Московский государственный технический университет им. Н.Э. Баумана
Факультет «Информатика и системы управления»
Кафедра «Системы обработки информации и управления»

Отчёт

“Методы машинного обучения”

Лабораторная работа № 3

“Обработка пропусков в данных, кодирование категориальных признаков, масштабирование данных”

ИСПОЛНИТЕЛЬ:

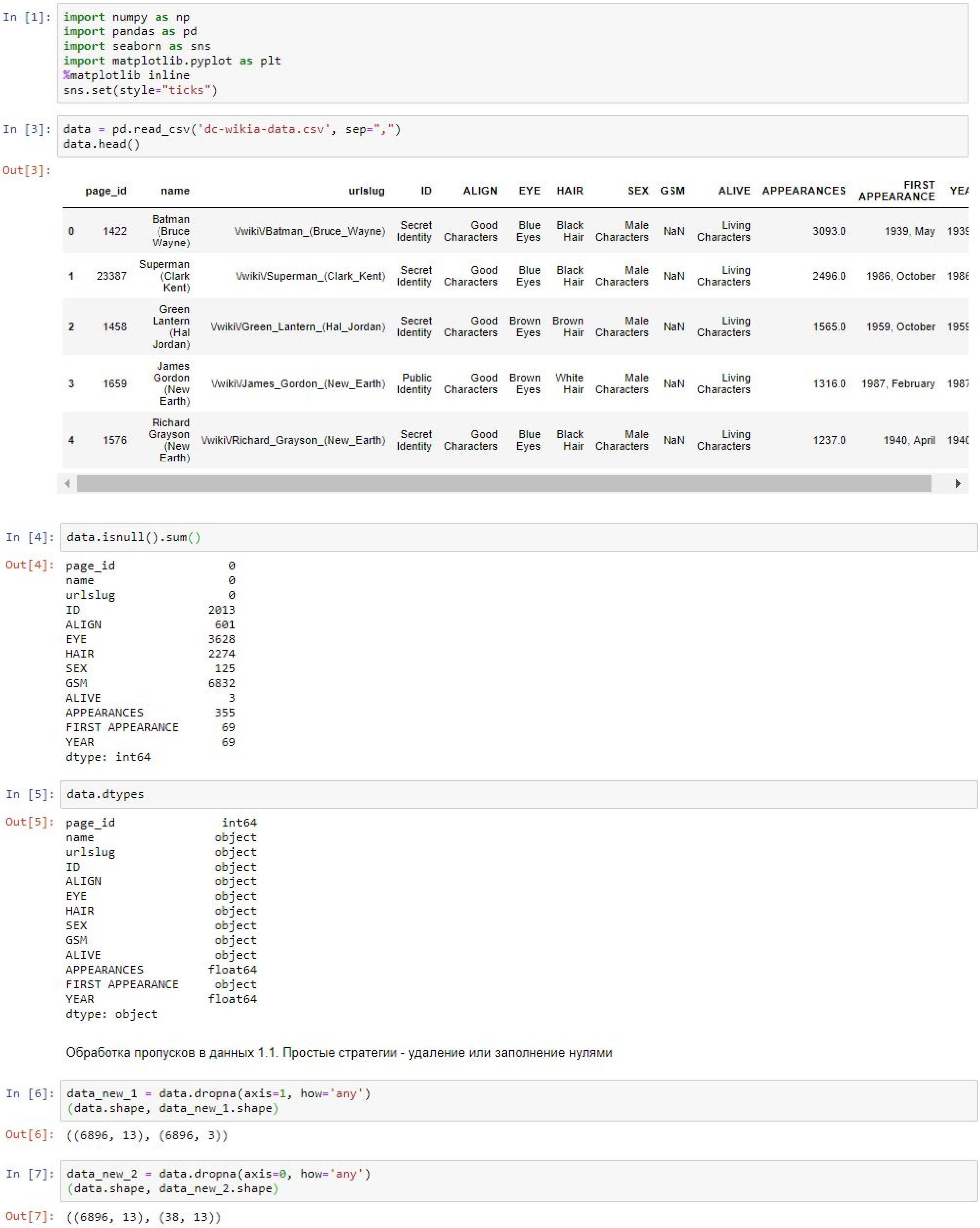
Студент группы ИУ5-21М

Коростелёв В.М. _____________

ПРЕПОДАВАТЕЛЬ:

Гапанюк Ю.Е. _____________

Москва – 2019



In [1]:
```
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
%matplotlib inline
sns.set(style="ticks")
```

