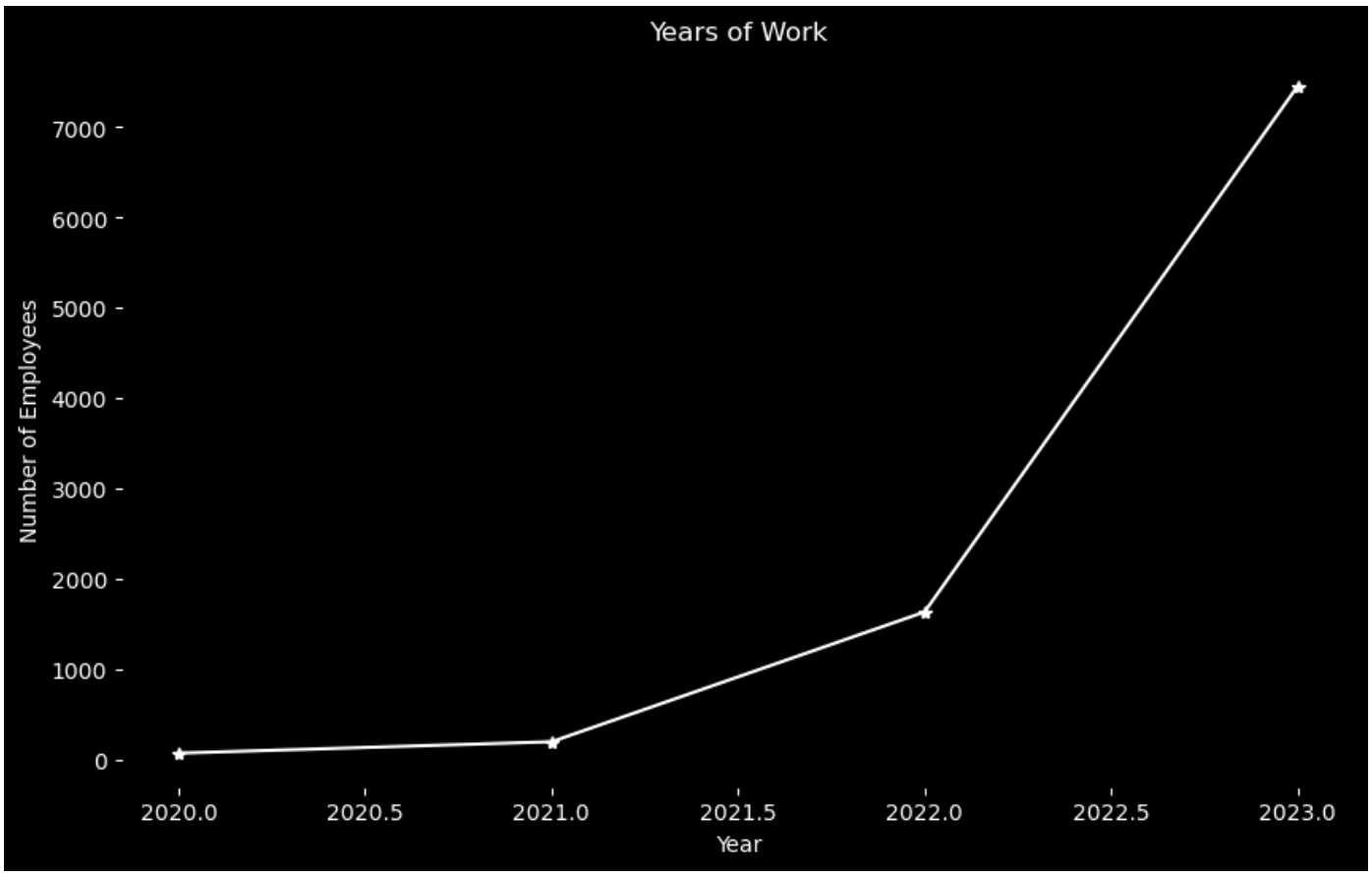
In [34]:
```
# Calculate the frequency and proportion of occurrences for each unique value in the "wo

data_work = data['work_year'].value_counts().reset_index()
data_work.columns = ['work_year', 'count']
```

```
data_work = data_work.sort_values(by = 'count', ascending=False)
print(data_work)
```

```
   work_year  count
0       2023   7453
1       2022   1634
2       2021    197
3       2020     71
```

In [52]:

```
plt.figure(figsize=(10,6))
year_counts = data['work_year'].value_counts().sort_index()
plt.plot(year_counts.index, year_counts.values, marker='*',linestyle='-',color="white")
plt.xlabel("Year", color = 'white' )
plt.ylabel("Number of Employees", color = 'white')
plt.title("Years of Work", color = 'white')
plt.gca().set_facecolor('black')
plt.gcf().set_facecolor('black')
plt.gca().tick_params(axis='x',colors='white')
plt.gca().tick_params(axis='y',colors='white')
plt.show()
```



From here we can conclude that the dataset includes work year from 2020 to 2023 with the highest amount of data from the year 2023

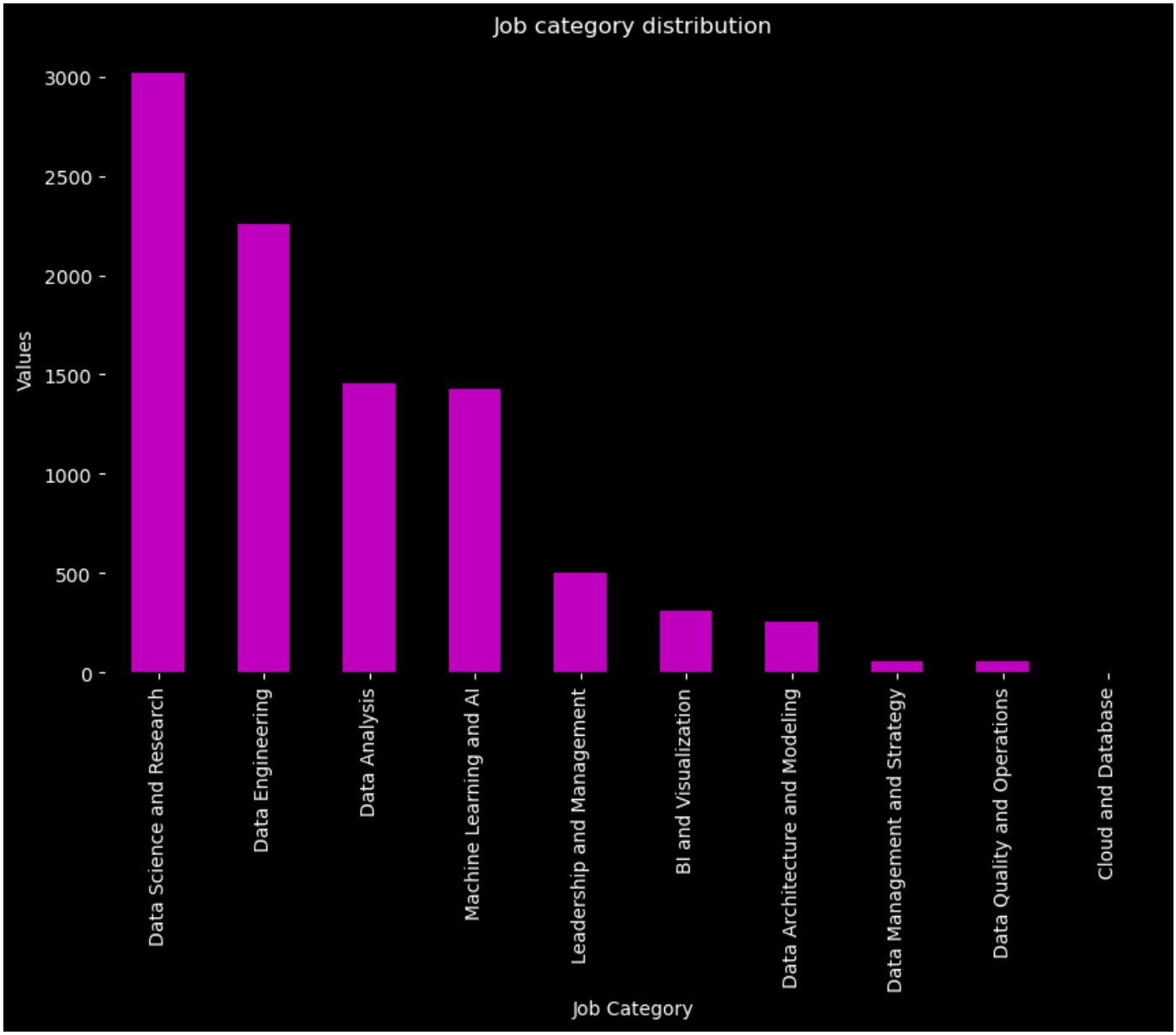
Each job category consists of several similar job titles depending on the main field. Fo instance if we consider job category Data Engineering then it includes several job titles like Data Engineer, ETL Developer, Software data engineer, etc.

In [57]:

```
# Calculate the frequency of occurrences for each unique job_category in the column

data_job = data['job_category'].value_counts().reset_index()
data_job.columns = ['Job_Category', 'Count']
data_job = data_job.sort_values(by='Count', ascending=False)
print(data_job)
```

	Job_Category	Count
0	Data Science and Research	3014
1	Data Engineering	2260
2	Data Analysis	1457
3	Machine Learning and AI	1428
4	Leadership and Management	503
5	BI and Visualization	313
6	Data Architecture and Modeling	259
7	Data Management and Strategy	61
8	Data Quality and Operations	55
9	Cloud and Database	5

