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Факультет «Информатика и управление»

Кафедра ИУ5. Курс «Технологии машинного обучения»

Отчет по лабораторной работе №3: «Обработка пропусков в данных, кодирование категориальных признаков, масштабирование данных»

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Подпись и дата:

Проверил:

Подпись и дата:

Москва, 2019 г.

1. Обработка пропусков в данных

In [3]:

```
import numpy as np
import pandas as pd
pd.set_option('display.max.rows', 1000)
import seaborn as sns
import matplotlib.pyplot as plt
%matplotlib inline
sns.set(style='ticks')
```

In [4]:

```
data = pd.read_csv('data/fifa18-all-player-statistics-2019.csv')
data.shape
```

Out[4]:

```
(18207, 89)
```

In [5]:

```
data.dtypes
```

```
Out[5]: Unnamed: 0                    int64
        ID                            int64
        Name                         object
        Age                           int64
        Photo                        object
        Nationality                  object
        Flag                         object
        Overall                       int64
        Potential                     int64
        Club                         object
        Club Logo                    object
        Value                        object
        Wage                         object
        Special                       int64
        Preferred Foot               object
        International Reputation    float64
        Weak Foot                   float64
        Skill Moves                 float64
        Work Rate                    object
        Body Type                    object
        Real Face                    object
        Position                     object
        Jersey Number               float64
        Joined                       object
        Loaned From                  object
        Contract Valid Until         object
        Height                       object
        Weight                       object
        LS                           object
        ST                           object
        RS                           object
        LW                           object
        LF                           object
        CF                           object
        RF                           object
        RW                           object
        LAM                          object
        CAM                          object
        RAM                          object
        LM                           object
        LCM                          object
```

```
CM                                 object
RCM                                object
RM                                 object
LWB                                object
LDM                                object
CDM                                object
RDM                                object
RWB                                object
LB                                 object
LCB                                object
CB                                 object
RCB                                object
RB                                 object
Crossing                          float64
Finishing                         float64
HeadingAccuracy                   float64
ShortPassing                      float64
Volleys                           float64
Dribbling                         float64
Curve                             float64
FKAccuracy                        float64
LongPassing                       float64
BallControl                       float64
Acceleration                      float64
SprintSpeed                       float64
Agility                           float64
Reactions                         float64
Balance                           float64
ShotPower                         float64
Jumping                           float64
Stamina                           float64
Strength                          float64
LongShots                         float64
Aggression                        float64
Interceptions                     float64
Positioning                       float64
Vision                            float64
Penalties                         float64
Composure                         float64
Marking                           float64
StandingTackle                    float64
SlidingTackle                     float64
```

```
GKDiving                    float64
GKHandling                  float64
GKKicking                   float64
GKPositioning               float64
GKReflexes                  float64
Release Clause               object
dtype: object
```

In [6]:

```
data.isnull().sum()
```

```
Out[6]: Unnamed: 0                      0
        ID                              0
        Name                            0
        Age                             0
        Photo                           0
        Nationality                     0
        Flag                            0
        Overall                         0
        Potential                       0
        Club                          241
        Club Logo                       0
        Value                           0
        Wage                            0
        Special                         0
        Preferred Foot                 48
        International Reputation       48
        Weak Foot                      48
        Skill Moves                    48
        Work Rate                      48
        Body Type                      48
        Real Face                      48
        Position                       60
        Jersey Number                  60
        Joined                       1553
        Loaned From                 16943
        Contract Valid Until          289
        Height                         48
        Weight                         48
        LS                           2085
        ST                           2085
        RS                           2085
        LW                           2085
        LF                           2085
        CF                           2085
        RF                           2085
        RW                           2085
        LAM                          2085
        CAM                          2085
        RAM                          2085
        LM                           2085
        LCM                          2085
```

```
CM                           2085
RCM                          2085
RM                           2085
LWB                          2085
LDM                          2085
CDM                          2085
RDM                          2085
RWB                          2085
LB                           2085
LCB                          2085
CB                           2085
RCB                          2085
RB                           2085
Crossing                       48
Finishing                      48
HeadingAccuracy                48
ShortPassing                   48
Volleys                        48
Dribbling                      48
Curve                          48
FKAccuracy                     48
LongPassing                    48
BallControl                    48
Acceleration                   48
SprintSpeed                    48
Agility                        48
Reactions                      48
Balance                        48
ShotPower                      48
Jumping                        48
Stamina                        48
Strength                       48
LongShots                      48
Aggression                     48
Interceptions                  48
Positioning                    48
Vision                         48
Penalties                      48
Composure                      48
Marking                        48
StandingTackle                 48
SlidingTackle                  48
```

```
GKDiving                     48
GKHandling                   48
GKKicking                    48
GKPositioning                48
GKReflexes                   48
Release Clause             1564
dtype: int64
```

Обработка датасета

In [7]:

```python
# Удалим колонку с большим кол-вом пропусков (> 70%)
data = data.drop(columns='Loaned From')
```

In [8]:

```python
# Числовые колонки с нулевыми значениями
cols_with_null_values = []
for col in data.columns:
    null_count = data[col].isnull().sum()
    if data[col].dtype in ('float64', 'int64') and null_count != 0:
        cols_with_null_values.append(col)

print('Числовые (int64, float64) колонки с нулевыми значениями:', cols_with_null_values)
```

```
Числовые (int64, float64) колонки с нулевыми значениями: ['International Reputation', 'Weak Foot', 'Skill Moves',
'Jersey Number', 'Crossing', 'Finishing', 'HeadingAccuracy', 'ShortPassing', 'Volleys', 'Dribbling', 'Curv
e', 'FKAccuracy', 'LongPassing', 'BallControl', 'Acceleration', 'SprintSpeed', 'Agility', 'Reactions', 'Bala
nce', 'ShotPower', 'Jumping', 'Stamina', 'Strength', 'LongShots', 'Aggression', 'Interceptions', 'Positionin
g', 'Vision', 'Penalties', 'Composure', 'Marking', 'StandingTackle', 'SlidingTackle', 'GKDiving', 'GKHandlin
g', 'GKKicking', 'GKPositioning', 'GKReflexes']
```

In [9]:

```python
from sklearn.impute import SimpleImputer
from sklearn.impute import MissingIndicator
```

In [10]:

```
# Заполним пустые значения в числовых колонках
# используем медианную стратегию
for col in cols_with_null_values:
    indicator = MissingIndicator()
    mask_missing_values_only = indicator.fit_transform(data[[col]])
    imp_num = SimpleImputer(strategy='median')
    data[[col]] = imp_num.fit_transform(data[[col]])
```

In [11]:

```
data.isnull().sum()
```

```
Out[11]: Unnamed: 0                     0
         ID                             0
         Name                           0
         Age                            0
         Photo                          0
         Nationality                    0
         Flag                           0
         Overall                        0
         Potential                      0
         Club                         241
         Club Logo                      0
         Value                          0
         Wage                           0
         Special                        0
         Preferred Foot                48
         International Reputation       0
         Weak Foot                      0
         Skill Moves                    0
         Work Rate                     48
         Body Type                     48
         Real Face                     48
         Position                      60
         Jersey Number                  0
         Joined                      1553
         Contract Valid Until         289
         Height                        48
         Weight                        48
         LS                          2085
         ST                          2085
         RS                          2085
         LW                          2085
         LF                          2085
         CF                          2085
         RF                          2085
         RW                          2085
         LAM                         2085
         CAM                         2085
         RAM                         2085
         LM                          2085
         LCM                         2085
         CM                          2085
```

```
RCM                         2085
RM                          2085
LWB                         2085
LDM                         2085
CDM                         2085
RDM                         2085
RWB                         2085
LB                          2085
LCB                         2085
CB                          2085
RCB                         2085
RB                          2085
Crossing                       0
Finishing                      0
HeadingAccuracy                0
ShortPassing                   0
Volleys                        0
Dribbling                      0
Curve                          0
FKAccuracy                     0
LongPassing                    0
BallControl                    0
Acceleration                   0
SprintSpeed                    0
Agility                        0
Reactions                      0
Balance                        0
ShotPower                      0
Jumping                        0
Stamina                        0
Strength                       0
LongShots                      0
Aggression                     0
Interceptions                  0
Positioning                    0
Vision                         0
Penalties                      0
Composure                      0
Marking                        0
StandingTackle                 0
SlidingTackle                  0
GKDiving                       0
```

```
GKHandling                     0
GKKicking                      0
GKPositioning                  0
GKReflexes                     0
Release Clause              1564
dtype: int64
```

In [12]:

```
# Заполним пустые значения в категориальных данных
cat_cols_with_null_values = []
for col in data.columns:
    null_count = data[col].isnull().sum()
    if data[col].dtype not in ('float64', 'int64') and null_count != 0: # object
        cat_cols_with_null_values.append(col)

print('Категориальные not(int64, float64) колонки с нулевыми значениями:', cat_cols_with_null_values)
```

```
Категориальные not(int64, float64) колонки с нулевыми значениями: ['Club', 'Preferred Foot', 'Work Rate', 'Body Ty
pe', 'Real Face', 'Position', 'Joined', 'Contract Valid Until', 'Height', 'Weight', 'LS', 'ST', 'RS', 'LW',
'LF', 'CF', 'RF', 'RW', 'LAM', 'CAM', 'RAM', 'LM', 'LCM', 'CM', 'RCM', 'RM', 'LWB', 'LDM', 'CDM', 'RDM', 'RW
B', 'LB', 'LCB', 'CB', 'RCB', 'RB', 'Release Clause']
```