In [3]:
```
data = pd.read_csv('dc-wikia-data.csv', sep=",")
data.head()
```

Out[3]:

	page_id	name	urlslug	ID	ALIGN	EYE	HAIR	SEX	GSM	ALIVE	APPEARANCES	FIRST APPEARANCE	YEA
0	1422	Batman (Bruce Wayne)	\/wiki\/Batman_(Bruce_Wayne)	Secret Identity	Good Characters	Blue Eyes	Black Hair	Male Characters	NaN	Living Characters	3093.0	1939, May	1939
1	23387	Superman (Clark Kent)	\/wiki\/Superman_(Clark_Kent)	Secret Identity	Good Characters	Blue Eyes	Black Hair	Male Characters	NaN	Living Characters	2496.0	1986, October	1986
2	1458	Green Lantern (Hal Jordan)	\/wiki\/Green_Lantern_(Hal_Jordan)	Secret Identity	Good Characters	Brown Eyes	Brown Hair	Male Characters	NaN	Living Characters	1565.0	1959, October	1959
3	1659	James Gordon (New Earth)	\/wiki\/James_Gordon_(New_Earth)	Public Identity	Good Characters	Brown Eyes	White Hair	Male Characters	NaN	Living Characters	1316.0	1987, February	1987
4	1576	Richard Grayson (New Earth)	\/wiki\/Richard_Grayson_(New_Earth)	Secret Identity	Good Characters	Blue Eyes	Black Hair	Male Characters	NaN	Living Characters	1237.0	1940, April	1940

In [4]:
```
data.isnull().sum()
```

Out[4]:
```
page_id                0
name                   0
urlslug                0
ID                  2013
ALIGN                601
EYE                 3628
HAIR                2274
SEX                  125
GSM                 6832
ALIVE                  3
APPEARANCES          355
FIRST APPEARANCE      69
YEAR                  69
dtype: int64
```

In [5]:
```
data.dtypes
```

Out[5]:
```
page_id               int64
name                 object
urlslug              object
ID                   object
ALIGN                object
EYE                  object
HAIR                 object
SEX                  object
GSM                  object
ALIVE                object
APPEARANCES         float64
FIRST APPEARANCE     object
YEAR                float64
dtype: object
```

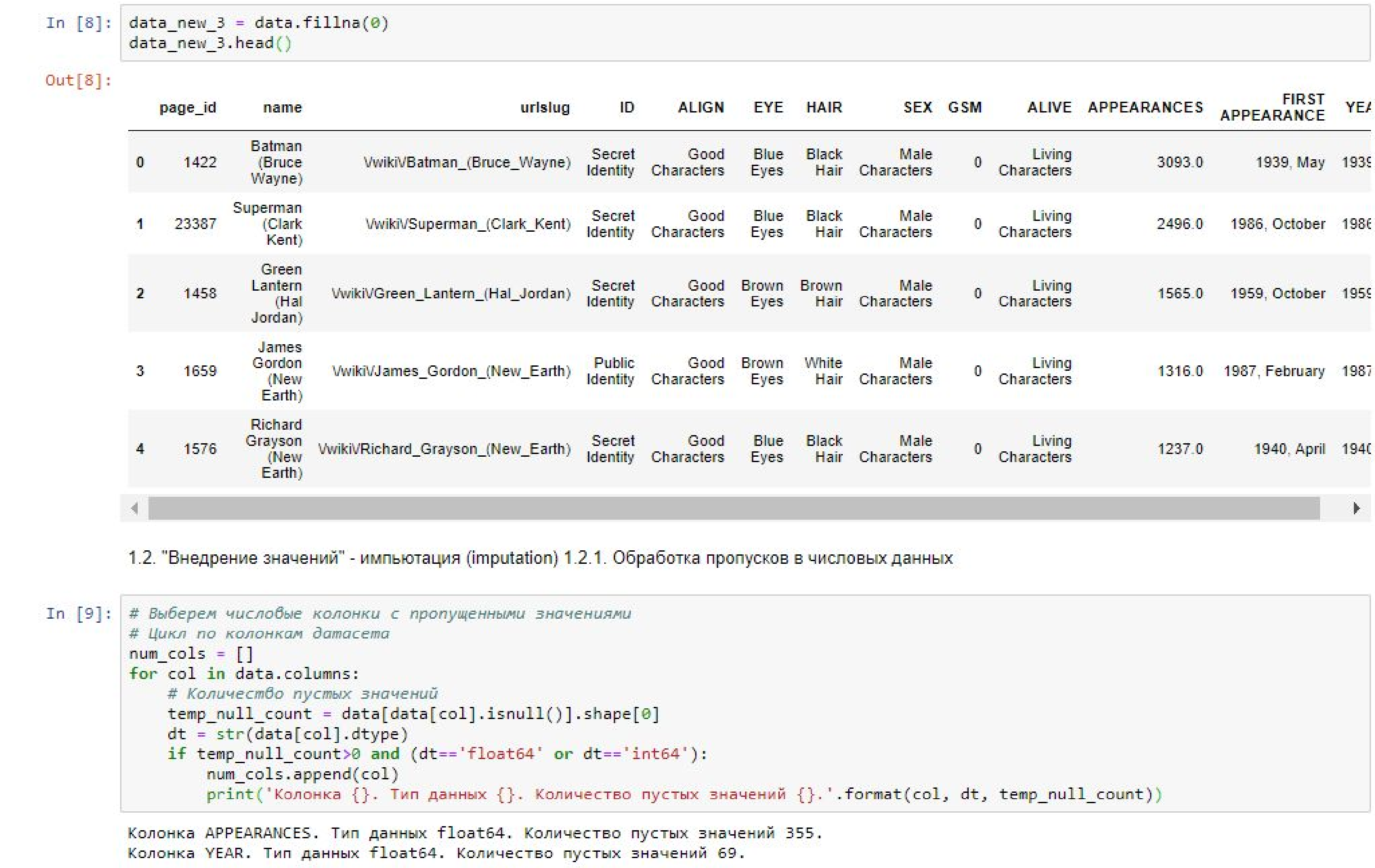
Обработка пропусков в данных 1.1. Простые стратегии - удаление или заполнение нулями