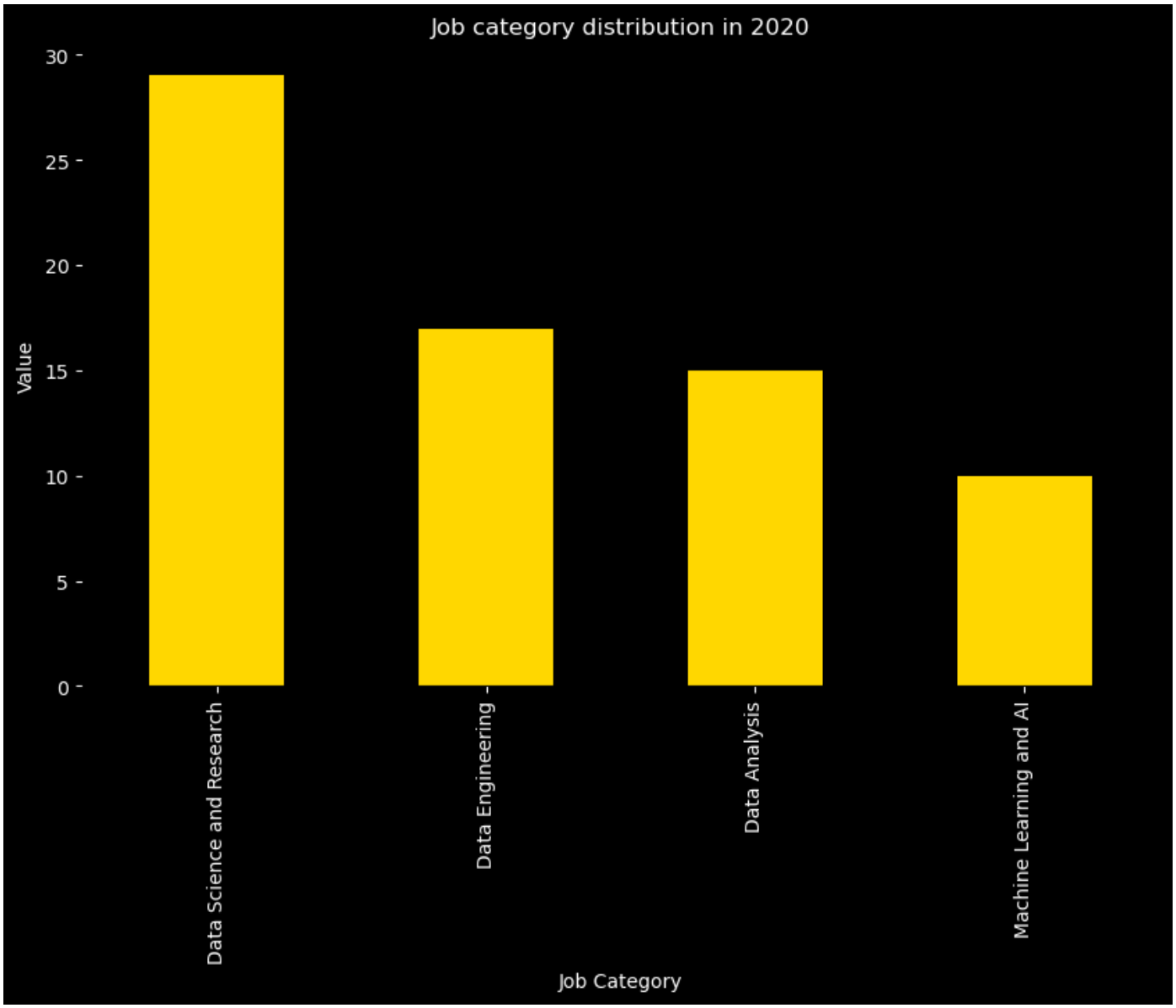
In [61]:
```
plt.figure(figsize=(10,6))
data['job_category'].value_counts().plot(kind='bar', color = 'm')
plt.xlabel("Job Category", color = 'white' )
plt.ylabel("Values", color = 'white')
plt.title("Job category distribution", color = 'white')
plt.gca().set_facecolor('black')
plt.gcf().set_facecolor('black')
plt.gca().tick_params(axis='x',colors='white')
plt.gca().tick_params(axis='y',colors='white')
plt.show()
```

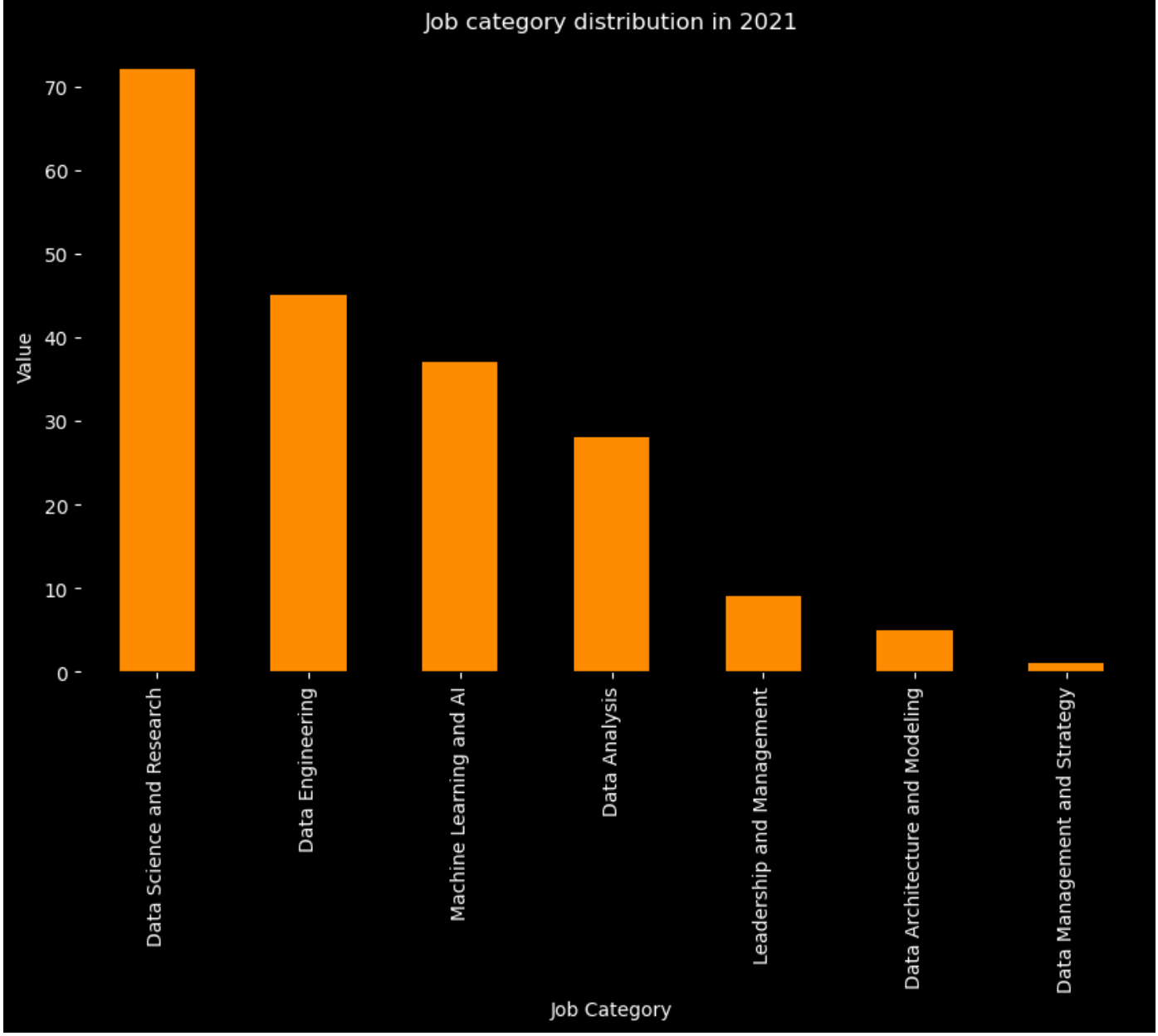


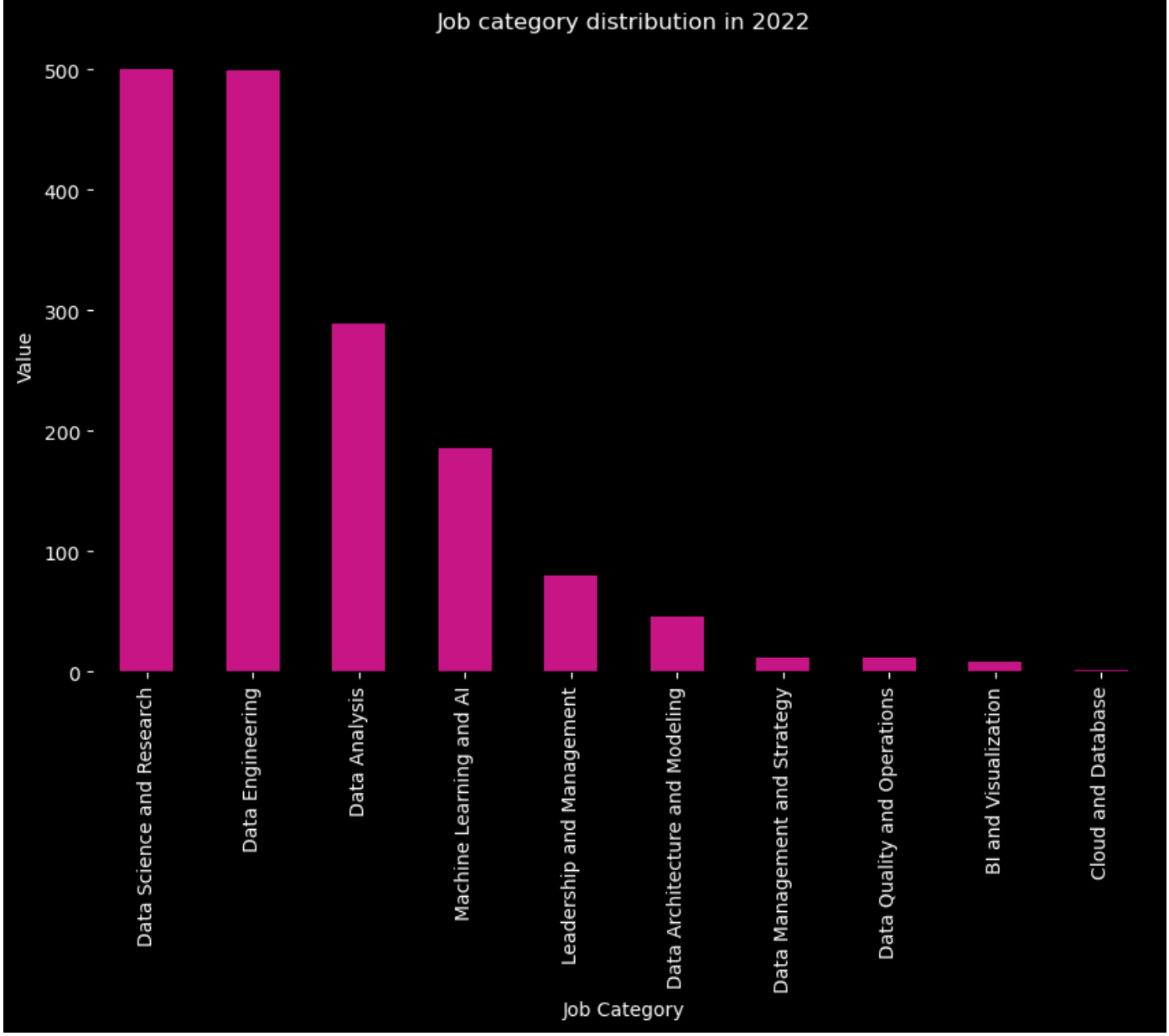
From here we can say that our data consists of 10 different job category's data. The Data Science and Research being the category with highest number of jobs, followed by Data Engineering, Data

