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Факультет «Информатика и системы управления»
Кафедра ИУ5 «Системы обработки информации и управления»

Курс «Технологии машинного обучения»

Лабораторная работа №2.

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Задание:

1. Выбрать набор данных (датасет), содержащий категориальные признаки и пропуски в данных. Для выполнения следующих пунктов можно использовать несколько различных наборов данных (один для обработки пропусков, другой для категориальных признаков и т.д.)
2. Для выбранного датасета (датасетов) на основе материалов лекции решить следующие задачи:
   - обработку пропусков в данных;
   - кодирование категориальных признаков;
   - масштабирование данных.

Лабораторяная работа №2: Обработка пропусков в данных, кодирование категориальных признаков, масштабирование данных.

1) Обработка пропусков в данных

In [1]:

```
import pandas as pd
import matplotlib.pyplot as plt
import numpy  as  np
import seaborn as sns
sns.set(style="darkgrid")
```

In [2]:

```
df = pd.read_csv('fake_job_postings.csv')
```

In [3]:

```
df.head()
```

Out[3]:

	job_id	title	location	department	salary_range	company_profile	description	requirements	benefits	telec
0	1	Marketing Intern	US, NY, New York	Marketing	NaN	We're Food52, and we've created a groundbreaki...	Food52, a fast-growing, James Beard Award-winn...	Experience with content management systems a m...	NaN	
1	2	Customer Service - Cloud Video Production	NZ, , Auckland	Success	NaN	90 Seconds, the worlds Cloud Video Production ...	Organised - Focused - Vibrant - Awesome!Do you...	What we expect from you:Your key responsibilit...	What you will get from usThrough being part of...	
2	3	Commissioning Machinery Assistant (CMA)	US, IA, Wever	NaN	NaN	Valor Services provides Workforce Solutions th...	Our client, located in Houston, is actively se...	Implement pre-commissioning and commissioning ...	NaN	
3	4	Account Executive - Washington DC	US, DC, Washington	Sales	NaN	Our passion for improving quality of life thro...	THE COMPANY: ESRI – Environmental Systems Rese...	EDUCATION: Bachelor’s or Master’s in GIS, busi...	Our culture is anything but corporate—we have ...	
4	5	Bill Review Manager	US, FL, Fort Worth	NaN	NaN	SpotSource Solutions LLC is a Global Human Cap...	JOB TITLE: Itemization Review ManagerLOCATION:...	QUALIFICATIONS:RN license in the State of Texa...	Full Benefits Offered	

In [4]:

```
df.shape
```

Out[4]:

```
(17880, 18)
```

In [5]:

```
df.dtypes
```

Out[5]:

```
job_id                  int64
title                  object
location               object
department             object
salary_range           object
company_profile        object
description            object
requirements           object
benefits               object
telecommuting           int64
has_company_logo        int64
has_questions           int64
employment_type        object
required_experience    object
required_education     object
industry               object
function               object
fraudulent              int64
dtype: object
```

In [6]:

```
# отбор числовых колонок
df_numeric = df.select_dtypes(include=[np.number])
numeric_cols = df_numeric.columns.values
print(numeric_cols)
```

```
['job_id' 'telecommuting' 'has_company_logo' 'has_questions' 'fraudulent']
```

In [7]:

```
# отбор нечисловых колонок
df_non_numeric = df.select_dtypes(exclude=[np.number])
non_numeric_cols = df_non_numeric.columns.values
print(non_numeric_cols)
```

```
['title' 'location' 'department' 'salary_range' 'company_profile'
 'description' 'requirements' 'benefits' 'employment_type'
 'required_experience' 'required_education' 'industry' 'function']
```

In [8]:

```
for col in df.columns:
    pct_missing = np.mean(df[col].isnull())
    print('{} - {}%'.format(col, round(pct_missing*100)))
```

```
job_id - 0%
title - 0%
location - 2%
department - 65%
salary_range - 84%
company_profile - 19%
description - 0%
requirements - 15%
benefits - 40%
telecommuting - 0%
has_company_logo - 0%
has_questions - 0%
employment_type - 19%
required_experience - 39%
required_education - 45%
industry - 27%
function - 36%
fraudulent - 0%
```