In [6]:
```
data_new_1 = data.dropna(axis=1, how='any')
(data.shape, data_new_1.shape)
```

Out[6]:
```
((6896, 13), (6896, 3))
```

In [7]:
```
data_new_2 = data.dropna(axis=0, how='any')
(data.shape, data_new_2.shape)
```

Out[7]:
```
((6896, 13), (38, 13))
```



```
In [8]: data_new_3 = data.fillna(0)
        data_new_3.head()
```

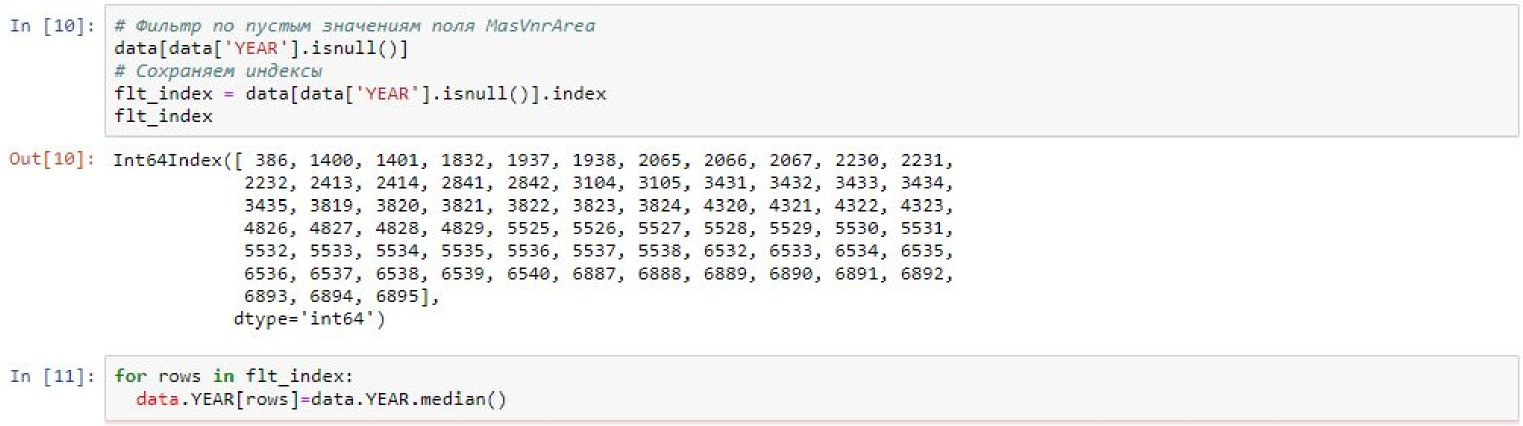
Out[8]:

	page_id	name	urlslug	ID	ALIGN	EYE	HAIR	SEX	GSM	ALIVE	APPEARANCES	FIRST APPEARANCE	YEA
0	1422	Batman (Bruce Wayne)	VwikiVBatman_(Bruce_Wayne)	Secret Identity	Good Characters	Blue Eyes	Black Hair	Male Characters	0	Living Characters	3093.0	1939, May	1939
1	23387	Superman (Clark Kent)	VwikiVSuperman_(Clark_Kent)	Secret Identity	Good Characters	Blue Eyes	Black Hair	Male Characters	0	Living Characters	2496.0	1986, October	1986
2	1458	Green Lantern (Hal Jordan)	VwikiVGreen_Lantern_(Hal_Jordan)	Secret Identity	Good Characters	Brown Eyes	Brown Hair	Male Characters	0	Living Characters	1565.0	1959, October	1959
3	1659	James Gordon (New Earth)	VwikiVJames_Gordon_(New_Earth)	Public Identity	Good Characters	Brown Eyes	White Hair	Male Characters	0	Living Characters	1316.0	1987, February	1987
4	1576	Richard Grayson (New Earth)	VwikiVRichard_Grayson_(New_Earth)	Secret Identity	Good Characters	Blue Eyes	Black Hair	Male Characters	0	Living Characters	1237.0	1940, April	1940

1.2. "Внедрение значений" - импьютация (imputation) 1.2.1. Обработка пропусков в числовых данных

```
In [9]: # Выберем числовые колонки с пропущенными значениями
        # Цикл по колонкам датасета
        num_cols = []
        for col in data.columns:
            # Количество пустых значений
            temp_null_count = data[data[col].isnull()].shape[0]
            dt = str(data[col].dtype)
            if temp_null_count>0 and (dt=='float64' or dt=='int64'):
                num_cols.append(col)
                print('Колонка {}. Тип данных {}. Количество пустых значений {}.'.format(col, dt, temp_null_count))
```

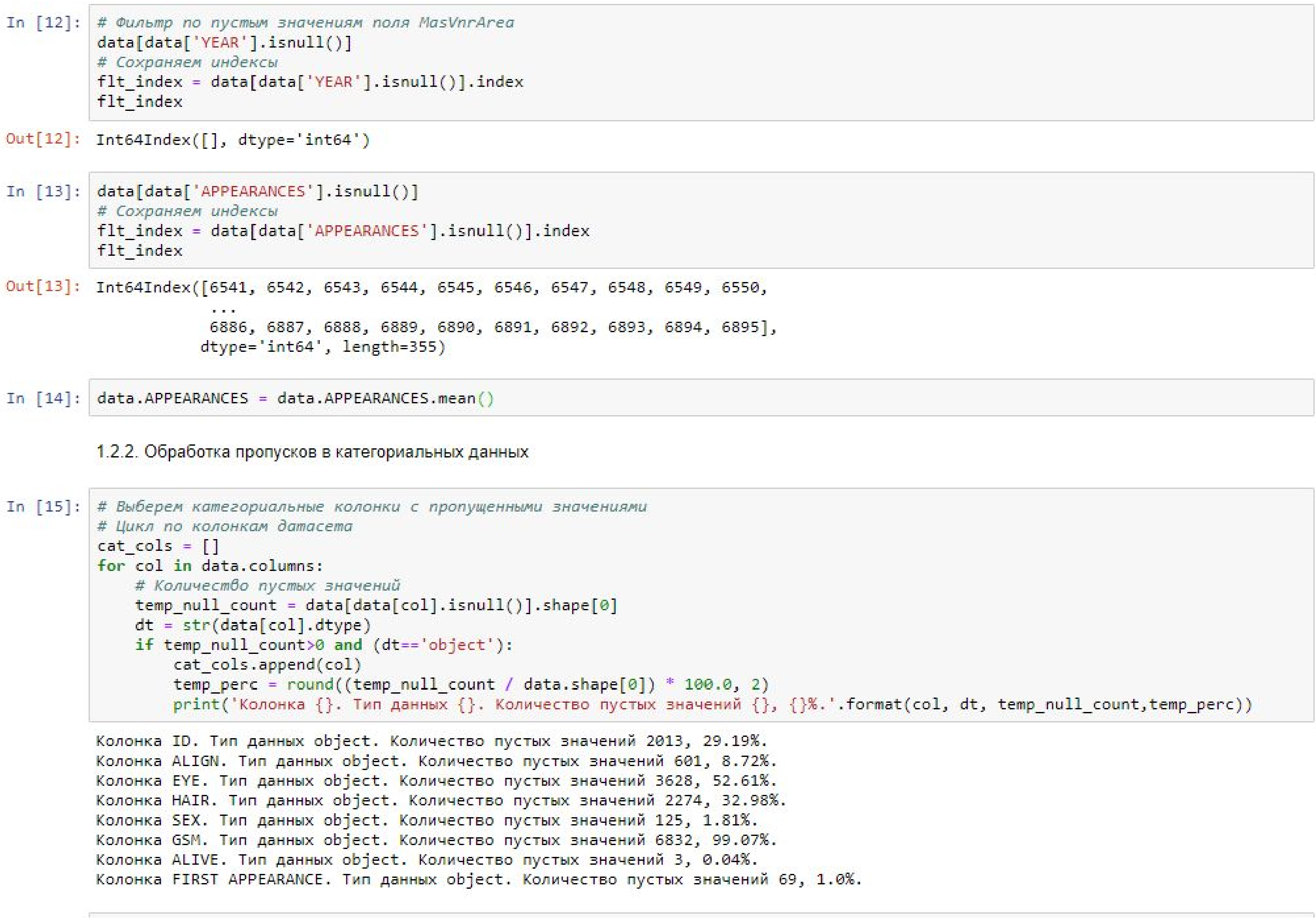
```
Колонка APPEARANCES. Тип данных float64. Количество пустых значений 355.
Колонка YEAR. Тип данных float64. Количество пустых значений 69.
```



```
In [10]: # Фильтр по пустым значениям поля MasVnrArea
         data[data['YEAR'].isnull()]
         # Сохраняем индексы
         flt_index = data[data['YEAR'].isnull()].index
         flt_index
```

```
Out[10]: Int64Index([ 386, 1400, 1401, 1832, 1937, 1938, 2065, 2066, 2067, 2230, 2231,
                     2232, 2413, 2414, 2841, 2842, 3104, 3105, 3431, 3432, 3433, 3434,
                     3435, 3819, 3820, 3821, 3822, 3823, 3824, 4320, 4321, 4322, 4323,
                     4826, 4827, 4828, 4829, 5525, 5526, 5527, 5528, 5529, 5530, 5531,
                     5532, 5533, 5534, 5535, 5536, 5537, 5538, 6532, 6533, 6534, 6535,
                     6536, 6537, 6538, 6539, 6540, 6887, 6888, 6889, 6890, 6891, 6892,
                     6893, 6894, 6895],
                    dtype='int64')
```

```
In [11]: for rows in flt_index:
           data.YEAR[rows]=data.YEAR.median()
```