In [13]:

```
# Заполним пустые значения в категориальных колонках
# используем most_frequent (мода) стратегию
for col in cat_cols_with_null_values:
    indicator = MissingIndicator()
    mask_missing_values_only = indicator.fit_transform(data[[col]])
    imp_num = SimpleImputer(strategy='most_frequent')
    data[[col]] = imp_num.fit_transform(data[[col]])
```

In [14]:

```
data.isnull().sum()
```

```
Out[14]: Unnamed: 0                  0
         ID                          0
         Name                        0
         Age                         0
         Photo                       0
         Nationality                 0
         Flag                        0
         Overall                     0
         Potential                   0
         Club                        0
         Club Logo                   0
         Value                       0
         Wage                        0
         Special                     0
         Preferred Foot              0
         International Reputation    0
         Weak Foot                   0
         Skill Moves                 0
         Work Rate                   0
         Body Type                   0
         Real Face                   0
         Position                    0
         Jersey Number               0
         Joined                      0
         Contract Valid Until        0
         Height                      0
         Weight                      0
         LS                          0
         ST                          0
         RS                          0
         LW                          0
         LF                          0
         CF                          0
         RF                          0
         RW                          0
         LAM                         0
         CAM                         0
         RAM                         0
         LM                          0
         LCM                         0
         CM                          0
```

```
RCM                           0
RM                            0
LWB                           0
LDM                           0
CDM                           0
RDM                           0
RWB                           0
LB                            0
LCB                           0
CB                            0
RCB                           0
RB                            0
Crossing                      0
Finishing                     0
HeadingAccuracy               0
ShortPassing                  0
Volleys                       0
Dribbling                     0
Curve                         0
FKAccuracy                    0
LongPassing                   0
BallControl                   0
Acceleration                  0
SprintSpeed                   0
Agility                       0
Reactions                     0
Balance                       0
ShotPower                     0
Jumping                       0
Stamina                       0
Strength                      0
LongShots                     0
Aggression                    0
Interceptions                 0
Positioning                   0
Vision                        0
Penalties                     0
Composure                     0
Marking                       0
StandingTackle                0
SlidingTackle                 0
GKDiving                      0
```

```
GKHandling               0
GKKicking                0
GKPositioning            0
GKReflexes               0
Release Clause           0
dtype: int64
```