In [9]:

```
#Выберем числовые колонки с пропущенными значениями
#Цикл по колонкам датасета
num_cols =[]
for col in df.columns:
    temp_null_count = df[df[col].isnull()].shape[0]
    dt = str(df[col].dtype)
    if temp_null_count>0 and (dt=='float64' or dt=='int64' or dt=='object'):
        num_cols.append(col)
        print('Столбец {}. Тип данных {}. Количество пустых значений {}.'.format(col, dt, temp_null_count))
```

```
Столбец location. Тип данных object. Количество пустых значений 346.
Столбец department. Тип данных object. Количество пустых значений 11547.
Столбец salary_range. Тип данных object. Количество пустых значений 15012.
Столбец company_profile. Тип данных object. Количество пустых значений 3308.
Столбец description. Тип данных object. Количество пустых значений 1.
Столбец requirements. Тип данных object. Количество пустых значений 2695.
Столбец benefits. Тип данных object. Количество пустых значений 7210.
Столбец employment_type. Тип данных object. Количество пустых значений 3471.
Столбец required_experience. Тип данных object. Количество пустых значений 7050.
Столбец required_education. Тип данных object. Количество пустых значений 8105.
Столбец industry. Тип данных object. Количество пустых значений 4903.
Столбец function. Тип данных object. Количество пустых значений 6455.
```

Для данного датасета наличие пустых значений во многих столбцах является нормой. Следует отбросить пустые строки для столбцов `industry` , `function` , `descriprion` , `requirements` . В остальных столбцах заменим пропущенные значения: на `_MISSING_` для нечисловых признаков.

In [10]:

```
df =  df.dropna(subset=['industry'],  axis=0)
df =  df.dropna(subset=['function'],  axis=0)
df = df.dropna(subset=['description'], axis=0)
df = df.dropna(subset=['requirements'], axis=0)
```

In [11]:

```
for col in df.columns:
    pct_missing = np.mean(df[col].isnull())
    print('{} - {}%'.format(col, round(pct_missing*100)))
```

```
job_id - 0%
title - 0%
location - 1%
department - 58%
salary_range - 76%
company_profile - 15%
description - 0%
requirements - 0%
benefits - 29%
telecommuting - 0%
has_company_logo - 0%
has_questions - 0%
employment_type - 2%
required_experience - 12%
required_education - 21%
industry - 0%
function - 0%
fraudulent - 0%
```

In [12]:

```
for col in df.columns:
    temp_null_count = df[df[col].isnull()].shape[0]
    if temp_null_count>0:
        df[col] = df[col].fillna(0)
```

In [13]:

```
for col in df.columns:
    pct_missing = np.mean(df[col].isnull())
    print('{} - {}%'.format(col, round(pct_missing*100)))
```

```
job_id - 0%
title - 0%
location - 0%
department - 0%
salary_range - 0%
company_profile - 0%
description - 0%
requirements - 0%
benefits - 0%
telecommuting - 0%
has_company_logo - 0%
has_questions - 0%
employment_type - 0%
required_experience - 0%
required_education - 0%
industry - 0%
function - 0%
fraudulent - 0%
```

2) Кодирование категориальных признаков

In [14]:

```
df.head()
```

Out[14]:

	job_id	title	location	department	salary_range	company_profile	description	requirements	benefits
1	2	Customer Service - Cloud Video Production	NZ, , Auckland	Success	0	90 Seconds, the worlds Cloud Video Production ...	Organised - Focused - Vibrant - Awesome!Do you...	What we expect from you:Your key responsibilit...	What you will get from usThrough being part of...
3	4	Account Executive - Washington DC	US, DC, Washington	Sales	0	Our passion for improving quality of life thro...	THE COMPANY: ESRI – Environmental Systems Rese...	EDUCATION: Bachelor’s or Master’s in GIS, busi...	Our culture is anything but corporate—we have ...
4	5	Bill Review Manager	US, FL, Fort Worth	0	0	SpotSource Solutions LLC is a Global Human Cap...	JOB TITLE: Itemization Review ManagerLOCATION:...	QUALIFICATIONS:RN license in the State of Texa...	Full Benefits Offered
6	7	Head of Content (m/f)	DE, BE, Berlin	ANDROIDPIT	20000-28000	Founded in 2009, the Fonpit AG rose with its i...	Your Responsibilities: Manage the English-spea...	How: Your Know- ...	Your Benefits: Being part of a fast-growing co...
9	10	Customer Service Associate - Part Time	US, AZ, Phoenix	0	0	Novitex Enterprise Solutions, formerly Pitney ...	The Customer Service Associate will be based i...	Minimum Requirements:Minimum of 6 months custo...	0

In [15]:

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 9739 entries, 1 to 17879
Data columns (total 18 columns):
 #   Column               Non-Null Count  Dtype 
---  ------               --------------  ----- 
 0   job_id               9739 non-null   int64 
 1   title                9739 non-null   object
 2   location             9739 non-null   object
 3   department           9739 non-null   object
 4   salary_range         9739 non-null   object
 5   company_profile      9739 non-null   object
 6   description          9739 non-null   object
 7   requirements         9739 non-null   object
 8   benefits             9739 non-null   object
 9   telecommuting        9739 non-null   int64 
 10  has_company_logo     9739 non-null   int64 
 11  has_questions        9739 non-null   int64 
 12  employment_type      9739 non-null   object
 13  required_experience  9739 non-null   object
 14  required_education   9739 non-null   object
 15  industry             9739 non-null   object
 16  function             9739 non-null   object
 17  fraudulent           9739 non-null   int64 
dtypes: int64(5), object(13)
memory usage: 1.4+ MB
```

In [16]:

```
category_cols1 = ['title', 'location', 'department', 'salary_range', 'company_profile', 'description', 'requirem
                  'benefits', 'required_experience', 'required_education', 'industry', 'function']
```

In [17]:

```
print("Количество уникальных значений\n")
for col in category_cols1:
    print(f'{col}: {df[col].unique().size}')
```

```
Количество уникальных значений

title: 6417
location: 1977
department: 890
salary_range: 752
company_profile: 1320
description: 8468
requirements: 7945
benefits: 4326
required_experience: 8
required_education: 14
industry: 131
function: 37
```

In [26]:

```
category_cols = []
for col in category_cols1:
    unic = int(df[col].unique().size)
    if unic<1000:
        category_cols.append(col)
print(category_cols)
```

```
['department', 'salary_range', 'required_experience', 'required_education', 'industry', 'function']
```

In [27]:

```
for col in category_cols:
    df = pd.concat([df, pd.get_dummies(df[col])], axis=1)
```

In [28]:

```
df.head()
```

Out[28]:

	job_id	title	location	department	salary_range	company_profile	description	requirements	benefits
1	2	Customer Service - Cloud Video Production	NZ, , Auckland	Success	0	90 Seconds, the worlds Cloud Video Production ...	Organised - Focused - Vibrant - Awesome!Do you...	What we expect from you:Your key responsibilit...	What you will get from usThrough being part of...
		Account							Our culture is

3	4	Executive - Washington DC	US, DC, Washington	Sales	0	Our passion for improving quality of life thro...	THE COMPANY: ESRI – Environmental Systems Rese...	EDUCATION: Bachelor's or Master's in GIS, busi...	anything but corporate—we have ...
4	5	Bill Review Manager	US, FL, Fort Worth	0	0	SpotSource Solutions LLC is a Global Human Cap...	JOB TITLE: Itemization Review ManagerLOCATION:...	QUALIFICATIONS:RN license in the State of Texa...	Full Benefits Offered
6	7	Head of Content (m/f)	DE, BE, Berlin	ANDROIDPIT	20000-28000	Founded in 2009, the Fonpit AG rose with its i...	Your Responsibilities: Manage the English-spea...	How: Your Know- ...	Your Benefits: Being part of a fast-growing co...
9	10	Customer Service Associate - Part Time	US, AZ, Phoenix	0	0	Novitex Enterprise Solutions, formerly Pitney ...	The Customer Service Associate will be based i...	Minimum Requirements:Minimum of 6 months custo...	0

5 rows × 1850 columns

3) Масштабирование данных

В текущем датасете не нашлось признаков для масштабирования, поэтому используем другой датасет для выполнения пункта.

In [38]:
```
data = pd.read_csv('fortune500.csv')
data.columns = ['year', 'rank', 'company', 'revenue', 'profit']
data.head()
```

Out[38]:

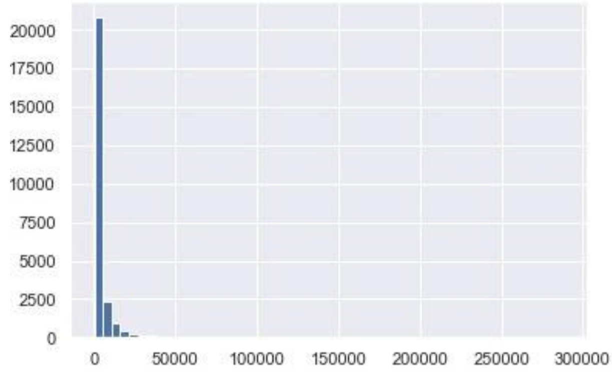
	year	rank	company	revenue	profit
0	1955	1	General Motors	9823.5	806
1	1955	2	Exxon Mobil	5661.4	584.8
2	1955	3	U.S. Steel	3250.4	195.4
3	1955	4	General Electric	2959.1	212.6
4	1955	5	Esmark	2510.8	19.1

In [29]:
```
from sklearn.preprocessing import MinMaxScaler, StandardScaler
```

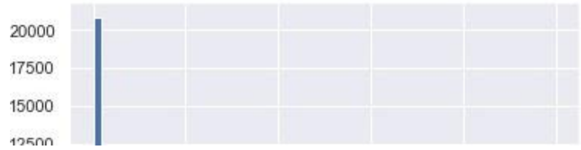
MinMax масштабирование

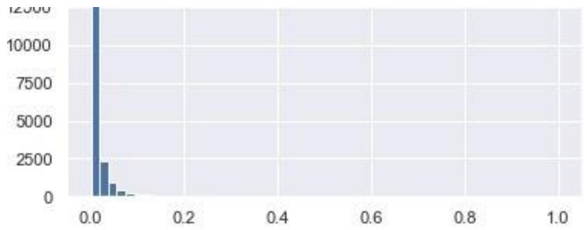
In [47]:
```
sc1 = MinMaxScaler()
sc1_data = sc1.fit_transform(data[['revenue']])
```

In [50]:
```
plt.hist(data['revenue'], 54)
plt.show()
```



In [51]:
```
plt.hist(sc1_data, 54)
plt.show()
```





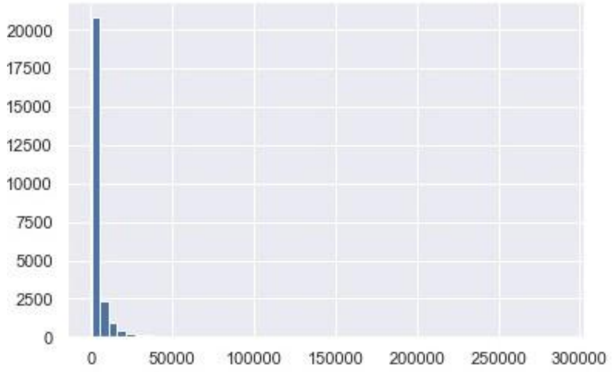
Масштабирование данных на основе Z-оценки

In [52]:

```
sc2 = StandardScaler()
sc2_data = sc2.fit_transform(data[['revenue']])
```

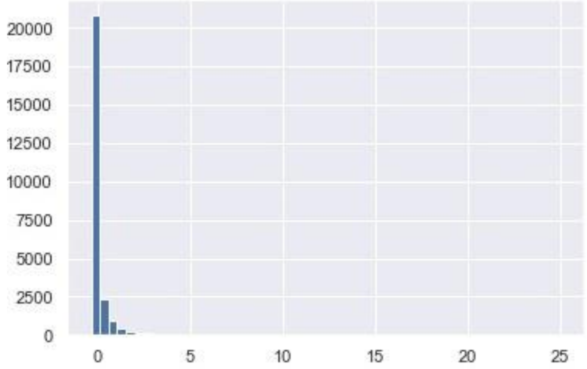
In [54]:

```
plt.hist(data['revenue'], 54)
plt.show()
```



In [55]:

```
plt.hist(sc2_data, 54)
plt.show()
```



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