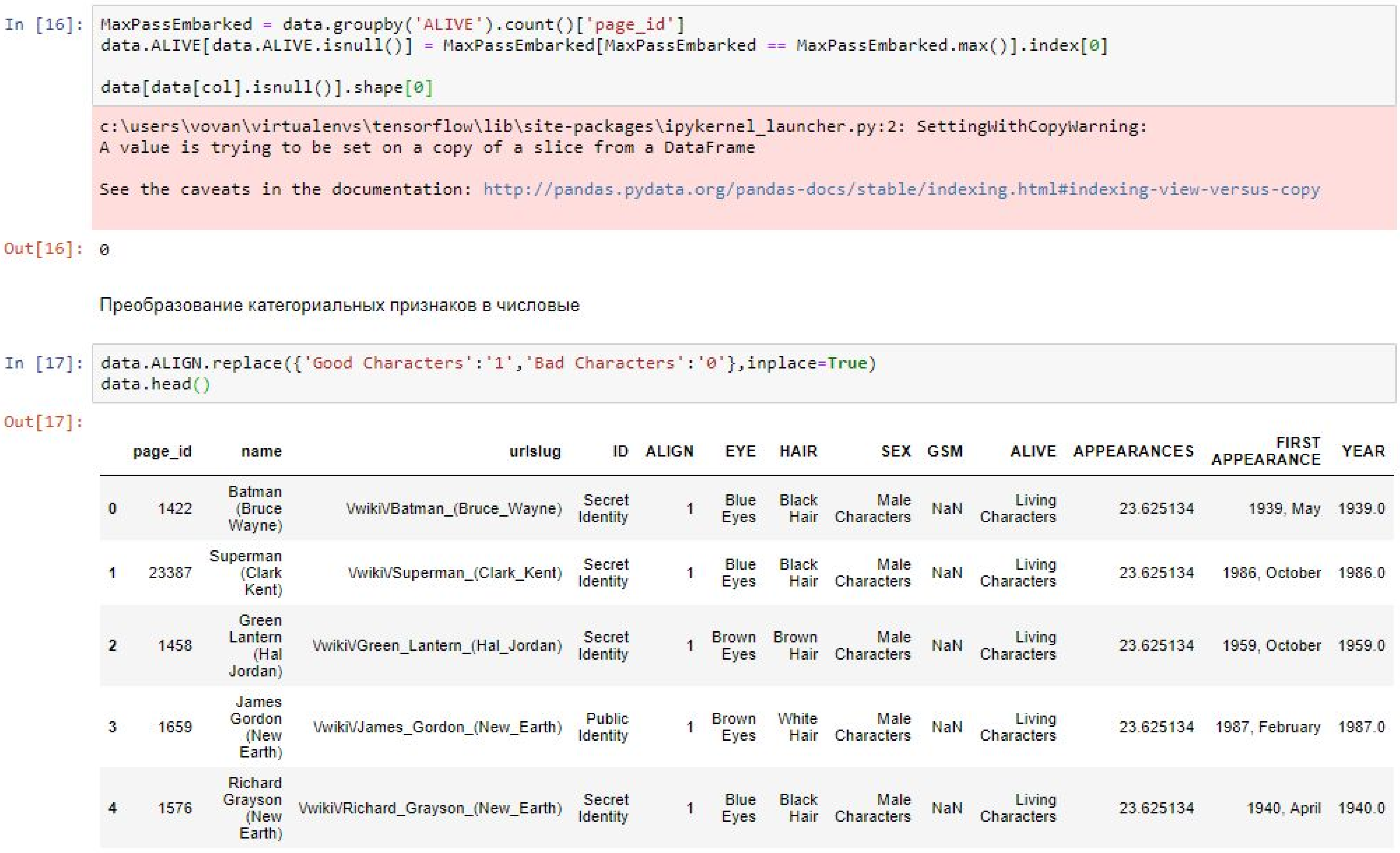
```
In [12]: # Фильтр по пустым значениям поля MasVnrArea
         data[data['YEAR'].isnull()]
         # Сохраняем индексы
         flt_index = data[data['YEAR'].isnull()].index
         flt_index

Out[12]: Int64Index([], dtype='int64')
```

```
In [13]: data[data['APPEARANCES'].isnull()]
         # Сохраняем индексы
         flt_index = data[data['APPEARANCES'].isnull()].index
         flt_index

Out[13]: Int64Index([6541, 6542, 6543, 6544, 6545, 6546, 6547, 6548, 6549, 6550,
                     ...
                     6886, 6887, 6888, 6889, 6890, 6891, 6892, 6893, 6894, 6895],
                    dtype='int64', length=355)
```

```
In [14]: data.APPEARANCES = data.APPEARANCES.mean()
```