2. Преобразование категориальных признаков в числовые

In [15]:
```
cat_cols = []
for col in data.columns:
    if data[col].dtype == 'object':
        cat_cols.append(col)
# колонки Photo, Flag, Club Logo не представляют ценности
cat_cols.remove('Photo')
cat_cols.remove('Flag')
cat_cols.remove('Club Logo')
for col in cat_cols:
    print(col, data[col].unique())
```

```
Name ['L. Messi' 'Cristiano Ronaldo' 'Neymar Jr' ... 'B. Worman'
 'D. Walker-Rice' 'G. Nugent']
Nationality ['Argentina' 'Portugal' 'Brazil' 'Spain' 'Belgium' 'Croatia' 'Uruguay'
 'Slovenia' 'Poland' 'Germany' 'France' 'England' 'Italy' 'Egypt'
 'Colombia' 'Denmark' 'Gabon' 'Wales' 'Senegal' 'Costa Rica' 'Slovakia'
 'Netherlands' 'Bosnia Herzegovina' 'Morocco' 'Serbia' 'Algeria' 'Austria'
 'Greece' 'Chile' 'Sweden' 'Korea Republic' 'Finland' 'Guinea'
 'Montenegro' 'Armenia' 'Switzerland' 'Norway' 'Czech Republic' 'Scotland'
 'Ghana' 'Central African Rep.' 'DR Congo' 'Ivory Coast' 'Russia'
 'Ukraine' 'Iceland' 'Mexico' 'Jamaica' 'Albania' 'Venezuela' 'Japan'
 'Turkey' 'Ecuador' 'Paraguay' 'Mali' 'Nigeria' 'Cameroon'
 'Dominican Republic' 'Israel' 'Kenya' 'Hungary' 'Republic of Ireland'
 'Romania' 'United States' 'Cape Verde' 'Australia' 'Peru' 'Togo' 'Syria'
 'Zimbabwe' 'Angola' 'Burkina Faso' 'Iran' 'Estonia' 'Tunisia'
 'Equatorial Guinea' 'New Zealand' 'FYR Macedonia' 'United Arab Emirates'
 'China PR' 'Guinea Bissau' 'Bulgaria' 'Kosovo' 'South Africa'
 'Madagascar' 'Georgia' 'Tanzania' 'Gambia' 'Cuba' 'Belarus' 'Uzbekistan'
 'Benin' 'Congo' 'Mozambique' 'Honduras' 'Canada' 'Northern Ireland'
 'Cyprus' 'Saudi Arabia' 'Curacao' 'Moldova' 'Bolivia' 'Trinidad & Tobago'
 'Sierra Leone' 'Zambia' 'Chad' 'Philippines' 'Haiti' 'Comoros' 'Libya'
 'Panama' 'São Tomé & Príncipe' 'Eritrea' 'Oman' 'Iraq' 'Burundi' 'Fiji'
 'New Caledonia' 'Lithuania' 'Luxembourg' 'Korea DPR' 'Liechtenstein'
 'St Kitts Nevis' 'Latvia' 'Suriname' 'Uganda' 'El Salvador' 'Bermuda'
 'Kuwait' 'Antigua & Barbuda' 'Thailand' 'Mauritius' 'Guatemala' 'Liberia'
 'Kazakhstan' 'Niger' 'Mauritania' 'Montserrat' 'Namibia' 'Azerbaijan'
 'Guam' 'Faroe Islands' 'India' 'Nicaragua' 'Barbados' 'Lebanon'
 'Palestine' 'Guyana' 'Sudan' 'St Lucia' 'Ethiopia' 'Puerto Rico'
 'Grenada' 'Jordan' 'Rwanda' 'Qatar' 'Afghanistan' 'Hong Kong' 'Andorra'
 'Malta' 'Belize' 'South Sudan' 'Indonesia' 'Botswana']
Club ['FC Barcelona' 'Juventus' 'Paris Saint-Germain' 'Manchester United'
 'Manchester City' 'Chelsea' 'Real Madrid' 'Atlético Madrid'
 'FC Bayern München' 'Tottenham Hotspur' 'Liverpool' 'Napoli' 'Arsenal'
 'Milan' 'Inter' 'Lazio' 'Borussia Dortmund' 'Vissel Kobe'
 'Olympique Lyonnais' 'Roma' 'Valencia CF'
 'Guangzhou Evergrande Taobao FC' 'FC Porto' 'FC Schalke 04' 'Beşiktaş JK'
 'LA Galaxy' 'Sporting CP' 'Real Betis' 'Olympique de Marseille'
 'RC Celta' 'Bayer 04 Leverkusen' 'Real Sociedad' 'Villarreal CF'
 'Sevilla FC' 'SL Benfica' 'AS Saint-Étienne' 'AS Monaco' 'Leicester City'
 'Atalanta' 'Grêmio' 'Atlético Mineiro' 'RB Leipzig' 'Ajax'
 'Dalian YiFang FC' 'Everton' 'West Ham United' '1. FC Köln'
 'TSG 1899 Hoffenheim' 'Shanghai SIPG FC' 'OGC Nice' 'Al Nassr'
```

```
'Wolverhampton Wanderers' 'Borussia Mönchengladbach' 'Hertha BSC'
'SV Werder Bremen' 'Cruzeiro' 'Athletic Club de Bilbao' 'Torino'
'Medipol Başakşehir FK' 'Beijing Sinobo Guoan FC' 'Crystal Palace'
'PFC CSKA Moscow' 'VfL Wolfsburg' 'Shakhtar Donetsk' 'Toronto FC'
'Lokomotiv Moscow' 'Sassuolo' 'New York City FC' 'Fluminense' 'PSV'
'Levante UD' 'Fulham' 'Watford' 'Atlanta United' 'Montpellier HSC'
'Galatasaray SK' 'Fenerbahçe SK' 'SD Eibar' 'Los Angeles FC' 'Sampdoria'
'Al Hilal' 'VfB Stuttgart' 'SC Braga' 'River Plate' 'Deportivo Alavés'
'Eintracht Frankfurt' 'Girona FC' 'Guangzhou R&F; FC' 'Burnley'
'Stoke City' 'Southampton' 'Tianjin Quanjian FC' 'Getafe CF'
'Beijing Renhe FC' 'Montreal Impact' 'Chievo Verona' 'Genoa'
'Portland Timbers' 'Tigres U.A.N.L.' 'RCD Espanyol'
'Hebei China Fortune FC' 'Cagliari' 'Chicago Fire' 'DC United'
'Sagan Tosu' 'Dynamo Kyiv' 'Santos' 'Internacional'
'América FC (Minas Gerais)' 'Independiente' 'Boca Juniors' 'Cruz Azul'
'1. FSV Mainz 05' 'Bournemouth' 'Spartak Moscow' 'Racing Club'
'FC Augsburg' 'Fiorentina' 'FC Nantes' 'Feyenoord' 'Club Brugge KV'
'Brighton & Hove Albion' 'Al Ahli' 'Jiangsu Suning FC' 'SC Freiburg'
'PAOK' 'Stade Rennais FC' 'Trabzonspor' 'SPAL' 'Portimonense SC'
'Olympiacos CFP' 'Club Atlético Huracán' 'Kasimpaşa SK'
'Newcastle United' 'Frosinone' 'Querétaro' 'KRC Genk' 'Hannover 96'
'Stade Malherbe Caen' 'Godoy Cruz' 'Toulouse Football Club'
'RSC Anderlecht' 'Huddersfield Town' 'CD Tondela' 'Seattle Sounders FC'
'Hamburger SV' 'FC Red Bull Salzburg' 'Rio Ave FC'
'FC Girondins de Bordeaux' 'Melbourne Victory' 'Parma' 'FC Basel 1893'
'Al Wehda' 'BSC Young Boys' 'KAA Gent' 'Al Ittihad' 'Standard de Liège'
'Shanghai Greenland Shenhua FC' 'Colo-Colo' 'Junior FC'
'West Bromwich Albion' 'RC Strasbourg Alsace' 'Göztepe SK'
'Deportivo Cali' 'Deportivo Toluca' 'Bologna' 'Nagoya Grampus'
'Amiens SC' 'Changchun Yatai FC' 'Club Atlético Lanús' 'Botafogo'
'Club América' 'Udinese' 'Real Valladolid CF' 'CD Leganés'
'Club Atlético Banfield' 'Celtic' 'Vitória Guimarães' 'FC København'
'UD Las Palmas' 'Deportivo de La Coruña' 'Universidad Católica'
'San Lorenzo de Almagro' 'Rayo Vallecano' 'Monterrey' 'Columbus Crew SC'
'MKE Ankaragücü' 'Guizhou Hengfeng FC' 'Swansea City' 'Tianjin TEDA FC'
'Chongqing Dangdai Lifan FC SWM Team' 'AEK Athens' 'Al Taawoun'
'Melbourne City FC' 'En Avant de Guingamp' 'Akhisar Belediyespor'
'Foggia' 'LOSC Lille' '1. FC Nürnberg' 'Clube Sport Marítimo'
'Real Sporting de Gijón' 'BB Erzurumspor' 'Shandong Luneng TaiShan FC'
'Club Atlético Colón' 'Bahia' 'Once Caldas' 'FC Groningen' 'Angers SCO'
'Paraná' 'Antalyaspor' 'Minnesota United FC' 'Club León' 'Empoli'
'VVV-Venlo' 'Leeds United' 'Viktoria Plzeň' 'Alanyaspor'
```

```
'Atlético Paranaense' 'Derby County' 'Kawasaki Frontale' 'Cardiff City'
'Aston Villa' 'Guadalajara' 'Dijon FCO' 'Santos Laguna' 'Málaga CF'
'Vitória' 'Çaykur Rizespor' 'U.N.A.M.' 'Nottingham Forest'
'Royal Antwerp FC' 'Club Tijuana' 'Sport Club do Recife' 'Real Salt Lake'
'AZ Alkmaar' 'SK Slavia Praha' 'Willem II' 'Middlesbrough'
'Dinamo Zagreb' 'Club Atlas' 'Granada CF' 'Sydney FC'
'Sporting Kansas City' 'SV Zulte-Waregem' 'Philadelphia Union'
'Real Oviedo' 'Pachuca' 'Boavista FC' 'Atiker Konyaspor' 'Kaizer Chiefs'
'GD Chaves' 'Palermo' 'Atlético Nacional' 'Puebla FC' 'Perth Glory'
'Panathinaikos FC' 'FC Sion' 'Vitória de Setúbal' 'New York Red Bulls'
'Al Shabab' 'Monarcas Morelia' 'Albacete BP' 'Rangers FC' 'Sparta Praha'
'Legia Warszawa' 'Urawa Red Diamonds' 'Rosario Central' 'Stade de Reims'
'ADO Den Haag' 'Chapecoense' 'FC Midtjylland' 'San Jose Earthquakes'
'Belgrano de Córdoba' 'Brescia' 'Kashima Antlers'
'CD Everton de Viña del Mar' 'Fortuna Düsseldorf' 'SD Huesca'
'Preston North End' 'Club Atlético Talleres' 'Benevento' 'Vitesse'
'Gimnasia y Esgrima La Plata' 'Houston Dynamo' 'Club Necaxa'
'Norwich City' 'Holstein Kiel' 'Ettifaq FC' 'Kayserispor'
'1. FC Heidenheim 1846' 'Brentford' 'Yeni Malatyaspor' 'Lobos BUAP'
'Bursaspor' 'Ceará Sporting Club' 'Sheffield United' 'FC Ingolstadt 04'
'Estudiantes de La Plata' 'AIK' 'Queens Park Rangers'
'Suwon Samsung Bluewings' 'Heart of Midlothian' 'Reading' 'FC Dallas'
'Heracles Almelo' 'Venezia FC' 'CD Lugo' 'Henan Jianye FC'
'Orlando City SC' 'CA Osasuna' 'NAC Breda' 'Livorno'
'Universidad de Chile' 'Brøndby IF' 'Aberdeen' 'Defensa y Justicia'
'Atlético Tucumán' 'Blackburn Rovers' 'SV Darmstadt 98' 'Moreirense FC'
'Sanfrecce Hiroshima' 'CD Numancia' 'KV Oostende' 'FC Utrecht'
'Vancouver Whitecaps FC' 'Odense Boldklub' 'SC Heerenveen'
'Racing Club de Lens' 'Independiente Santa Fe' 'Sporting de Charleroi'
'Millonarios FC' 'Sheffield Wednesday' 'Perugia' 'Daegu FC'
'Vélez Sarsfield' 'Grasshopper Club Zürich' 'Sivasspor' 'Nîmes Olympique'
'Rosenborg BK' 'SK Sturm Graz' 'FC Metz' 'CD Universidad de Concepción'
'Hellas Verona' 'Brisbane Roar' 'CD Feirense' 'Hull City'
'Waasland-Beveren' 'Neuchâtel Xamax' 'Real Zaragoza' 'CD Aves' 'Millwall'
'Unión de Santa Fe' 'KAS Eupen' 'Cádiz CF' 'FC Tokyo' 'CD Tenerife'
'1. FC Union Berlin' 'Al Fayha' 'AJ Auxerre' 'Patriotas Boyacá FC'
'Molde FK' 'Bristol City' 'CD Nacional' 'Sporting Lokeren' 'FC St. Pauli'
'Deportes Iquique' 'Al Qadisiyah' 'Atlético Bucaramanga'
'Club Atlético Tigre' 'FK Austria Wien' 'Patronato' 'Malmö FF'
'Kashiwa Reysol' 'US Cremonese' 'VfL Bochum 1848' 'SK Rapid Wien'
'KSV Cercle Brugge' 'Rionegro Águilas' 'Gimnàstic de Tarragona' 'Lecce'
'Santa Clara' 'BK Häcken' 'New England Revolution' 'Orlando Pirates'
```

```
'Atlético Huila' 'Western Sydney Wanderers' 'Kalmar FF'
'Independiente Medellín' 'Fortuna Sittard' 'Lech Poznań' 'Djurgårdens IF'
'CF Reus Deportiu' 'SK Brann' 'Ulsan Hyundai FC' 'Sint-Truidense VV'
'Carpi' 'Al Fateh' 'Royal Excel Mouscron' 'AC Ajaccio' 'PEC Zwolle'
'Sunderland' 'Club Atlético Aldosivi' 'US Salernitana 1919' 'FC Lorient'
'Argentinos Juniors' 'AD Alcorcón' 'Crotone' 'Excelsior' 'KV Kortrijk'
'IFK Norrköping' 'Adelaide United' 'FC St. Gallen'
'Tiburones Rojos de Veracruz' 'CD Palestino' 'Jeju United FC'
'Deportes Tolima' 'Jeonbuk Hyundai Motors' 'Birmingham City'
'América de Cali' 'La Equidad' 'Spezia' 'Aalborg BK' 'Le Havre AC'
'Górnik Zabrze' 'Central Coast Mariners' 'Wigan Athletic'
'Jagiellonia Białystok' 'Cittadella' 'Hibernian' 'FC Lugano'
'San Martín de San Juan' 'Strømsgodset IF' 'Júbilo Iwata'
"Newell's Old Boys" 'Al Faisaly' 'Colorado Rapids' 'IF Elfsborg'
'SV Sandhausen' 'Al Batin' 'Stade Brestois 29' 'UD Almería'
'Gyeongnam FC' 'Yokohama F. Marinos' 'Kilmarnock' 'Pescara'
'Newcastle Jets' 'Córdoba CF' 'RCD Mallorca' 'Hammarby IF' 'Cerezo Osaka'
'KFC Uerdingen 05' 'Shimizu S-Pulse' 'MSV Duisburg' 'Os Belenenses'
'DSC Arminia Bielefeld' 'Ipswich Town' 'FC Seoul' 'Lechia Gdańsk'
'Gamba Osaka' 'CF Rayo Majadahonda' 'LASK Linz' 'Bolton Wanderers'
'Al Raed' 'Extremadura UD' 'SC Paderborn 07' 'Wellington Phoenix'
'Unión Española' 'Alianza Petrolera' 'Cracovia' 'Gangwon FC' 'Elche CF'
'ESTAC Troyes' 'AS Béziers' 'La Berrichonne de Châteauroux'
'Clermont Foot 63' '1. FC Magdeburg' 'Pohang Steelers' 'Örebro SK'
'Arka Gdynia' 'SG Dynamo Dresden' 'SpVgg Greuther Fürth' 'CD Huachipato'
'Wisła Kraków' 'Stabæk Fotball' 'Eintracht Braunschweig'
'Valenciennes FC' 'FC Thun' 'San Luis de Quillota' ' SSV Jahn Regensburg'
'Cosenza' 'FC Nordsjælland' 'FC Erzgebirge Aue' 'Jeonnam Dragons'
'Wolfsberger AC' 'Chamois Niortais Football Club' 'Club Deportes Temuco'
'AS Nancy Lorraine' 'Red Star FC' 'Al Hazem' 'Pogoń Szczecin'
'Charlton Athletic' 'Grenoble Foot 38' 'FC Hansa Rostock'
'San Martin de Tucumán' 'Incheon United FC' 'Śląsk Wrocław' 'GFC Ajaccio'
'1. FC Kaiserslautern' 'Deportivo Pasto' 'Lincoln City' 'Motherwell'
'Rotherham United' 'Burton Albion' 'Wisła Płock' 'FC Wacker Innsbruck'
'Peterborough United' 'Ascoli' 'FC Zürich' 'Fleetwood Town' 'Padova'
'FC Sochaux-Montbéliard' 'SV Wehen Wiesbaden' 'Unión La Calera'
'Scunthorpe United' "CD O'Higgins" 'CD Antofagasta' 'Plymouth Argyle'
'Aarhus GF' 'Lillestrøm SK' 'Karlsruher SC' 'GIF Sundsvall' 'FC Emmen'
'Barnsley' 'Audax Italiano' 'V-Varen Nagasaki' 'Paris FC'
'SpVgg Unterhaching' 'Hobro IK' 'De Graafschap'
'Hokkaido Consadole Sapporo' 'Tromsø IL' 'FC Luzern' 'FK Haugesund'
'Zagłębie Lubin' 'VfR Aalen' 'Dundalk' 'Oxford United' 'Piast Gliwice'
