Лабораторная работа №2

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Часть 1

Цель лабораторной работы: изучение продвинутых способов предварительной обработки данных для дальнейшего формирования моделей.

Требования к отчету:

1) Отчет по лабораторной работе должен содержать:

- титульный лист;
- описание задания;
- текст программы;
- экранные формы с примерами выполнения программы.

2) Задание:

- Выбрать набор данных (датасет), содержащий категориальные и числовые 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.) Просьба не использовать датасет, на котором данная задача решалась в лекции.
- Для выбранного датасета (датасетов) на основе материалов лекций решить следующие задачи:
  - устранение пропусков в данных;
  - кодирование категориальных признаков;
  - нормализацию числовых признаков.

In [ ]:

```
!pip install category_encoders
!pip install catboost
```

```
Requirement already satisfied: category_encoders in /usr/local/lib/python3.7/
dist-packages (2.2.2)
Requirement already satisfied: scipy>=1.0.0 in /usr/local/lib/python3.7/dist-
packages (from category_encoders) (1.4.1)
Requirement already satisfied: numpy>=1.14.0 in /usr/local/lib/python3.7/dist
-packages (from category_encoders) (1.19.5)
Requirement already satisfied: patsy>=0.5.1 in /usr/local/lib/python3.7/dist-
packages (from category_encoders) (0.5.1)
Requirement already satisfied: pandas>=0.21.1 in /usr/local/lib/python3.7/dis
t-packages (from category_encoders) (1.1.5)
Requirement already satisfied: statsmodels>=0.9.0 in /usr/local/lib/python3.
7/dist-packages (from category_encoders) (0.10.2)
Requirement already satisfied: scikit-learn>=0.20.0 in /usr/local/lib/python
3.7/dist-packages (from category_encoders) (0.22.2.post1)
Requirement already satisfied: six in /usr/local/lib/python3.7/dist-packages
(from patsy>=0.5.1->category_encoders) (1.15.0)
```

```
Requirement already satisfied: python-dateutil>=2.7.3 in /usr/local/lib/pytho
n3.7/dist-packages (from pandas>=0.21.1->category_encoders) (2.8.1)
Requirement already satisfied: pytz>=2017.2 in /usr/local/lib/python3.7/dist-
packages (from pandas>=0.21.1->category_encoders) (2018.9)
Requirement already satisfied: joblib>=0.11 in /usr/local/lib/python3.7/dist-
packages (from scikit-learn>=0.20.0->category_encoders) (1.0.1)
Collecting catboost
  Downloading https://files.pythonhosted.org/packages/47/80/8e9c57ec32dfed6ba
2922bc5c96462cbf8596ce1a6f5de532ad1e43e53fe/catboost-0.25.1-cp37-none-manylin
ux1_x86_64.whl (67.3MB)
     |████████████████████████████████| 67.3MB 65kB/s
Requirement already satisfied: six in /usr/local/lib/python3.7/dist-packages
(from catboost) (1.15.0)
Requirement already satisfied: plotly in /usr/local/lib/python3.7/dist-packag
es (from catboost) (4.4.1)
Requirement already satisfied: matplotlib in /usr/local/lib/python3.7/dist-pa
ckages (from catboost) (3.2.2)
Requirement already satisfied: graphviz in /usr/local/lib/python3.7/dist-pack
ages (from catboost) (0.10.1)
Requirement already satisfied: scipy in /usr/local/lib/python3.7/dist-package
s (from catboost) (1.4.1)
Requirement already satisfied: pandas>=0.24.0 in /usr/local/lib/python3.7/dis
t-packages (from catboost) (1.1.5)
Requirement already satisfied: numpy>=1.16.0 in /usr/local/lib/python3.7/dist
-packages (from catboost) (1.19.5)
Requirement already satisfied: retrying>=1.3.3 in /usr/local/lib/python3.7/di
st-packages (from plotly->catboost) (1.3.3)
Requirement already satisfied: cycler>=0.10 in /usr/local/lib/python3.7/dist-
packages (from matplotlib->catboost) (0.10.0)
Requirement already satisfied: pyparsing!=2.0.4,!=2.1.2,!=2.1.6,>=2.0.1 in /u
sr/local/lib/python3.7/dist-packages (from matplotlib->catboost) (2.4.7)
Requirement already satisfied: kiwisolver>=1.0.1 in /usr/local/lib/python3.7/
dist-packages (from matplotlib->catboost) (1.3.1)
Requirement already satisfied: python-dateutil>=2.1 in /usr/local/lib/python
3.7/dist-packages (from matplotlib->catboost) (2.8.1)
Requirement already satisfied: pytz>=2017.2 in /usr/local/lib/python3.7/dist-
packages (from pandas>=0.24.0->catboost) (2018.9)
Installing collected packages: catboost
Successfully installed catboost-0.25.1
```