1.2.2. Обработка пропусков в категориальных данных

```
In [15]: # Выберем категориальные колонки с пропущенными значениями
         # Цикл по колонкам датасета
         cat_cols = []
         for col in data.columns:
             # Количество пустых значений
             temp_null_count = data[data[col].isnull()].shape[0]
             dt = str(data[col].dtype)
             if temp_null_count>0 and (dt=='object'):
                 cat_cols.append(col)
                 temp_perc = round((temp_null_count / data.shape[0]) * 100.0, 2)
                 print('Колонка {}. Тип данных {}. Количество пустых значений {}, {}%.'.format(col, dt, temp_null_count,temp_perc))

         Колонка ID. Тип данных object. Количество пустых значений 2013, 29.19%.
         Колонка ALIGN. Тип данных object. Количество пустых значений 601, 8.72%.
         Колонка EYE. Тип данных object. Количество пустых значений 3628, 52.61%.
         Колонка HAIR. Тип данных object. Количество пустых значений 2274, 32.98%.
         Колонка SEX. Тип данных object. Количество пустых значений 125, 1.81%.
         Колонка GSM. Тип данных object. Количество пустых значений 6832, 99.07%.
         Колонка ALIVE. Тип данных object. Количество пустых значений 3, 0.04%.
         Колонка FIRST APPEARANCE. Тип данных object. Количество пустых значений 69, 1.0%.
```



```
In [16]: MaxPassEmbarked = data.groupby('ALIVE').count()['page_id']
         data.ALIVE[data.ALIVE.isnull()] = MaxPassEmbarked[MaxPassEmbarked == MaxPassEmbarked.max()].index[0]

         data[data[col].isnull()].shape[0]
```

```
c:\users\vovan\virtualenvs\tensorflow\lib\site-packages\ipykernel_launcher.py:2: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: http://pandas.pydata.org/pandas-docs/stable/indexing.html#indexing-view-versus-copy
```

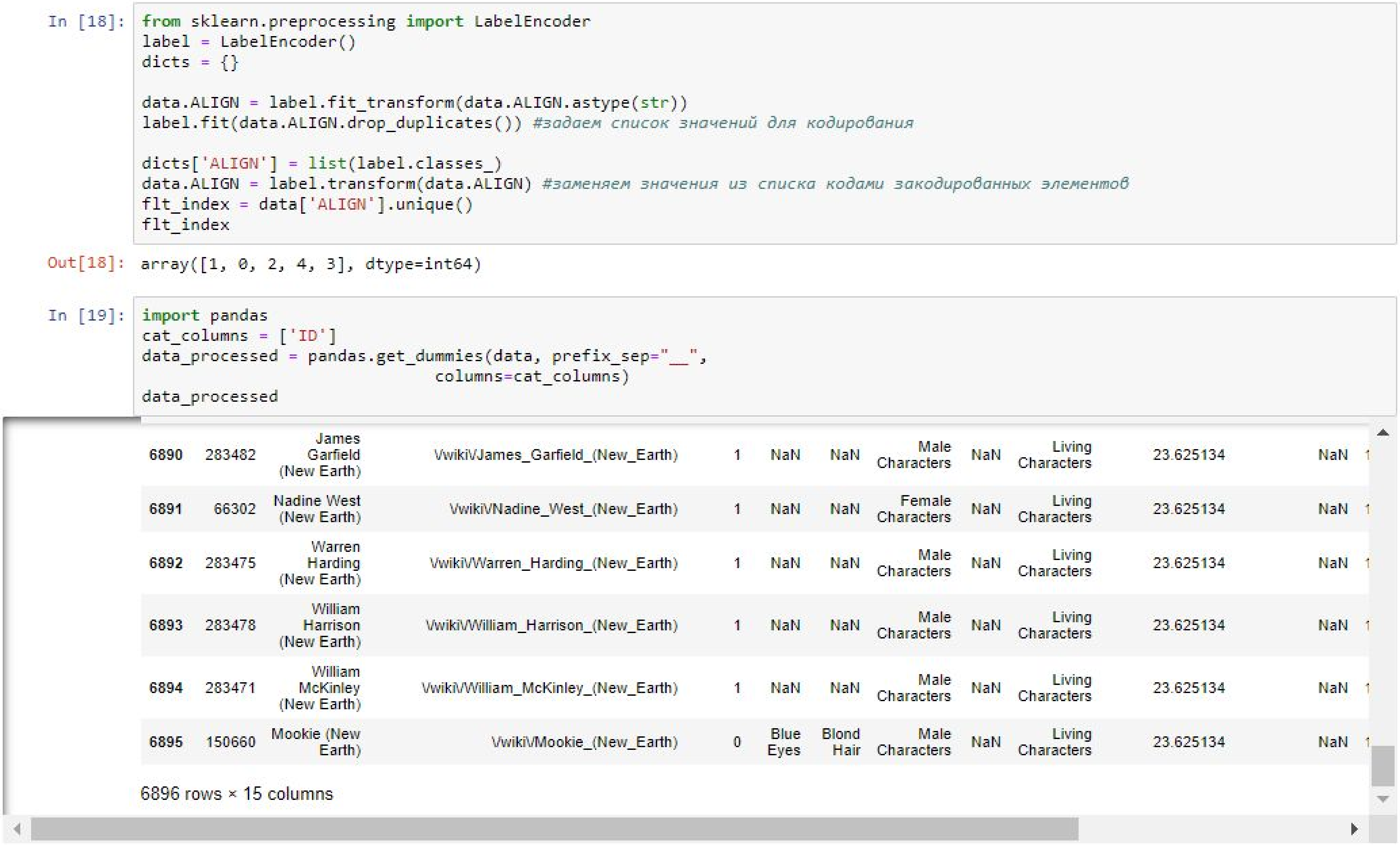
```
Out[16]: 0
```

Преобразование категориальных признаков в числовые

```
In [17]: data.ALIGN.replace({'Good Characters':'1','Bad Characters':'0'},inplace=True)
         data.head()
```

Out[17]:

	page_id	name	urlslug	ID	ALIGN	EYE	HAIR	SEX	GSM	ALIVE	APPEARANCES	FIRST APPEARANCE	YEAR
0	1422	Batman (Bruce Wayne)	VwikiVBatman_(Bruce_Wayne)	Secret Identity	1	Blue Eyes	Black Hair	Male Characters	NaN	Living Characters	23.625134	1939, May	1939.0
1	23387	Superman (Clark Kent)	VwikiVSuperman_(Clark_Kent)	Secret Identity	1	Blue Eyes	Black Hair	Male Characters	NaN	Living Characters	23.625134	1986, October	1986.0
2	1458	Green Lantern (Hal Jordan)	VwikiVGreen_Lantern_(Hal_Jordan)	Secret Identity	1	Brown Eyes	Brown Hair	Male Characters	NaN	Living Characters	23.625134	1959, October	1959.0
3	1659	James Gordon (New Earth)	VwikiVJames_Gordon_(New_Earth)	Public Identity	1	Brown Eyes	White Hair	Male Characters	NaN	Living Characters	23.625134	1987, February	1987.0
4	1576	Richard Grayson (New Earth)	VwikiVRichard_Grayson_(New_Earth)	Secret Identity	1	Blue Eyes	Black Hair	Male Characters	NaN	Living Characters	23.625134	1940, April	1940.0



In [18]:
```
from sklearn.preprocessing import LabelEncoder
label = LabelEncoder()
dicts = {}

data.ALIGN = label.fit_transform(data.ALIGN.astype(str))
label.fit(data.ALIGN.drop_duplicates()) #задаем список значений для кодирования

dicts['ALIGN'] = list(label.classes_)
data.ALIGN = label.transform(data.ALIGN) #заменяем значения из списка кодами закодированных элементов
flt_index = data['ALIGN'].unique()
flt_index
```

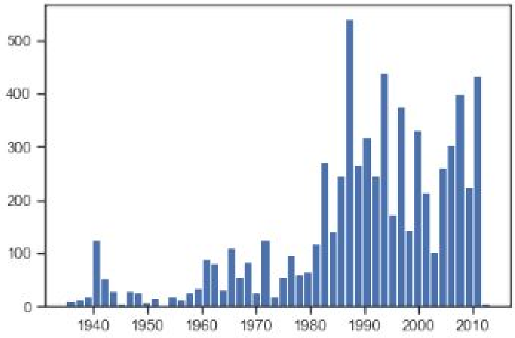
Out[18]:
```
array([1, 0, 2, 4, 3], dtype=int64)
```

In [19]:
```
import pandas
cat_columns = ['ID']
data_processed = pandas.get_dummies(data, prefix_sep="__",
                              columns=cat_columns)
data_processed
```

6890	283482	James Garfield (New Earth)	\/wiki\/James_Garfield_(New_Earth)	1	NaN	NaN	Male Characters	NaN	Living Characters	23.625134	NaN	1
6891	66302	Nadine West (New Earth)	\/wiki\/Nadine_West_(New_Earth)	1	NaN	NaN	Female Characters	NaN	Living Characters	23.625134	NaN	1
6892	283475	Warren Harding (New Earth)	\/wiki\/Warren_Harding_(New_Earth)	1	NaN	NaN	Male Characters	NaN	Living Characters	23.625134	NaN	1
6893	283478	William Harrison (New Earth)	\/wiki\/William_Harrison_(New_Earth)	1	NaN	NaN	Male Characters	NaN	Living Characters	23.625134	NaN	1
6894	283471	William McKinley (New Earth)	\/wiki\/William_McKinley_(New_Earth)	1	NaN	NaN	Male Characters	NaN	Living Characters	23.625134	NaN	1
6895	150660	Mookie (New Earth)	\/wiki\/Mookie_(New_Earth)	0	Blue Eyes	Blond Hair	Male Characters	NaN	Living Characters	23.625134	NaN	1

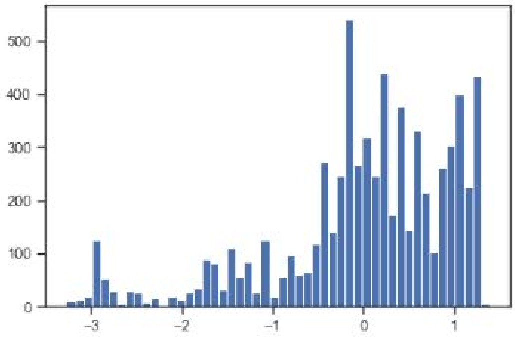
6896 rows × 15 columns

```
In [20]: from sklearn.preprocessing import MinMaxScaler, StandardScaler, Normalizer

         sc1 = MinMaxScaler()
         sc1_data = sc1.fit_transform(data[['YEAR']])
         plt.hist(data['YEAR'], 50)
         plt.show()
```

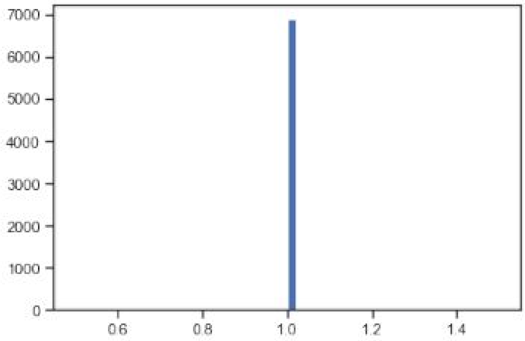


Масштабирование данных на основе Z-оценки

```
In [21]: sc2 = StandardScaler()
         sc2_data = sc2.fit_transform(data[['YEAR']])

         plt.hist(sc2_data, 50)
         plt.show()
```



```
In [22]: sc3 = Normalizer()
         sc3_data = sc3.fit_transform(data[['YEAR']])
         flt_index = data['YEAR'].unique()
         flt_index
         plt.hist(sc3_data, 50)
         plt.show()
```



0
1000
2000
3000
4000
5000
6000
7000
0.6
0.8
1.0
1.2
1.4