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 'Ohod Club' 'Östersunds FK' 'Vegalta Sendai' 'Crawley Town'
 'FC Admira Wacker Mödling' 'Vålerenga Fotball' 'Dundee FC' 'Portsmouth'
 'Envigado FC' 'Miedź Legnica' 'Odds BK' 'SC Fortuna Köln'
 'US Orléans Loiret Football' 'Sarpsborg 08 FF' 'Jaguares de Córdoba'
 'Bradford City' 'Accrington Stanley' 'St. Johnstone FC' 'Boyacá Chicó FC'
 'Luton Town' 'SV Mattersburg' 'Kristiansund BK' 'Sangju Sangmu FC'
 'Rochdale' 'Walsall' 'Korona Kielce' 'Shonan Bellmare'
 'FC Würzburger Kickers' 'FSV Zwickau' 'St. Mirren' 'AC Horsens'
 'Esbjerg fB' 'HJK Helsinki' 'Southend United' 'Bristol Rovers'
 'Hamilton Academical FC' 'TSV 1860 München' 'Curicó Unido' 'SCR Altach'
 'Ranheim Fotball' 'Stevenage' 'SG Sonnenhof Großaspach' 'Oldham Athletic'
 'Milton Keynes Dons' 'FK Bodø/Glimt' 'SC Preußen Münster'
 'Wycombe Wanderers' 'Vejle Boldklub' 'Bury' 'Randers FC' 'VfL Osnabrück'
 'SønderjyskE' 'IFK Göteborg' 'Mansfield Town' 'Coventry City'
 'Waterford FC' 'Shrewsbury' 'IK Start' 'Gillingham' 'FC Energie Cottbus'
 'FC Carl Zeiss Jena' 'Hallescher FC' 'SV Meppen' 'AFC Wimbledon'
 'Blackpool' 'Doncaster Rovers' 'Sandefjord Fotball'
 'VfL Sportfreunde Lotte' 'Cheltenham Town' 'IK Sirius' 'Vendsyssel FF'
 'Swindon Town' 'Notts County' 'SKN St. Pölten' 'Exeter City'
 'Northampton Town' 'Shamrock Rovers' 'Colchester United' 'Livingston FC'
 'TSV Hartberg' 'Tranmere Rovers' 'Cambridge United' 'Grimsby Town'
 'Port Vale' 'Itagüí Leones FC' 'Forest Green Rovers' 'Dalkurd FF'
 'Zagłębie Sosnowiec' 'Carlisle United' 'Trelleborgs FF'
 "St. Patrick's Athletic" 'Morecambe' 'Cork City' 'IF Brommapojkarna'
 'Crewe Alexandra' 'Yeovil Town' 'Bohemian FC' 'Macclesfield Town'
 'Newport County' 'Sligo Rovers' 'Derry City' 'Limerick FC'
 'Bray Wanderers']
Value ['€110.5M' '€77M' '€118.5M' '€72M' '€102M' '€93M' '€67M' '€80M' '€51M'
 '€68M' '€76.5M' '€44M' '€60M' '€63M' '€89M' '€83.5M' '€78M' '€58M'
 '€53.5M' '€51.5M' '€38M' '€64.5M' '€27M' '€81M' '€69.5M' '€59.5M' '€62M'
 '€73.5M' '€59M' '€46M' '€43M' '€36M' '€57M' '€24M' '€30M' '€4M' '€64M'
 '€30.5M' '€62.5M' '€52M' '€45M' '€34M' '€46.5M' '€61M' '€41.5M' '€44.5M'
 '€56.5M' '€53M' '€50M' '€55M' '€36.5M' '€45.5M' '€43.5M' '€35M' '€39M'
 '€18M' '€21.5M' '€50.5M' '€54M' '€40.5M' '€37.5M' '€28.5M' '€37M' '€32M'
 '€26M' '€33M' '€38.5M' '€35.5M' '€9M' '€15.5M' '€22M' '€14M' '€42.5M'
 '€31.5M' '€42M' '€25M' '€29.5M' '€31M' '€24.5M' '€27.5M' '€29M' '€16.5M'
 '€23M' '€19M' '€4.2M' '€40M' '€41M' '€28M' '€22.5M' '€34.5M' '€32.5M'
 '€20M' '€26.5M' '€25.5M' '€21M' '€13M' '€17.5M' '€11.5M' '€8M' '€6M'
 '€19.5M' '€6.5M' '€20.5M' '€23.5M' '€18.5M' '€17M' '€12.5M' '€15M'
 '€13.5M' '€4.8M' '€3M' '€1.5M' '€16M' '€10M' '€11M' '€7M' '€14.5M'
 '€5.5M' '€10.5M' '€4.5M' '€12M' '€0' '€9.5M' '€8.5M' '€2M' '€1.7M' '€1M'
 '€3.6M' '€7.5M' '€3.8M' '€5M' '€2.4M' '€2.9M' '€4.7M' '€4.1M' '€2.1M'
 '€600K' '€2.7M' '€3.4M' '€2.5M' '€3.2M' '€3.1M' '€4.9M' '€4.3M' '€2.3M'
 '€525K' '€3.9M' '€1.8M' '€2.2M' '€4.4M' '€1.6M' '€900K' '€3.7M' '€3.5M'
 '€1.9M' '€450K' '€775K' '€650K' '€750K' '€2.8M' '€1.3M' '€4.6M' '€2.6M'
 '€1.2M' '€375K' '€3.3M' '€270K' '€950K' '€550K' '€1.1M' '€975K' '€1.4M'
 '€725K' '€425K' '€210K' '€875K' '€675K' '€325K' '€800K' '€850K' '€160K'
 '€120K' '€825K' '€925K' '€625K' '€240K' '€500K' '€575K' '€200K' '€250K'
 '€700K' '€350K' '€475K' '€300K' '€70K' '€140K' '€230K' '€400K' '€280K'
 '€100K' '€60K' '€260K' '€180K' '€220K' '€50K' '€290K' '€90K' '€150K'
 '€40K' '€130K' '€190K' '€170K' '€110K' '€30K' '€80K' '€20K' '€10K']
Wage ['€565K' '€405K' '€290K' '€260K' '€355K' '€340K' '€420K' '€455K' '€380K'
 '€94K' '€205K' '€125K' '€285K' '€225K' '€145K' '€240K' '€315K' '€200K'
 '€130K' '€300K' '€215K' '€100K' '€255K' '€165K' '€265K' '€160K' '€150K'
 '€245K' '€110K' '€77K' '€115K' '€210K' '€195K' '€230K' '€250K' '€135K'
 '€155K' '€180K' '€175K' '€190K' '€185K' '€21K' '€82K' '€73K' '€92K'
 '€88K' '€96K' '€170K' '€66K' '€235K' '€28K' '€105K' '€38K' '€81K' '€57K'
 '€15K' '€63K' '€22K' '€84K' '€120K' '€90K' '€72K' '€93K' '€45K' '€74K'
 '€51K' '€42K' '€31K' '€75K' '€25K' '€140K' '€41K' '€78K' '€53K' '€95K'
 '€80K' '€43K' '€60K' '€85K' '€64K' '€67K' '€18K' '€70K' '€91K' '€20K'
 '€49K' '€87K' '€86K' '€26K' '€29K' '€55K' '€35K' '€33K' '€56K' '€30K'
 '€11K' '€59K' '€23K' '€46K' '€39K' '€32K' '€36K' '€98K' '€54K' '€68K'
 '€58K' '€27K' '€40K' '€44K' '€19K' '€1K' '€61K' '€50K' '€99K' '€17K'
 '€52K' '€62K' '€12K' '€10K' '€71K' '€14K' '€76K' '€48K' '€65K' '€69K'
 '€24K' '€34K' '€16K' '€37K' '€47K' '€89K' '€0' '€97K' '€79K' '€13K'
 '€83K' '€6K' '€3K' '€9K' '€8K' '€7K' '€4K' '€2K' '€5K']
Preferred Foot ['Left' 'Right']
Work Rate ['Medium/ Medium' 'High/ Low' 'High/ Medium' 'High/ High' 'Medium/ High'
 'Medium/ Low' 'Low/ High' 'Low/ Medium' 'Low/ Low']
Body Type ['Messi' 'C. Ronaldo' 'Neymar' 'Lean' 'Normal' 'Courtois' 'Stocky'
 'PLAYER_BODY_TYPE_25' 'Shaqiri' 'Akinfenwa']
Real Face ['Yes' 'No']
Position ['RF' 'ST' 'LW' 'GK' 'RCM' 'LF' 'RS' 'RCB' 'LCM' 'CB' 'LDM' 'CAM' 'CDM'
 'LS' 'LCB' 'RM' 'LAM' 'LM' 'LB' 'RDM' 'RW' 'CM' 'RB' 'RAM' 'CF' 'RWB'
 'LWB']
Joined ['Jul 1, 2004' 'Jul 10, 2018' 'Aug 3, 2017' ... 'May 22, 2017'
 'Nov 6, 2016' 'Nov 27, 2018']
Contract Valid Until ['2021' '2022' '2020' '2023' '2019' '2024' 'Jun 30, 2019' '2025' '2026'
 'Dec 31, 2018' '2018' 'May 31, 2020' 'Jun 30, 2020' 'May 31, 2019'
 'Dec 31, 2019' 'Jan 1, 2019' 'Jun 1, 2019' 'Jan 4, 2019' 'Jan 31, 2019'
 'Jan 7, 2019' 'Jan 2, 2019' 'Jan 6, 2019' 'Oct 14, 2019' 'Jan 3, 2019'
 'May 4, 2019' 'Jan 12, 2019' 'Jan 25, 2019' 'Jan 18, 2019' 'Dec 1, 2019'
 'Nov 30, 2018' 'Feb 27, 2020' 'Jan 5, 2019' 'Jan 15, 2019' 'Jan 30, 2019'
 'Jan 11, 2019' 'Jan 20, 2019']
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Height ["5'7" "6'2" "5'9" "6'4" "5'11" "5'8" "6'0" "5'6" "5'10" "6'6" "6'1" "5'4"
 "6'3" "5'5" "6'5" "6'7" "5'3" "5'2" "6'8" "5'1" "6'9"]
Weight ['159lbs' '183lbs' '150lbs' '168lbs' '154lbs' '163lbs' '146lbs' '190lbs'
 '181lbs' '192lbs' '176lbs' '172lbs' '148lbs' '165lbs' '196lbs' '161lbs'
 '187lbs' '212lbs' '170lbs' '203lbs' '157lbs' '185lbs' '130lbs' '174lbs'
 '207lbs' '134lbs' '141lbs' '152lbs' '179lbs' '132lbs' '201lbs' '198lbs'
 '209lbs' '214lbs' '143lbs' '205lbs' '137lbs' '194lbs' '216lbs' '139lbs'
 '220lbs' '126lbs' '218lbs' '123lbs' '227lbs' '128lbs' '223lbs' '225lbs'
 '121lbs' '115lbs' '117lbs' '236lbs' '229lbs' '243lbs' '110lbs' '119lbs'
 '234lbs']
LS ['88+2' '91+3' '84+3' '61+2' '82+3' '83+3' '77+3' '87+5' '73+3' '87+3'
 '78+3' '64+3' '72+3' '86+3' '71+3' '85+3' '58+3' '80+3' '76+3' '79+3'
 '69+3' '66+3' '70+3' '52+3' '81+3' '68+3' '82+2' '75+2' '62+3' '74+3'
 '75+3' '67+3' '65+3' '61+3' '57+2' '81+2' '49+3' '74+2' '63+3' '60+3'
 '82+4' '56+2' '64+2' '77+2' '59+3' '70+2' '57+3' '72+2' '55+3' '78+2'
 '59+2' '73+2' '76+2' '52+2' '80+2' '79+2' '56+3' '53+2' '58+2' '69+2'
 '51+3' '66+2' '67+2' '68+2' '65+2' '62+2' '55+2' '71+2' '63+2' '60+2'
 '54+2' '49+2' '50+2' '51+2' '48+2' '47+2' '47+3' '46+2' '42+2' '44+2'
 '45+2' '43+2' '40+2' '39+2' '37+2' '41+2' '38+2' '36+2' '34+2' '35+2'
 '31+2' '33+2' '32+2']
ST ['88+2' '91+3' '84+3' '61+2' '82+3' '83+3' '77+3' '87+5' '73+3' '87+3'
 '78+3' '64+3' '72+3' '86+3' '71+3' '85+3' '58+3' '80+3' '76+3' '79+3'
 '69+3' '66+3' '70+3' '52+3' '81+3' '68+3' '82+2' '75+2' '62+3' '74+3'
 '75+3' '67+3' '65+3' '61+3' '57+2' '81+2' '49+3' '74+2' '63+3' '60+3'
 '82+4' '56+2' '64+2' '77+2' '59+3' '70+2' '57+3' '72+2' '55+3' '78+2'
 '59+2' '73+2' '76+2' '52+2' '80+2' '79+2' '56+3' '53+2' '58+2' '69+2'
 '51+3' '66+2' '67+2' '68+2' '65+2' '62+2' '55+2' '71+2' '63+2' '60+2'
 '54+2' '49+2' '50+2' '51+2' '48+2' '47+2' '47+3' '46+2' '42+2' '44+2'
 '45+2' '43+2' '40+2' '39+2' '37+2' '41+2' '38+2' '36+2' '34+2' '35+2'
 '31+2' '33+2' '32+2']
RS ['88+2' '91+3' '84+3' '61+2' '82+3' '83+3' '77+3' '87+5' '73+3' '87+3'
 '78+3' '64+3' '72+3' '86+3' '71+3' '85+3' '58+3' '80+3' '76+3' '79+3'
 '69+3' '66+3' '70+3' '52+3' '81+3' '68+3' '82+2' '75+2' '62+3' '74+3'
 '75+3' '67+3' '65+3' '61+3' '57+2' '81+2' '49+3' '74+2' '63+3' '60+3'
 '82+4' '56+2' '64+2' '77+2' '59+3' '70+2' '57+3' '72+2' '55+3' '78+2'
 '59+2' '73+2' '76+2' '52+2' '80+2' '79+2' '56+3' '53+2' '58+2' '69+2'
 '51+3' '66+2' '67+2' '68+2' '65+2' '62+2' '55+2' '71+2' '63+2' '60+2'
 '54+2' '49+2' '50+2' '51+2' '48+2' '47+2' '47+3' '46+2' '42+2' '44+2'
 '45+2' '43+2' '40+2' '39+2' '37+2' '41+2' '38+2' '36+2' '34+2' '35+2'
 '31+2' '33+2' '32+2']
LW ['92+2' '89+3' '63+2' '87+3' '85+3' '86+5' '70+3' '83+3' '81+3' '61+3'
 '77+3' '82+3' '74+3' '86+3' '54+3' '69+3' '84+3' '68+3' '66+3' '76+3'
 '51+3' '79+3' '80+3' '64+3' '84+2' '65+3' '78+3' '71+3' '63+3' '57+3'
 '75+3' '56+2' '79+2' '49+3' '59+3' '77+2' '62+3' '60+3' '58+3' '77+4'
 '59+2' '51+2' '61+2' '81+2' '49+2' '83+2' '72+3' '76+2' '56+3' '82+2'
 '74+2' '62+2' '52+2' '55+3' '64+2' '78+2' '55+2' '80+2' '71+2' '44+3'
 '67+3' '60+2' '68+2' '58+2' '54+2' '72+2' '73+3' '53+3' '75+2' '50+3'
 '70+2' '73+2' '53+2' '66+2' '48+2' '65+2' '67+2' '57+2' '69+2' '48+3'
 '50+2' '52+3' '47+2' '42+2' '45+2' '41+3' '43+2' '46+2' '40+2' '44+2'
 '41+2' '38+2' '39+2' '34+2' '35+2' '36+2' '37+2' '33+2' '32+2' '28+2'
 '30+2' '31+2' '29+2' '27+2' '25+2']
LF ['93+2' '90+3' '89+3' '61+2' '87+3' '88+3' '84+3' '87+5' '71+3' '86+3'
 '82+3' '62+3' '77+3' '76+3' '83+3' '55+3' '73+3' '85+3' '69+3' '67+3'
 '81+3' '52+3' '79+3' '66+3' '84+2' '82+2' '63+3' '75+3' '70+3' '65+3'
 '78+3' '58+3' '57+2' '81+2' '48+3' '61+3' '77+2' '64+3' '80+3' '74+3'
 '59+3' '80+4' '60+2' '51+2' '63+2' '52+2' '76+2' '83+2' '68+3' '56+3'
 '59+2' '79+2' '78+2' '80+2' '53+2' '72+3' '71+2' '47+3' '65+2' '75+2'
 '73+2' '67+2' '72+2' '66+2' '55+2' '56+2' '58+2' '64+2' '62+2' '57+3'
 '74+2' '53+3' '60+3' '68+2' '70+2' '54+2' '69+2' '50+2' '51+3' '47+2'
 '48+2' '46+2' '45+2' '49+2' '43+3' '43+2' '42+2' '41+2' '40+2' '44+2'
 '39+2' '36+2' '38+2' '35+2' '37+2' '33+2' '34+2' '30+2' '31+2' '32+2'
 '27+2' '29+2']
CF ['93+2' '90+3' '89+3' '61+2' '87+3' '88+3' '84+3' '87+5' '71+3' '86+3'
 '82+3' '62+3' '77+3' '76+3' '83+3' '55+3' '73+3' '85+3' '69+3' '67+3'
 '81+3' '52+3' '79+3' '66+3' '84+2' '82+2' '63+3' '75+3' '70+3' '65+3'
 '78+3' '58+3' '57+2' '81+2' '48+3' '61+3' '77+2' '64+3' '80+3' '74+3'
 '59+3' '80+4' '60+2' '51+2' '63+2' '52+2' '76+2' '83+2' '68+3' '56+3'
 '59+2' '79+2' '78+2' '80+2' '53+2' '72+3' '71+2' '47+3' '65+2' '75+2'
 '73+2' '67+2' '72+2' '66+2' '55+2' '56+2' '58+2' '64+2' '62+2' '57+3'
 '74+2' '53+3' '60+3' '68+2' '70+2' '54+2' '69+2' '50+2' '51+3' '47+2'
 '48+2' '46+2' '45+2' '49+2' '43+3' '43+2' '42+2' '41+2' '40+2' '44+2'
 '39+2' '36+2' '38+2' '35+2' '37+2' '33+2' '34+2' '30+2' '31+2' '32+2'
 '27+2' '29+2']
RF ['93+2' '90+3' '89+3' '61+2' '87+3' '88+3' '84+3' '87+5' '71+3' '86+3'
 '82+3' '62+3' '77+3' '76+3' '83+3' '55+3' '73+3' '85+3' '69+3' '67+3'
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 '78+3' '46+3' '70+3' '52+2' '53+2' '76+3' '59+3' '73+3' '40+3' '83+2'
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 '71+3' '51+3' '81+3' '52+3' '75+3' '57+3' '63+2' '69+3' '83+3' '76+3'
 '76+2' '82+3' '59+3' '74+3' '71+2' '72+3' '51+4' '74+2' '77+2' '73+2'
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 '46+3' '49+3' '48+2' '52+2' '45+2' '47+2' '46+2' '48+3' '44+2' '43+2'
 '42+2' '41+3' '47+3' '42+3' '40+2' '41+2' '38+2' '39+2' '45+3' '36+2'
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Release Clause ['€226.5M' '€127.1M' '€228.1M' ... '€74K' '€101K' '€147K']
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```
In [16]: from sklearn.preprocessing import LabelEncoder
```