In [ ]:

```python
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
```

In [ ]:

```python
df = pd.read_csv('aug_train.csv')
df
```

Out[ ]:

	enrollee_id	city	city_development_index	gender	relevent_experience	enrolled_univers
0	8949	city_103	0.920	Male	Has relevent experience	no_enrollm
1	29725	city_40	0.776	Male	No relevent experience	no_enrollm
2	11561	city_21	0.624	NaN	No relevent experience	Full time cou
3	33241	city_115	0.789	NaN	No relevent experience	N
4	666	city_162	0.767	Male	Has relevent experience	no_enrollm
...	...	...	...	...	...	
19153	7386	city_173	0.878	Male	No relevent experience	no_enrollm

	enrollee_id	city	city_development_index	gender	relevent_experience	enrolled_univers
19154	31398	city_103	0.920	Male	Has relevent experience	no_enrollm
19155	24576	city_103	0.920	Male	Has relevent experience	no_enrollm
19156	5756	city_65	0.802	Male	Has relevent experience	no_enrollm
19157	23834	city_67	0.855	NaN	No relevent experience	no_enrollm

19158 rows × 14 columns

In [ ]:

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 19158 entries, 0 to 19157
Data columns (total 14 columns):
 #   Column                  Non-Null Count  Dtype  
---  ------                  --------------  -----  
 0   enrollee_id             19158 non-null  int64  
 1   city                    19158 non-null  object 
 2   city_development_index  19158 non-null  float64
 3   gender                  14650 non-null  object 
 4   relevent_experience     19158 non-null  object 
 5   enrolled_university     18772 non-null  object 
 6   education_level         18698 non-null  object 
 7   major_discipline        16345 non-null  object 
 8   experience              19093 non-null  object 
 9   company_size            13220 non-null  object 
 10  company_type            13018 non-null  object 
 11  last_new_job            18735 non-null  object 
 12  training_hours          19158 non-null  int64  
 13  target                  19158 non-null  float64
dtypes: float64(2), int64(2), object(10)
memory usage: 2.0+ MB
```

In [ ]:

```
df.isna().sum()
```

Out[ ]:

```
enrollee_id                  0
city                         0
city_development_index       0
gender                    4508
relevent_experience          0
enrolled_university        386
education_level            460
major_discipline          2813
experience                  65
company_size              5938
company_type              6140
last_new_job               423
training_hours               0
target                       0
dtype: int64
```

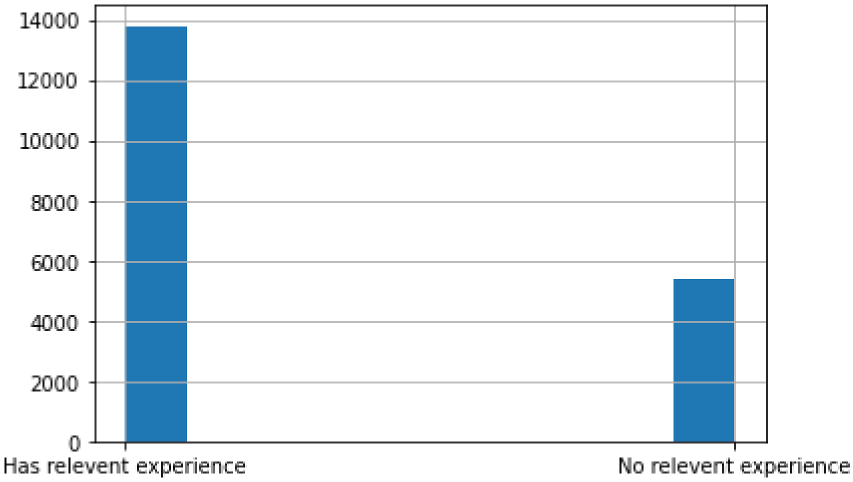
Кодирование категориального признака

In [ ]:

```
from category_encoders import TargetEncoder

df.relevent_experience.hist()
```

```
relevant_expiriense_te = TargetEncoder()
df.relevent_experience = relevant_expiriense_te.fit_transform(df.relevent_exp
```

```
/usr/local/lib/python3.7/dist-packages/category_encoders/utils.py:21: FutureW
arning: is_categorical is deprecated and will be removed in a future version.
Use is_categorical_dtype instead
  elif pd.api.types.is_categorical(cols):
```



In [ ]:

```
df.relevent_experience
```

Out[ ]:

```
0        0.214690
1        0.338427
2        0.338427
3        0.338427
4        0.214690
           ...
19153    0.338427
19154    0.214690
19155    0.214690
19156    0.214690
19157    0.338427
Name: relevent_experience, Length: 19158, dtype: float64
```

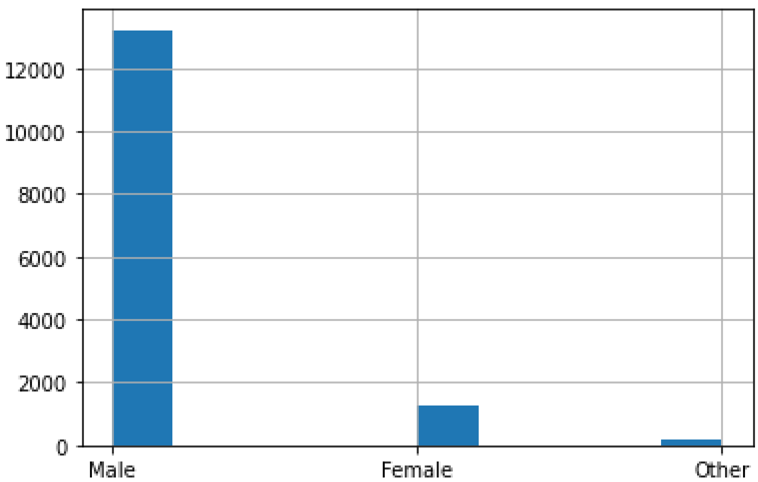
Устранение пропусков в признаке Пол

In [ ]:

```
df.gender.hist()
```

Out[ ]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f8601432810>
```

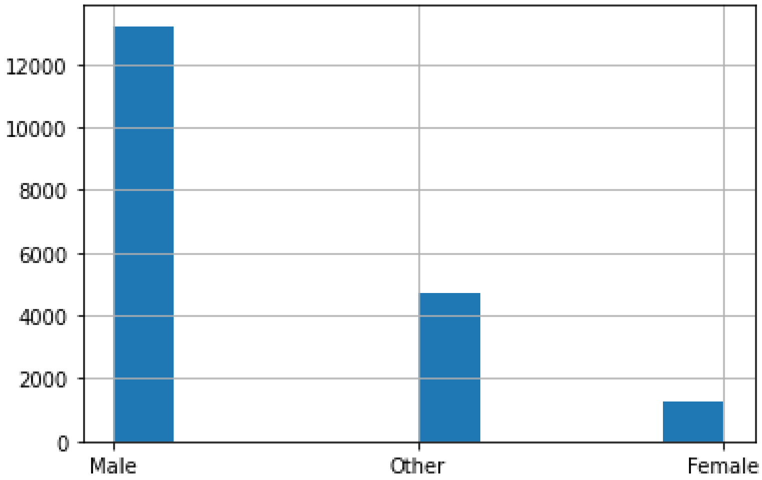


In [ ]:

```
df.gender = df.gender.fillna('Other')
```

```
df.gender.hist()
```

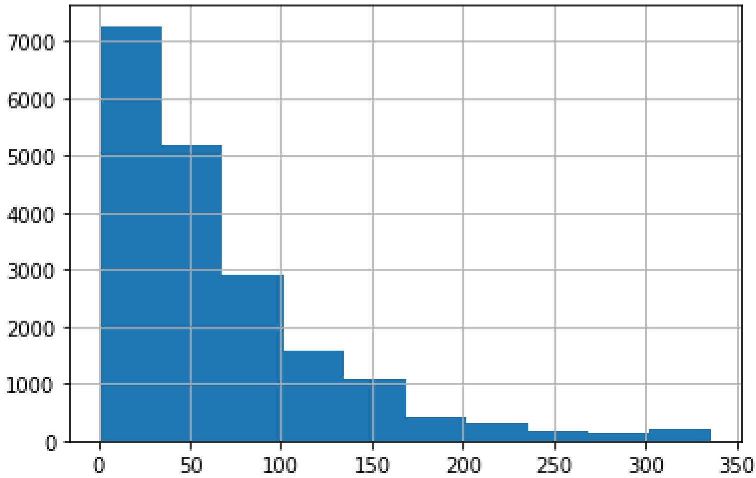
Out[ ]: <matplotlib.axes._subplots.AxesSubplot at 0x7f86013b5890>



Нормализация числового признака

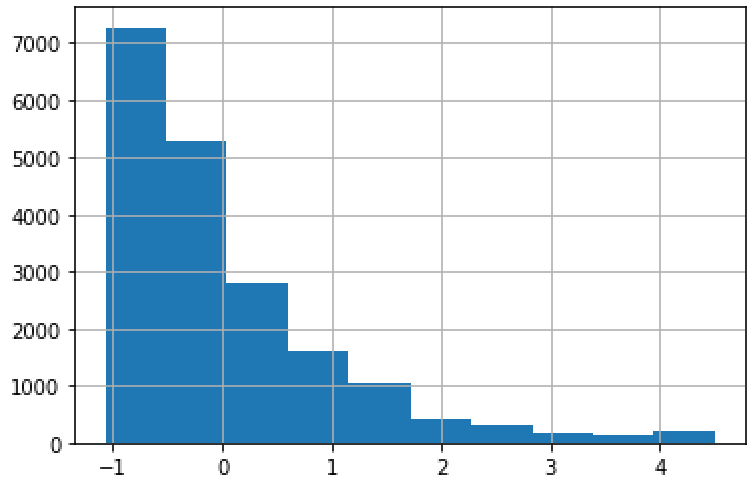
In [ ]:
```
df.training_hours.hist()
```

Out[ ]: <matplotlib.axes._subplots.AxesSubplot at 0x7f86013392d0>



In [ ]:
```
from sklearn.preprocessing import StandardScaler

scaler = StandardScaler()

df['training_hours_std_scale'] = scaler.fit_transform(np.array(df.training_ho
df.training_hours_std_scale.hist()
```

Out[ ]: <matplotlib.axes._subplots.AxesSubplot at 0x7f86012a5a10>



Часть 2

Цель лабораторной работы: изучение продвинутых способов предварительной обработки данных для дальнейшего формирования моделей.