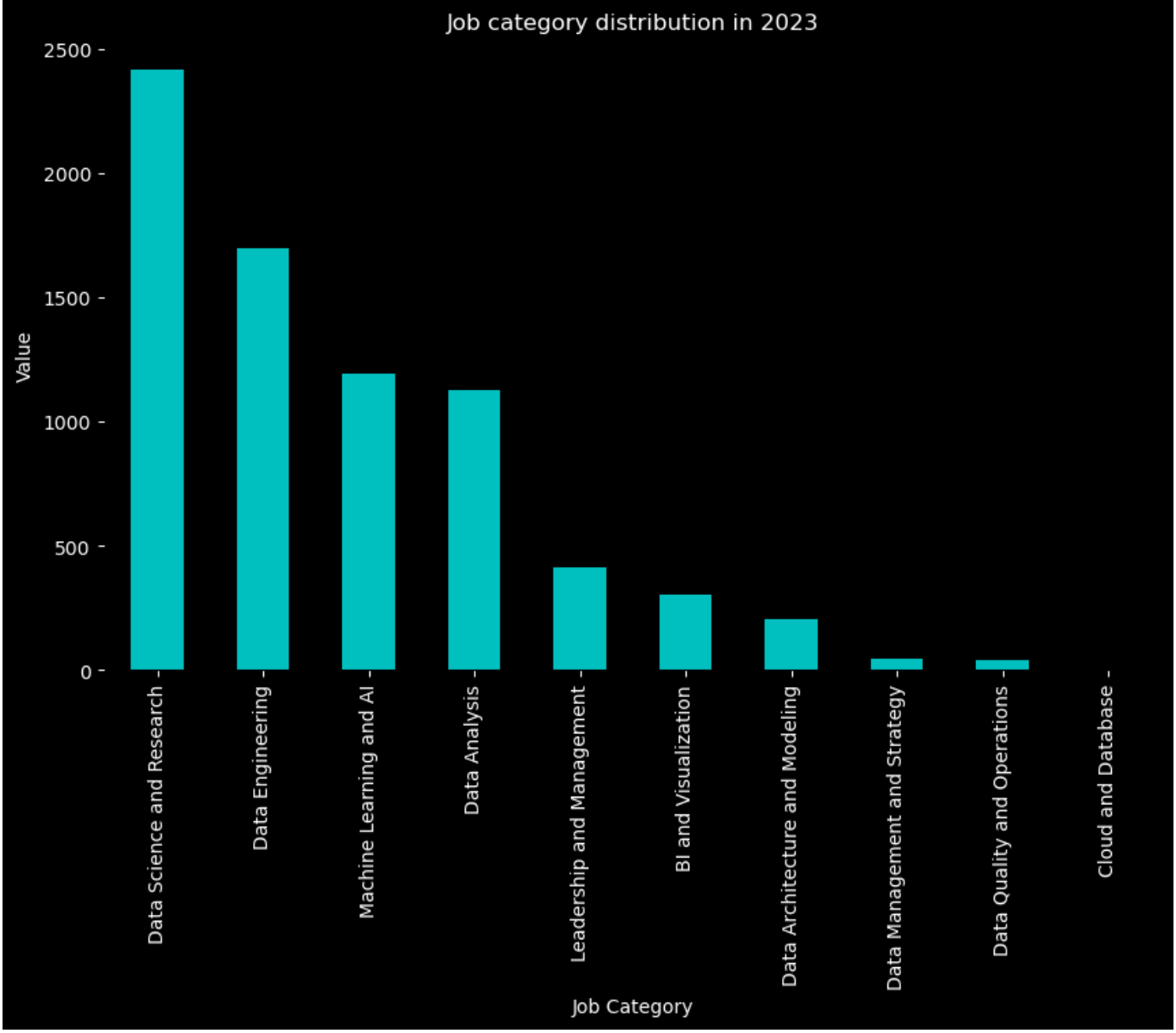
Analysis and Machine Learning AI. On the other hand, Cloud and Database is the job category with least number of jobs availablity.

In [68]:
```
# now we will try to understand the job category distribution every year

data_job_category = data.groupby('work_year')['job_category'].value_counts()
colors = ['gold','darkorange','mediumvioletred','c']
j = 0
for i in range(2020,2024):
    plt.figure(figsize=(10,6))
    data_job_category[i].plot(kind='bar', color = colors[j])
    plt.xlabel("Job Category", color = 'white' )
    plt.ylabel("Value", color = 'white')
    plt.title(f"Job category distribution in {i}", color = 'white')
    plt.gca().set_facecolor('black')
    plt.gcf().set_facecolor('black')
    plt.gca().tick_params(axis='x',colors='white')
    plt.gca().tick_params(axis='y',colors='white')
    plt.show()
    j+=1
```









Above ggraphs help us to understand yearwise job category distribution. In year 2020 data was offering jobs in only four categories, viz. Data science and research, Data engineering, Data Analysis and ML and AI in the descending order respectively. In 2021, the job categories increased to seven adding Leadership & Management, Data Architecture & modelling, and Data management& startegy as new categories. But this year also, Data Science and Research remained the most job offering category. In year 2022, the catgories in which data offered job further increased to 10. This year, Data Science & reserach and Data engineering became the categories offering same amount of jobs and were higest amongst the other categories. In 2023, the number of categories remained same but again, Data Science & research offered more jobs as compared to ther categories.

Now we will find the job titles included in each job category and try to find job titles the job seeker can concentrate on

In [70]:
```
data['job_category'].unique()
```

Out[70]:
```
array(['Data Engineering', 'Data Architecture and Modeling',
       'Data Science and Research', 'Machine Learning and AI',
       'Data Analysis', 'Leadership and Management',
       'BI and Visualization', 'Data Quality and Operations',
       'Data Management and Strategy', 'Cloud and Database'], dtype=object)
```

In [74]:
```
data_jobcategory = ['Data Engineering', 'Data Architecture and Modeling', 'Data Science
       'Data Analysis', 'Leadership and Management', 'BI and Visualization', 'Data Quali

j=0
for j in range (0,9):
    print(f"Job title distribution in {data_jobcategory[j]} category")
    data_science_df = data[data['job_category'] == data_jobcategory[j]]
    data_science_tibble = data_science_df['job_title'].value_counts().reset_index()
    data_science_tibble.columns = ['job_title', 'frequency']
    print(data_science_tibble)
    print("**********************************************************************************
    j+=1
```

Job title distribution in Data Engineering category

	job_title	frequency
0	Data Engineer	2195
1	ETL Developer	18
2	Data Infrastructure Engineer	12
3	Big Data Engineer	8
4	Lead Data Engineer	6
5	Cloud Data Engineer	4
6	Principal Data Engineer	3
7	Software Data Engineer	3
8	Data DevOps Engineer	2
9	Data Integration Engineer	2
10	Azure Data Engineer	2
11	ETL Engineer	2
12	Consultant Data Engineer	1
13	BI Data Engineer	1
14	Marketing Data Engineer	1

****

Job title distribution in Data Architecture and Modeling category

	job_title	frequency
0	Data Architect	213
1	Data Modeler	22
2	Data Strategist	18
3	Data Modeller	2
4	Big Data Architect	2
5	AWS Data Architect	1
6	Cloud Data Architect	1

****

Job title distribution in Data Science and Research category

	job_title	frequency
0	Data Scientist	1989
1	Applied Scientist	272
2	Research Scientist	269
3	Research Engineer	144
4	Data Science Manager	88
5	Data Science Consultant	44
6	Research Analyst	39
7	Decision Scientist	38
8	Director of Data Science	29
9	Data Science Lead	20
10	Data Science Engineer	14
11	Applied Data Scientist	11
12	Head of Data Science	11
13	Data Science Practitioner	10
14	Principal Data Scientist	10
15	Lead Data Scientist	8
16	AI Research Engineer	4
17	Data Science Director	4
18	Machine Learning Research Engineer	4
19	Staff Data Scientist	2
20	Data Scientist Lead	2
21	Managing Director Data Science	1
22	Data Science Tech Lead	1

****

Job title distribution in Machine Learning and AI category

	job_title	frequency
0	Machine Learning Engineer	991
1	ML Engineer	106
2	Machine Learning Scientist	76
3	AI Engineer	36
4	Machine Learning Infrastructure Engineer	27
5	Computer Vision Engineer	25
6	AI Scientist	18
7	AI Developer	18

```
8                Machine Learning Researcher         17
9         Machine Learning Software Engineer         13
10                             AI Architect         12
11        Applied Machine Learning Scientist         12
12                    Deep Learning Engineer         12
13                             NLP Engineer         12
14                           MLOps Engineer         11
15                 Machine Learning Developer          8
16          Computer Vision Software Engineer          5
17                             AI Programmer          5
18                  Machine Learning Manager          4
19             Lead Machine Learning Engineer          3
20          Applied Machine Learning Engineer          3
21        Principal Machine Learning Engineer          3
22                  Machine Learning Modeler          2
23                Machine Learning Specialist          2
24                   Head of Machine Learning          2
25              Autonomous Vehicle Technician          2
26            Staff Machine Learning Engineer          1
27       Machine Learning Operations Engineer          1
28                   Deep Learning Researcher          1
********************************************************************************
Job title distribution in Data Analysis category
                             job_title  frequency
0                         Data Analyst       1388
1                 Business Data Analyst         18
2                       BI Data Analyst         16
3                       Insight Analyst          8
4                  Product Data Analyst          5
5                Financial Data Analyst          4
6                    Staff Data Analyst          3
7                  Finance Data Analyst          3
8                     Lead Data Analyst          3
9   Business Intelligence Data Analyst          2
10              Compliance Data Analyst          2
11               Marketing Data Analyst          2
12               Principal Data Analyst          2
13                   Sales Data Analyst          1
********************************************************************************
Job title distribution in Leadership and Management category
                        job_title  frequency
0                Analytics Engineer        256
1                      Data Manager        132
2           Data Analytics Manager         38
3                      Head of Data         33
4                         Data Lead         14
5             Data Product Manager          8
6                   Data Developer          6
7          Data Analytics Engineer          5
8              Data Analytics Lead          3
9                Data Product Owner          2
10       Data Analytics Specialist          2
11       Data Analytics Consultant          2
12  Analytics Engineering Manager          1
13         Manager Data Management          1
********************************************************************************
Job title distribution in BI and Visualization category
                           job_title  frequency
0      Business Intelligence Engineer        144
1       Business Intelligence Analyst         54
2                       BI Developer         52
3                         BI Analyst         29
4     Business Intelligence Developer         17
5   Business Intelligence Specialist          4
```

```
6      Data Visualization Specialist          4
7        Data Visualization Engineer          4
8      Business Intelligence Manager          2
9         Data Visualization Analyst          2
10                Power BI Developer          1
**********************************************************************
Job title distribution in Data Quality and Operations category
                    job_title  frequency
0        Data Quality Analyst         20
1    Data Operations Engineer         16
2     Data Operations Analyst         10
3  Data Operations Specialist          4
4       Data Quality Engineer          3
5     Data Operations Manager          2
**********************************************************************
Job title distribution in Data Management and Strategy category
                     job_title  frequency
0              Data Specialist         40
1  Data Integration Specialist         10
2   Data Management Specialist          5
3        Data Strategy Manager          4
4      Data Management Analyst          2
**********************************************************************
```