In [17]:

```
encoding_of_cat = {}
for col in cat_cols:
    le = LabelEncoder()
    data[[col]] = le.fit_transform(data[col])
    print(col, data[col].unique())
    encoding_of_cat[col] = le
```

```
Name [ 9632  3153 12508 ...  2133  3997  5807]
Nationality [  6 123  20 139  13  35 158 136 122  59  55  46  78  44  31  41  56 161
 132  34 135 108  18 105 133   2   9  61  29 144  86  54  65 103   7 145
 115  39 131  60  27  40  79 128 155  72 101  80   1 160  81 153  43 119
  97 113  24  42  77  84  71 126 127 157  26   8 120 150 146 163   4  22
  75  49 152  47 110  51 156  30  66  21  87 137  96  58 148  57  36  12
 159  15  33 106  69  25 114  38 130  37 102  17 151 134 162  28 121  68
  32  92 118 147  48 116  76  23  53 109  94  95  85  93 140  89 143 154
  45  16  88   5 149 100  64  91  83 112  99 104 107  10  63  52  73 111
  11  90 117  67 142 141  50 124  62  82 129 125   0  70   3  98  14 138
  74  19]
Club [212 326 435 375 374 134 470  61 214 583 363 398  52 382 315 351  86 620
 418 482 605 280 232 234  77 346 552 469 419 457  72 473 619 530 504  19
  17 358  55 278  62 456  26 176 206 633   3 574 535 412  36 640  87 297
 511 168  56 581 377  74 169 427 616 531 582 367 527 401 254 428 359 260
 630  58 390 264 250 495 368 514  34 612 488 480 182 198 272 281 100 566
 544 577 268  73 391 137 267 450 580 459 293 121 136 173 513 195 524 316
  46 312  82 167   7  89 549 462 211 252 230 251 150  95  28 324 490 425
 562 585 505 449 417 146 340 404 259 455 331 291 561 273 584 461 303 117
 529 288 233 478 220 379 436 213  41  69 328  35 564 534 157 325 632 458
 285 183 185  84 397  45 131 147  88 141 595 475 110 144 127 623 224 591
 186 597 516 467 389 159 370 282 570 578 138  12  40 378 201  27 255 348
   5 155 474  67 533 145  70 420 221  48 433  49 386 152 200 604 356 618
  42  64 187 341 123  54 279 189 525 395 622 647 589 409 486 154 551 472
  20 501 636 380 190 142 274 572 553 512 443 471 429  81  57 335 261 431
  63 453 439 432 236 624 402  39 388  43 465 548 357 602 483 563  11 132
 229 515  75  94 338 107 257 496 452 148  76 621 270 302 153 408 301 205
 342   1  93 642 366 101 126 536 223 204  14 454 569 292 468 216 296 611
 111 295 421 104 396 365 598  99  23 179  65  79 506 393 521 113 334 242
 607 414 491 463 314 555 383 537 440 175 626 275 542 411 484 502 228 118
 294  96 108 304 627 399 476 106 384 601 329 171 241 116   6  32  15 437
 387  97 112 554 239 180  37  59 149 246 438 373 339 592 613 500 332 479
 271 353 523  68 400 422  60 634 336 313 258 354 191 120 499 596 541 125
  31 487   8 426 568 143 594 225  50  10 166 207 333 308  25 238 579 115
 321 181 322  78  47 350 550  21 352 284 128 635 319 139 298 226 519 567
 327 405  30 158 306 509  29 560 590 283 644 343 441 403 172 460 290 129
 330 538 371 423 174 317 235 355 265 119 347  85  38 209 492 631 599  44
 163 266 199 196  16 349 140   4 447 648  51 497 546 109 637 559 197 606
 240 517   0 161 231 219 323 639 130 151  18 477  33 446 133 276 222 518
 311 650 262   2 184 362 394 485 102 638 243 442  53 245 253 430 237 510
 600 528 114 105 445  22 360 337 263 217  71  66 603 434 547 299 178 300
 588 227 248 645 617 193 424 444 415 649 608 164 210 625 194 451 202 381
 413 489 593 526 320  91  24 556  90 369 507 345 522 481 628 344 539 244
 249 557   9 203 286 545  98 289 575 170 494 466 565 498 416 385 247 493
 641 609 103 464 614 573 307 376 162 629 540 310 269 218 215 287 508  13
  80 192 520 615 135 309 610 571 410 503 208 407 532 156 364 576 586 122
 277 448 318 256 177 646 124 587 558 392 160 305 165 643  83 372 406 543
 188 361  92]
Value [ 16 195  18 190  12 213 182 201 154 183 193 140 172 177 207 204 196 165
 157 153 116 178  78 202 184 166 176 191 167 145 138 111 164  69  98 147
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 117  40  58 149 159 128 112  79 114 103  75 104 115 107 216  29  63  28
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 101  57  73  70  60  25  35  15 208 185  41 169  54  64  38  37  20  31
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  47 155  94   8  46 122   6 210  92  90   9 142 194 180 192  52   3 124
  50   2 113  88  77 214 160   1 215   4 189 135  59 206 181 102 199 205
  33  21 203 212 175  68 150 163  55  71 187 108 146  96 188  27  65 129
  80  11 171  74  39  62 151  83 211  30 130  24  42  36  17  97 200  56
  13]
Wage [ 94  74  55  49  66  64  77  81  70 137  33   8  53  38  14  43  60  32
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  17  25  23  28  26  37 124 114 135 130 139  22 106  41  54   2  71 123
  96  18 103  39 126   7 133 113 136  82 115  89  78  61 116  48  13  76
 119  91 138 122  79 100 127 104 107  27 111 134  34  86 129 128  51  56
  93  67  63  95  59   6  98  42  83  72  62  68 141  92 108  97  52  75
  80  30  31 101  88 142  24  90 102   9   3 112  15 117  85 105 109  45
  65  21  69  84 131   0 140 120  12 125 110  73 143 132 121  87  57  99]
Preferred Foot [0 1]
Work Rate [8 1 2 0 6 7 3 5 4]
Body Type [4 1 5 3 6 2 9 7 8 0]
Real Face [1 0]
Position [21 26 14  5 19 11 23 18  9  1 10  0  2 13  8 22  6 12  7 20 24  4 17 16
  3 25 15]
Joined [ 774  794  247 ... 1340 1487 1464]
Contract Valid Until [ 3  4  2  5  1  6 29  7  8 10  0 32 30 31 11 13 28 24 23 27 18 26 35 21
 33 15 20 17  9 34 12 25 16 22 14 19]
Height [ 8 13 10 15  2  9 11  7  1 17 12  5 14  6 16 18  4  3 19  0 20]
Weight [21 32 17 25 19 23 15 35 31 36 29 27 16 24 38 22 34 45 26 41 20 33  8 28
 43 10 13 18 30  9 40 39 44 46 14 42 11 37 47 12 49  6 48  5 52  7 50 51
  4  1  2 55 53 56  0  3 54]
LS [91 92 86 40 83 85 73 90 65 89 75 47 63 88 61 87 35 79 71 77 57 51 59 25
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 81 55 82 68 43 67 69 53 49 41 32 80 20 66 45 39 84 30 46 72 37 58 33 62
 29 74 36 64 70 24 78 76 31 26 34 56 23 50 52 54 48 42 28 60 44 38 27 19
 21 22 18 16 17 15 11 13 14 12  9  8  6 10  7  5  3  4  0  2  1]
ST [91 92 86 40 83 85 73 90 65 89 75 47 63 88 61 87 35 79 71 77 57 51 59 25
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 29 74 36 64 70 24 78 76 31 26 34 56 23 50 52 54 48 42 28 60 44 38 27 19
 21 22 18 16 17 15 11 13 14 12  9  8  6 10  7  5  3  4  0  2  1]
RS [91 92 86 40 83 85 73 90 65 89 75 47 63 88 61 87 35 79 71 77 57 51 59 25
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 29 74 36 64 70 24 78 76 31 26 34 56 23 50 52 54 48 42 28 60 44 38 27 19
 21 22 18 16 17 15 11 13 14 12  9  8  6 10  7  5  3  4  0  2  1]
LW [104 103  54 102  99 101  69  96  92  51  83  94  77 100  37  67  98  65
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  30  68  65  21  53  73  69  57  67  55  33  35  39  51  47  38  71  31
  44  59  63  32  61  25  27  20  22  19  18  24  16  15  14  13  12  17
  11   8  10   7   9   5   6   2   3   4   0   1]
RW [104 103  54 102  99 101  69  96  92  51  83  94  77 100  37  67  98  65
  61  81  31  88  90  57  97  59  86  71  55  43  79  40  87  27  47  82
  53  49  45  84  46  30  50  91  26  95  73  80  41  93  76  52  32  39
  56  85  38  89  70  20  63  48  64  44  36  72  75  35  78  29  68  74
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  12   8   9   7   6   2   5   4   3   1   0]
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 92 58 93 52 85 54 60 44 43 84 30 46 80 74 48 40 77 47 29 51 88 28 82 86
 78 38 65 55 37 71 31 59 41 67 23 53 73 75 57 35 39 49 69 63 32 42 33 61
 70 27 26 22 21 25 18 19 24 17 20 12 16 14 11 15 13 10  9  2  8  7  6  5
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LCM [86 81 32 90 83 91 77 68 72 89 53 88 76 79 85 70 37 74 63 87 59 33 61 57
 66 65 78 55 41 46 84 29 51 43 64 48 28 56 82 36 71 62 35 49 73 44 54 80
 58 75 67 45 38 60 69 26 52 42 47 39 34 40 50 30 31 25 23 27 20 22 21 15
 24 14 17 18 19 16 13 11  9 10 12  8  4  5  7  6  3  1  2  0]
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 66 65 78 55 41 46 84 29 51 43 64 48 28 56 82 36 71 62 35 49 73 44 54 80
 58 75 67 45 38 60 69 26 52 42 47 39 34 40 50 30 31 25 23 27 20 22 21 15
 24 14 17 18 19 16 13 11  9 10 12  8  4  5  7  6  3  1  2  0]
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 92 58 93 52 85 54 60 44 43 84 30 46 80 74 48 40 77 47 29 51 88 28 82 86
 78 38 65 55 37 71 31 59 41 67 23 53 73 75 57 35 39 49 69 63 32 42 33 61
 70 27 26 22 21 25 18 19 24 17 20 12 16 14 11 15 13 10  9  2  8  7  6  5
  4  3  1  0]
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 35 87 33 46 93 77 55 61 92 62 40 72 80 74 44 36 68 76 63 30 78 41 66 82
 51 90 84 88 57 86 70 43 38 49 45 37 59 39 28 31 32 34 25 27 24 26 19 22
 16 14 17 23 15 20 18 13 11 12 29 10  9 21  5  6  8  7  4  2  3  1  0]
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 94 32 78 84 88 86 44 56 55 83 87 45 76 81 72 41 73 85 77 39 89 34 40 79
 27 65 36 42 66 93 75 35 31 62 37 60 58 91 30 54 33 46 52 22 67 29 71 69
 23 24 28 25 26 19 15 21 20 17 14 16 12 13 11 18  8 10  9  7  6  5  4  3
  2  1  0]
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 94 32 78 84 88 86 44 56 55 83 87 45 76 81 72 41 73 85 77 39 89 34 40 79
 27 65 36 42 66 93 75 35 31 62 37 60 58 91 30 54 33 46 52 22 67 29 71 69
 23 24 28 25 26 19 15 21 20 17 14 16 12 13 11 18  8 10  9  7  6  5  4  3
  2  1  0]
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 94 32 78 84 88 86 44 56 55 83 87 45 76 81 72 41 73 85 77 39 89 34 40 79
 27 65 36 42 66 93 75 35 31 62 37 60 58 91 30 54 33 46 52 22 67 29 71 69
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  2  1  0]
RWB [53 56 47 81 58 91 65 89 48 85 79 64 94 50 67 60 42 75 83 52 71 69 54 73
 35 87 33 46 93 77 55 61 92 62 40 72 80 74 44 36 68 76 63 30 78 41 66 82
 51 90 84 88 57 86 70 43 38 49 45 37 59 39 28 31 32 34 25 27 24 26 19 22
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 86 70 35 64 59 74 53 88 94 90 92 29 66 37 39 57 45 71 26 28 61 68 21 27
 24 33 18 22 20 25 17 16 14 13 23 15 11 12  9 10 19  7  5  6  8  4  3  2
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LCB [ 28  42  29  61  69  33  79  63 107  50  81 103  25  56  58 101  62 106
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  54  83  15 102  94  35  91  95  74  97  73  40 100  70  98  80  75  32
  86  17  34  36  68  90  65  14  64  45  47  78  43  19  96  60  21  92
  20  84  53  82  26  55  51  72  24  22  88  16  48  87  12  76  30  59
  66  49  57  13  67  18  11  10   9   6   8   7   5   1   3   4   2   0]
CB [ 28  42  29  61  69  33  79  63 107  50  81 103  25  56  58 101  62 106
  44 105  52  23  39  99  71  31 104  37  85  46  93  27  77  38  41  89
  54  83  15 102  94  35  91  95  74  97  73  40 100  70  98  80  75  32
  86  17  34  36  68  90  65  14  64  45  47  78  43  19  96  60  21  92
  20  84  53  82  26  55  51  72  24  22  88  16  48  87  12  76  30  59
  66  49  57  13  67  18  11  10   9   6   8   7   5   1   3   4   2   0]
RCB [ 28  42  29  61  69  33  79  63 107  50  81 103  25  56  58 101  62 106
  44 105  52  23  39  99  71  31 104  37  85  46  93  27  77  38  41  89
  54  83  15 102  94  35  91  95  74  97  73  40 100  70  98  80  75  32
  86  17  34  36  68  90  65  14  64  45  47  78  43  19  96  60  21  92
  20  84  53  82  26  55  51  72  24  22  88  16  48  87  12  76  30  59
  66  49  57  13  67  18  11  10   9   6   8   7   5   1   3   4   2   0]
RB [47 52 50 51 77 89 63 97 46 85 58 42 54 65 87 60 36 62 67 91 73 31 93 34
 81 44 55 69 96 83 82 95 48 79 72 75 32 78 84 76 80 41 56 38 40 43 49 30
 86 70 35 64 59 74 53 88 94 90 92 29 66 37 39 57 45 71 26 28 61 68 21 27
 24 33 18 22 20 25 17 16 14 13 23 15 11 12  9 10 19  7  5  6  8  4  3  2
  1  0]
Release Clause [ 293   82  294 ... 1032   19  126]
```