Требования к отчету:

1) Отчет по лабораторной работе должен содержать:

- титульный лист;
- описание задания;
- текст программы;
- экранные формы с примерами выполнения программы.

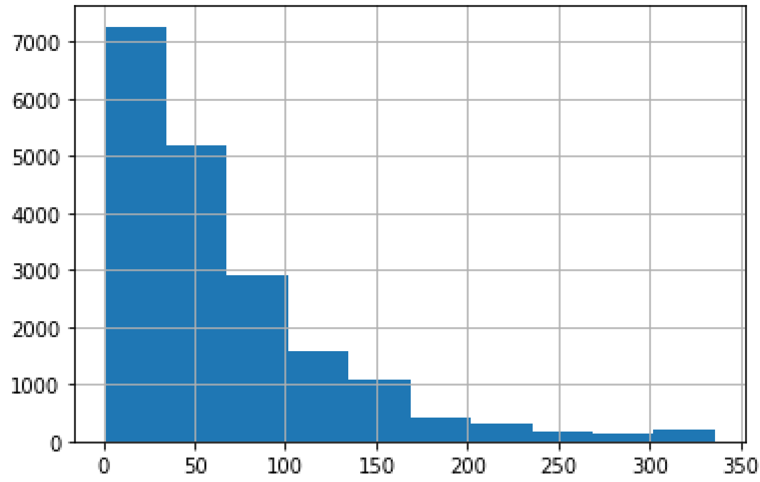
2) Задание:

- Выбрать один или несколько наборов данных (датасетов) для решения следующих задач. Каждая задача может быть решена на отдельном датасете, или несколько задач могут быть решены на одном датасете. Просьба не использовать датасет, на котором данная задача решалась в лекции.
- Для выбранного датасета (датасетов) на основе материалов лекций решить следующие задачи:
  - масштабирование признаков (не менее чем тремя способами);
  - обработку выбросов для числовых признаков (по одному способу для удаления выбросов и для замены выбросов);
  - обработку по крайней мере одного нестандартного признака (который не является числовым или категориальным);
  - отбор признаков:
    - один метод из группы методов фильтрации (filter methods);
    - один метод из группы методов обертывания (wrapper methods);
    - один метод из группы методов вложений (embedded methods).

Масштабируем признак несколькими способами

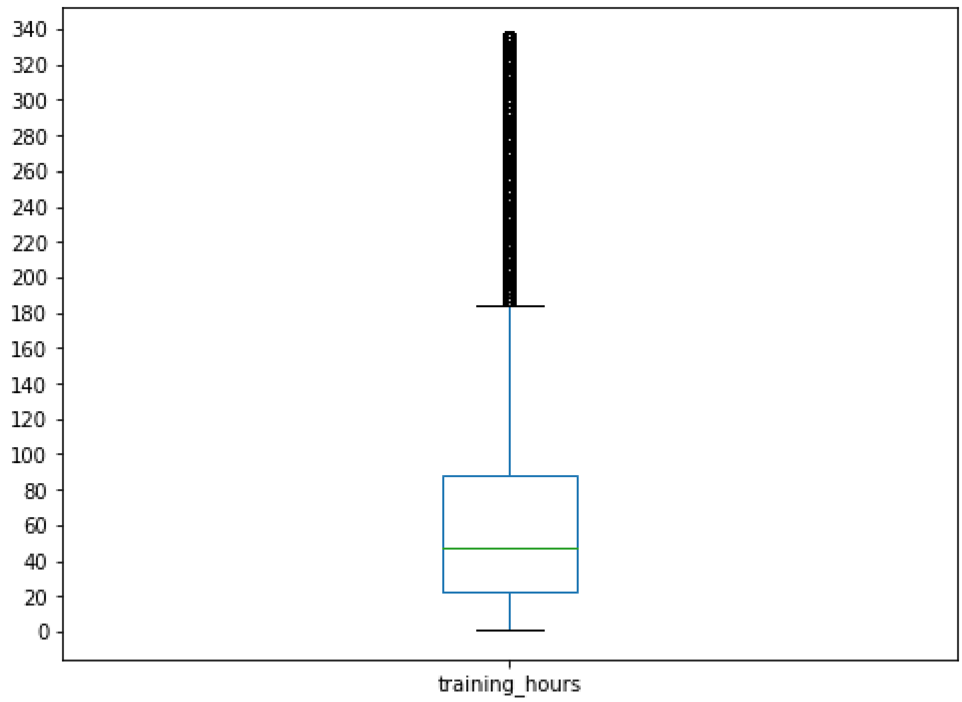
In [ ]:
```
df.training_hours.hist()
```