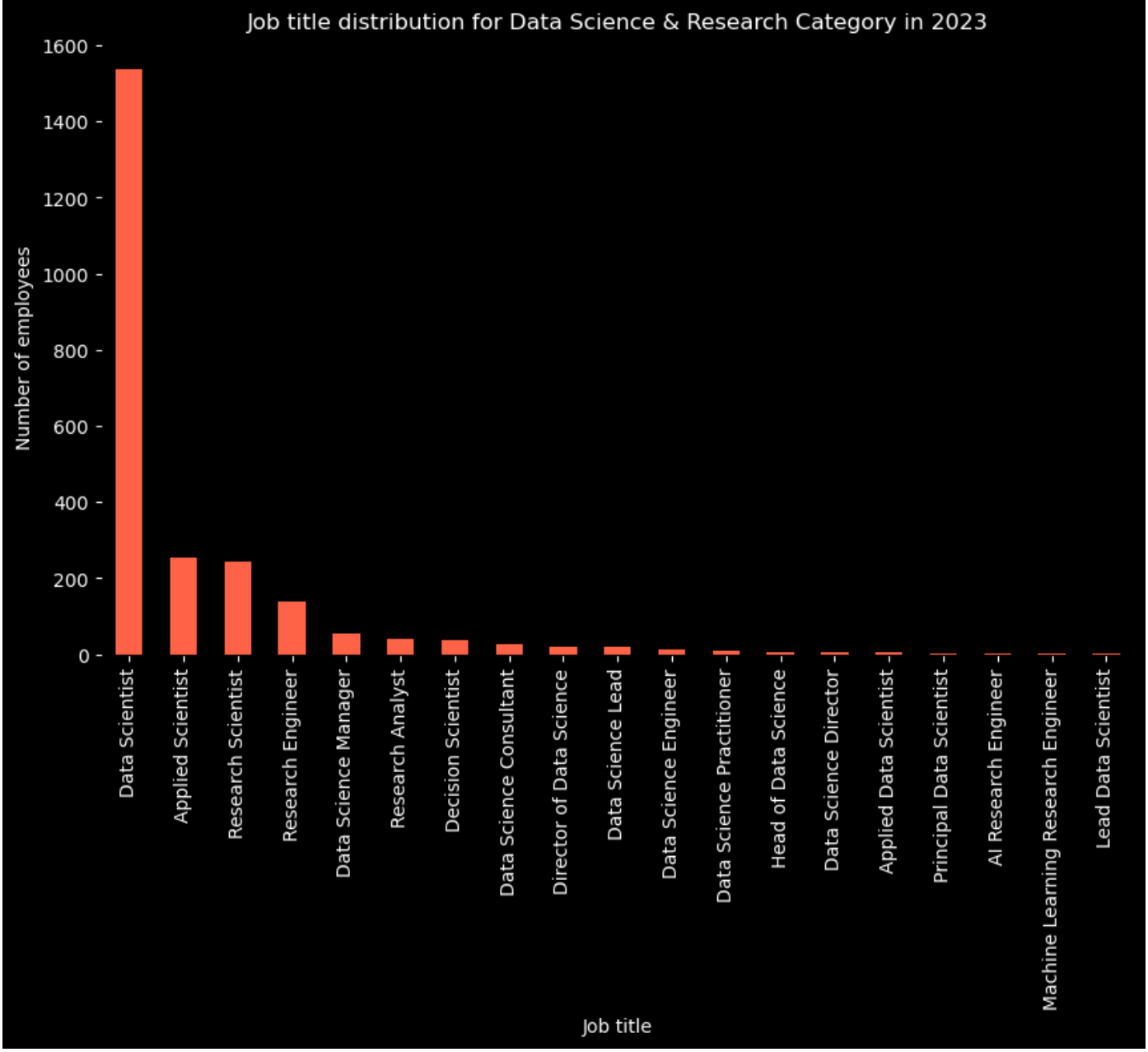
In 2023, Data Science and reserach was the category offering the highest number of jobs, so let us check the job title distibution amongst that category, to further easy the process of job search

In [85]:
```
data_science_df = data[data['job_category'] == 'Data Science and Research']
data_science_dfnew = data_science_df[data_science_df['work_year'] == 2023]
print(data_science_dfnew)
```

```
      work_year           job_title               job_category  \
3          2023      Data Scientist  Data Science and Research
4          2023      Data Scientist  Data Science and Research
5          2023      Data Scientist  Data Science and Research
6          2023      Data Scientist  Data Science and Research
13         2023      Data Scientist  Data Science and Research
...         ...                 ...                        ...
7469       2023  Research Scientist  Data Science and Research
7470       2023      Data Scientist  Data Science and Research
7471       2023      Data Scientist  Data Science and Research
7493       2023      Data Scientist  Data Science and Research
7494       2023      Data Scientist  Data Science and Research

     salary_currency  salary  salary_in_usd employee_residence  \
3                USD  212000         212000      United States
4                USD   93300          93300      United States
5                USD  130000         130000      United States
6                USD  100000         100000      United States
13               GBP   35000          43064     United Kingdom
...              ...     ...            ...                ...
7469             USD  145900         145900      United States
7470             USD  120000         120000             Canada
7471             USD  110000         110000             Canada
7493             USD  130000         130000      United States
7494             USD   90000          90000      United States

     experience_level employment_type work_setting company_location  \
3              Senior       Full-time    In-person    United States
4              Senior       Full-time    In-person    United States
5              Senior       Full-time       Remote    United States
6              Senior       Full-time       Remote    United States
13          Mid-level       Full-time    In-person   United Kingdom
...               ...             ...          ...              ...
7469           Senior       Full-time    In-person    United States
7470           Senior       Full-time    In-person           Canada
7471           Senior       Full-time    In-person           Canada
7493        Mid-level       Full-time    In-person    United States
7494        Mid-level       Full-time    In-person    United States

     company_size
3               M
4               M
5               M
6               M
13              M
...           ...
7469            M
7470            M
7471            M
7493            M
7494            M

[2413 rows x 12 columns]
```

In [88]:

```
plt.figure(figsize=(10,6))
data_science_dfnew['job_title'].value_counts().plot(kind='bar', color = 'tomato')
plt.xlabel("Job title", color = 'white' )
plt.ylabel("Number of employees", color = 'white')
plt.title("Job title distribution for Data Science & Research Category in 2023", color =
plt.gca().set_facecolor('black')
plt.gcf().set_facecolor('black')
plt.gca().tick_params(axis='x',colors='white')
plt.gca().tick_params(axis='y',colors='white')
plt.show()
```



From the above graph we can say that in 2023, in the category offering highest job, Data Scientists got highest employement followed by Applied scientist, Research Scientist and Reserach Engineer

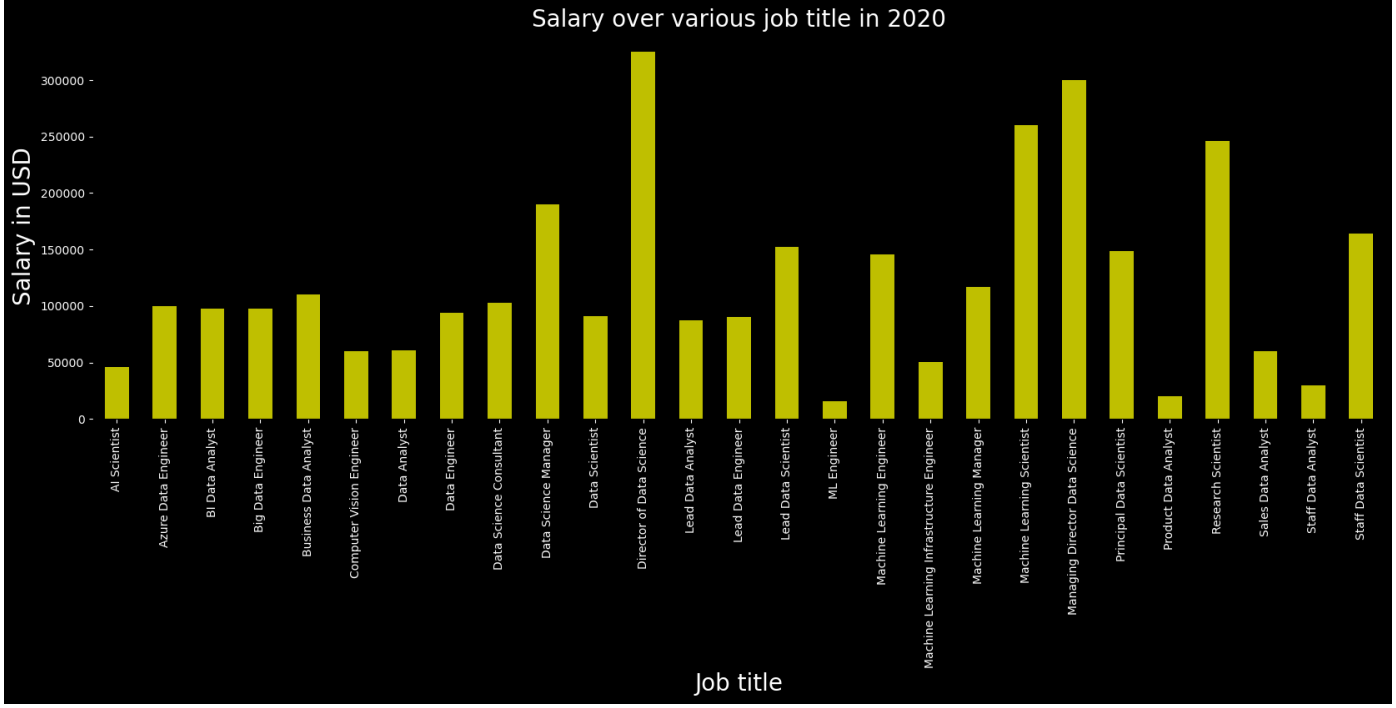
In [101…

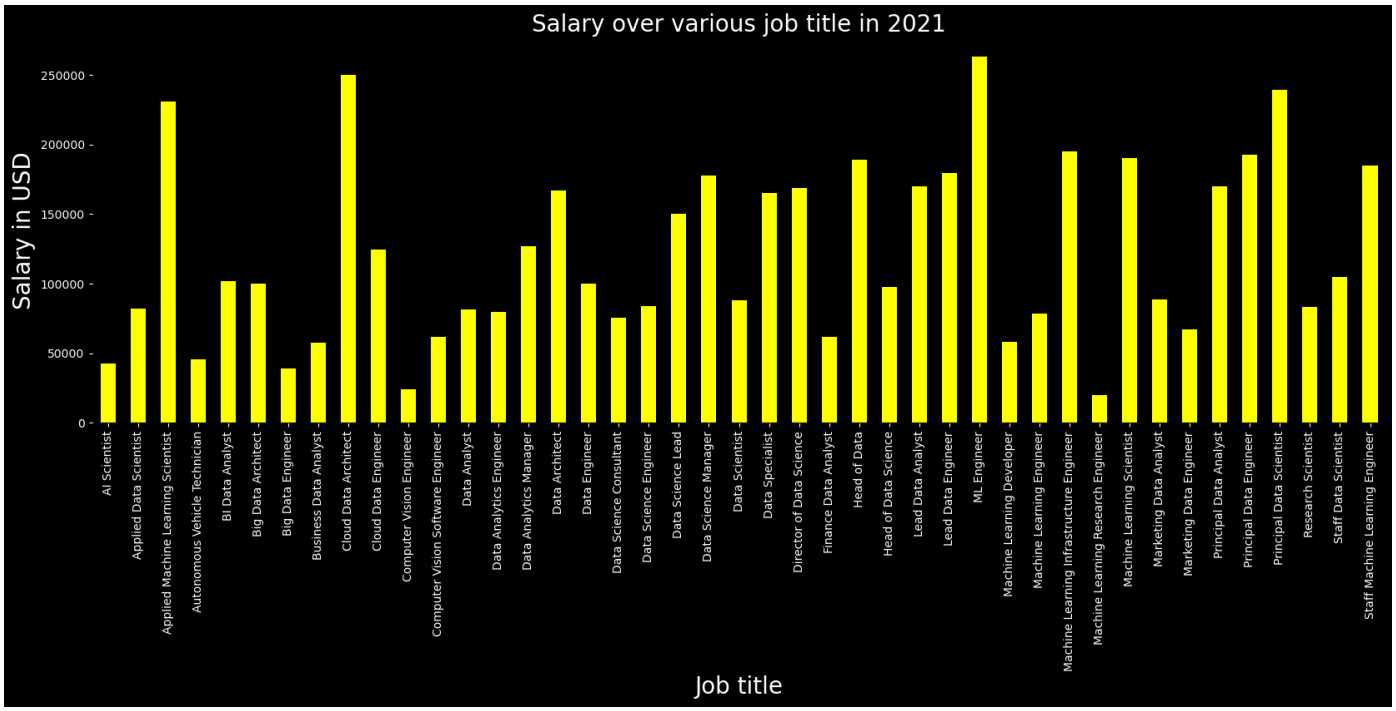
```
import plotly.express as px
from plotly.offline import iplot , plot
iplot(px.bar(df_job_title_USD.sort_values(ascending=False)[:10],
             orientation='h',
             labels={'value':'Salary in USD','job_title':'Job Title'},
             title='Job Title with Salaries USD',
             template='plotly_dark',
             color=df_job_title_USD.index[:10],
             text_auto=True
))
```

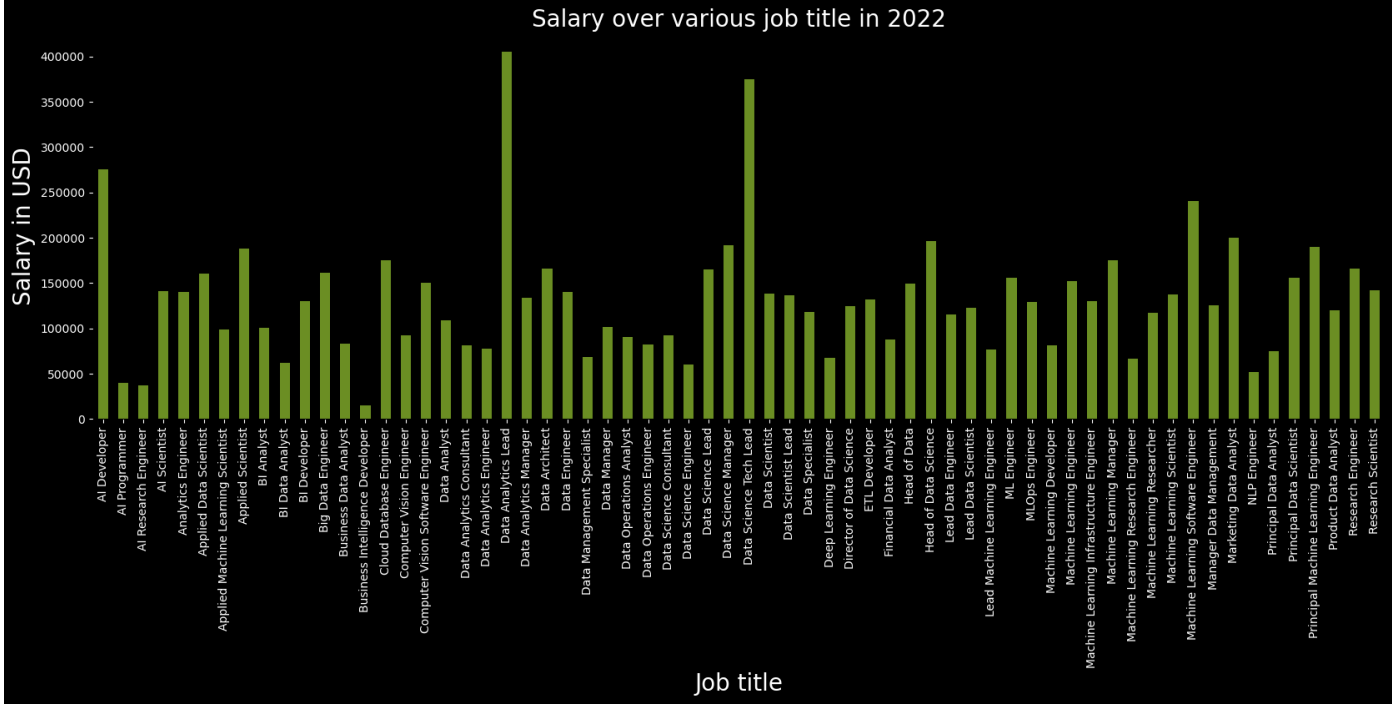
Above graph shows us that the maximum salary was offered by the Data Engineer job. Now we will analyse the salary distribution over various job titles in different years below:

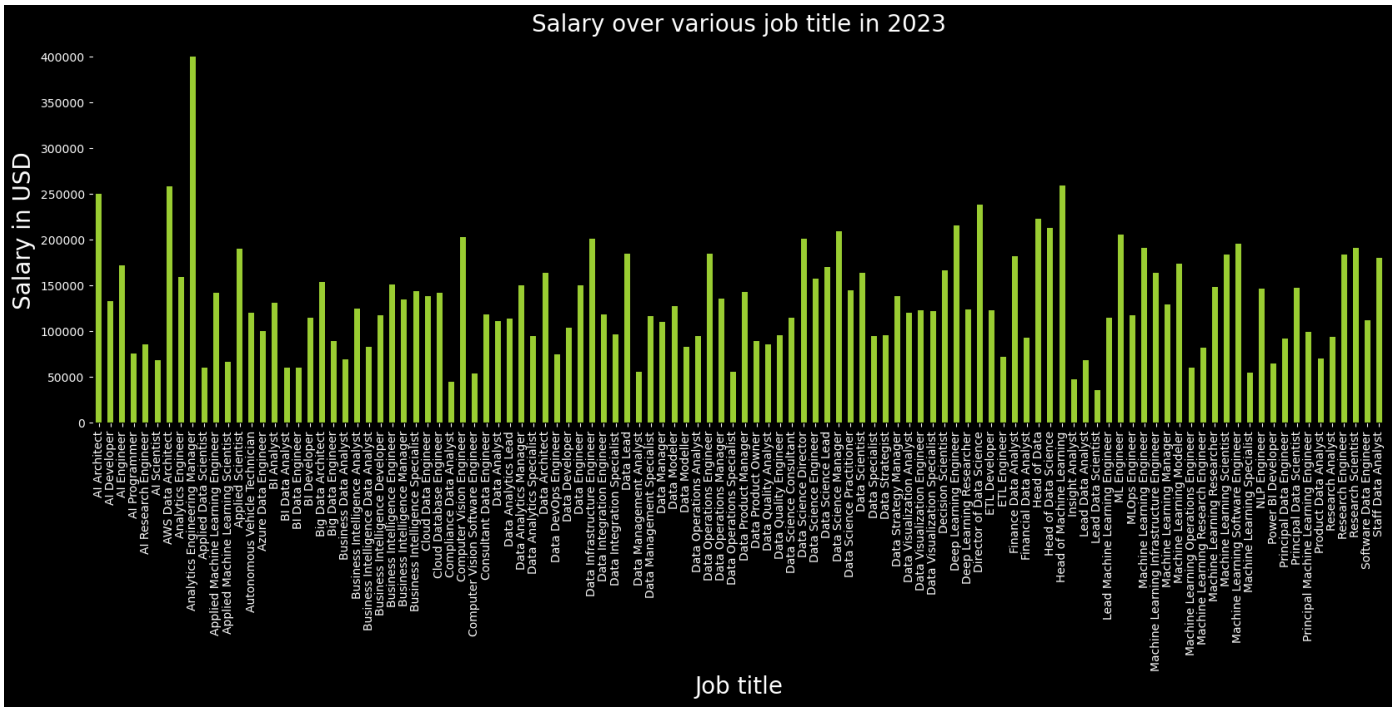
In [112…

```
df_salary_in_usd = data.groupby(['work_year','job_title'])['salary_in_usd'].mean()
colors = ['y','yellow','olivedrab','yellowgreen']
j = 0
for i in range(2020,2024):
    plt.figure(figsize=(20,6))
    df_salary_in_usd[i].plot(kind='bar', color = colors[j])
    plt.xlabel("Job title", color = 'white', fontsize = 20 )
    plt.ylabel("Salary in USD", color = 'white', fontsize = 20)
    plt.title(f"Salary over various job title in {i}", color = 'white', fontsize = 20)
    plt.gca().set_facecolor('black')
    plt.gcf().set_facecolor('black')
    plt.gca().tick_params(axis='x',colors='white')
    plt.gca().tick_params(axis='y',colors='white')
    plt.show()
    j+=1
```









The above graphs shows us the salary disrtibtion over different years under different job titles. Analysing these graphs will help us to selcet the job title as per the pay scale we are expecting and thus, will help the employee to prepare themselves for the particular job title

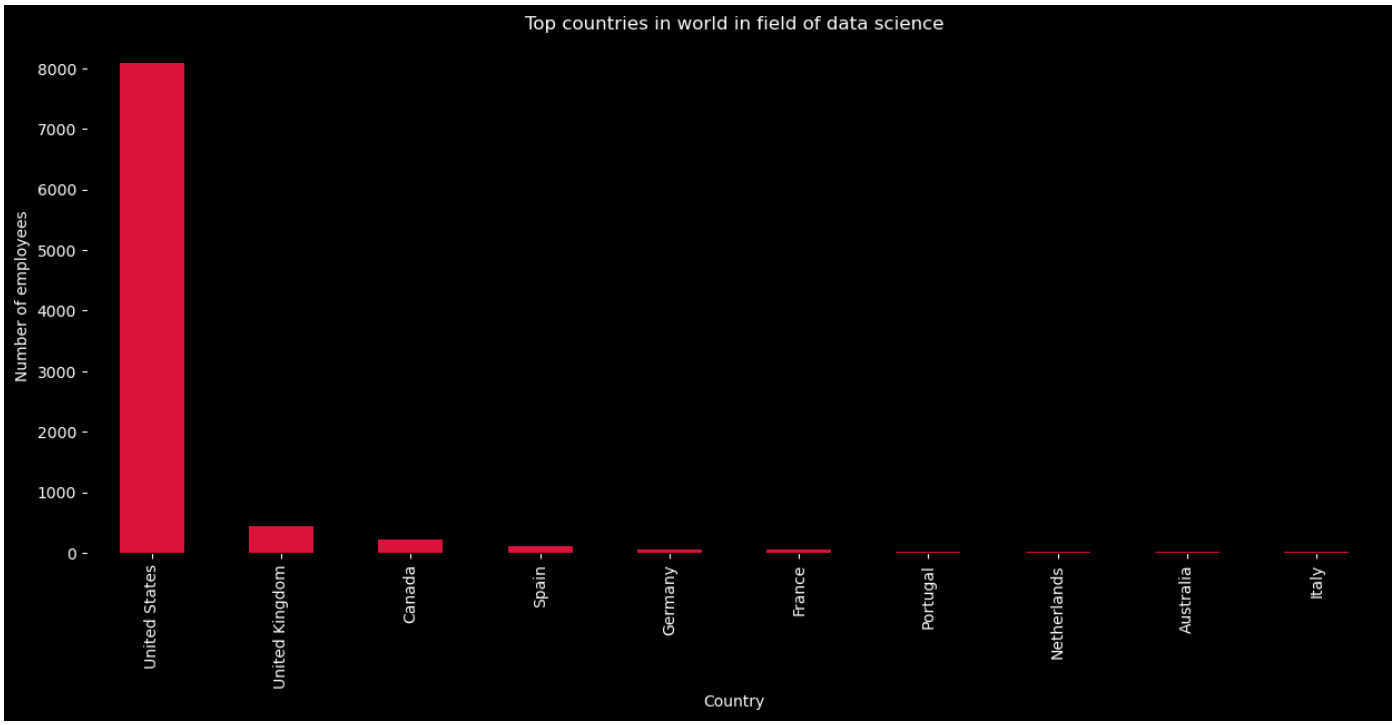
In [139…
```
data['employee_residence'].nunique()
```

Out[139]:
```
83
```

Now we can see that the dataset have data for 83 different countries, which will make it difficult to analyse it. SO we are analysing the data for only top 10 countries.

In [131…
```
plt.figure(figsize = (15,6))
var = data['employee_residence'].value_counts()
var[:10:].plot(kind='bar', color = 'crimson')
plt.xlabel("Country", color = 'white' )
plt.ylabel("Number of employees", color = 'white')
plt.title("Top countries in world in field of data science", color = 'white')
```

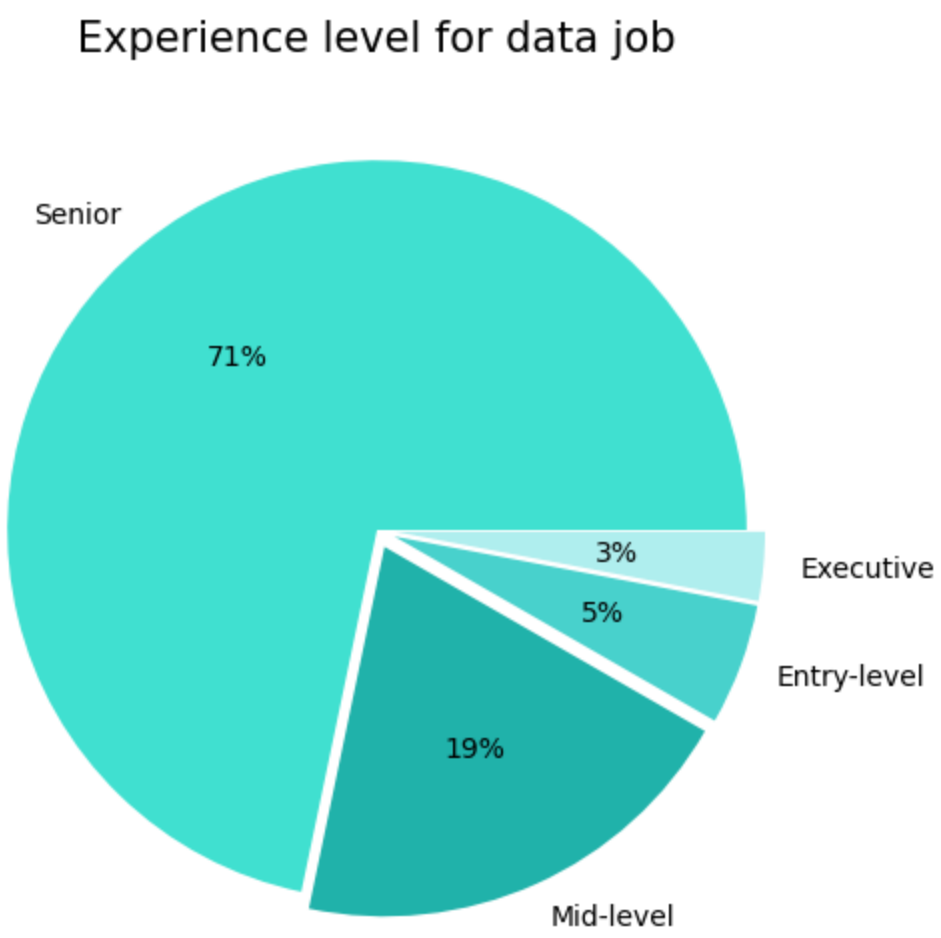
```
plt.gca().set_facecolor('black')
plt.gcf().set_facecolor('black')
plt.gca().tick_params(axis='x',colors='white')
plt.gca().tick_params(axis='y',colors='white')
plt.show()
```



From above graph we can say that the United states has maximum job opportunities for the data jobs followed by United Kingdom. Whereas Italy stands at 10th postion in this category.

In [137…

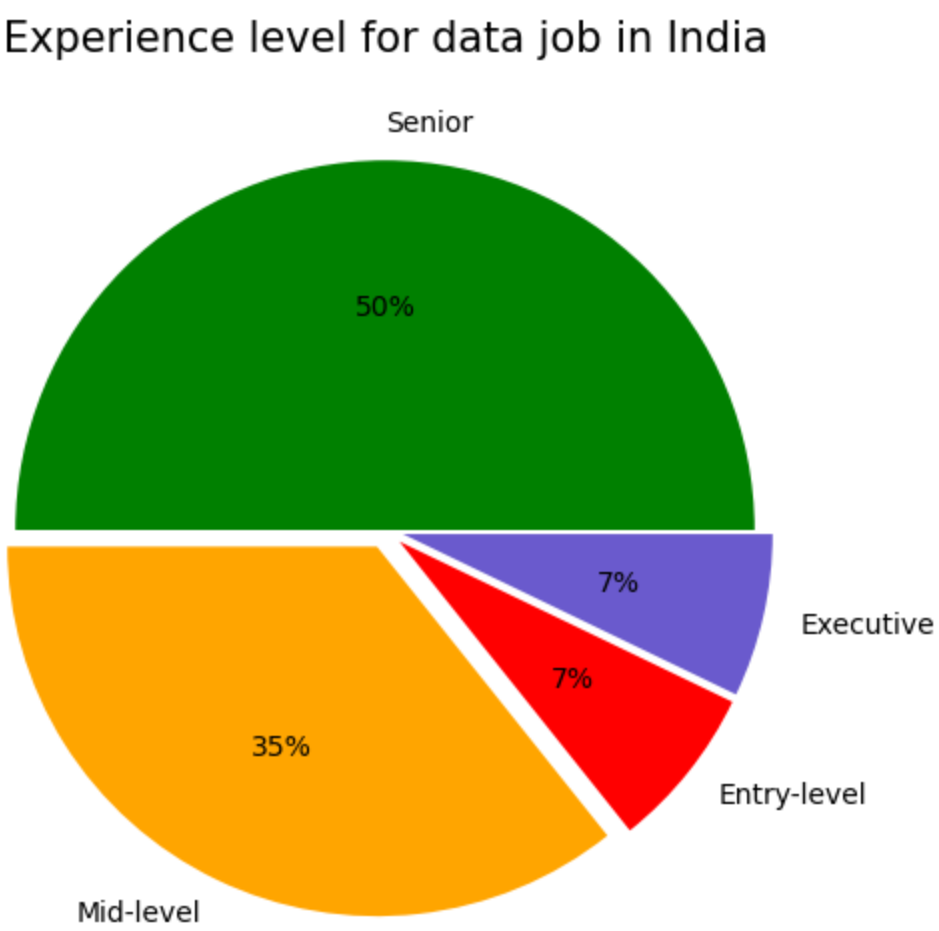
```
plt.figure(figsize=(10,6))
var1 = data['experience_level'].value_counts()
plt.pie(var1,labels=['Senior','Mid-level','Entry-level','Executive'],autopct='%i%%',colo
plt.title('Experience level for data job',fontsize=15,color='k');
```



The above pie chart shows that the maximum number of employment in the field was done for people with expertise at senior level for all these 4 years.Whereas the entry-level and the executive-level jobs contibute to total of 8% of job contibution.

In [147…

```
datajobs_india = data[data['employee_residence'] == 'India']          #creating a new dat
plt.figure(figsize=(10,6))
var2 = datajobs_india['experience_level'].value_counts()
plt.pie(var2,labels=['Senior','Mid-level','Entry-level','Executive'],autopct='%i%%',colo
plt.title('Experience level for data job in India',fontsize=15,color='k');
```

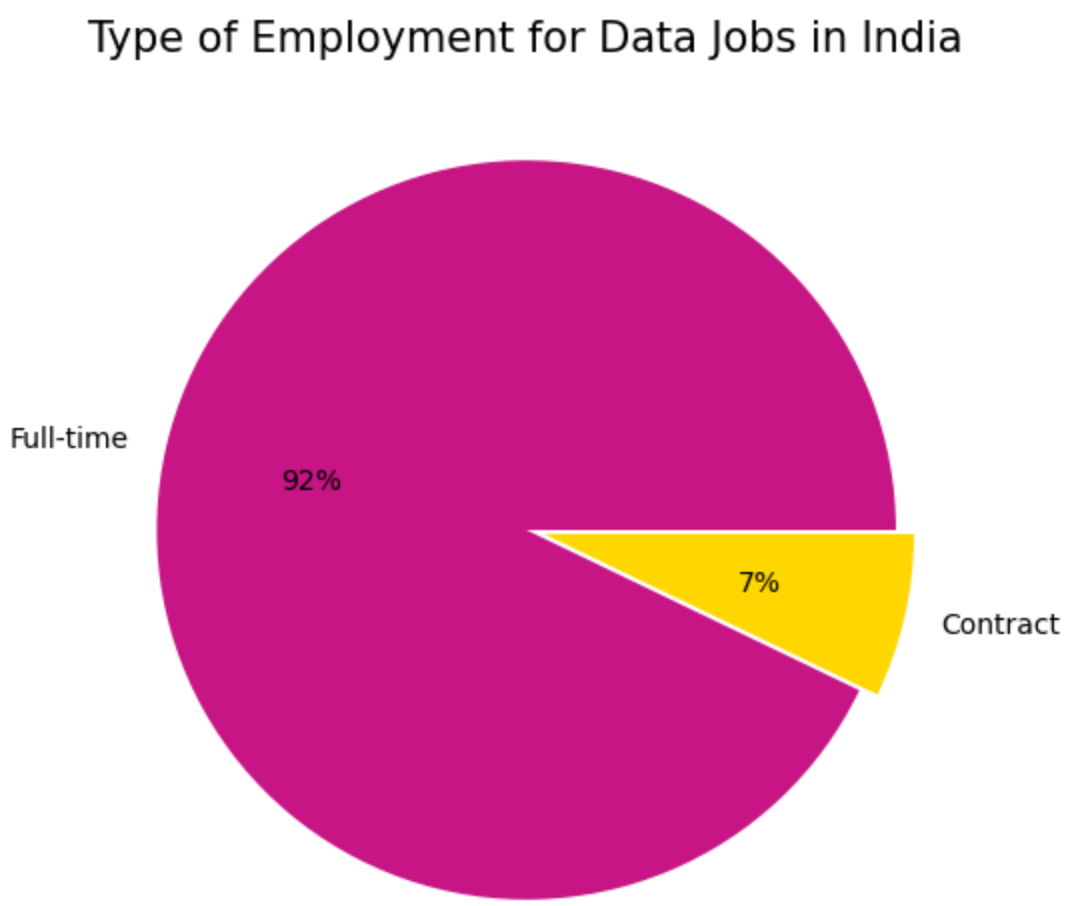


In Indian market the 50% of total jobs were offered for senior position whereas 14% of total jobs were offered for entry and executive level.

In [153…
```
data['employment_type'].unique()
```

Out[153]:
```
array(['Full-time', 'Part-time', 'Contract', 'Freelance'], dtype=object)
```

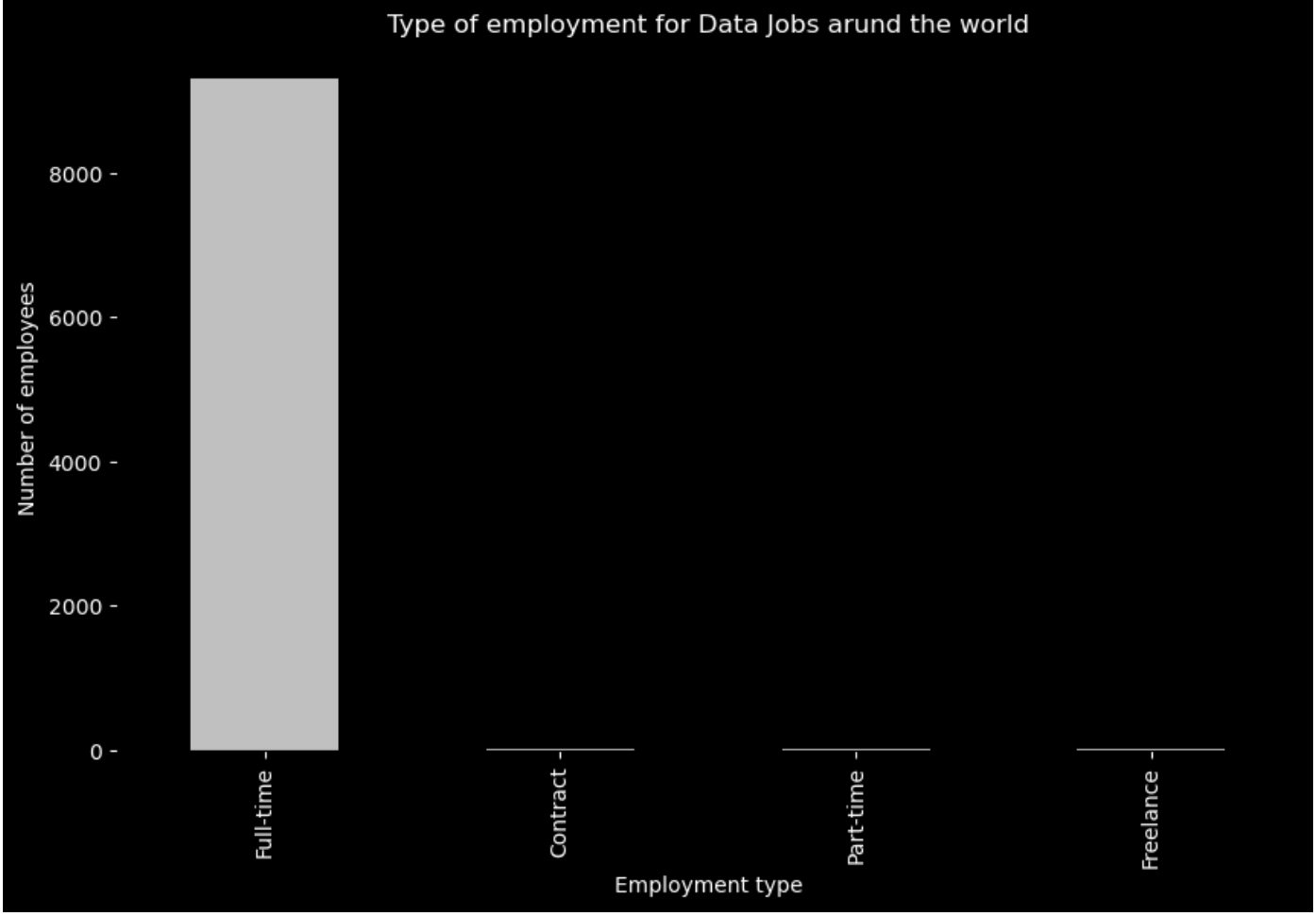
In [152…
```
plt.figure(figsize=(10,6))
var3 = datajobs_india['employment_type'].value_counts()
plt.pie(var3,labels=['Full-time','Contract'],autopct='%i%%',colors=['mediumvioletred','g
plt.title('Type of Employment for Data Jobs in India',fontsize=15,color='k');
```



In Indian market most of the employemnt is full-time and only 7% of jobs are offered on contract basis.

In [156…

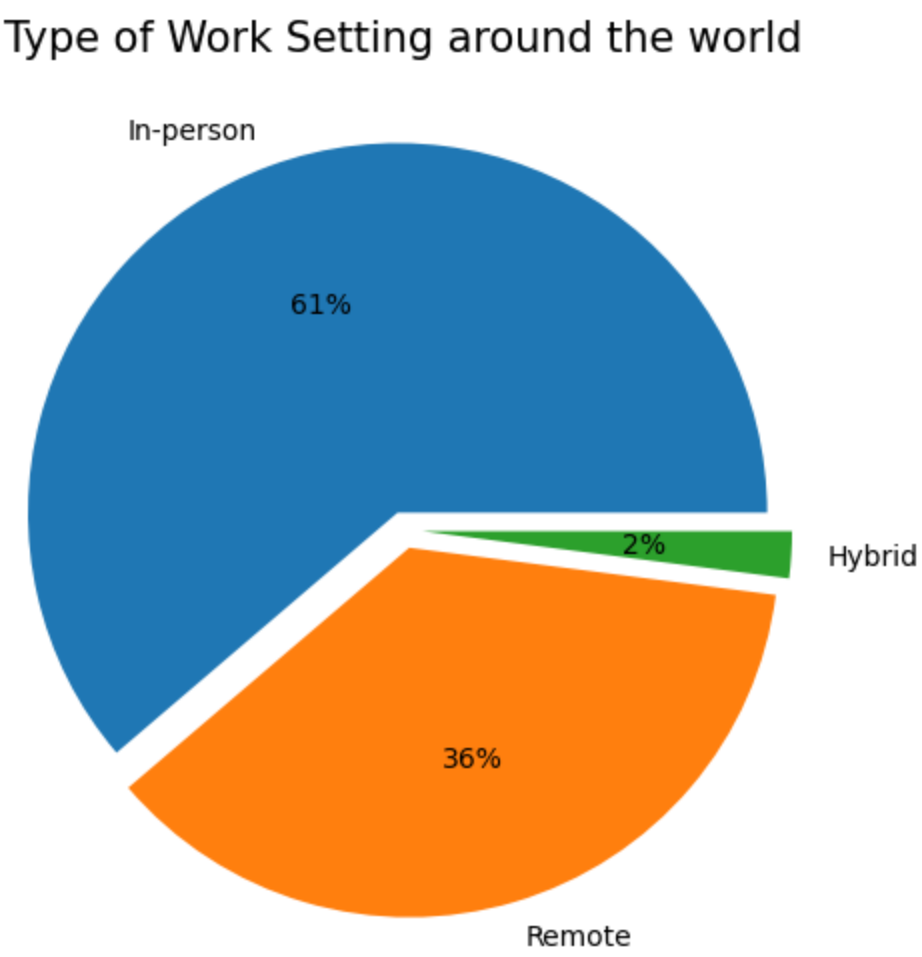
```
plt.figure(figsize=(10,6))
data['employment_type'].value_counts().plot(kind='bar', color = 'silver')
plt.xlabel("Employment type", color = 'white' )
plt.ylabel("Number of employees", color = 'white')
plt.title("Type of employment for Data Jobs arund the world", color = 'white')
plt.gca().set_facecolor('black')
plt.gcf().set_facecolor('black')
plt.gca().tick_params(axis='x',colors='white')
plt.gca().tick_params(axis='y',colors='white')
plt.show()
```



Around the world we can see that there are four job categories, with full-time category being the dominant one

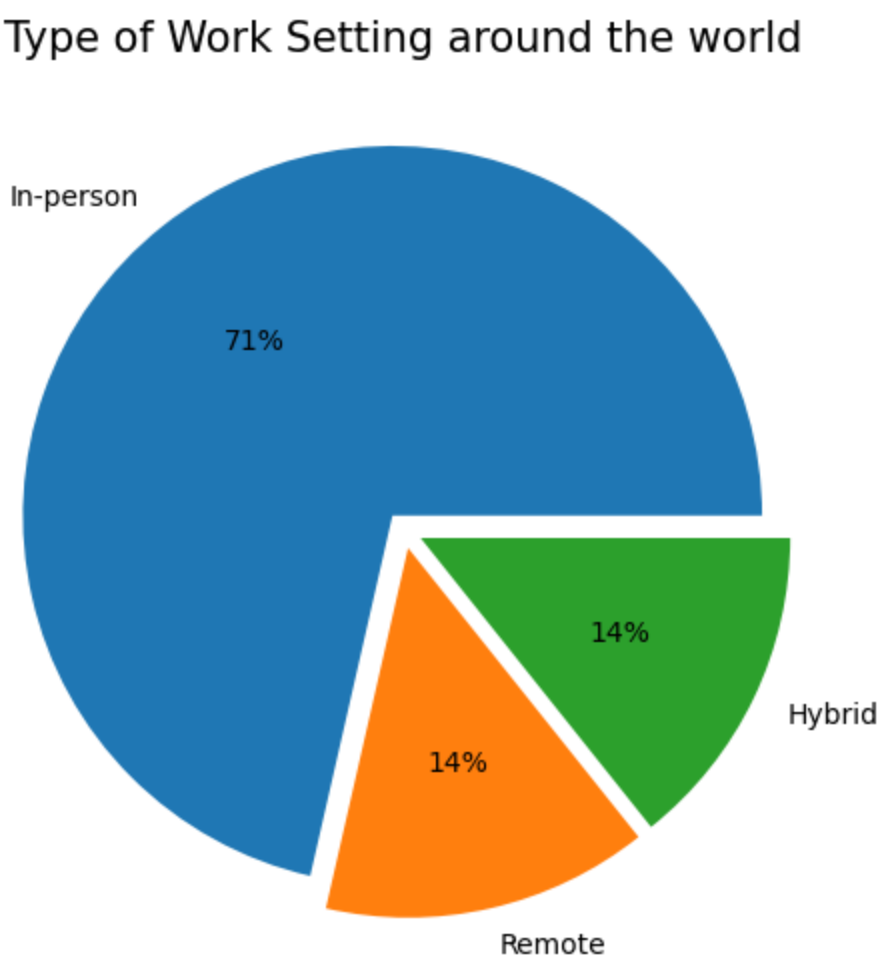
In [157…

```
plt.figure(figsize=(10,6))
var4 = data['work_setting'].value_counts()
plt.pie(var4,labels=['In-person','Remote','Hybrid'],autopct='%i%%',explode = [0.05,0.05,
plt.title('Type of Work Setting around the world',fontsize=15,color='k');
```



In [158…

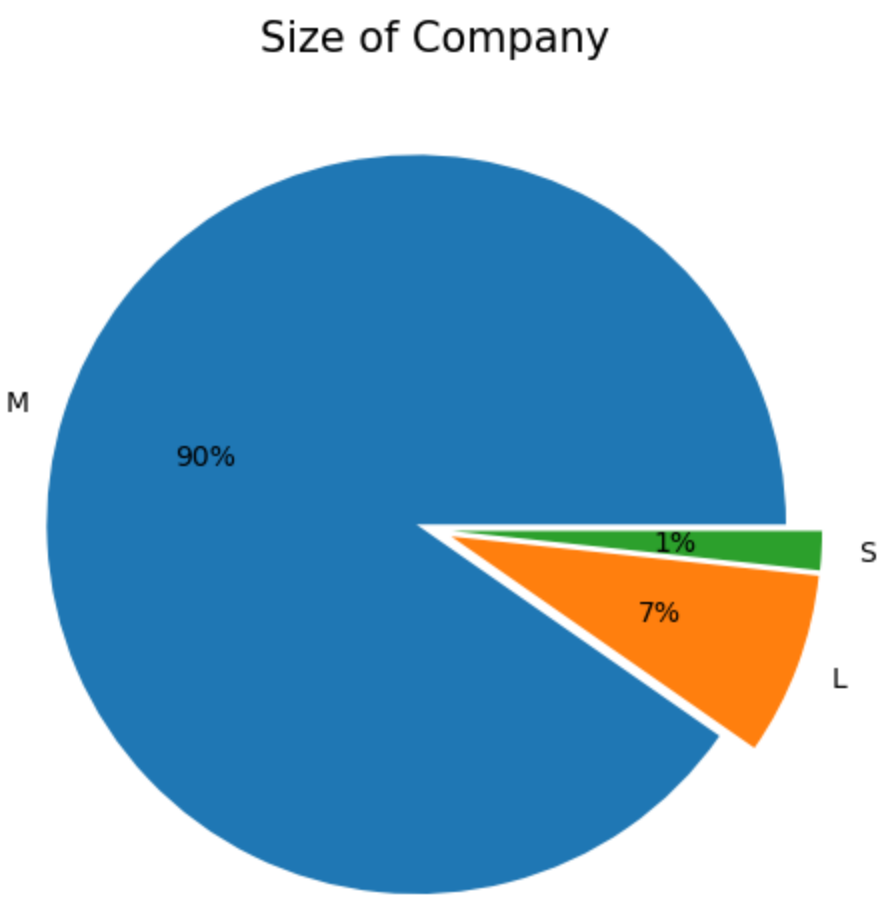
```
plt.figure(figsize=(10,6))
var4 = datajobs_india['work_setting'].value_counts()
plt.pie(var4,labels=['In-person','Remote','Hybrid'],autopct='%i%%',explode = [0.05,0.05,
plt.title('Type of Work Setting in India',fontsize=15,color='k');
```



In India and all over the world, the employment with in-person type of work setting is the dominant one. But in Indian market both the Hybrid and Remote work culture exsists with same percentage.This could be great insight form the point of view of the job-seekers with limited work setting requirements.

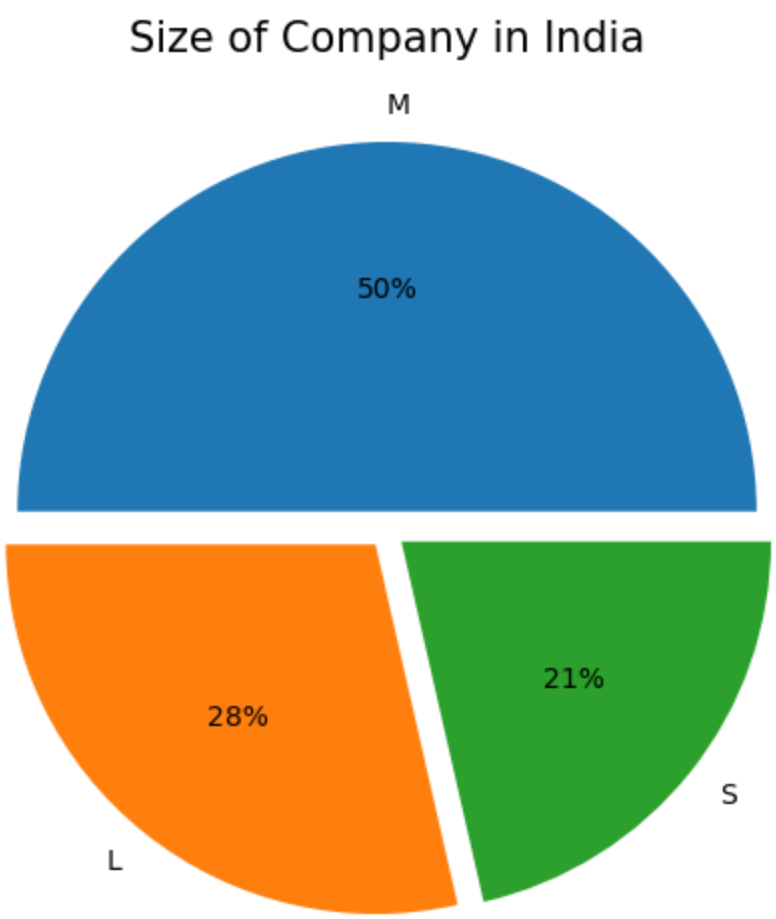
In [160…

```
plt.figure(figsize=(10,6))
var5 = data['company_size'].value_counts()
plt.pie(var5,labels=['M','L','S'],autopct='%i%%',explode = [0.05,0.05,0.05])
plt.title('Size of Company',fontsize=15,color='k');
```



In [161…

```
plt.figure(figsize=(10,6))
var6 = datajobs_india['company_size'].value_counts()
plt.pie(var6,labels=['M','L','S'],autopct='%i%%',explode = [0.05,0.05,0.05])
plt.title('Size of Company in India',fontsize=15,color='k');
```



Around the world medium-size company are the major employeer whereas in india the market is distibuted 50% with medium_scale companies and 50% with large-scale and small-scale companies.