In [18]:

```
data.dtypes
```

```
Out[18]: Unnamed: 0                    int64
         ID                            int64
         Name                          int64
         Age                           int64
         Photo                        object
         Nationality                   int64
         Flag                         object
         Overall                       int64
         Potential                     int64
         Club                          int64
         Club Logo                    object
         Value                         int64
         Wage                          int64
         Special                       int64
         Preferred Foot                int64
         International Reputation    float64
         Weak Foot                   float64
         Skill Moves                 float64
         Work Rate                     int64
         Body Type                     int64
         Real Face                     int64
         Position                      int64
         Jersey Number               float64
         Joined                        int64
         Contract Valid Until          int64
         Height                        int64
         Weight                        int64
         LS                            int64
         ST                            int64
         RS                            int64
         LW                            int64
         LF                            int64
         CF                            int64
         RF                            int64
         RW                            int64
         LAM                           int64
         CAM                           int64
         RAM                           int64
         LM                            int64
         LCM                           int64
         CM                            int64
```

```
RCM                           int64
RM                            int64
LWB                           int64
LDM                           int64
CDM                           int64
RDM                           int64
RWB                           int64
LB                            int64
LCB                           int64
CB                            int64
RCB                           int64
RB                            int64
Crossing                    float64
Finishing                   float64
HeadingAccuracy             float64
ShortPassing                float64
Volleys                     float64
Dribbling                   float64
Curve                       float64
FKAccuracy                  float64
LongPassing                 float64
BallControl                 float64
Acceleration                float64
SprintSpeed                 float64
Agility                     float64
Reactions                   float64
Balance                     float64
ShotPower                   float64
Jumping                     float64
Stamina                     float64
Strength                    float64
LongShots                   float64
Aggression                  float64
Interceptions               float64
Positioning                 float64
Vision                      float64
Penalties                   float64
Composure                   float64
Marking                     float64
StandingTackle              float64
SlidingTackle               float64
GKDiving                    float64
```

```
GKHandling                  float64
GKKicking                   float64
GKPositioning               float64
GKReflexes                  float64
Release Clause                int64
dtype: object
```