Out[ ]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x7f86012d8f90>
```



MinMaxScaling с работой с выбросами

In [ ]:
```
plt.figure(figsize=(8,6))
df.training_hours.plot(kind='box')
plt.yticks(list(range(0,350, 20)))
plt.show()
```



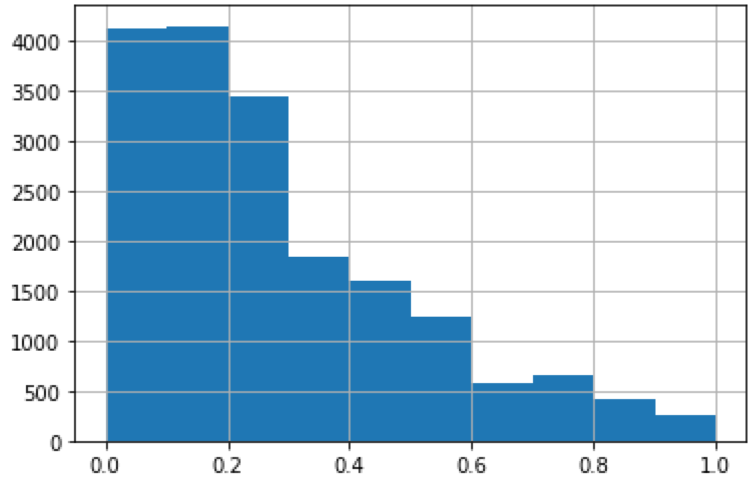
In [ ]:
```
# отбрасываем выбросы
tmp_df = df[df.training_hours < 200]
```

In [ ]:
```
from sklearn.preprocessing import MinMaxScaler

min_max = MinMaxScaler()
tmp_df.training_hours = min_max.fit_transform(np.array(tmp_df.training_hours)
tmp_df.training_hours.hist()
```

```
/usr/local/lib/python3.7/dist-packages/pandas/core/generic.py:5170: SettingWi
thCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
```

```
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/s
table/user_guide/indexing.html#returning-a-view-versus-a-copy
  self[name] = value
```

Out[ ]: <matplotlib.axes._subplots.AxesSubplot at 0x7f86014b0650>



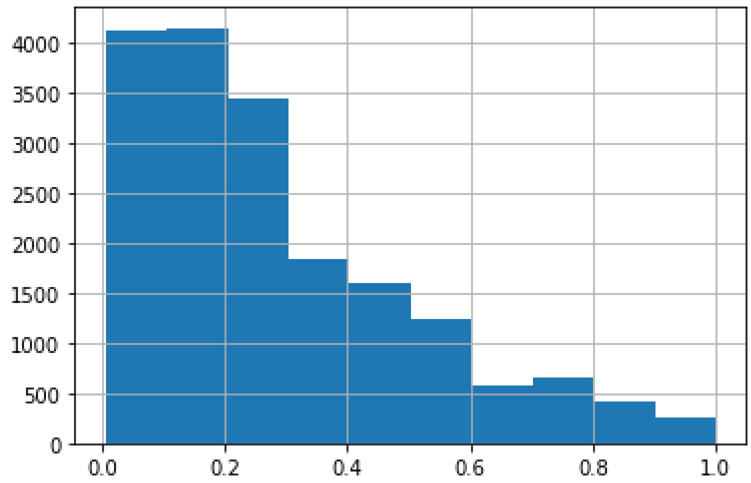
MaxAbsScaler

In [ ]:

```
from sklearn.preprocessing import MaxAbsScaler

tmp_df = df[df.training_hours < 200]
min_abs = MaxAbsScaler()
tmp_df.training_hours = min_abs.fit_transform(np.array(tmp_df.training_hours)
tmp_df.training_hours.hist()
```

```
/usr/local/lib/python3.7/dist-packages/pandas/core/generic.py:5170: SettingWi
thCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/s
table/user_guide/indexing.html#returning-a-view-versus-a-copy
  self[name] = value
```

Out[ ]: <matplotlib.axes._subplots.AxesSubplot at 0x7f8601156e10>



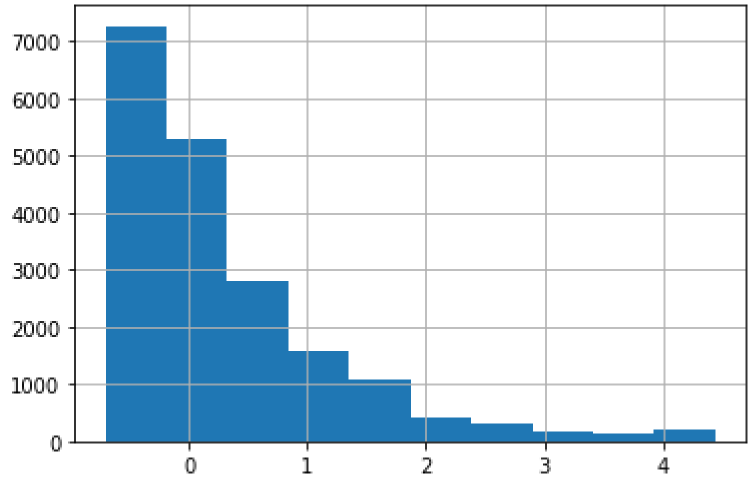
RobustScaler

In [ ]:

```
from sklearn.preprocessing import RobustScaler

robust_scaler = RobustScaler()
```

```
tmp_df = df.copy()
tmp_df['training_hours_std_scale'] = robust_scaler.fit_transform(np.array(tmp
tmp_df.training_hours_std_scale.hist()
```

Out[ ]: <matplotlib.axes._subplots.AxesSubplot at 0x7f8601104110>



Обработка выбросов для числовых признаков (по одному способу для удаления выбросов и для замены выбросов);

In [ ]:
```
df.experience.unique()  # сделаем числовой признак из фичи experience
```

Out[ ]:
```
array(['>20', '15', '5', '<1', '11', '13', '7', '17', '2', '16', '1', '4',
       '10', '14', '18', '19', '12', '3', '6', '9', '8', '20', nan],
      dtype=object)
```

In [ ]:
```
df.experience = df.experience.apply(lambda x: str(x).strip('<>') if str(x) !=
```

In [ ]:
```
df.experience.isna().sum() # 65 пропущенных значений
```

Out[ ]: 65

удалим строки с experience - nan

In [ ]:
```
shape_before = df.shape[0]
res_df = df.dropna(subset=['experience'], inplace=False)
print(shape_before, res_df.shape[0], ', dropped', shape_before - res_df.shape
```

```
19158 19093 , dropped 65 rows
```

Заполним пропуски в том же признаке с помощью моды

In [ ]:
```
print('experience mode:', df.experience.mode)
new_experience = df.experience.fillna(df.experience.mode)
print('nan values count:', new_experience.isna().sum())
```

```
experience mode: <bound method Series.mode of 0        20
1        15
2         5
3         1
4        20
         ..
19153    14
19154    14
```

```
19155    20
19156     1
19157     2
Name: experience, Length: 19158, dtype: object>
nan values count: 0
```

Создадим еще признак из признака company_size этот признак будет не числовым и не категориальным

In [ ]:
```
df.company_size.unique()
```

Out[ ]:
```
array([nan, '50-99', '<10', '10000+', '5000-9999', '1000-4999', '10/49',
       '100-500', '500-999'], dtype=object)
```

In [ ]:
```
def mean_mapper(value):
  if isinstance(value, float):  # если значение пропущено вернем его же
    return np.nan
  if '-' in value:
    low, high = [int(i) for i in value.strip().split('-')]
    return (high-low)/2
  if '/' in value:
    low, high = [int(i) for i in value.strip().split('/')]
    return (high-low)/2
  if '<' in value or '>' in value:
    return int(str(value).strip('<>'))
```

In [ ]:
```
df.company_size.unique()
```

Out[ ]:
```
array([nan, '50-99', '<10', '10000+', '5000-9999', '1000-4999', '10/49',
       '100-500', '500-999'], dtype=object)
```

In [ ]:
```
df['company_size_numeric'] = df.company_size.apply(mean_mapper)
df.company_size_numeric = df.company_size_numeric.fillna(df.company_size_nume
```

In [ ]:
```
df.company_size_numeric.unique()
```

Out[ ]:
```
array([ 438.60940987,   24.5       ,   10.        , 2499.5       ,
       1999.5       ,   19.5       ,  200.        ,  249.5       ])
```

Отбор признаков

Закодируем все признаки в численные

In [ ]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 19158 entries, 0 to 19157
Data columns (total 16 columns):
 #   Column                  Non-Null Count  Dtype  
---  ------                  --------------  -----  
 0   enrollee_id             19158 non-null  int64  
 1   city                    19158 non-null  object 
 2   city_development_index  19158 non-null  float64
 3   gender                  19158 non-null  object 
 4   relevent_experience     19158 non-null  float64
 5   enrolled_university     18772 non-null  object 
 6   education_level         18698 non-null  object 
 7   major_discipline        16345 non-null  object 
 8   experience              19093 non-null  object 
```

```
 9   company_size               13220 non-null  object
 10  company_type               13018 non-null  object
 11  last_new_job               18735 non-null  object
 12  training_hours             19158 non-null  int64
 13  target                     19158 non-null  float64
 14  training_hours_std_scale   19158 non-null  float64
 15  company_size_numeric       19158 non-null  float64
dtypes: float64(5), int64(2), object(9)
memory usage: 2.3+ MB
```

In [ ]:

```
df.gender.dtype
```

Out[ ]:

```
dtype('O')
```

In [ ]:

```
from category_encoders import TargetEncoder
from sklearn.preprocessing import LabelEncoder

encoders = {}

for col in df.columns:
  if df[col].dtype == 'O' and len(df[col].unique()) >= 4:
      tmp_enc = TargetEncoder()
      encoders[str(col)+'_te'] = tmp_enc
      df[col] = tmp_enc.fit_transform(df[col], df.target)
  elif len(df[col].unique()) < 4 and df[col].dtype == 'O':
      tmp_enc = LabelEncoder()
      encoders[str(col)+'_le'] = tmp_enc
      df[col] = tmp_enc.fit_transform(df[col])

X = df[[i for i in df.columns if i !='target']]
y = df.target
```

```
/usr/local/lib/python3.7/dist-packages/category_encoders/utils.py:21: FutureW
arning: is_categorical is deprecated and will be removed in a future version.
Use is_categorical_dtype instead
  elif pd.api.types.is_categorical(cols):
/usr/local/lib/python3.7/dist-packages/category_encoders/utils.py:21: FutureW
arning: is_categorical is deprecated and will be removed in a future version.
Use is_categorical_dtype instead
  elif pd.api.types.is_categorical(cols):
/usr/local/lib/python3.7/dist-packages/category_encoders/utils.py:21: FutureW
arning: is_categorical is deprecated and will be removed in a future version.
Use is_categorical_dtype instead
  elif pd.api.types.is_categorical(cols):
/usr/local/lib/python3.7/dist-packages/category_encoders/utils.py:21: FutureW
arning: is_categorical is deprecated and will be removed in a future version.
Use is_categorical_dtype instead
  elif pd.api.types.is_categorical(cols):
/usr/local/lib/python3.7/dist-packages/category_encoders/utils.py:21: FutureW
arning: is_categorical is deprecated and will be removed in a future version.
Use is_categorical_dtype instead
  elif pd.api.types.is_categorical(cols):
/usr/local/lib/python3.7/dist-packages/category_encoders/utils.py:21: FutureW
arning: is_categorical is deprecated and will be removed in a future version.
Use is_categorical_dtype instead
  elif pd.api.types.is_categorical(cols):
/usr/local/lib/python3.7/dist-packages/category_encoders/utils.py:21: FutureW
arning: is_categorical is deprecated and will be removed in a future version.
Use is_categorical_dtype instead
  elif pd.api.types.is_categorical(cols):
/usr/local/lib/python3.7/dist-packages/category_encoders/utils.py:21: FutureW
arning: is_categorical is deprecated and will be removed in a future version.
Use is_categorical_dtype instead
  elif pd.api.types.is_categorical(cols):
```

Метод фильтрации связанный с статистическими характеристиками

In [ ]:

```
from sklearn.feature_selection import SelectKBest, chi2

res = SelectKBest().fit(X, y)

selected_features = [name for name, mask in zip(X.columns, res.get_support())
print(selected_features)
```

```
['city', 'city_development_index', 'relevent_experience', 'enrolled_universit
y', 'education_level', 'major_discipline', 'experience', 'company_size', 'com
pany_type', 'last_new_job']
```

Метод обертывания

In [ ]:

```
!pip install mlxtend
```

```
Requirement already satisfied: mlxtend in /usr/local/lib/python3.7/dist-packa
ges (0.14.0)
Requirement already satisfied: scikit-learn>=0.18 in /usr/local/lib/python3.
7/dist-packages (from mlxtend) (0.22.2.post1)
Requirement already satisfied: numpy>=1.10.4 in /usr/local/lib/python3.7/dist
-packages (from mlxtend) (1.19.5)
Requirement already satisfied: scipy>=0.17 in /usr/local/lib/python3.7/dist-p
ackages (from mlxtend) (1.4.1)
Requirement already satisfied: matplotlib>=1.5.1 in /usr/local/lib/python3.7/
dist-packages (from mlxtend) (3.2.2)
Requirement already satisfied: pandas>=0.17.1 in /usr/local/lib/python3.7/dis
t-packages (from mlxtend) (1.1.5)
Requirement already satisfied: setuptools in /usr/local/lib/python3.7/dist-pa
ckages (from mlxtend) (54.2.0)
Requirement already satisfied: joblib>=0.11 in /usr/local/lib/python3.7/dist-
packages (from scikit-learn>=0.18->mlxtend) (1.0.1)
Requirement already satisfied: cycler>=0.10 in /usr/local/lib/python3.7/dist-
packages (from matplotlib>=1.5.1->mlxtend) (0.10.0)
Requirement already satisfied: pyparsing!=2.0.4,!=2.1.2,!=2.1.6,>=2.0.1 in /u
sr/local/lib/python3.7/dist-packages (from matplotlib>=1.5.1->mlxtend) (2.4.
7)
Requirement already satisfied: kiwisolver>=1.0.1 in /usr/local/lib/python3.7/
dist-packages (from matplotlib>=1.5.1->mlxtend) (1.3.1)
Requirement already satisfied: python-dateutil>=2.1 in /usr/local/lib/python
3.7/dist-packages (from matplotlib>=1.5.1->mlxtend) (2.8.1)
Requirement already satisfied: pytz>=2017.2 in /usr/local/lib/python3.7/dist-
packages (from pandas>=0.17.1->mlxtend) (2018.9)
Requirement already satisfied: six in /usr/local/lib/python3.7/dist-packages
(from cycler>=0.10->matplotlib>=1.5.1->mlxtend) (1.15.0)
```

In [ ]:

```
from mlxtend.feature_selection import ExhaustiveFeatureSelector as EFS
from sklearn.tree import DecisionTreeClassifier
from sklearn.neighbors import KNeighborsClassifier

knn = KNeighborsClassifier(n_neighbors=5)

efs1 = EFS(knn,
           min_features=2,
           max_features=3,
           scoring='roc_auc',
           print_progress=True,
           cv=5, n_jobs=-1)

efs1 = efs1.fit(X, y)

print('Best accuracy score: %.2f' % efs1.best_score_)
print('Best subset (indices):', efs1.best_idx_)
print('Best subset (corresponding names):', efs1.best_feature_names_)
```

```
Features: 560/560
Best accuracy score: 0.75
Best subset (indices): (2, 7, 9)
Best subset (corresponding names): ('city_development_index', 'major_discipli
ne', 'company_size')
```

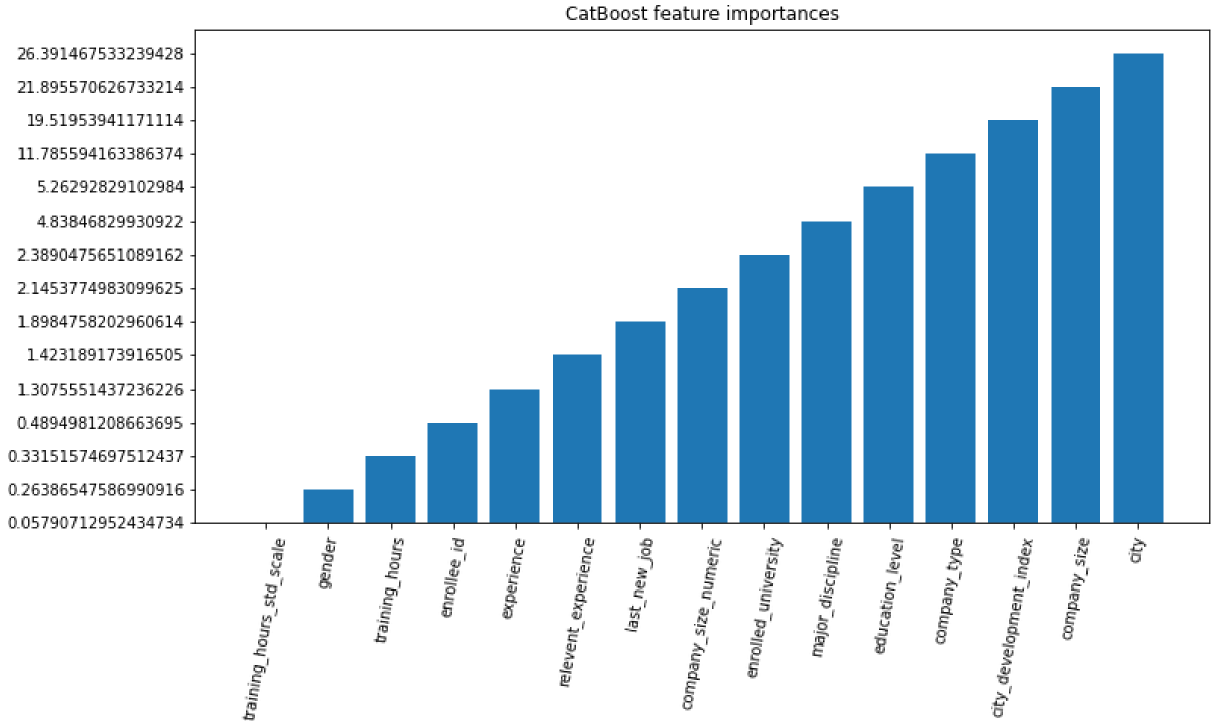
Метод вложений

In [ ]:

```
from operator import itemgetter

def draw_feature_importances(tree_model, X_dataset, title, figsize=(7,4)):
    """
    Вывод важности признаков в виде графика!
    """
    # Сортировка значений важности признаков по убыванию
    list_to_sort = list(zip(X_dataset.columns.values, tree_model.feature_impo
    sorted_list = sorted(list_to_sort, key=itemgetter(1), reverse = True)
    # Названия признаков
    labels = [x for x,_ in sorted_list]
    # Важности признаков
    data = [x for _,x in sorted_list]
    # Вывод графика
    fig, ax = plt.subplots(figsize=figsize)
    ax.set_title(title)
    ind = np.arange(len(labels))
    plt.bar(ind, data)
    plt.xticks(ind, labels, rotation='vertical')
    # Вывод значений
    for a,b in zip(ind, data):
        plt.text(a-0.1, b+0.005, str(round(b,3)))
    plt.show()
    return labels, data
```

In [ ]:

```
from catboost import CatBoostClassifier
from sklearn.model_selection import train_test_split

X_train, X_val, y_train, y_val = train_test_split(X, y, test_size=0.05, rando

cat_clf = CatBoostClassifier(random_state=42, iterations=2000, early_stopping
cat_clf.fit(X_train, y_train, eval_set=(X_val, y_val))

res = np.array(sorted([(n,float(f)) for n,f in zip(X_train.columns, cat_clf.f


plt.figure(figsize=(12, 6))
plt.bar(res[:,0], res[:,1])
plt.title('CatBoost feature importances')
plt.xticks(res[:,0], rotation=80)
plt.show()
```


CatBoost feature importances
26.391467533239428
21.895570626733214
19.51953941171114
11.785594163386374
5.26292829102984
4.83846829930922
2.3890475651089162
2.1453774983099625
1.8984758202960614
1.423189173916505
1.3075551437236226
0.4894981208663695
0.33151574697512437
0.26386547586990916
0.05790712952434734
training_hours_std_scale
gender
training_hours
enrollee_id
experience
relevent_experience
last_new_job
company_size_numeric
enrolled_university
major_discipline
education_level
company_type
city_development_index
company_size
city