In [19]:

```
encoding_of_cat
# можем выполнить декодирование
```

```
Out[19]: {'Name': LabelEncoder(),
          'Nationality': LabelEncoder(),
          'Club': LabelEncoder(),
          'Value': LabelEncoder(),
          'Wage': LabelEncoder(),
          'Preferred Foot': LabelEncoder(),
          'Work Rate': LabelEncoder(),
          'Body Type': LabelEncoder(),
          'Real Face': LabelEncoder(),
          'Position': LabelEncoder(),
          'Joined': LabelEncoder(),
          'Contract Valid Until': LabelEncoder(),
          'Height': LabelEncoder(),
          'Weight': LabelEncoder(),
          'LS': LabelEncoder(),
          'ST': LabelEncoder(),
          'RS': LabelEncoder(),
          'LW': LabelEncoder(),
          'LF': LabelEncoder(),
          'CF': LabelEncoder(),
          'RF': LabelEncoder(),
          'RW': LabelEncoder(),
          'LAM': LabelEncoder(),
          'CAM': LabelEncoder(),
          'RAM': LabelEncoder(),
          'LM': LabelEncoder(),
          'LCM': LabelEncoder(),
          'CM': LabelEncoder(),
          'RCM': LabelEncoder(),
          'RM': LabelEncoder(),
          'LWB': LabelEncoder(),
          'LDM': LabelEncoder(),
          'CDM': LabelEncoder(),
          'RDM': LabelEncoder(),
          'RWB': LabelEncoder(),
          'LB': LabelEncoder(),
          'LCB': LabelEncoder(),
          'CB': LabelEncoder(),
          'RCB': LabelEncoder(),
          'RB': LabelEncoder(),
          'Release Clause': LabelEncoder()}
```

In [20]:
```
encoding_of_cat['Preferred Foot'].inverse_transform([0, 1])
```

Out[20]:
```
array(['Left', 'Right'], dtype=object)
```

In [21]:
```
enc_value = encoding_of_cat['Name'].transform(['L. Messi'])[0]
l_messi_data = data[data['Name'] == enc_value]
l_messi_data
```

Out[21]:

	Unnamed: 0	ID	Name	Age	Photo	Nationality	Flag	Overall	Potential	Club
0	0	158023	9632	31	https://cdn.sofifa.org/players/4/19/158023.png	6	https://cdn.sofifa.org/flags/52.png	94	94	212

1 rows × 88 columns

In [22]:
```
encoding_of_cat['Nationality'].inverse_transform([l_messi_data['Nationality'][0]])
```

Out[22]:
```
array(['Argentina'], dtype=object)
```

In [23]:
```
encoding_of_cat['Club'].inverse_transform([l_messi_data['Club'][0]])
```

Out[23]:
```
array(['FC Barcelona'], dtype=object)
```

In [24]:
```
encoding_of_cat['Preferred Foot'].inverse_transform([l_messi_data['Preferred Foot'][0]])
```

Out[24]:
```
array(['Left'], dtype=object)
```

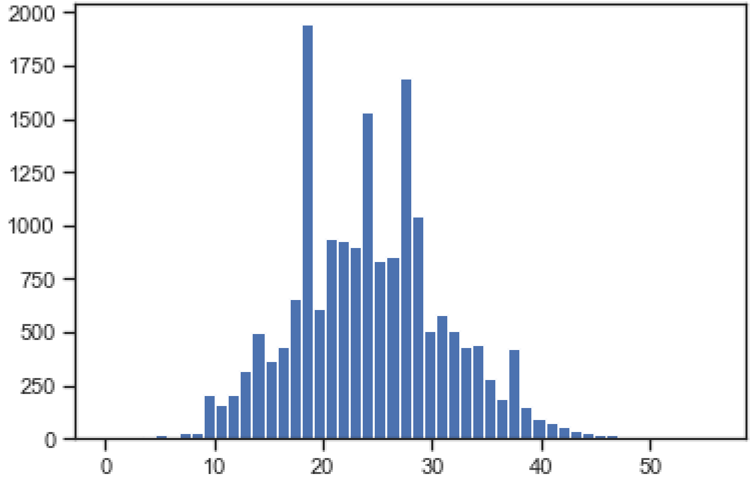
In [25]:
```
from sklearn.preprocessing import MinMaxScaler, StandardScaler, Normalizer
```

In [26]:
```
sc1 = MinMaxScaler()
sc1_data = sc1.fit_transform(data[['Weight']])
```

```
/Users/artyom.andreev/Study/.venv/lib/python3.7/site-packages/sklearn/preprocessing/data.py:334: DataConvers
ionWarning: Data with input dtype int64 were all converted to float64 by MinMaxScaler.
  return self.partial_fit(X, y)
```

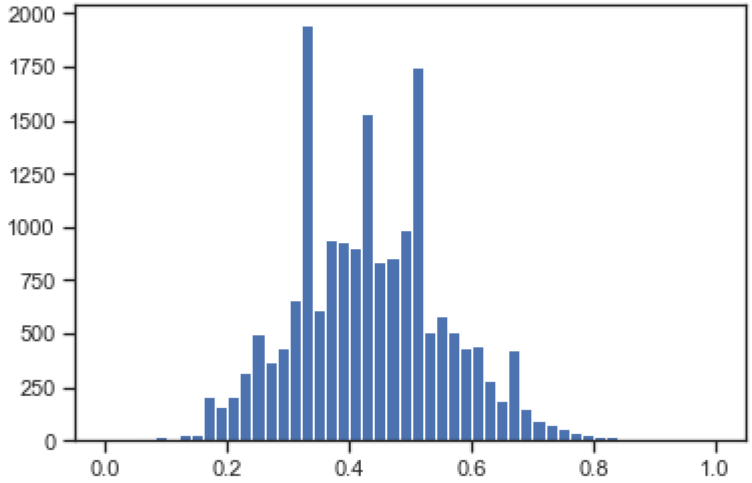
In [28]:

```
plt.hist(data['Weight'], 50)
plt.show()
```



In [29]:

```
plt.hist(sc1_data, 50)
plt.show()
```



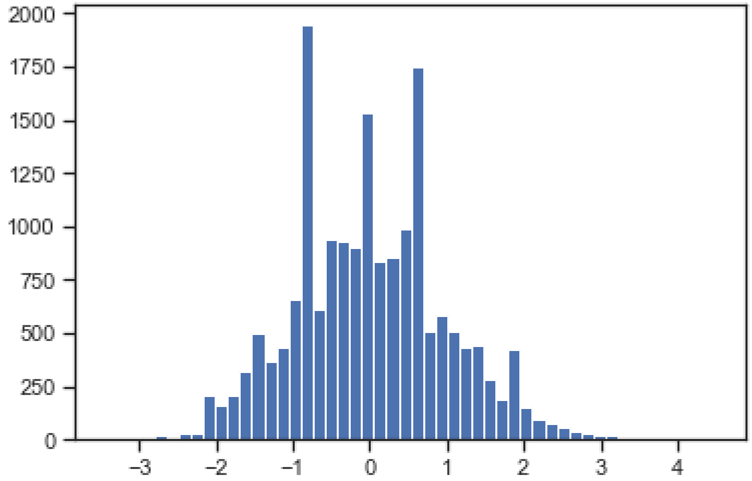
In [31]:

```
# на основе z-оценки
sc2 = StandardScaler()
sc2_data = sc2.fit_transform(data[['Weight']])
```

```
/Users/artyom.andreev/Study/.venv/lib/python3.7/site-packages/sklearn/preprocessing/data.py:645: DataConvers
ionWarning: Data with input dtype int64 were all converted to float64 by StandardScaler.
  return self.partial_fit(X, y)
/Users/artyom.andreev/Study/.venv/lib/python3.7/site-packages/sklearn/base.py:464: DataConversionWarning: Da
ta with input dtype int64 were all converted to float64 by StandardScaler.
  return self.fit(X, **fit_params).transform(X)
```

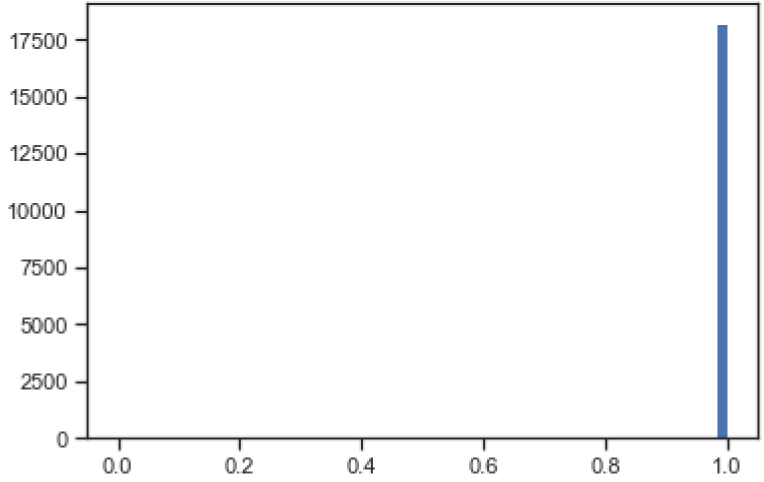
In [32]:

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



In [49]:

```
# нормализация
sc3 = Normalizer()
sc3_data = sc3.fit_transform(data[['Weight']])
plt.hist(sc3_data, 50)
plt.show()
```



In [ ]: