eda_projekt_2

May 10, 2021

1 Projekt 2

1.1 EDA

[260]:
```
import os
os.getcwd()
os.chdir("/home/kurowskik/UCI HAR Dataset")
os.getcwd()
```

[260]:
```
'/home/kurowskik/UCI HAR Dataset'
```

[263]:
```
import pandas as pd
import numpy as np
import seaborn as sns
```

[262]:
```
names = pd.read_csv( "features.txt", sep=" ", header = None)
#names = np.unique( names[[1]].values.flatten().tolist())
names = names[[1]].values.flatten().tolist()
names = [ names[i] + str(i) for i in range( len( names))]
```

[264]:
```
X_train = pd.read_csv( "train/X_train.txt", delim_whitespace = True,␣
↪names=names)
X_test  = pd.read_csv( "test/X_test.txt", delim_whitespace = True, names=names)
```

[265]:
```
y_train = pd.read_csv( "train/y_train.txt", delim_whitespace = True, header=␣
↪None)
y_test = pd.read_csv( "test/y_test.txt", delim_whitespace = True, header= None)
```

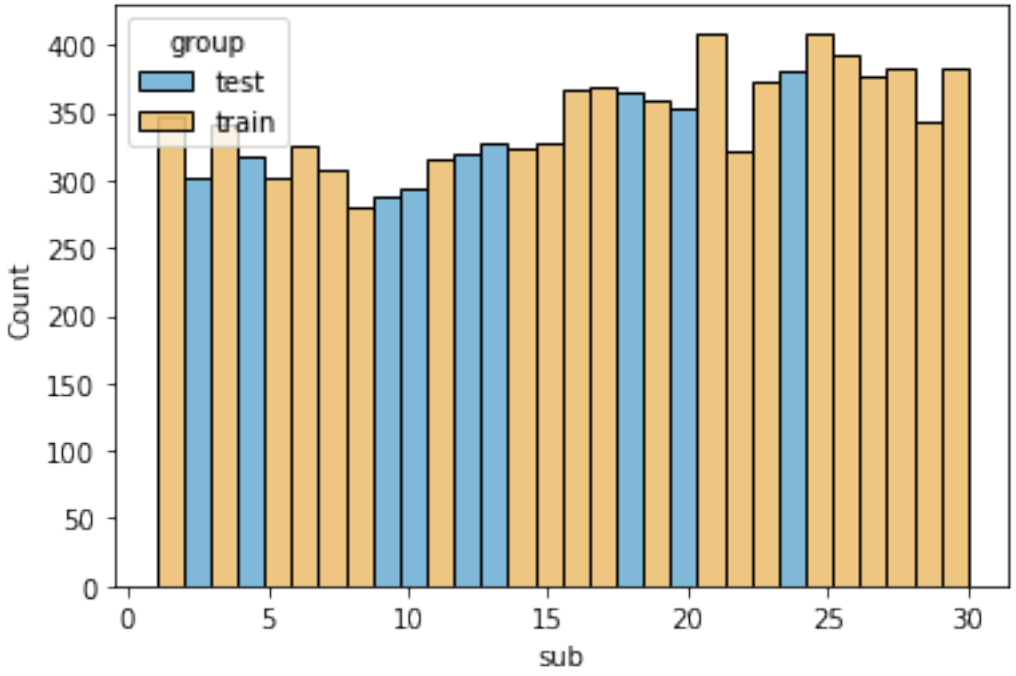
[266]:
```
train_subjects = pd.read_csv( "train/subject_train.txt", delim_whitespace =␣
↪True, header= None, names = ["sub"])
test_subjects = pd.read_csv( "test/subject_test.txt", delim_whitespace = True,␣
↪header= None, names = ["sub"])
```

rozkład obserwacji względem uczestników

[267]:
```
train_subjects["group"] = "train"
test_subjects["group"] = "test"
subjects = pd.concat([ test_subjects, train_subjects], ignore_index=True)
sns.histplot( data = subjects, x = "sub", bins = 30,# y = "size",
```

```
                hue = "group", palette = "colorblind")
```

[267]: <matplotlib.axes._subplots.AxesSubplot at 0x7f942dbd5e20>



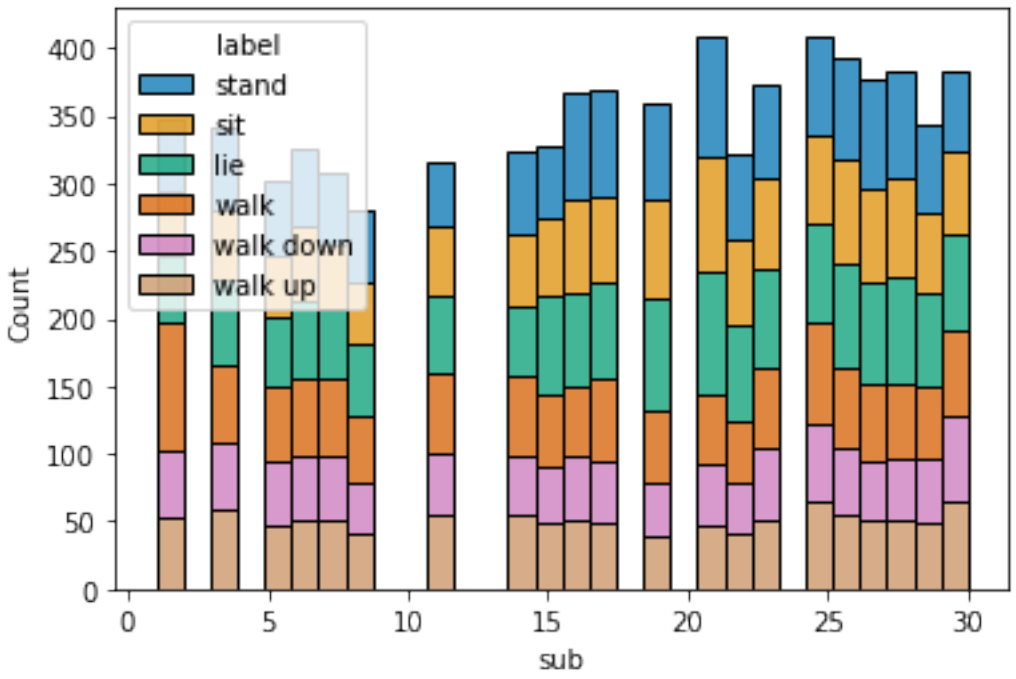
rozkład obserwacji względem uczestników z podziałem na labele

[292]:
```
train_sub_with_labels = train_subjects.copy()
train_sub_with_labels["label"] = y_train
test_sub_with_labels = test_subjects.copy()
test_sub_with_labels["label"] = y_test

train_sub_with_labels["label"] = train_sub_with_labels["label"].map( decode)
test_sub_with_labels["label"] = test_sub_with_labels["label"].map( decode)
```

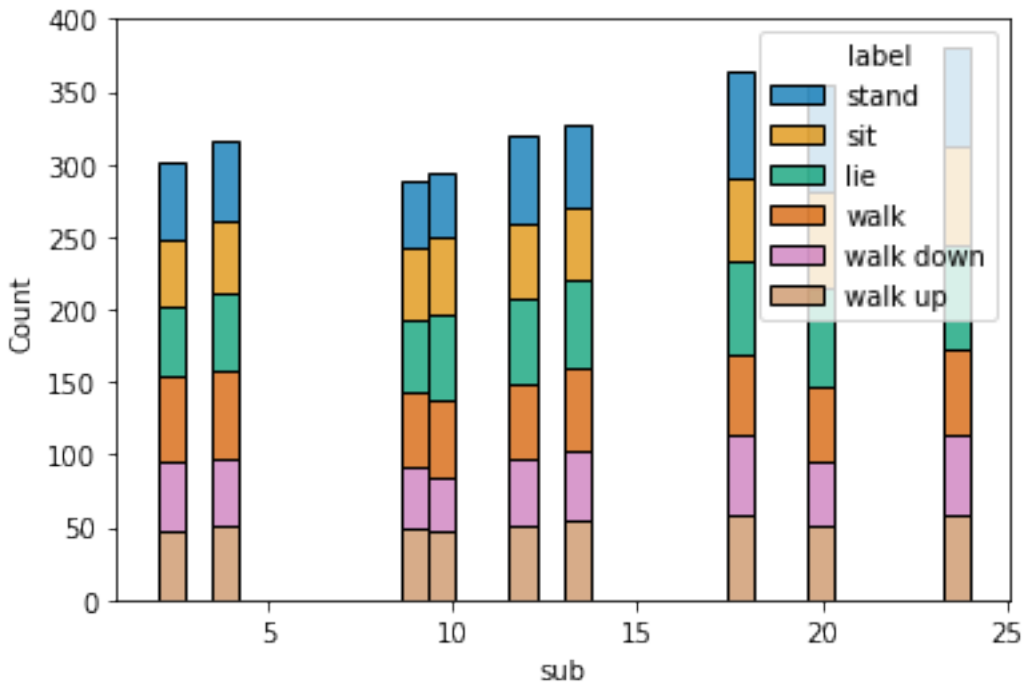
[293]:
```
sns.histplot( data = train_sub_with_labels, x = "sub", bins = 30,# y = "size",
             hue = "label", palette = "colorblind", multiple = "stack",
            stat = "count")
```

[293]: <matplotlib.axes._subplots.AxesSubplot at 0x7f9427e9b9a0>



[294]:
```
sns.histplot( data = test_sub_with_labels, x = "sub", bins = 30,# y = "size",
             hue = "label", palette = "colorblind", multiple = "stack",
            stat = "count")
```

[294]: <matplotlib.axes._subplots.AxesSubplot at 0x7f9427ad0c10>



proste sprawdzenie co jest w środku

[269]:
```
merged_train = X_train.copy()
merged_train["to_predict"] = y_train.values
merged_train["to_predict"]
```

[269]:
```
0       5
1       5
2       5
3       5
4       5
       ..
7347    2
7348    2
7349    2
7350    2
7351    2
Name: to_predict, Length: 7352, dtype: int64
```

[14]:
```
merged_train.head()
```

[14]:
```
   tBodyAcc-mean()-X0  tBodyAcc-mean()-Y1  tBodyAcc-mean()-Z2  \
0            0.288585           -0.020294           -0.132905
1            0.278419           -0.016411           -0.123520
2            0.279653           -0.019467           -0.113462
```

```
3           0.279174          -0.026201          -0.123283
4           0.276629          -0.016570          -0.115362

   tBodyAcc-std()-X3  tBodyAcc-std()-Y4  tBodyAcc-std()-Z5  tBodyAcc-mad()-X6  \
0          -0.995279          -0.983111          -0.913526          -0.995112
1          -0.998245          -0.975300          -0.960322          -0.998807
2          -0.995380          -0.967187          -0.978944          -0.996520
3          -0.996091          -0.983403          -0.990675          -0.997099
4          -0.998139          -0.980817          -0.990482          -0.998321

   tBodyAcc-mad()-Y7  tBodyAcc-mad()-Z8  tBodyAcc-max()-X9  …  \
0          -0.983185          -0.923527          -0.934724  …
1          -0.974914          -0.957686          -0.943068  …
2          -0.963668          -0.977469          -0.938692  …
3          -0.982750          -0.989302          -0.938692  …
4          -0.979672          -0.990441          -0.942469  …

   fBodyBodyGyroJerkMag-skewness()552  fBodyBodyGyroJerkMag-kurtosis()553  \
0                           -0.298676                           -0.710304
1                           -0.595051                           -0.861499
2                           -0.390748                           -0.760104
3                           -0.117290                           -0.482845
4                           -0.351471                           -0.699205

   angle(tBodyAccMean,gravity)554  angle(tBodyAccJerkMean),gravityMean)555  \
0                       -0.112754                                 0.030400
1                        0.053477                                -0.007435
2                       -0.118559                                 0.177899
3                       -0.036788                                -0.012892
4                        0.123320                                 0.122542

   angle(tBodyGyroMean,gravityMean)556  \
0                           -0.464761
1                           -0.732626
2                            0.100699
3                            0.640011
4                            0.693578

   angle(tBodyGyroJerkMean,gravityMean)557  angle(X,gravityMean)558  \
0                                -0.018446                -0.841247
1                                 0.703511                -0.844788
2                                 0.808529                -0.848933
3                                -0.485366                -0.848649
4                                -0.615971                -0.847865

   angle(Y,gravityMean)559  angle(Z,gravityMean)560  to_predict
0                 0.179941                -0.058627           5
```

```
1                0.180289               -0.054317          5
2                0.180637               -0.049118          5
3                0.181935               -0.047663          5
4                0.185151               -0.043892          5

[5 rows x 562 columns]
```

[15]:
```
merged_train.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 7352 entries, 0 to 7351
Columns: 562 entries, tBodyAcc-mean()-X0 to to_predict
dtypes: float64(561), int64(1)
memory usage: 31.5 MB
```

[195]:
```
decode = {1: "walk", 2:"walk up", 3:"walk down", 4:"sit", 5:"stand", 6:"lie"}
merged_train["to_predict"] = merged_train["to_predict"].map( decode)
merged_train["to_predict"]
```

[195]:
```
0         stand
1         stand
2         stand
3         stand
4         stand
         …
7347    walk up
7348    walk up
7349    walk up
7350    walk up
7351    walk up
Name: to_predict, Length: 7352, dtype: object
```

[16]:
```
merged_train.describe()
```

[16]:
```
       tBodyAcc-mean()-X0  tBodyAcc-mean()-Y1  tBodyAcc-mean()-Z2  \
count         7352.000000         7352.000000         7352.000000
mean             0.274488           -0.017695           -0.109141
std              0.070261            0.040811            0.056635
min             -1.000000           -1.000000           -1.000000
25%              0.262975           -0.024863           -0.120993
50%              0.277193           -0.017219           -0.108676
75%              0.288461           -0.010783           -0.097794
max              1.000000            1.000000            1.000000

       tBodyAcc-std()-X3  tBodyAcc-std()-Y4  tBodyAcc-std()-Z5  \
count        7352.000000        7352.000000        7352.000000
mean           -0.605438          -0.510938          -0.604754
std             0.448734           0.502645           0.418687
```

```
min            -1.000000          -0.999873          -1.000000
25%            -0.992754          -0.978129          -0.980233
50%            -0.946196          -0.851897          -0.859365
75%            -0.242813          -0.034231          -0.262415
max             1.000000           0.916238           1.000000

       tBodyAcc-mad()-X6  tBodyAcc-mad()-Y7  tBodyAcc-mad()-Z8  \
count        7352.000000        7352.000000        7352.000000
mean           -0.630512          -0.526907          -0.606150
std             0.424073           0.485942           0.414122
min            -1.000000          -1.000000          -1.000000
25%            -0.993591          -0.978162          -0.980251
50%            -0.950709          -0.857328          -0.857143
75%            -0.292680          -0.066701          -0.265671
max             1.000000           0.967664           1.000000

       tBodyAcc-max()-X9  …  fBodyBodyGyroJerkMag-skewness()552  \
count        7352.000000  …                        7352.000000
mean           -0.468604  …                          -0.307009
std             0.544547  …                           0.321011
min            -1.000000  …                          -0.995357
25%            -0.936219  …                          -0.542602
50%            -0.881637  …                          -0.343685
75%            -0.017129  …                          -0.126979
max             1.000000  …                           0.989538

       fBodyBodyGyroJerkMag-kurtosis()553  angle(tBodyAccMean,gravity)554  \
count                         7352.000000                     7352.000000
mean                            -0.625294                        0.008684
std                              0.307584                        0.336787
min                             -0.999765                       -0.976580
25%                             -0.845573                       -0.121527
50%                             -0.711692                        0.009509
75%                             -0.503878                        0.150865
max                              0.956845                        1.000000

       angle(tBodyAccJerkMean),gravityMean)555  \
count                             7352.000000
mean                                 0.002186
std                                  0.448306
min                                 -1.000000
25%                                 -0.289549
50%                                  0.008943
75%                                  0.292861
max                                  1.000000

       angle(tBodyGyroMean,gravityMean)556  \
```

```
count                          7352.000000
mean                              0.008726
std                               0.608303
min                              -1.000000
25%                              -0.482273
50%                               0.008735
75%                               0.506187
max                               0.998702

       angle(tBodyGyroJerkMean,gravityMean)557  angle(X,gravityMean)558  \
count                                7352.000000              7352.000000
mean                                   -0.005981                -0.489547
std                                     0.477975                 0.511807
min                                    -1.000000                -1.000000
25%                                    -0.376341                -0.812065
50%                                    -0.000368                -0.709417
75%                                     0.359368                -0.509079
max                                     0.996078                 1.000000

       angle(Y,gravityMean)559  angle(Z,gravityMean)560   to_predict
count              7352.000000              7352.000000  7352.000000
mean                  0.058593                -0.056515     3.643362
std                   0.297480                 0.279122     1.744802
min                  -1.000000                -1.000000     1.000000
25%                  -0.017885                -0.143414     2.000000
50%                   0.182071                 0.003181     4.000000
75%                   0.248353                 0.107659     5.000000
max                   0.478157                 1.000000     6.000000

[8 rows x 562 columns]
```

[160]:
```
cols = merged_train.columns
cols.values
```

[160]:
```
array(['tBodyAcc-mean()-X0', 'tBodyAcc-mean()-Y1', 'tBodyAcc-mean()-Z2',
       'tBodyAcc-std()-X3', 'tBodyAcc-std()-Y4', 'tBodyAcc-std()-Z5',
       'tBodyAcc-mad()-X6', 'tBodyAcc-mad()-Y7', 'tBodyAcc-mad()-Z8',
       'tBodyAcc-max()-X9', 'tBodyAcc-max()-Y10', 'tBodyAcc-max()-Z11',
       'tBodyAcc-min()-X12', 'tBodyAcc-min()-Y13', 'tBodyAcc-min()-Z14',
       'tBodyAcc-sma()15', 'tBodyAcc-energy()-X16',
       'tBodyAcc-energy()-Y17', 'tBodyAcc-energy()-Z18',
       'tBodyAcc-iqr()-X19', 'tBodyAcc-iqr()-Y20', 'tBodyAcc-iqr()-Z21',
       'tBodyAcc-entropy()-X22', 'tBodyAcc-entropy()-Y23',
       'tBodyAcc-entropy()-Z24', 'tBodyAcc-arCoeff()-X,125',
       'tBodyAcc-arCoeff()-X,226', 'tBodyAcc-arCoeff()-X,327',
       'tBodyAcc-arCoeff()-X,428', 'tBodyAcc-arCoeff()-Y,129',
       'tBodyAcc-arCoeff()-Y,230', 'tBodyAcc-arCoeff()-Y,331',
```

'tBodyAcc-arCoeff()-Y,432', 'tBodyAcc-arCoeff()-Z,133',
'tBodyAcc-arCoeff()-Z,234', 'tBodyAcc-arCoeff()-Z,335',
'tBodyAcc-arCoeff()-Z,436', 'tBodyAcc-correlation()-X,Y37',
'tBodyAcc-correlation()-X,Z38', 'tBodyAcc-correlation()-Y,Z39',
'tGravityAcc-mean()-X40', 'tGravityAcc-mean()-Y41',
'tGravityAcc-mean()-Z42', 'tGravityAcc-std()-X43',
'tGravityAcc-std()-Y44', 'tGravityAcc-std()-Z45',
'tGravityAcc-mad()-X46', 'tGravityAcc-mad()-Y47',
'tGravityAcc-mad()-Z48', 'tGravityAcc-max()-X49',
'tGravityAcc-max()-Y50', 'tGravityAcc-max()-Z51',
'tGravityAcc-min()-X52', 'tGravityAcc-min()-Y53',
'tGravityAcc-min()-Z54', 'tGravityAcc-sma()55',
'tGravityAcc-energy()-X56', 'tGravityAcc-energy()-Y57',
'tGravityAcc-energy()-Z58', 'tGravityAcc-iqr()-X59',
'tGravityAcc-iqr()-Y60', 'tGravityAcc-iqr()-Z61',
'tGravityAcc-entropy()-X62', 'tGravityAcc-entropy()-Y63',
'tGravityAcc-entropy()-Z64', 'tGravityAcc-arCoeff()-X,165',
'tGravityAcc-arCoeff()-X,266', 'tGravityAcc-arCoeff()-X,367',
'tGravityAcc-arCoeff()-X,468', 'tGravityAcc-arCoeff()-Y,169',
'tGravityAcc-arCoeff()-Y,270', 'tGravityAcc-arCoeff()-Y,371',
'tGravityAcc-arCoeff()-Y,472', 'tGravityAcc-arCoeff()-Z,173',
'tGravityAcc-arCoeff()-Z,274', 'tGravityAcc-arCoeff()-Z,375',
'tGravityAcc-arCoeff()-Z,476', 'tGravityAcc-correlation()-X,Y77',
'tGravityAcc-correlation()-X,Z78',
'tGravityAcc-correlation()-Y,Z79', 'tBodyAccJerk-mean()-X80',
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'tBodyAccJerk-max()-Z91', 'tBodyAccJerk-min()-X92',
'tBodyAccJerk-min()-Y93', 'tBodyAccJerk-min()-Z94',
'tBodyAccJerk-sma()95', 'tBodyAccJerk-energy()-X96',
'tBodyAccJerk-energy()-Y97', 'tBodyAccJerk-energy()-Z98',
'tBodyAccJerk-iqr()-X99', 'tBodyAccJerk-iqr()-Y100',
'tBodyAccJerk-iqr()-Z101', 'tBodyAccJerk-entropy()-X102',
'tBodyAccJerk-entropy()-Y103', 'tBodyAccJerk-entropy()-Z104',
'tBodyAccJerk-arCoeff()-X,1105', 'tBodyAccJerk-arCoeff()-X,2106',
'tBodyAccJerk-arCoeff()-X,3107', 'tBodyAccJerk-arCoeff()-X,4108',
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'tBodyAccJerk-correlation()-X,Z118',
'tBodyAccJerk-correlation()-Y,Z119', 'tBodyGyro-mean()-X120',
'tBodyGyro-mean()-Y121', 'tBodyGyro-mean()-Z122',

```
'tBodyGyro-std()-X123', 'tBodyGyro-std()-Y124',
'tBodyGyro-std()-Z125', 'tBodyGyro-mad()-X126',
'tBodyGyro-mad()-Y127', 'tBodyGyro-mad()-Z128',
'tBodyGyro-max()-X129', 'tBodyGyro-max()-Y130',
'tBodyGyro-max()-Z131', 'tBodyGyro-min()-X132',
'tBodyGyro-min()-Y133', 'tBodyGyro-min()-Z134',
'tBodyGyro-sma()135', 'tBodyGyro-energy()-X136',
'tBodyGyro-energy()-Y137', 'tBodyGyro-energy()-Z138',
'tBodyGyro-iqr()-X139', 'tBodyGyro-iqr()-Y140',
'tBodyGyro-iqr()-Z141', 'tBodyGyro-entropy()-X142',
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'tBodyGyro-arCoeff()-X,3147', 'tBodyGyro-arCoeff()-X,4148',
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'tBodyGyro-arCoeff()-Y,3151', 'tBodyGyro-arCoeff()-Y,4152',
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'tBodyGyro-correlation()-X,Y157', 'tBodyGyro-correlation()-X,Z158',
'tBodyGyro-correlation()-Y,Z159', 'tBodyGyroJerk-mean()-X160',
'tBodyGyroJerk-mean()-Y161', 'tBodyGyroJerk-mean()-Z162',
'tBodyGyroJerk-std()-X163', 'tBodyGyroJerk-std()-Y164',
'tBodyGyroJerk-std()-Z165', 'tBodyGyroJerk-mad()-X166',
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'tBodyGyroJerk-max()-X169', 'tBodyGyroJerk-max()-Y170',
'tBodyGyroJerk-max()-Z171', 'tBodyGyroJerk-min()-X172',
'tBodyGyroJerk-min()-Y173', 'tBodyGyroJerk-min()-Z174',
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'tBodyGyroJerk-arCoeff()-Z,1193', 'tBodyGyroJerk-arCoeff()-Z,2194',
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'tBodyGyroJerk-correlation()-Y,Z199', 'tBodyAccMag-mean()200',
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'tBodyAccMag-max()203', 'tBodyAccMag-min()204',
'tBodyAccMag-sma()205', 'tBodyAccMag-energy()206',
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'tBodyAccMag-arCoeff()1209', 'tBodyAccMag-arCoeff()2210',
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'tGravityAccMag-mean()213', 'tGravityAccMag-std()214',
```

```
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'tGravityAccMag-min()217', 'tGravityAccMag-sma()218',
'tGravityAccMag-energy()219', 'tGravityAccMag-iqr()220',
'tGravityAccMag-entropy()221', 'tGravityAccMag-arCoeff()1222',
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'tBodyGyroMag-energy()245', 'tBodyGyroMag-iqr()246',
'tBodyGyroMag-entropy()247', 'tBodyGyroMag-arCoeff()1248',
'tBodyGyroMag-arCoeff()2249', 'tBodyGyroMag-arCoeff()3250',
'tBodyGyroMag-arCoeff()4251', 'tBodyGyroJerkMag-mean()252',
'tBodyGyroJerkMag-std()253', 'tBodyGyroJerkMag-mad()254',
'tBodyGyroJerkMag-max()255', 'tBodyGyroJerkMag-min()256',
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'tBodyGyroJerkMag-iqr()259', 'tBodyGyroJerkMag-entropy()260',
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```

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'fBodyGyro-max()-Z434', 'fBodyGyro-min()-X435',
'fBodyGyro-min()-Y436', 'fBodyGyro-min()-Z437',
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'fBodyGyro-iqr()-Z444', 'fBodyGyro-entropy()-X445',
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'fBodyBodyAccJerkMag-entropy()523',
'fBodyBodyAccJerkMag-maxInds524',
'fBodyBodyAccJerkMag-meanFreq()525',
'fBodyBodyAccJerkMag-skewness()526',
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'fBodyBodyGyroJerkMag-mad()543', 'fBodyBodyGyroJerkMag-max()544',
'fBodyBodyGyroJerkMag-min()545', 'fBodyBodyGyroJerkMag-sma()546',
'fBodyBodyGyroJerkMag-energy()547',
'fBodyBodyGyroJerkMag-iqr()548',
'fBodyBodyGyroJerkMag-entropy()549',
'fBodyBodyGyroJerkMag-maxInds550',
'fBodyBodyGyroJerkMag-meanFreq()551',
'fBodyBodyGyroJerkMag-skewness()552',
'fBodyBodyGyroJerkMag-kurtosis()553',
'angle(tBodyAccMean,gravity)554',
```

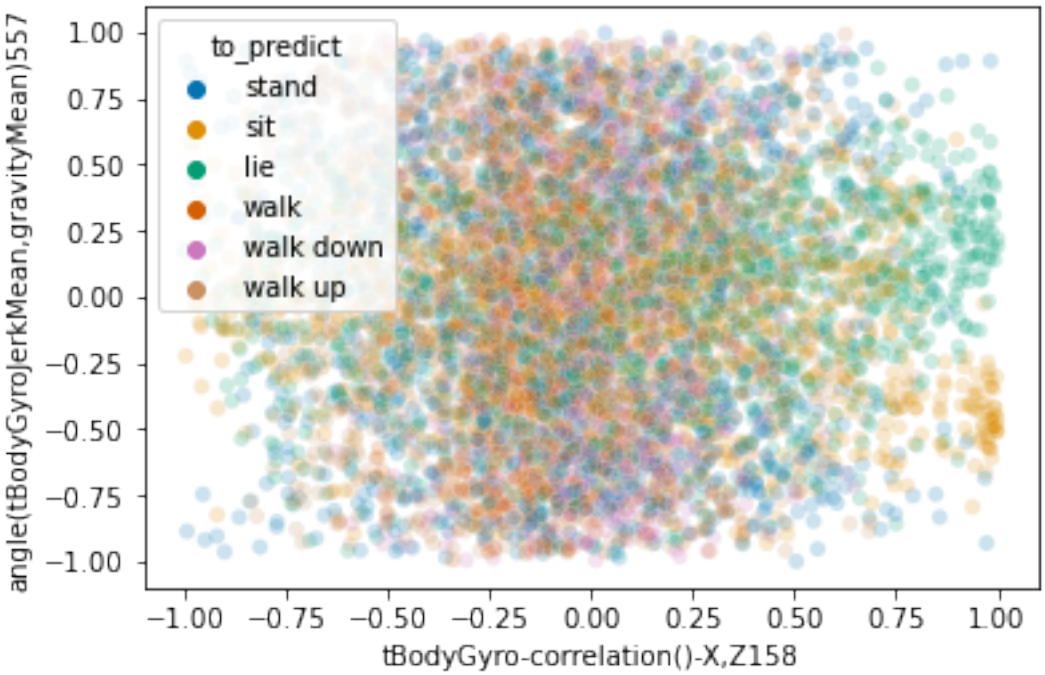
```
       'angle(tBodyAccJerkMean),gravityMean)555',
       'angle(tBodyGyroMean,gravityMean)556',
       'angle(tBodyGyroJerkMean,gravityMean)557',
       'angle(X,gravityMean)558', 'angle(Y,gravityMean)559',
       'angle(Z,gravityMean)560', 'to_predict'], dtype=object)
```

różne wyrkesy

[196]:
```
import seaborn as sns

sns.scatterplot(x="tBodyGyro-correlation()-X,Z158",␣
↪y="angle(tBodyGyroJerkMean,gravityMean)557", hue="to_predict",
                data=merged_train,
                  alpha = 0.2,
    palette = "colorblind")#, kind = 'kde')
```

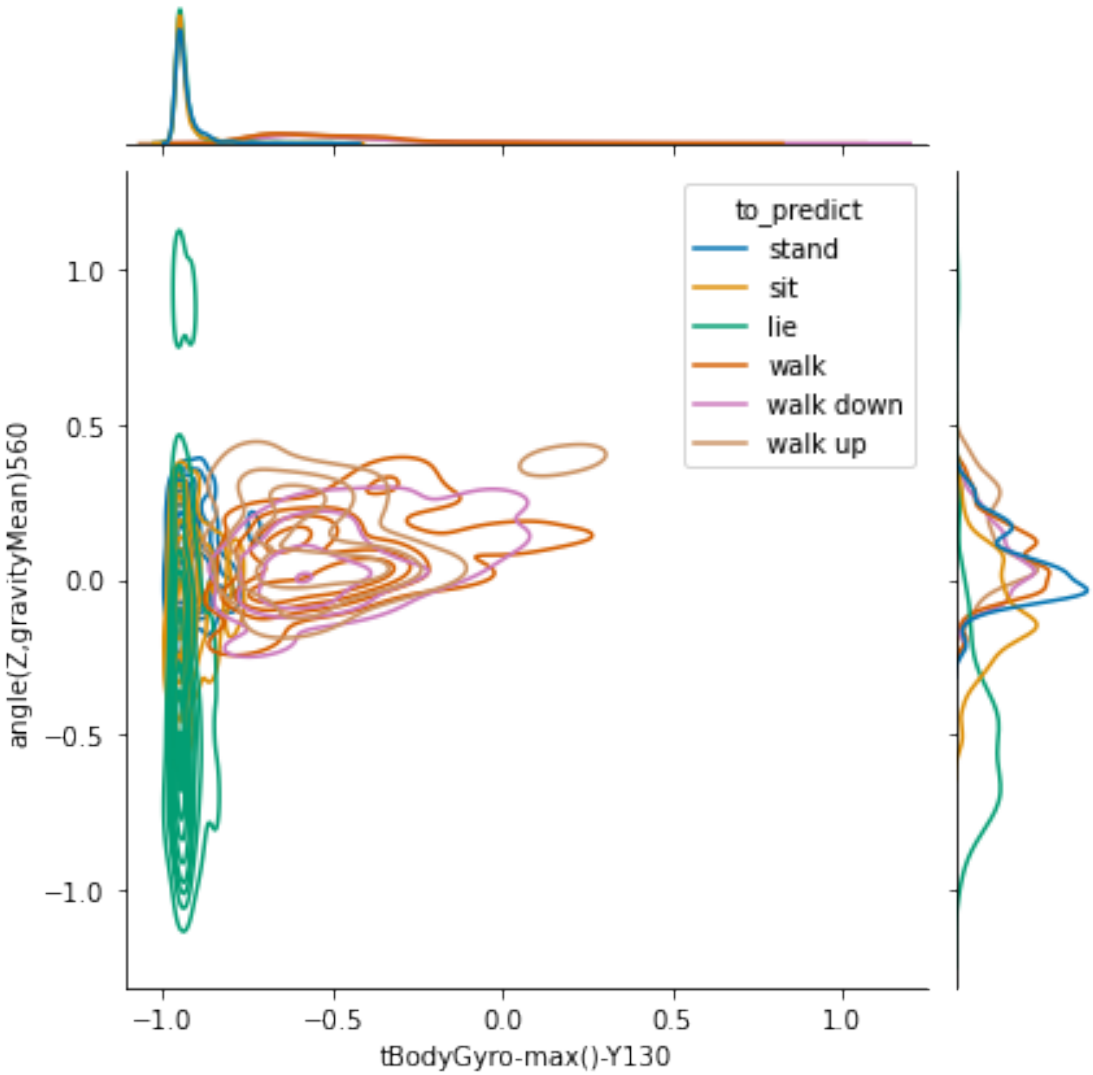
[196]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x7f9467939760>
```



[197]:
```
sns.jointplot(
    data= merged_train,
    x="tBodyGyro-max()-Y130",
    y='angle(Z,gravityMean)560',
    hue="to_predict",
    kind="kde",
    palette = "colorblind"
```

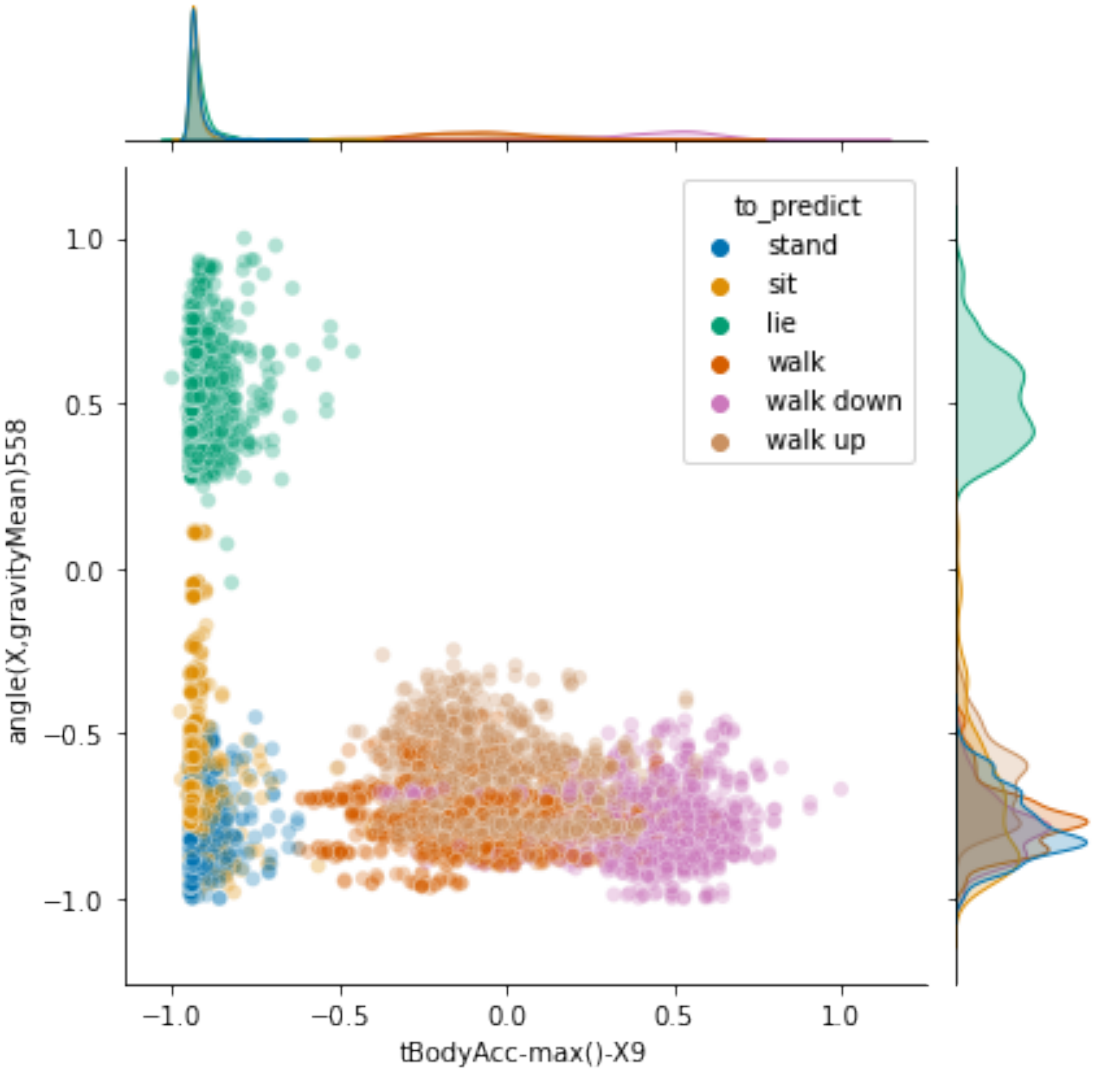
```
)
```

[197]: <seaborn.axisgrid.JointGrid at 0x7f9467890520>



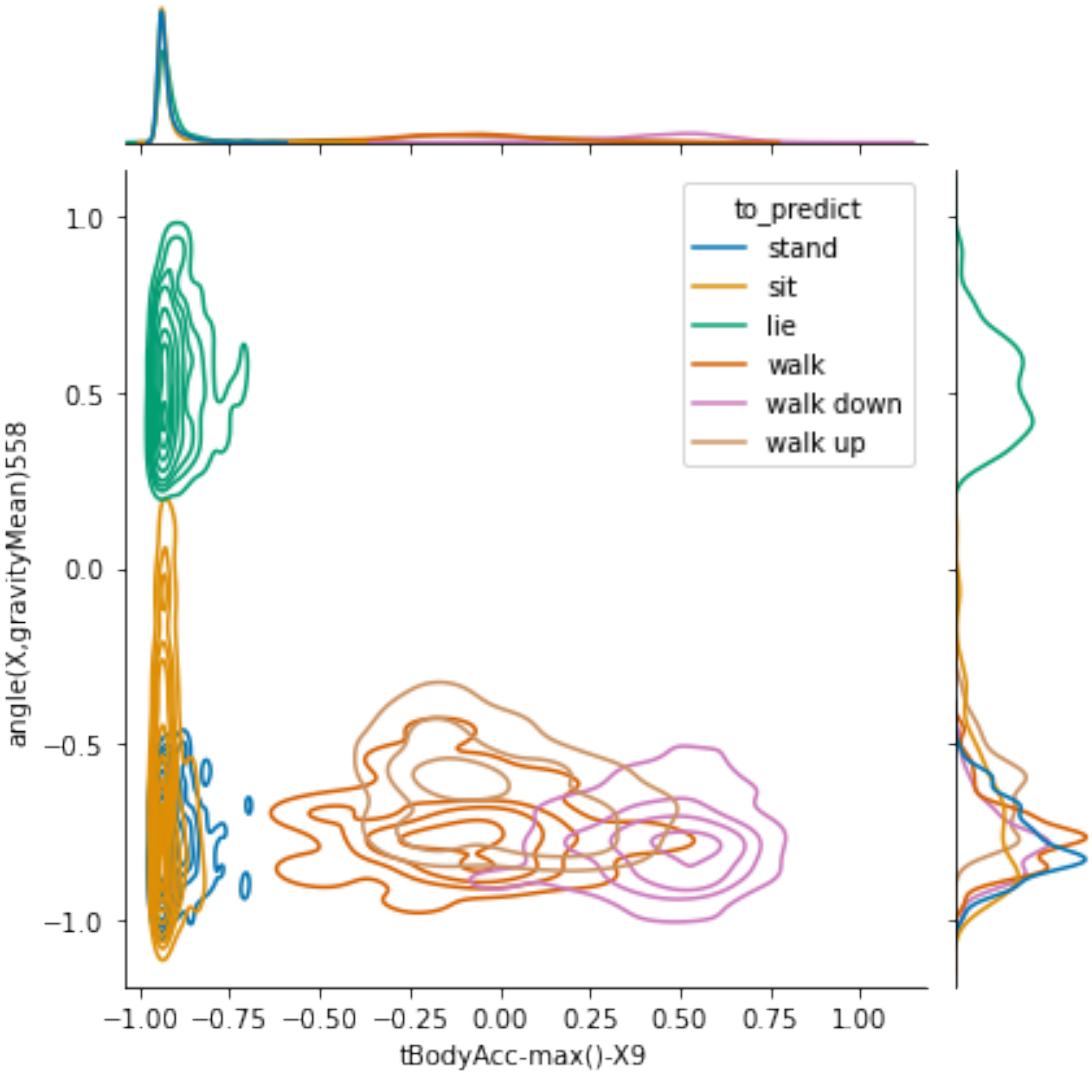
[230]:
```
sns.jointplot(
    data= merged_train,
    x="tBodyAcc-max()-X9",
    y='angle(X,gravityMean)558',
    hue="to_predict",
   # kind="kde",
    palette = "colorblind",
    alpha = 0.3
)
```

[230]: <seaborn.axisgrid.JointGrid at 0x7f942fadb220>



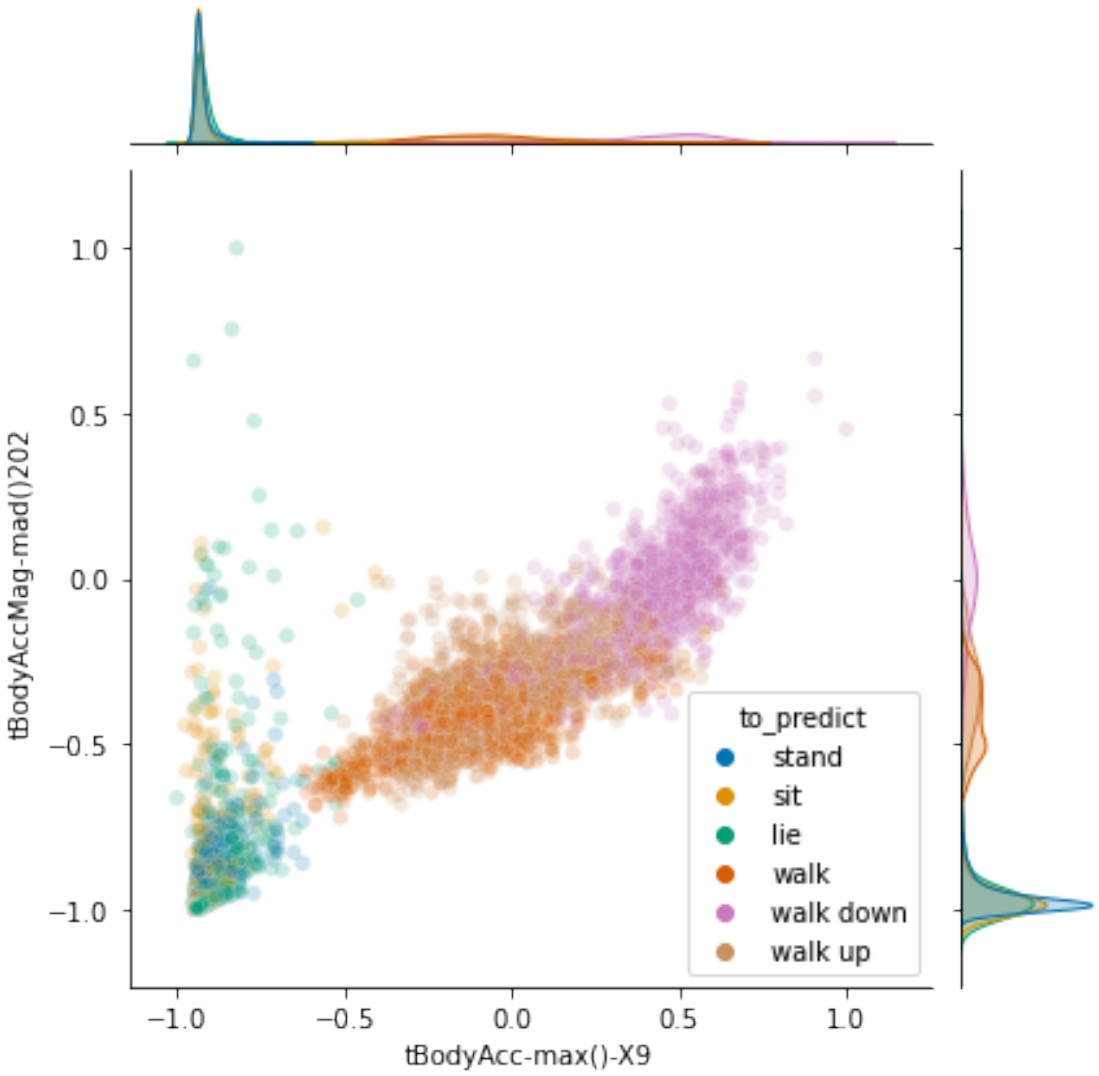
[231]:
```
sns.jointplot(
    data= merged_train,
    x="tBodyAcc-max()-X9",
    y='angle(X,gravityMean)558',
    hue="to_predict",
    kind="kde",
    palette = "colorblind",
)
```

[231]: <seaborn.axisgrid.JointGrid at 0x7f942fa073a0>



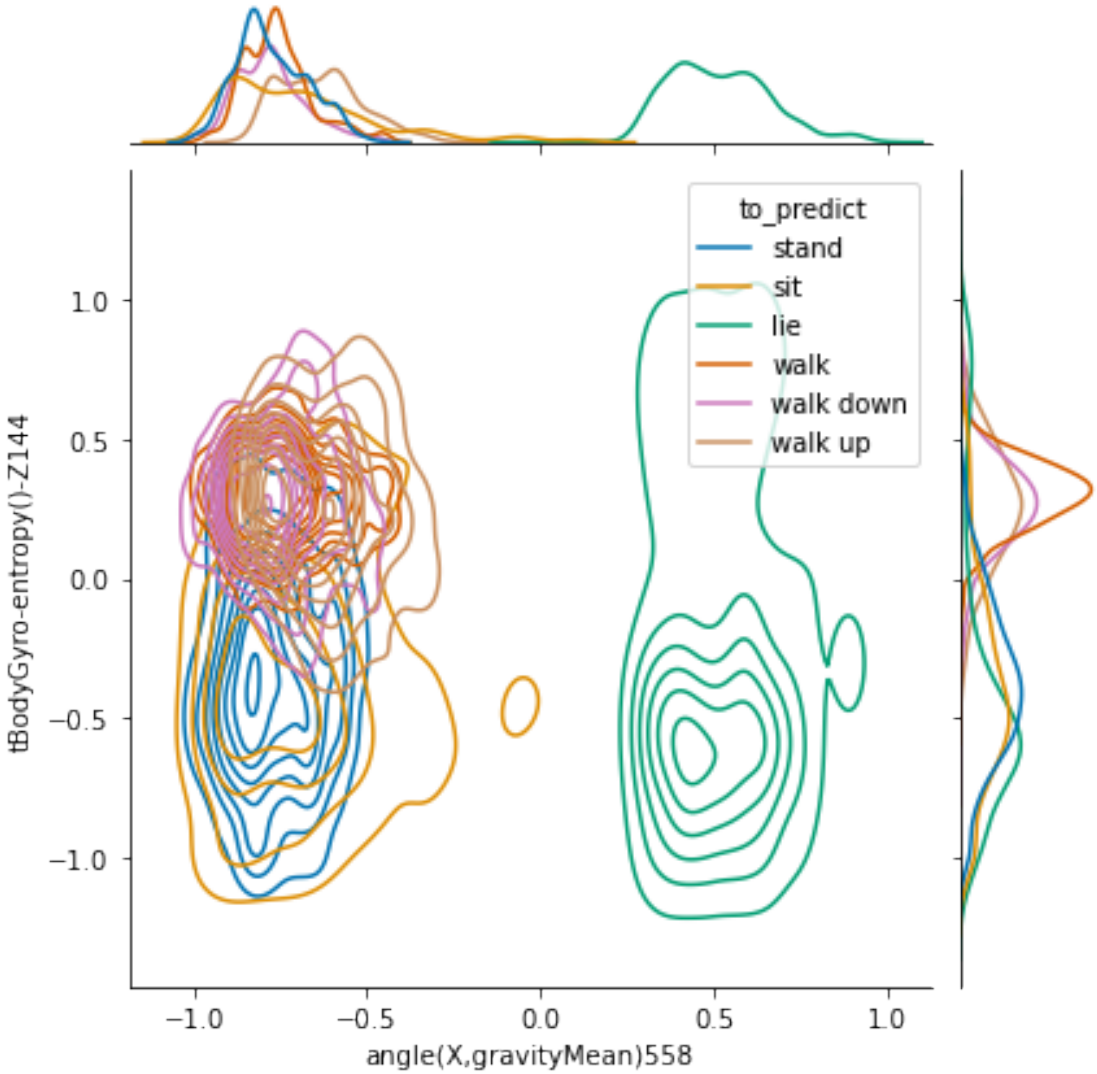
[234]:
```
sns.jointplot(
    data= merged_train,
    x="tBodyAcc-max()-X9",
    y='tBodyAccMag-mad()202',
    hue="to_predict",
    alpha = 0.2,
    palette = "colorblind",
)
```

[234]: <seaborn.axisgrid.JointGrid at 0x7f942f6e0c40>



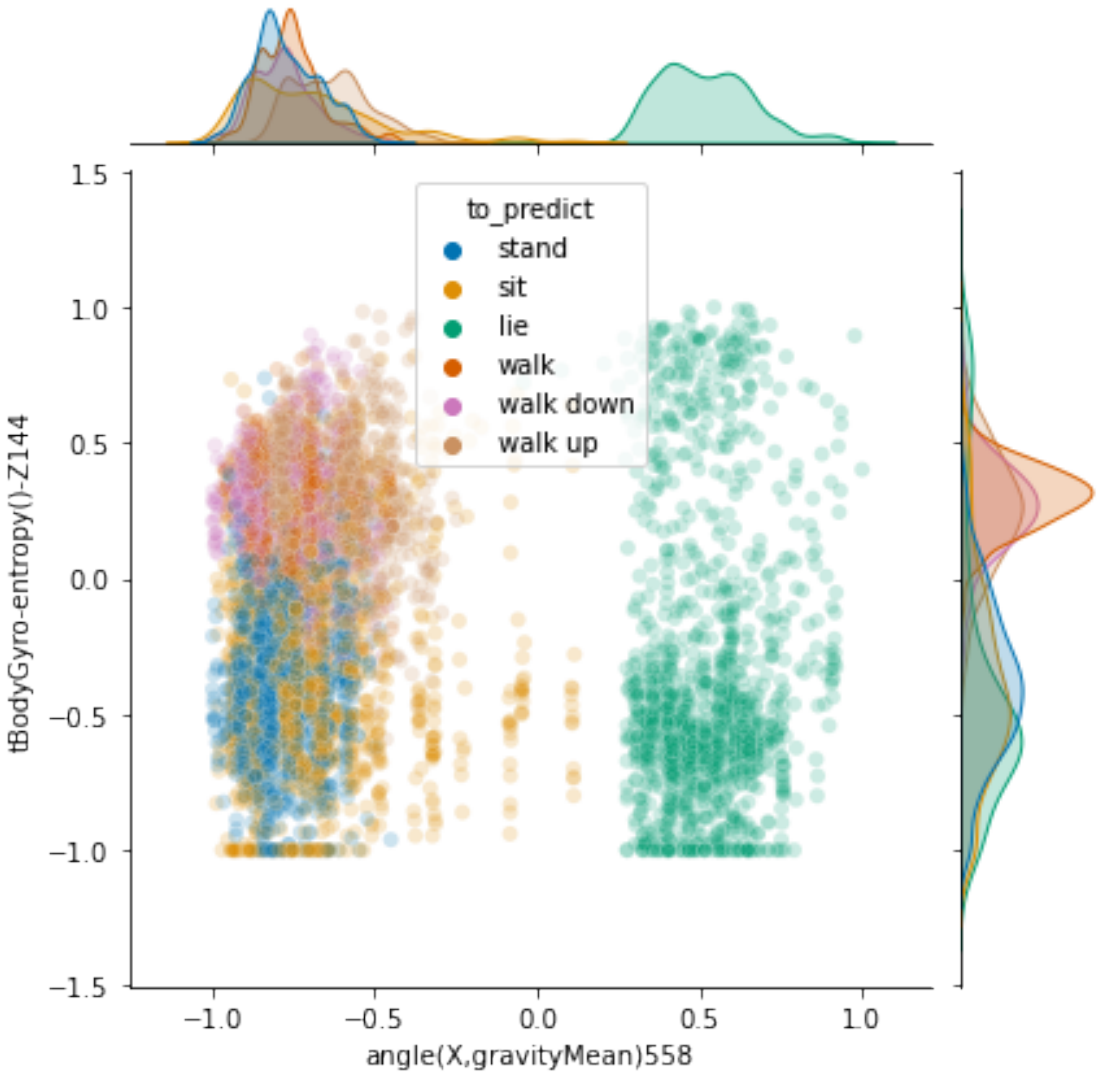
[238]:
```
sns.jointplot(
    data= merged_train,
    x="angle(X,gravityMean)558",
    y='tBodyGyro-entropy()-Z144',
    hue="to_predict",
    kind = "kde",
    palette = "colorblind",
)
```

[238]: <seaborn.axisgrid.JointGrid at 0x7f942f2acaf0>



[244]:
```
sns.jointplot(
    data= merged_train,
    x="angle(X,gravityMean)558",
    y='tBodyGyro-entropy()-Z144',
    hue="to_predict",
    alpha = 0.2,
    palette = "colorblind",
)
```

[244]: <seaborn.axisgrid.JointGrid at 0x7f942ebbcfd0>

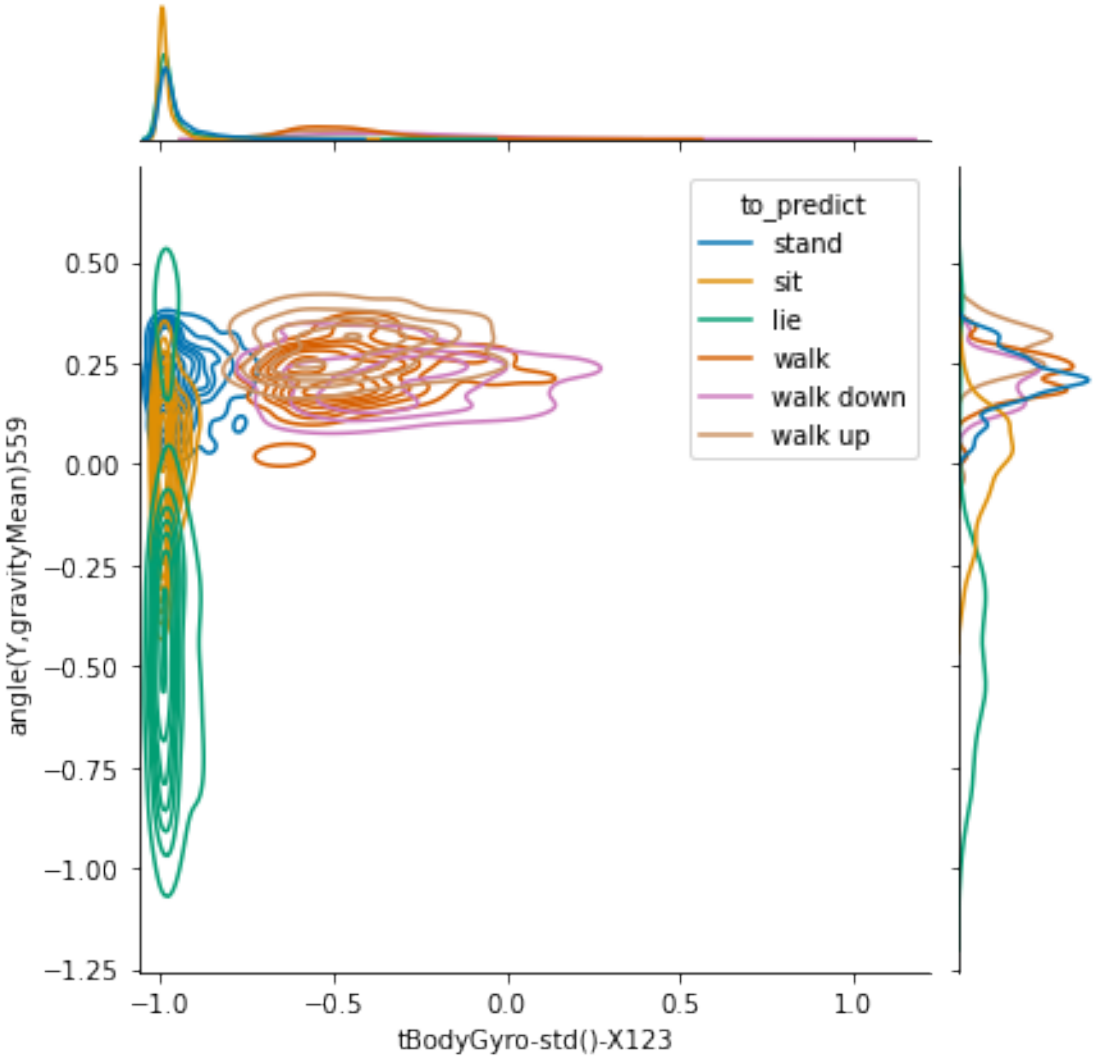


[ ]:

[ ]:

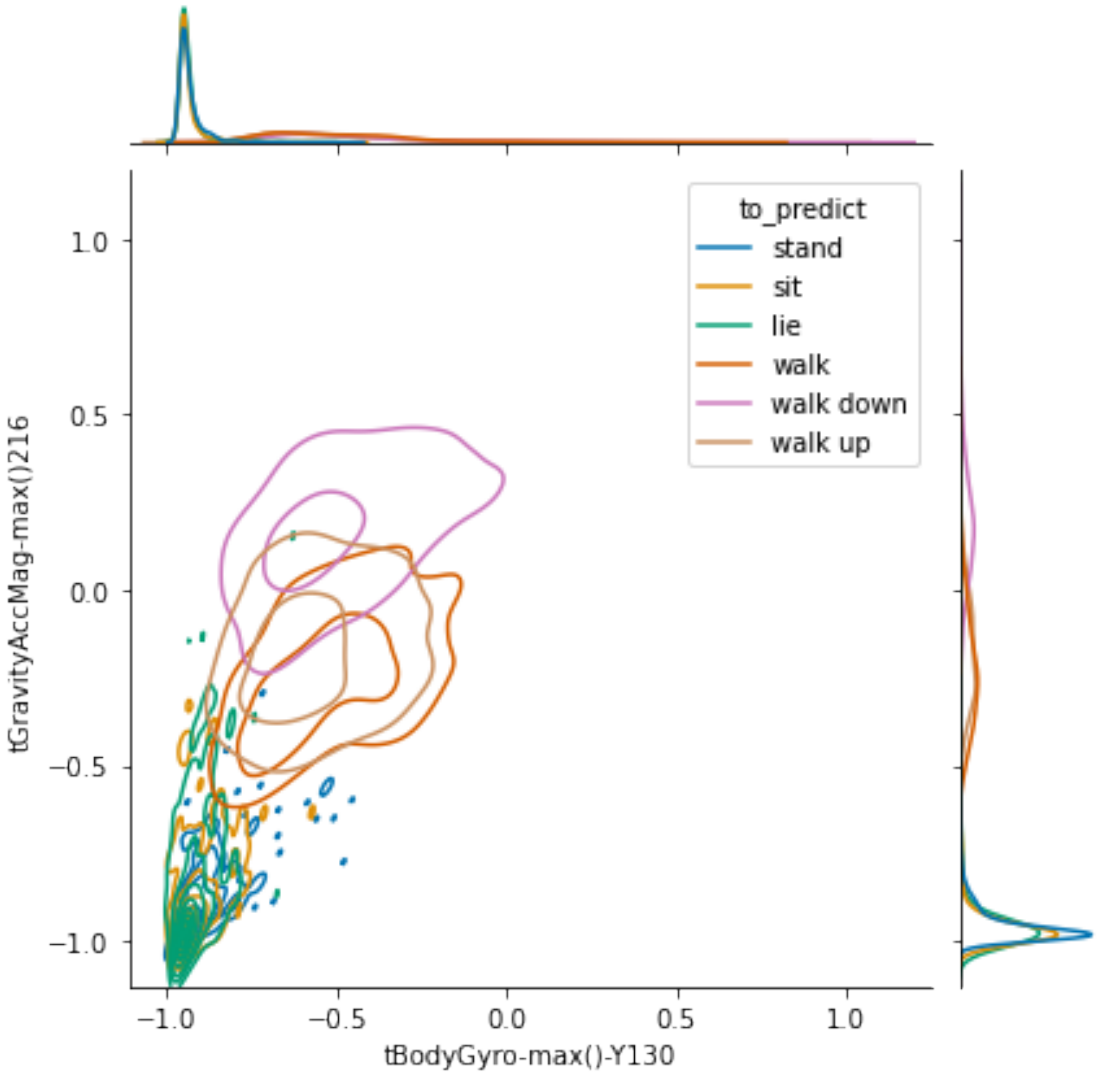
[198]:
```
sns.jointplot(
    data= merged_train,
    x="tBodyGyro-std()-X123",
    y='angle(Y,gravityMean)559',
    hue="to_predict",
    kind="kde",
    palette = "colorblind"
)
```

[198]: <seaborn.axisgrid.JointGrid at 0x7f946ee423d0>



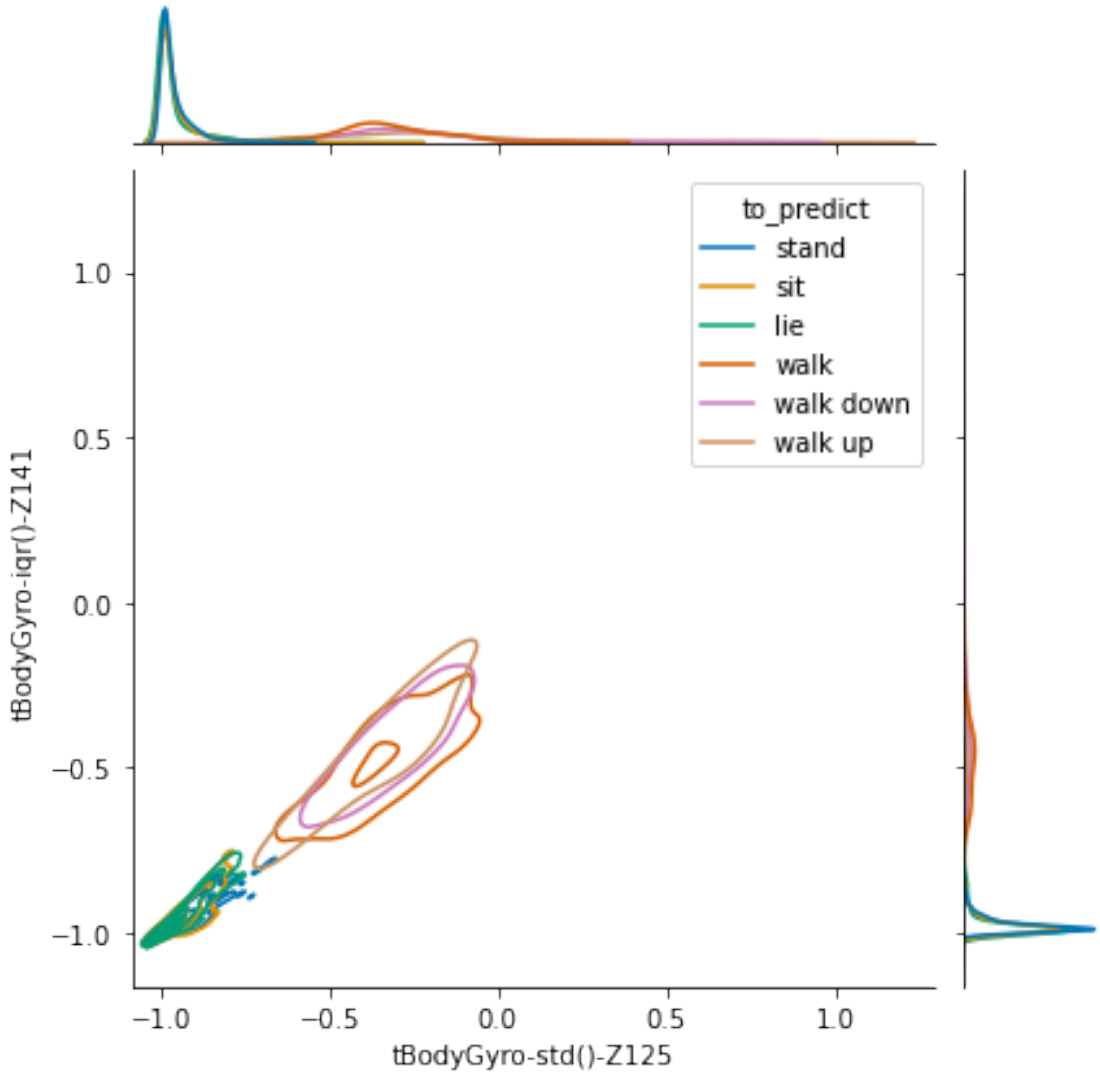
[199]:
```
sns.jointplot(
    data= merged_train,
    x="tBodyGyro-max()-Y130",
    y='tGravityAccMag-max()216',
    hue="to_predict",
    kind="kde",
    palette = "colorblind"
)
```

[199]: <seaborn.axisgrid.JointGrid at 0x7f946ecbe0d0>



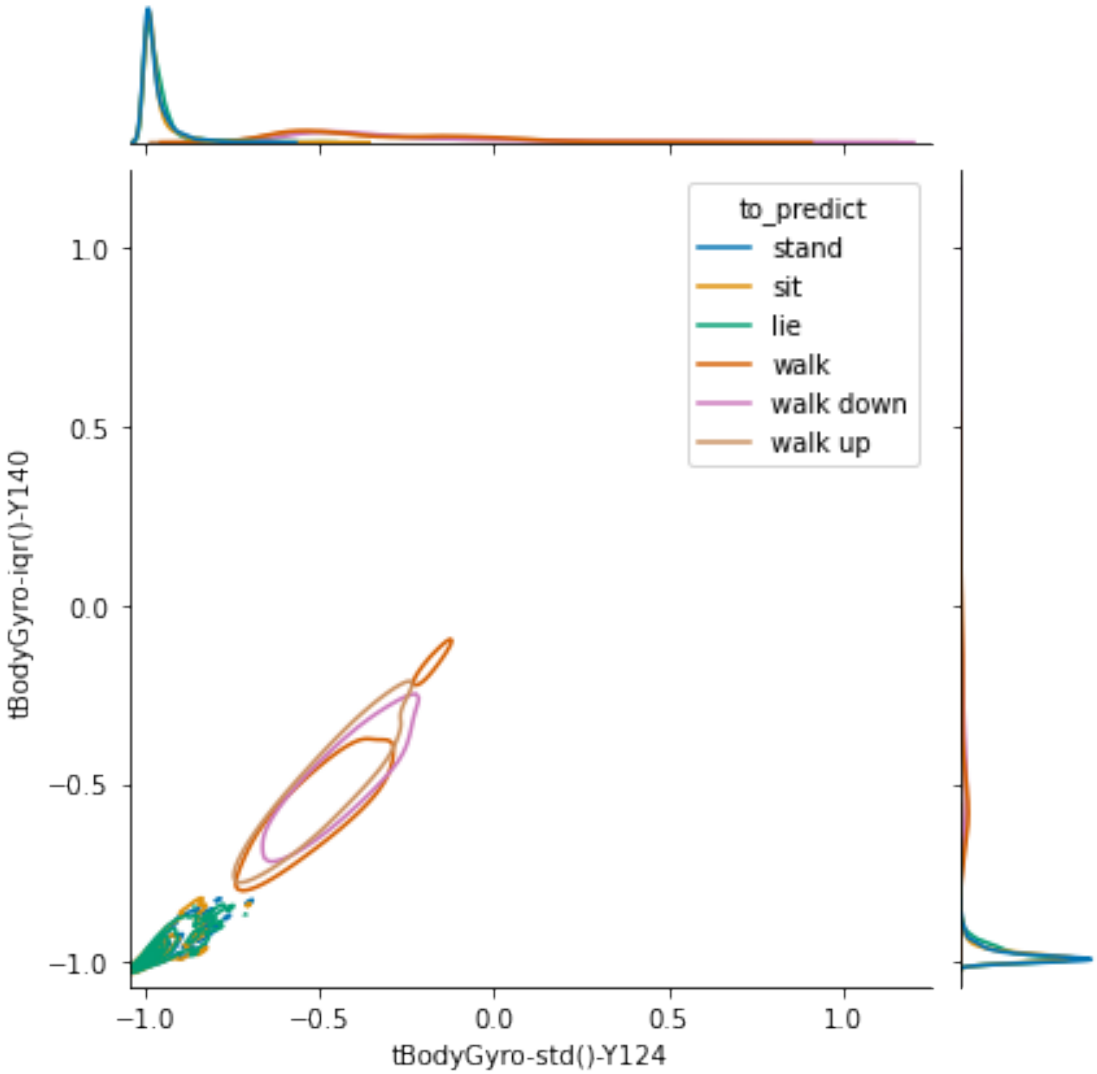
[242]:
```
sns.jointplot(
    data= merged_train,
    x="tBodyGyro-std()-Z125",
    y='tBodyGyro-iqr()-Z141',
    hue="to_predict",
    kind="kde",
    palette = "colorblind",
    #alpha = 0.2
)
```

[242]: <seaborn.axisgrid.JointGrid at 0x7f942ed4f700>



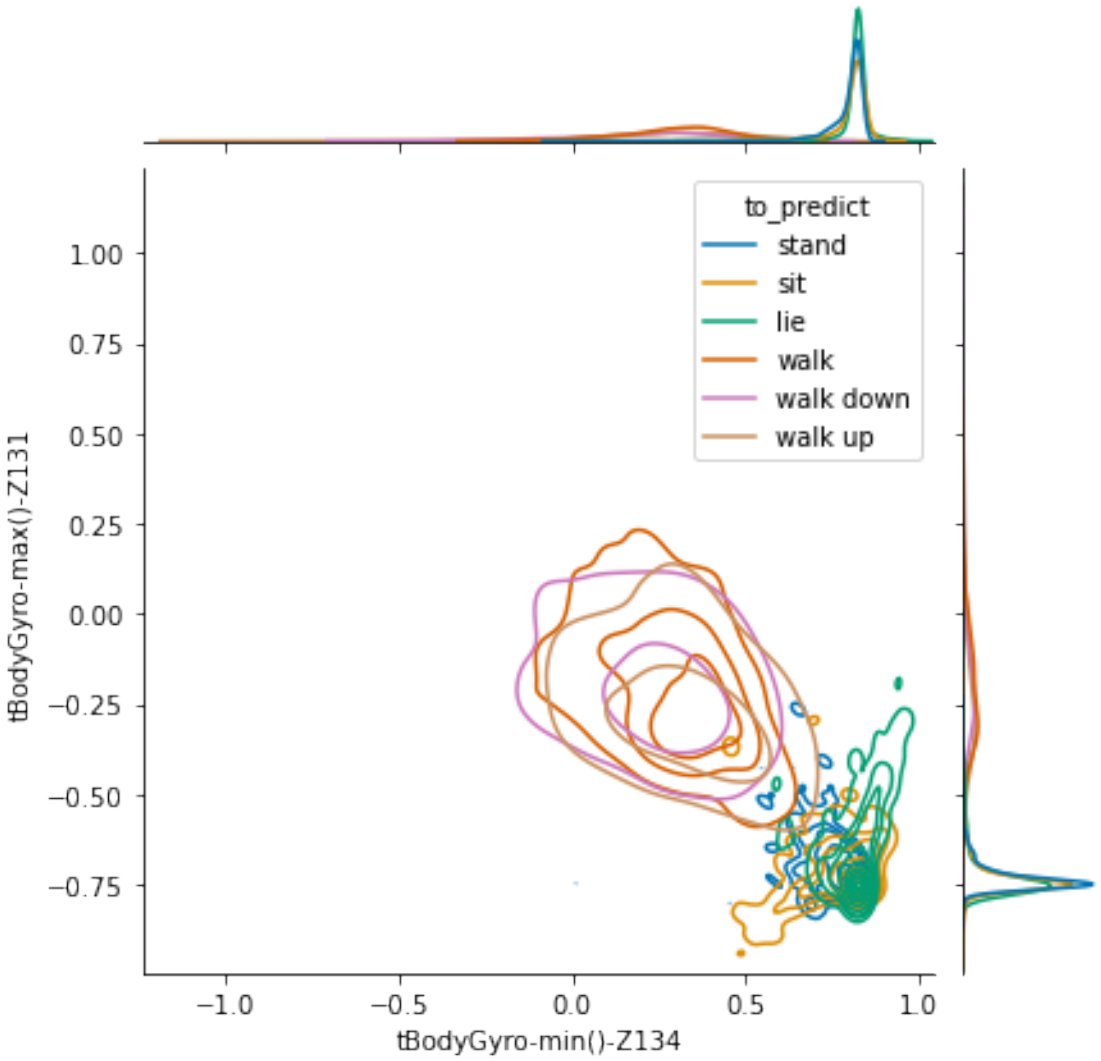
[201]:
```
sns.jointplot(
    data= merged_train,
    x="tBodyGyro-std()-Y124",
    y='tBodyGyro-iqr()-Y140',
    hue="to_predict",
    kind="kde",
    palette = "colorblind"
)
```

[201]: <seaborn.axisgrid.JointGrid at 0x7f946ea69730>



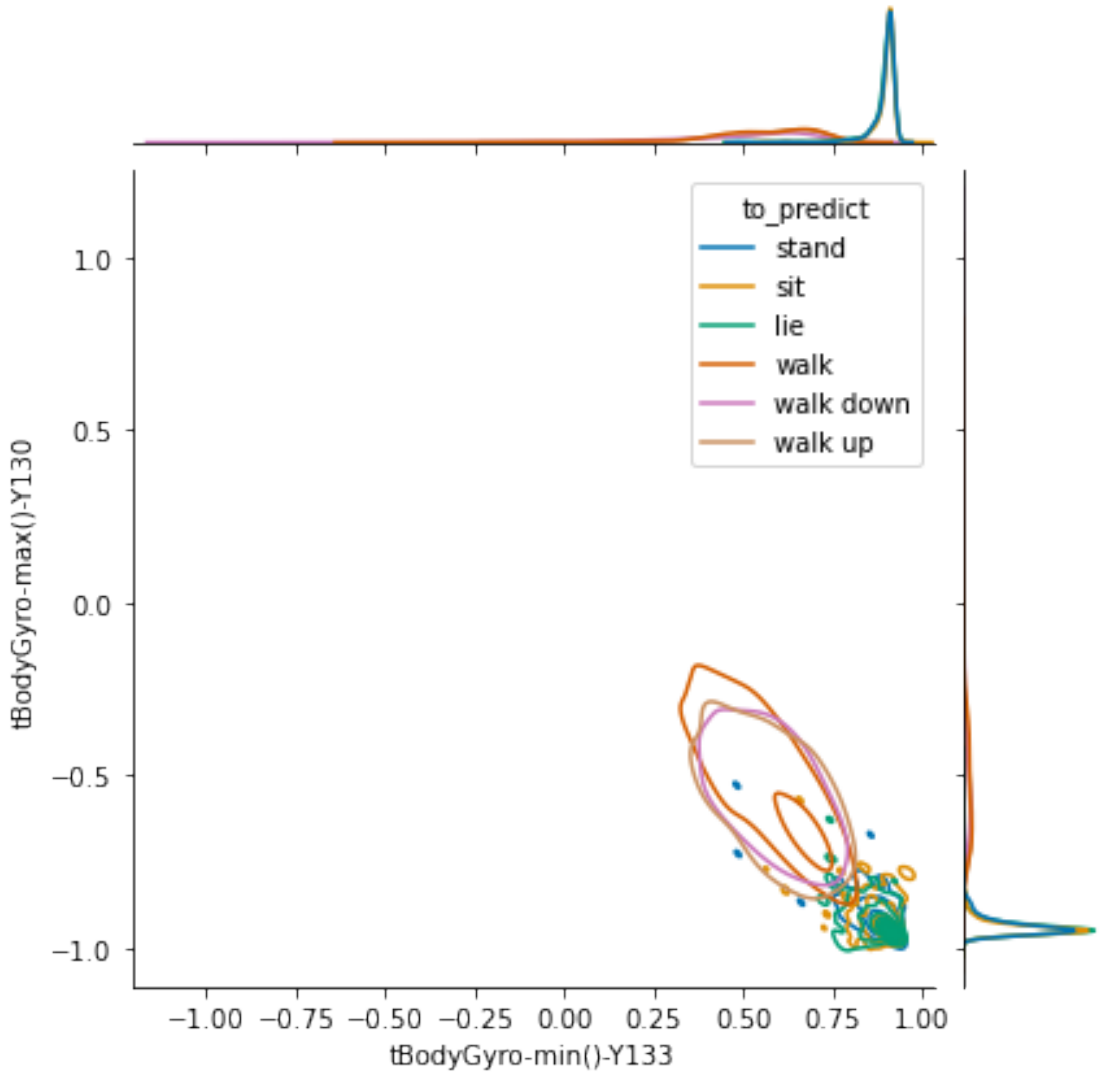
[202]:
```
sns.jointplot(
    data=  merged_train,
    x="tBodyGyro-min()-Z134",
    y='tBodyGyro-max()-Z131',
    hue="to_predict",
    kind="kde",
    palette = "colorblind"
)
```

[202]: <seaborn.axisgrid.JointGrid at 0x7f946e7eae50>



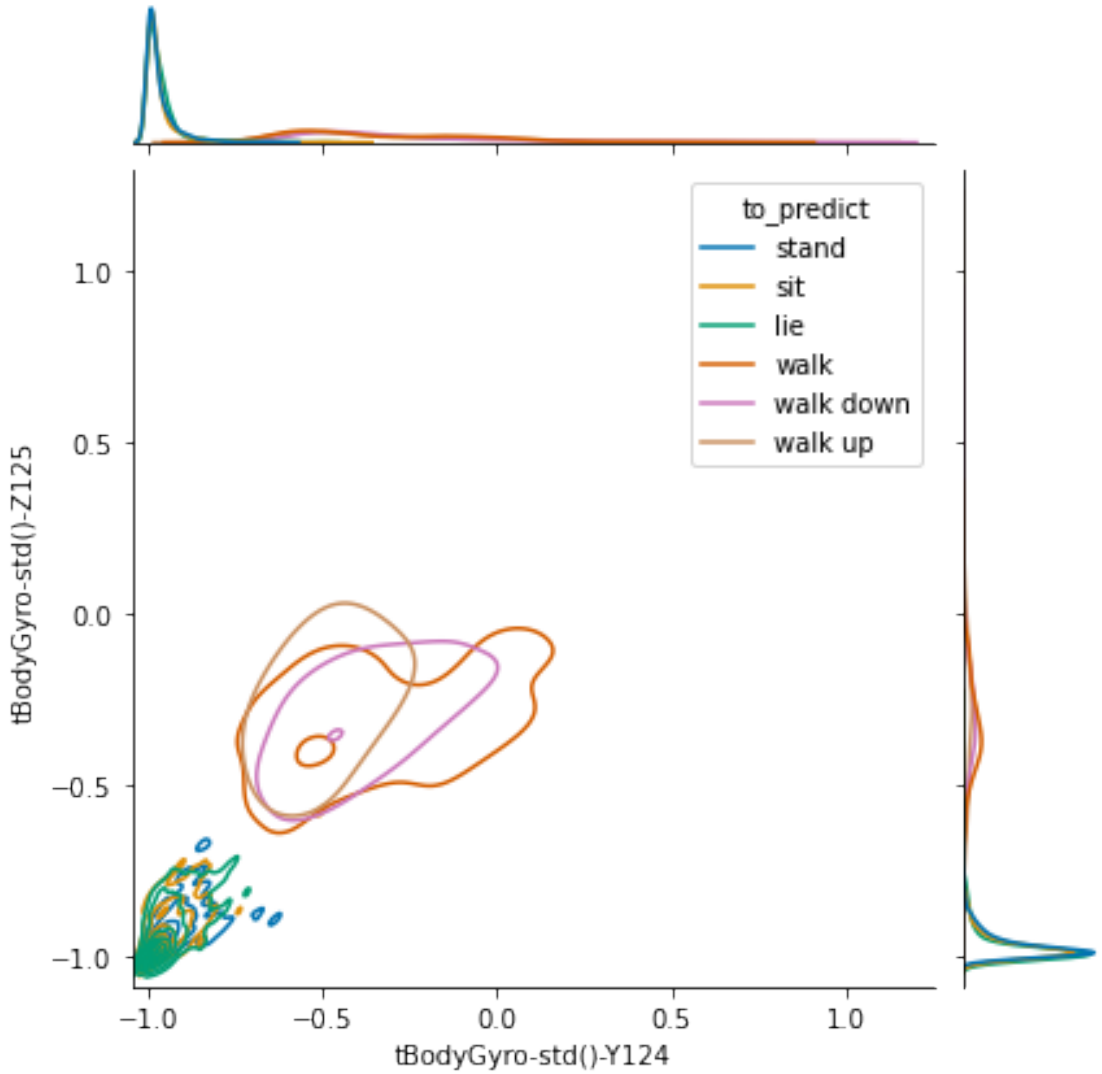
[203]:
```
sns.jointplot(
    data= merged_train,
    x="tBodyGyro-min()-Y133",
    y='tBodyGyro-max()-Y130',
    hue="to_predict",
    kind="kde",
    palette="colorblind"
)
```

[203]: <seaborn.axisgrid.JointGrid at 0x7f946e78e7c0>



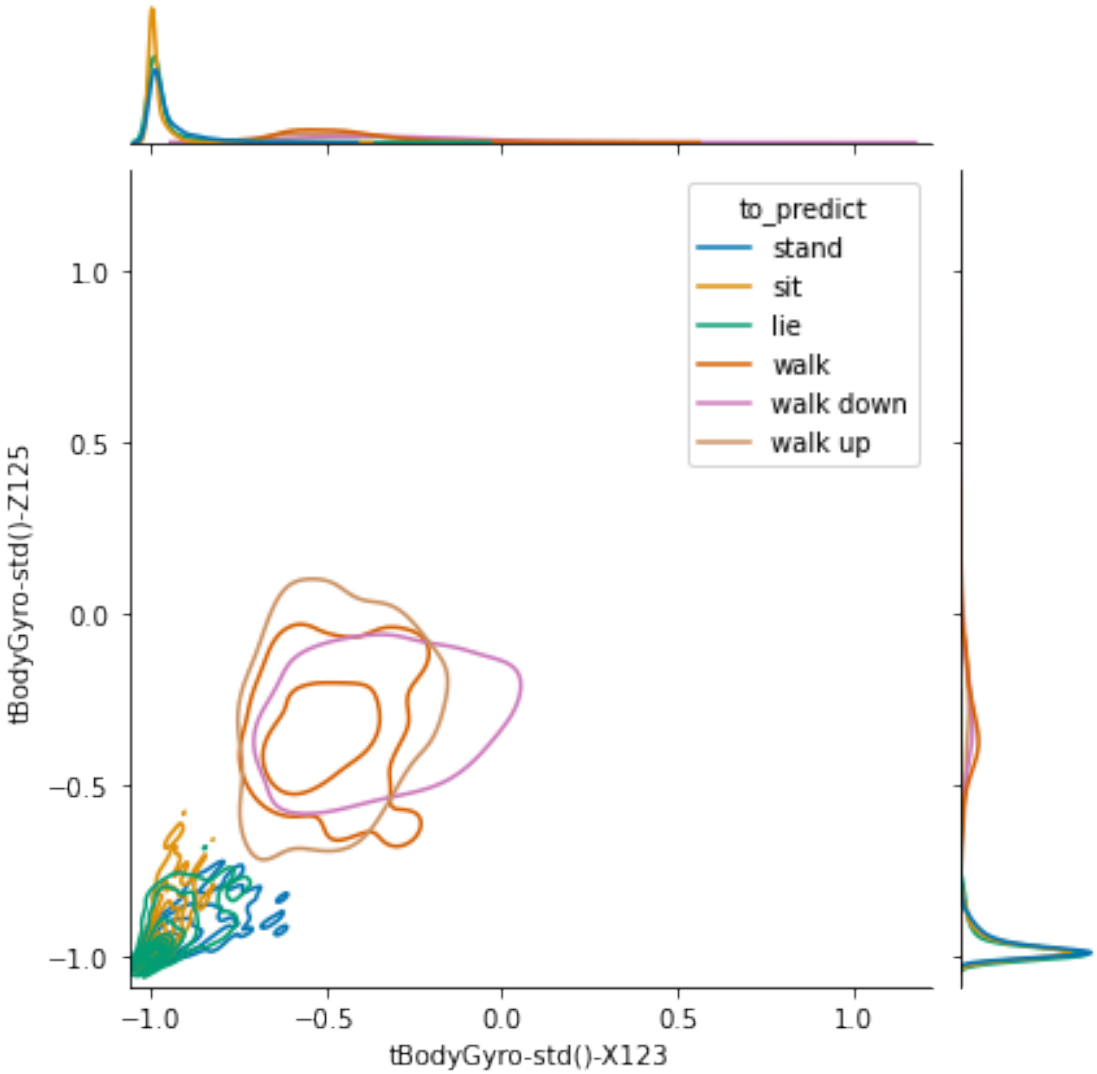
[204]:
```
sns.jointplot(
    data= merged_train,
    x="tBodyGyro-std()-Y124",
    y='tBodyGyro-std()-Z125',
    hue="to_predict",
    kind="kde",
    palette = "colorblind"
)
```

[204]: <seaborn.axisgrid.JointGrid at 0x7f946e4b20d0>



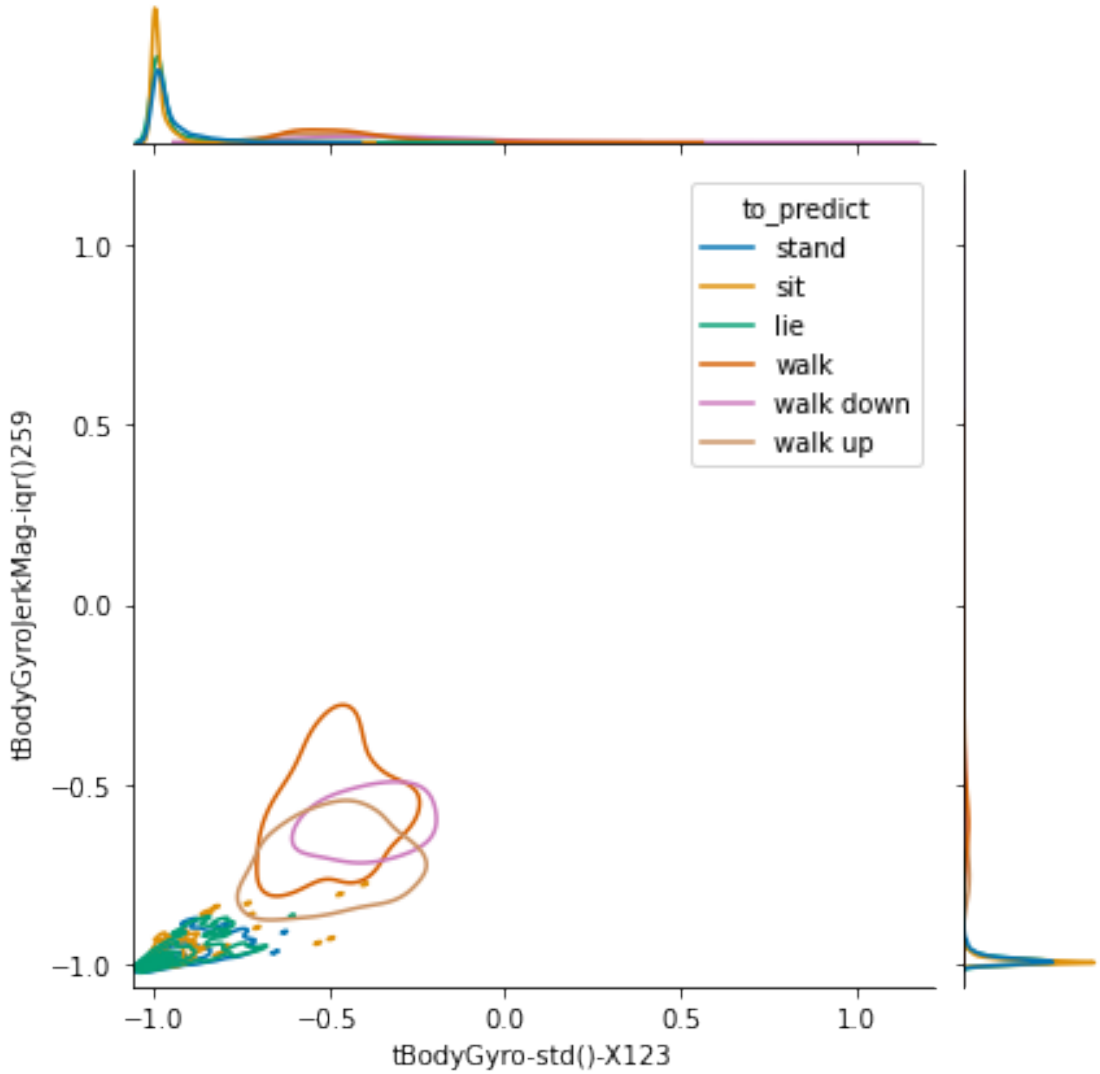
[205]:
```
sns.jointplot(
    data= merged_train,
    x="tBodyGyro-std()-X123",
    y='tBodyGyro-std()-Z125',
    hue="to_predict",
    kind="kde",
    palette = "colorblind"
)
```

[205]: <seaborn.axisgrid.JointGrid at 0x7f946e387c40>



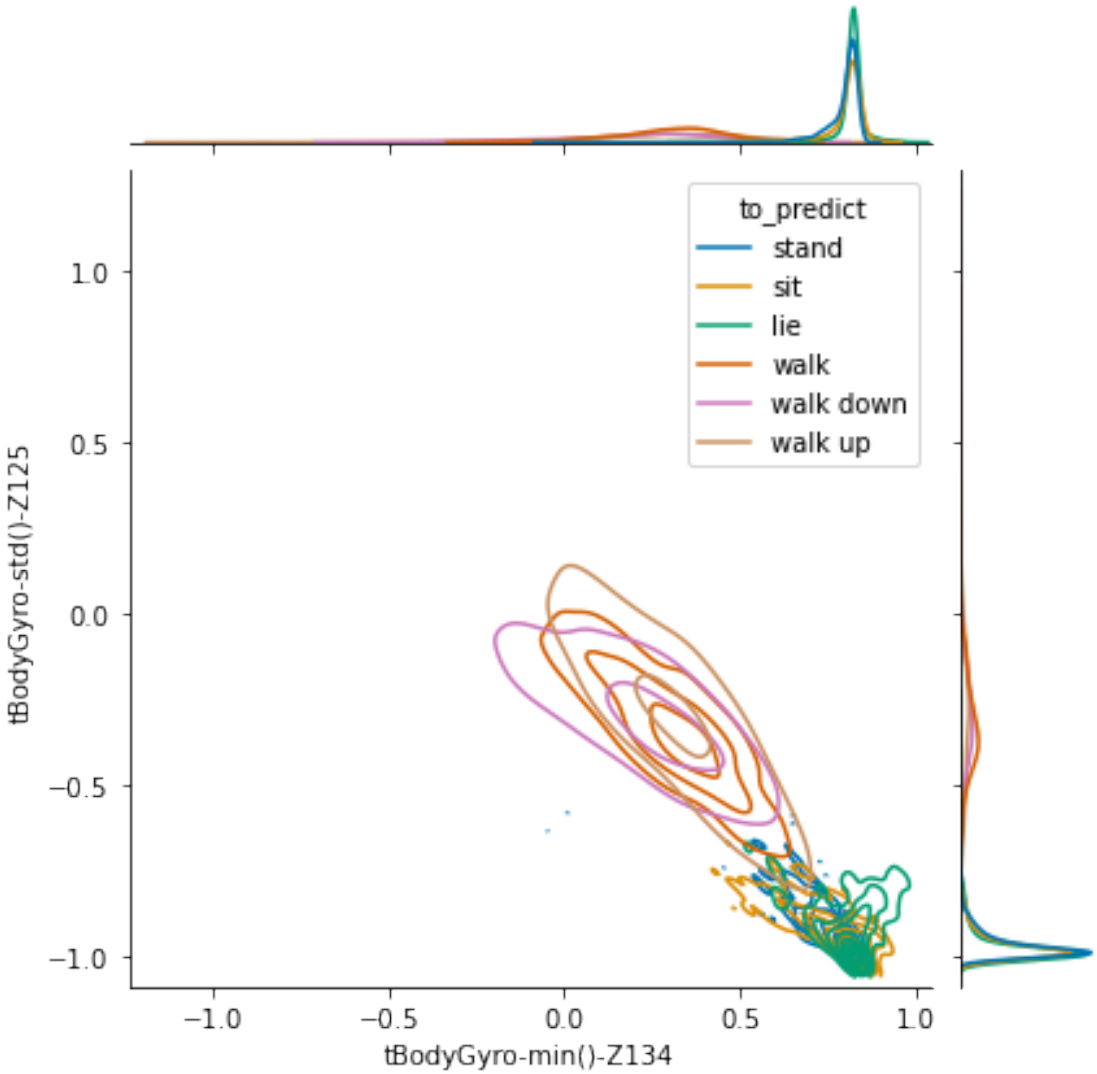
[206]:
```
sns.jointplot(
    data= merged_train,
    x="tBodyGyro-std()-X123",
    y='tBodyGyroJerkMag-iqr()259',
    hue="to_predict",
    kind="kde",
    palette = "colorblind"
)
```

[206]: <seaborn.axisgrid.JointGrid at 0x7f946e5acdc0>



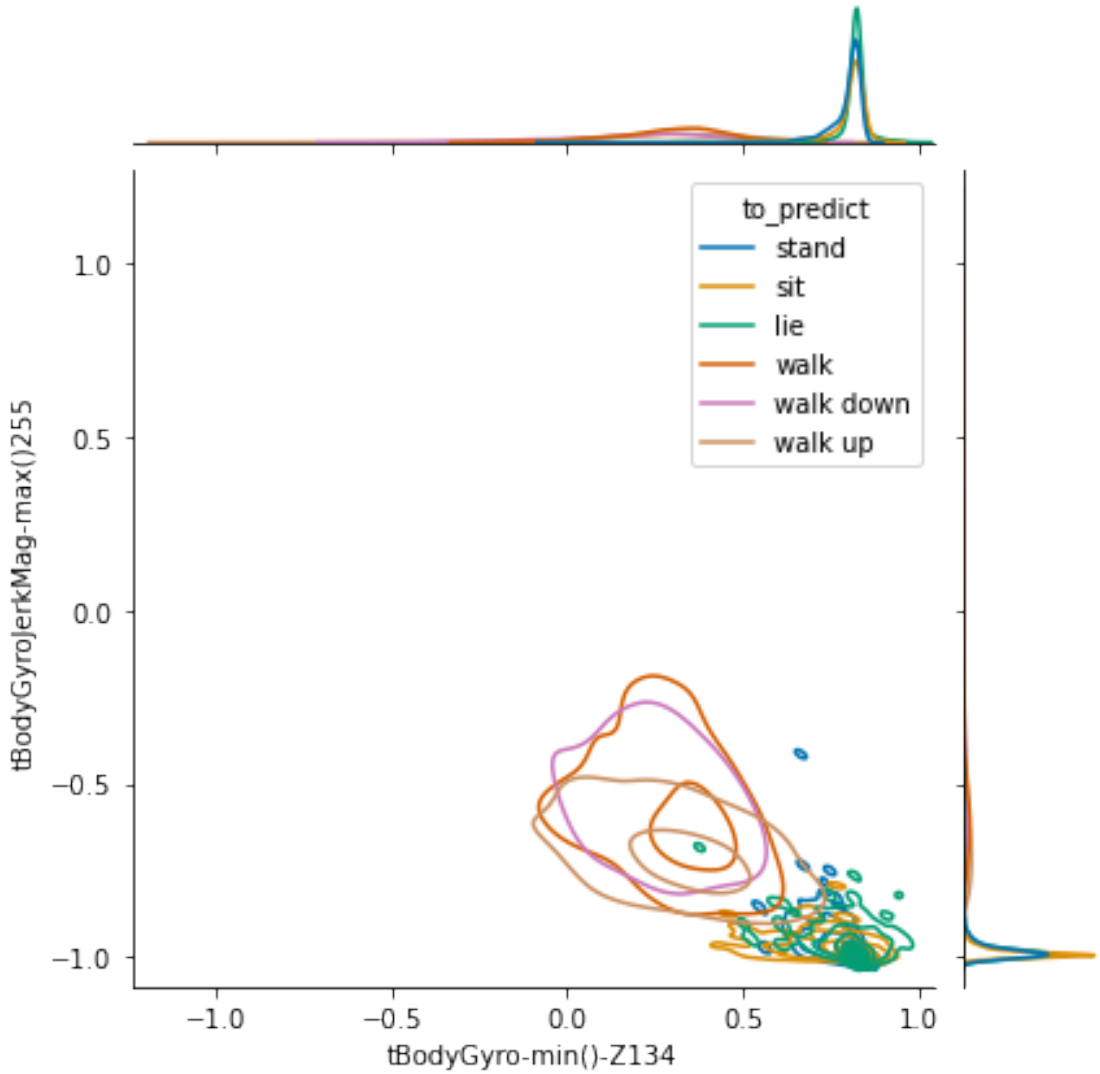
[207]:
```
sns.jointplot(
    data= merged_train,
    x="tBodyGyro-min()-Z134",
    y='tBodyGyro-std()-Z125',
    hue="to_predict",
    kind="kde",
    palette = "colorblind"
)
```

[207]: <seaborn.axisgrid.JointGrid at 0x7f946ca01b20>



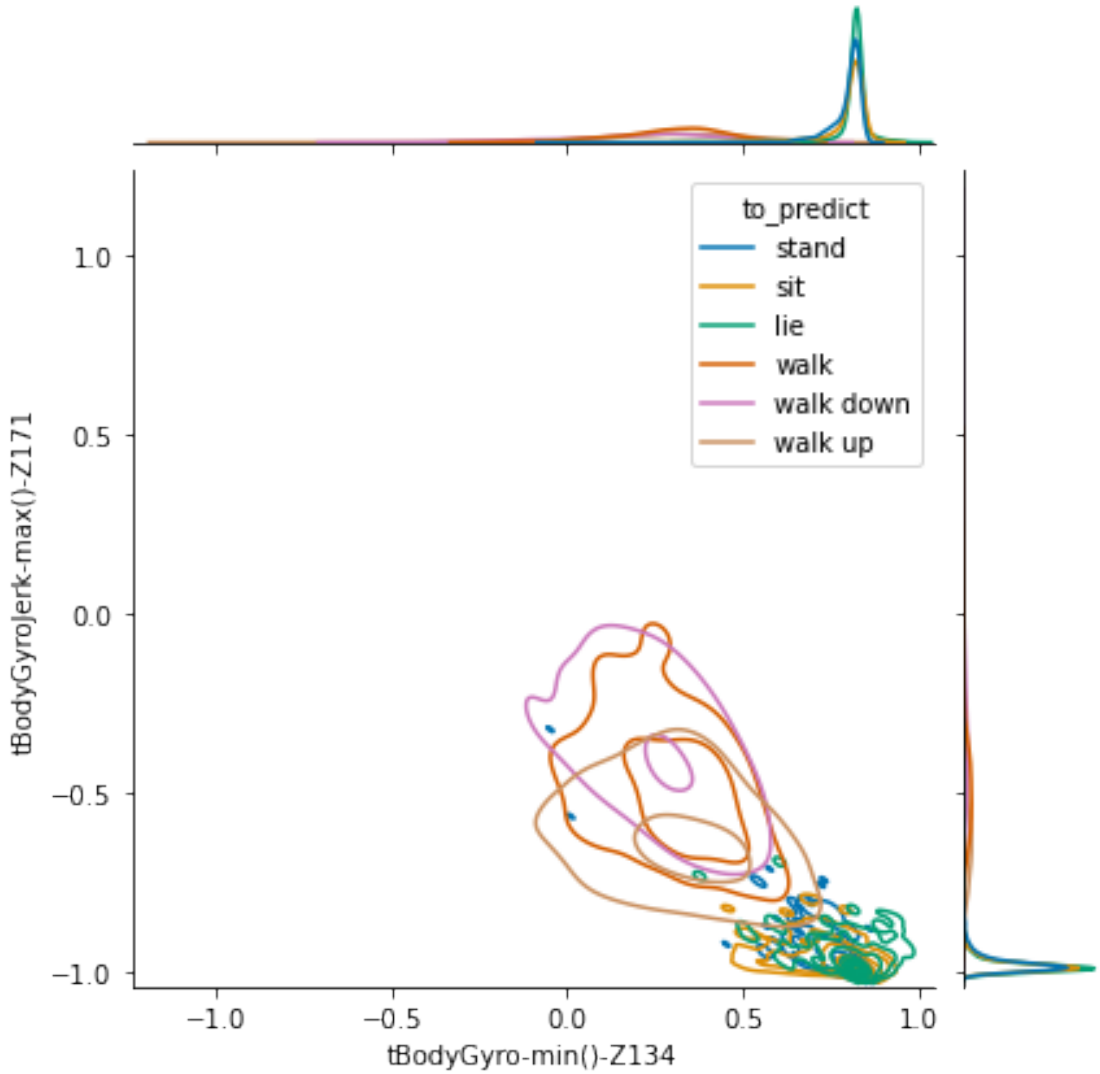
[208]:
```
sns.jointplot(
    data= merged_train,
    x="tBodyGyro-min()-Z134",
    y='tBodyGyroJerkMag-max()255',
    hue="to_predict",
    kind="kde",
    palette = "colorblind"
)
```

[208]: <seaborn.axisgrid.JointGrid at 0x7f946c7231c0>



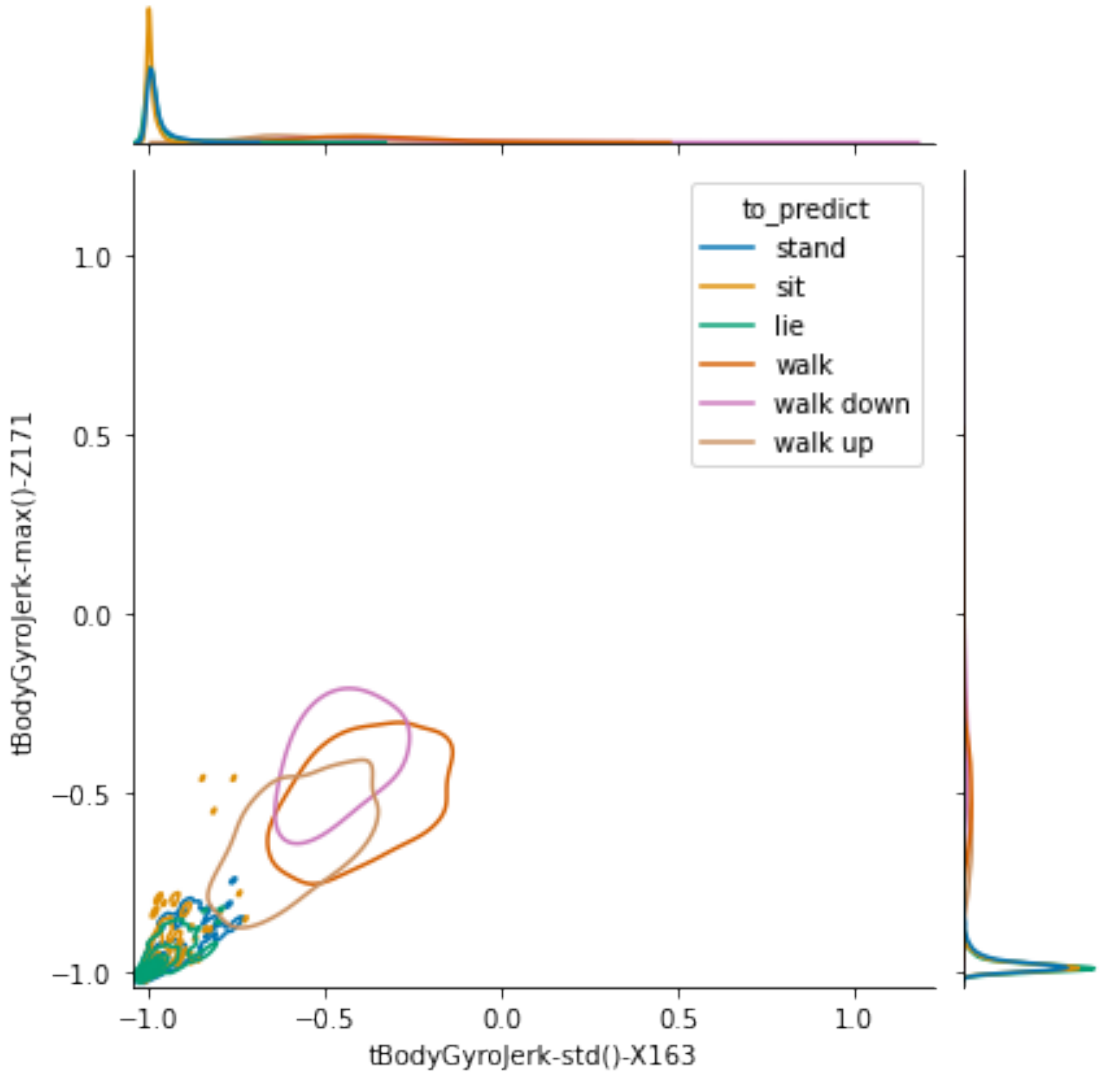
[209]:
```
sns.jointplot(
    data= merged_train,
    x="tBodyGyro-min()-Z134",
    y='tBodyGyroJerk-max()-Z171',
    hue="to_predict",
    kind="kde",
    palette = "colorblind"
)
```

[209]: <seaborn.axisgrid.JointGrid at 0x7f946c611880>



[210]:
```
sns.jointplot(
    data= merged_train,
    x="tBodyGyroJerk-std()-X163",
    y='tBodyGyroJerk-max()-Z171',
    hue="to_predict",
    kind="kde",
    palette = "colorblind"
)
```

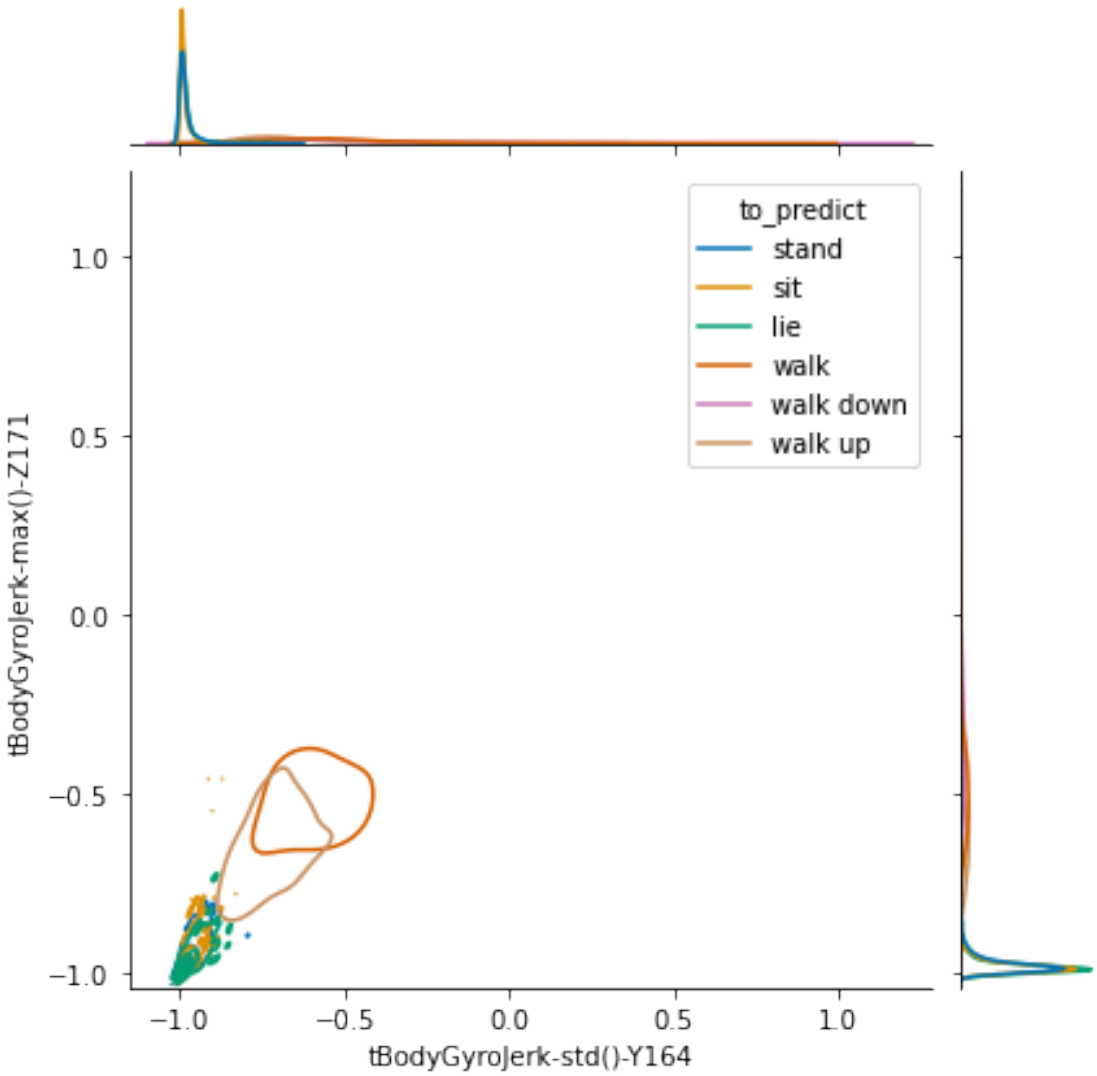
[210]: <seaborn.axisgrid.JointGrid at 0x7f946c539a30>



[211]:
```
sns.jointplot(
    data= merged_train,
    x="tBodyGyroJerk-std()-Y164",
    y='tBodyGyroJerk-max()-Z171',
    hue="to_predict",
    kind="kde",
    palette = "colorblind"
)
```

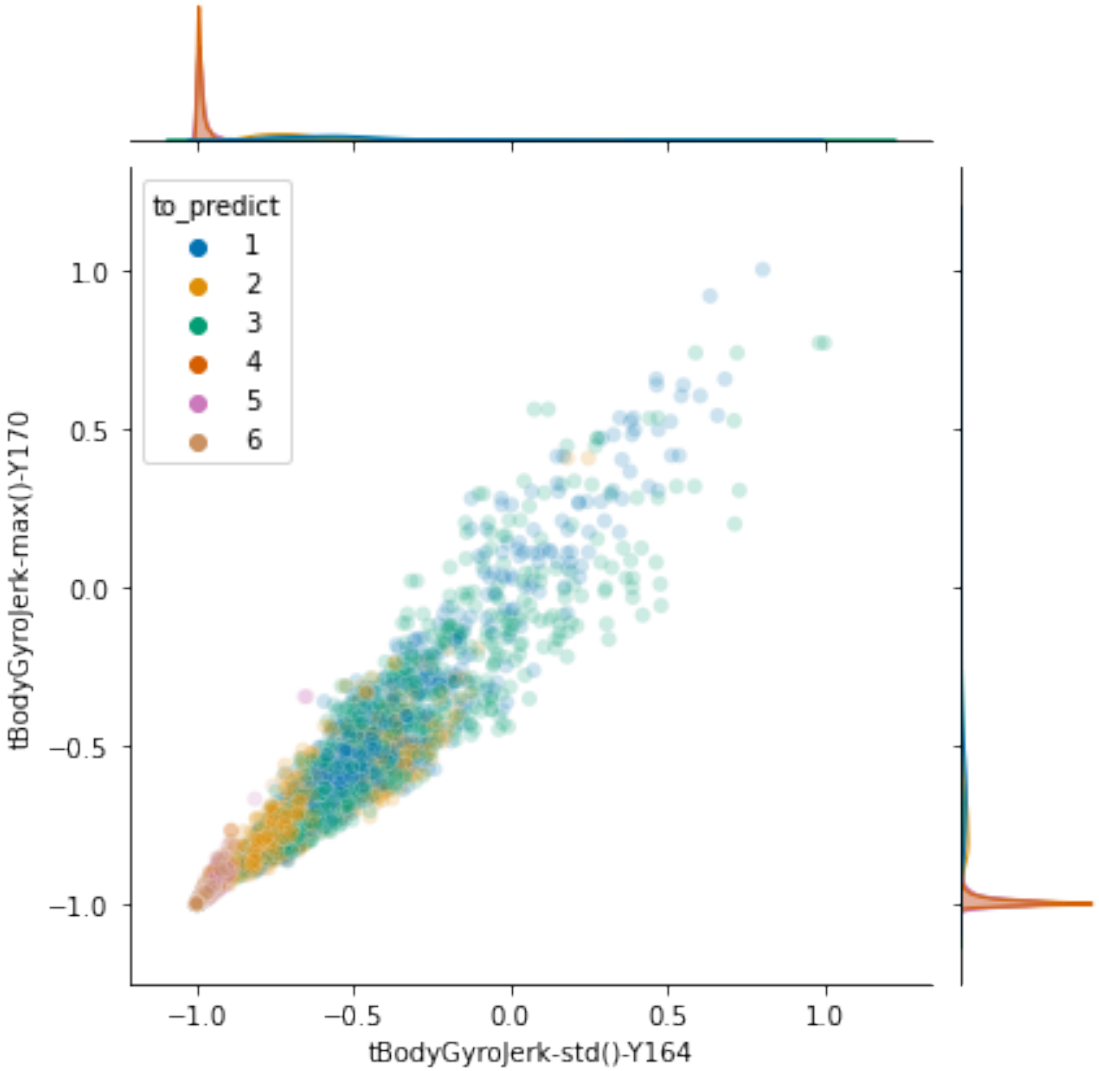
```
/home/kurowskik/anaconda3/lib/python3.8/site-
packages/seaborn/distributions.py:1181: UserWarning: No contour levels were
found within the data range.
  cset = contour_func(
```

[211]: <seaborn.axisgrid.JointGrid at 0x7f946c3b1130>



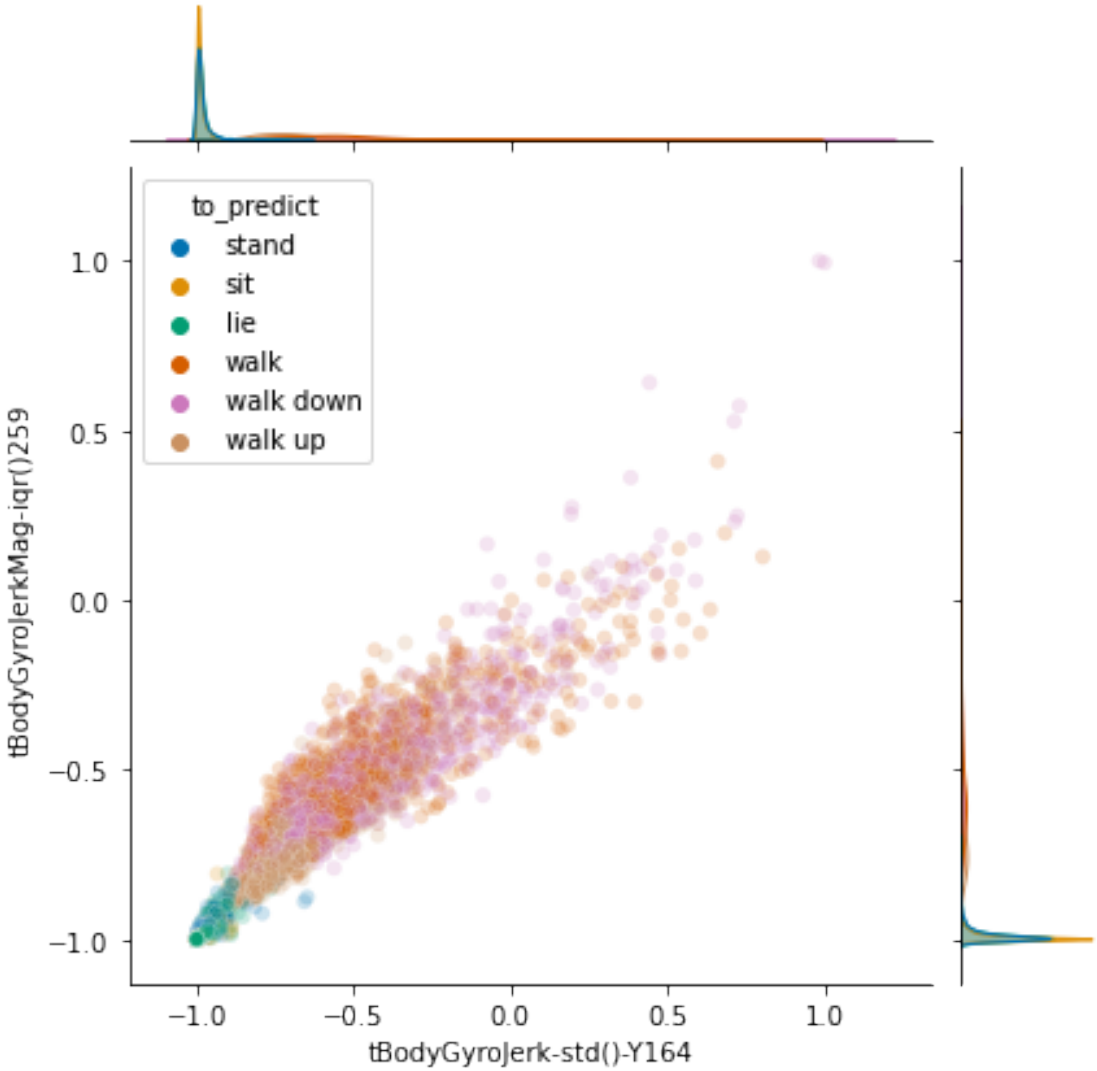
[271]:
```
sns.jointplot(
    data= merged_train,
    x="tBodyGyroJerk-std()-Y164",
    y='tBodyGyroJerk-max()-Y170',
    hue="to_predict",
    #kind="kde",
    alpha = 0.2,
    palette = "colorblind"
)
```

[271]: <seaborn.axisgrid.JointGrid at 0x7f942d6518e0>



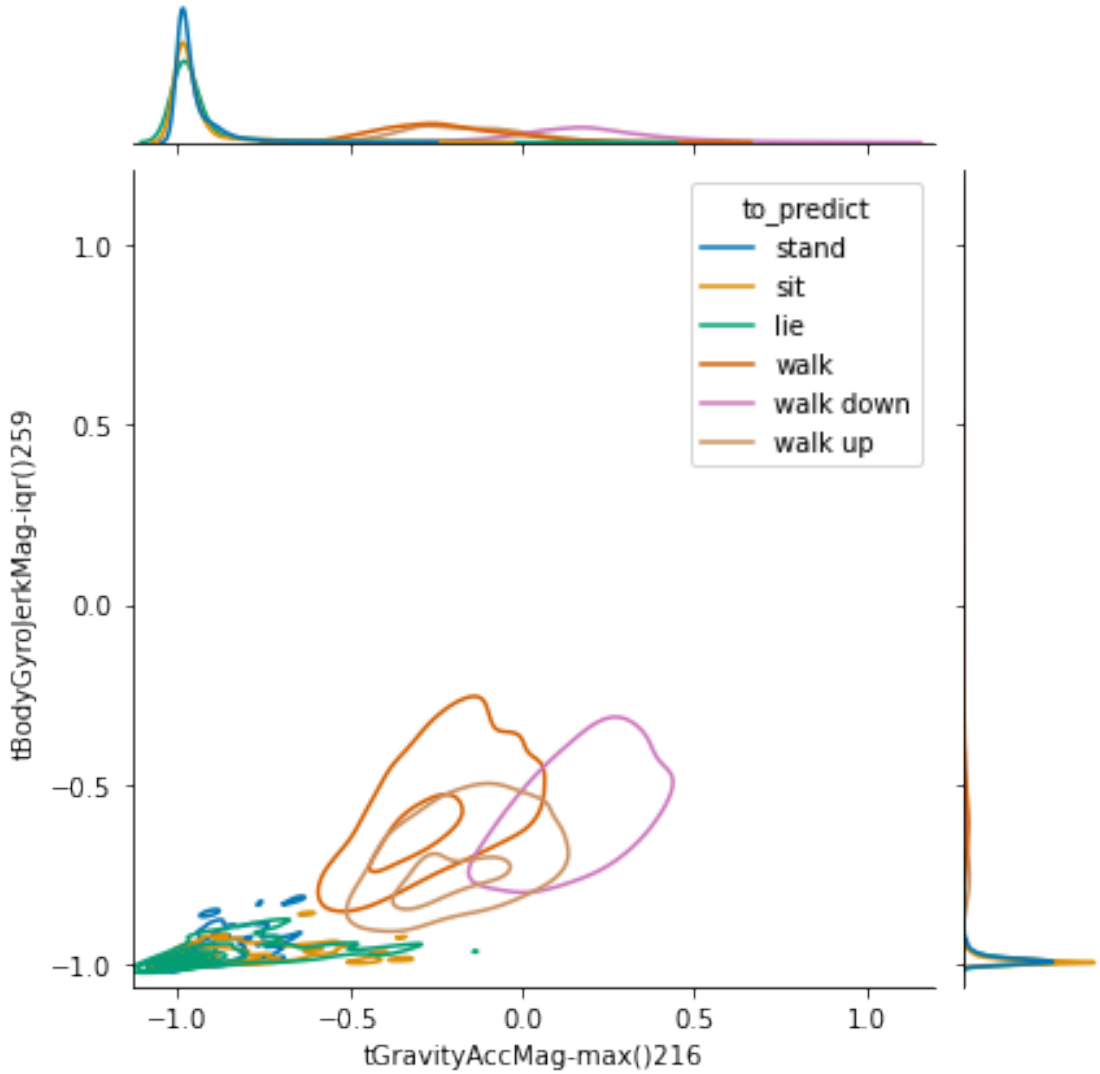
[245]:
```
sns.jointplot(
    data= merged_train,
    x="tBodyGyroJerk-std()-Y164",
    y='tBodyGyroJerkMag-iqr()259',
    hue="to_predict",
    #kind="kde",
    alpha = 0.2,
    palette = "colorblind"
)
```

[245]: <seaborn.axisgrid.JointGrid at 0x7f942e9ff760>



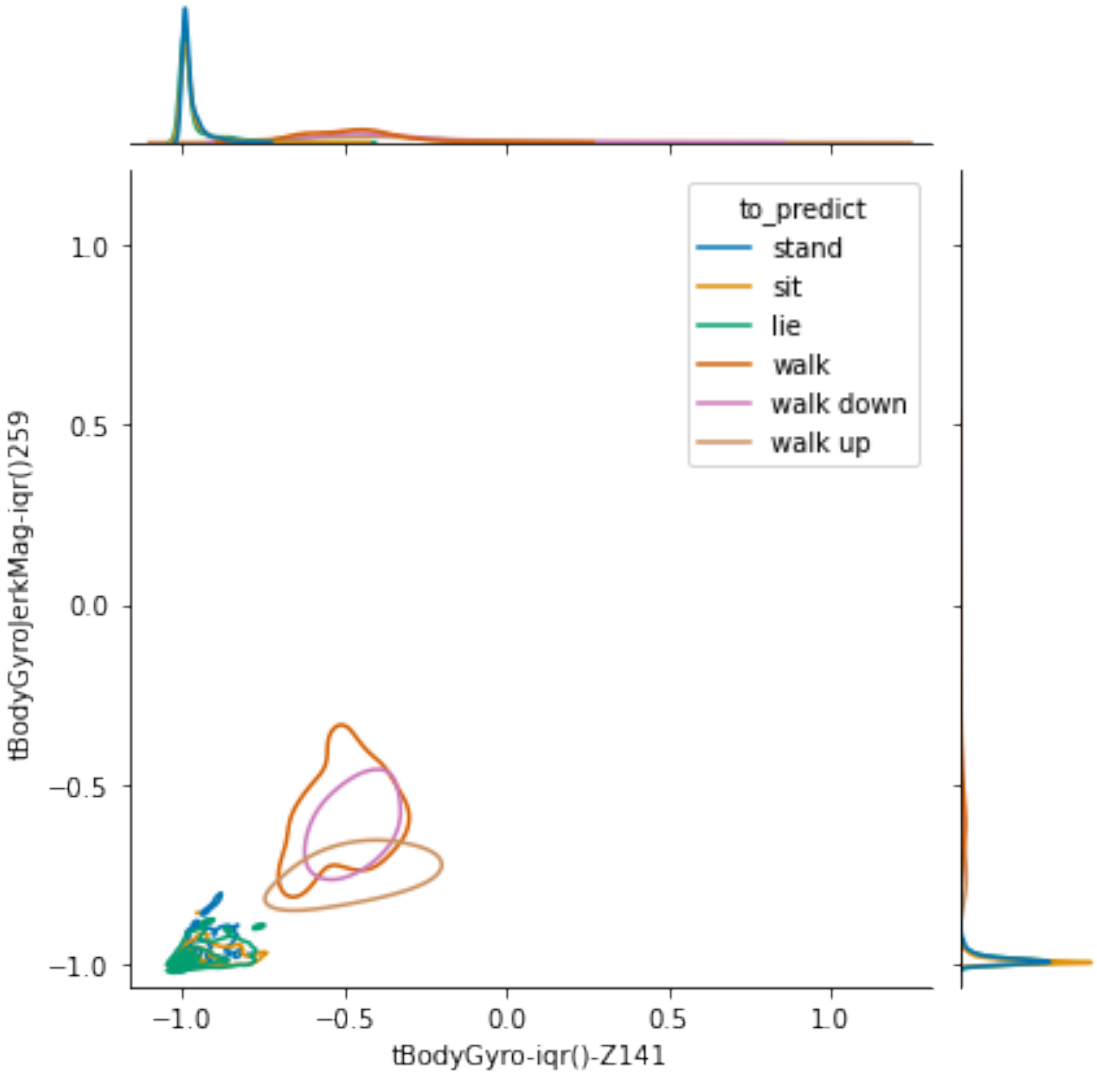
[214]:
```
sns.jointplot(
    data= merged_train,
    x="tGravityAccMag-max()216",
    y='tBodyGyroJerkMag-iqr()259',
    hue="to_predict",
    kind="kde",
    palette = "colorblind"
)
```

[214]: <seaborn.axisgrid.JointGrid at 0x7f946cb876d0>



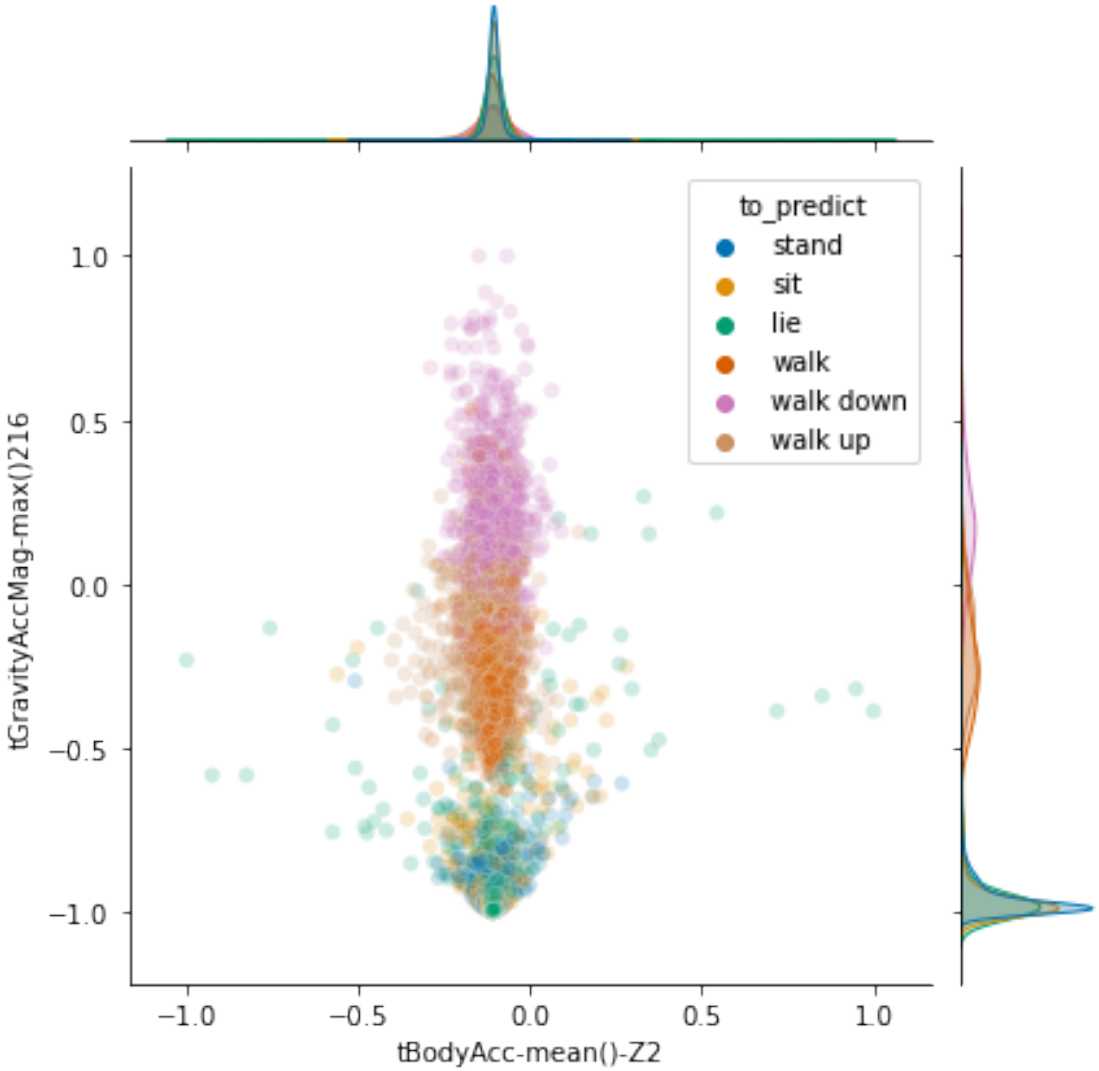
[215]:
```
sns.jointplot(
    data= merged_train,
    x="tBodyGyro-iqr()-Z141",
    y='tBodyGyroJerkMag-iqr()259',
    hue="to_predict",
    kind="kde",
    palette = "colorblind"
)
```

[215]: <seaborn.axisgrid.JointGrid at 0x7f946bdf2fa0>



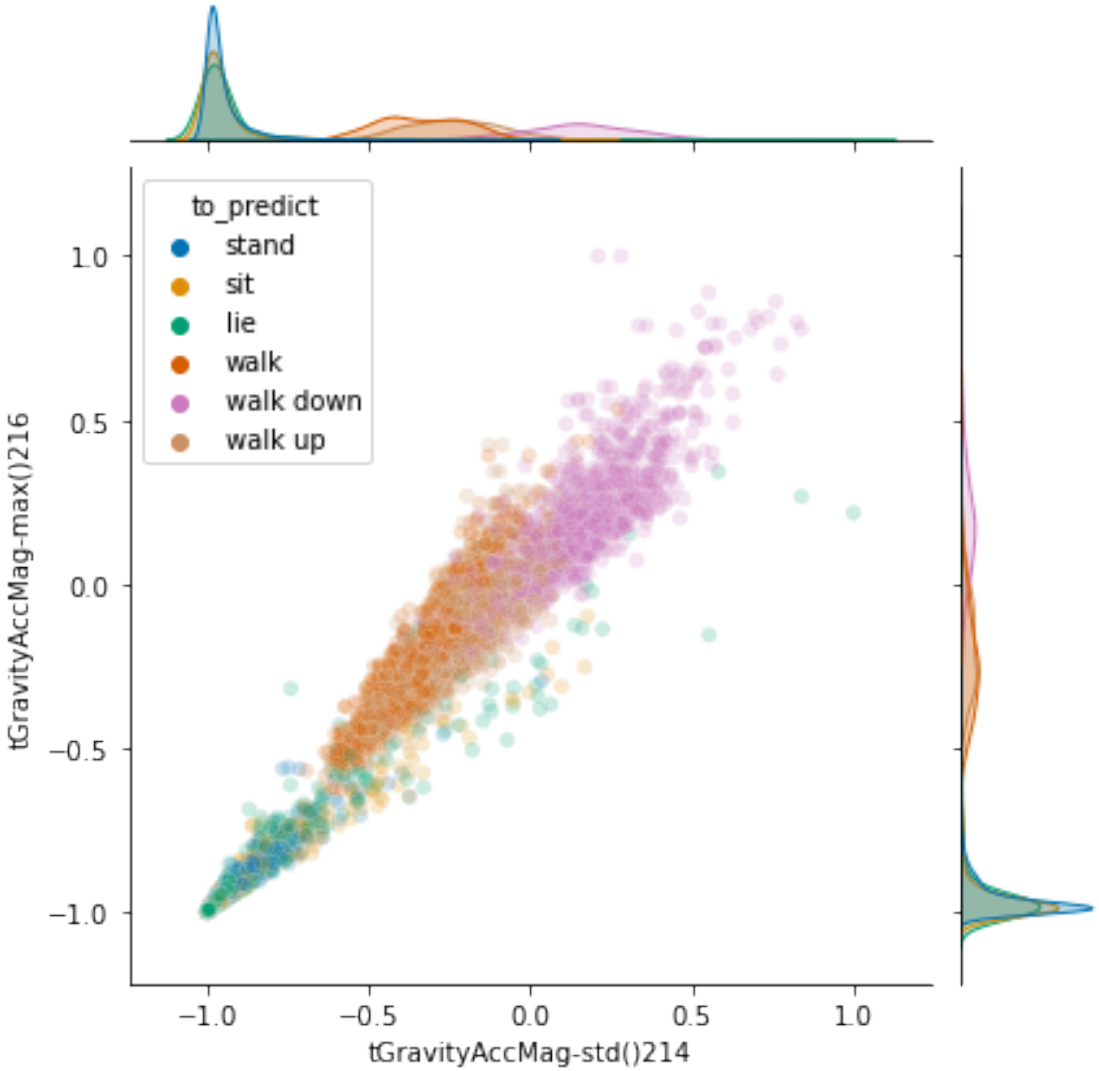
[246]:
```
sns.jointplot(
    data= merged_train,
    x="tBodyAcc-mean()-Z2",
    y='tGravityAccMag-max()216',
    hue="to_predict",
    #kind="kde",
    alpha = 0.2,
    palette = "colorblind"
)
```

[246]: <seaborn.axisgrid.JointGrid at 0x7f942e9331c0>



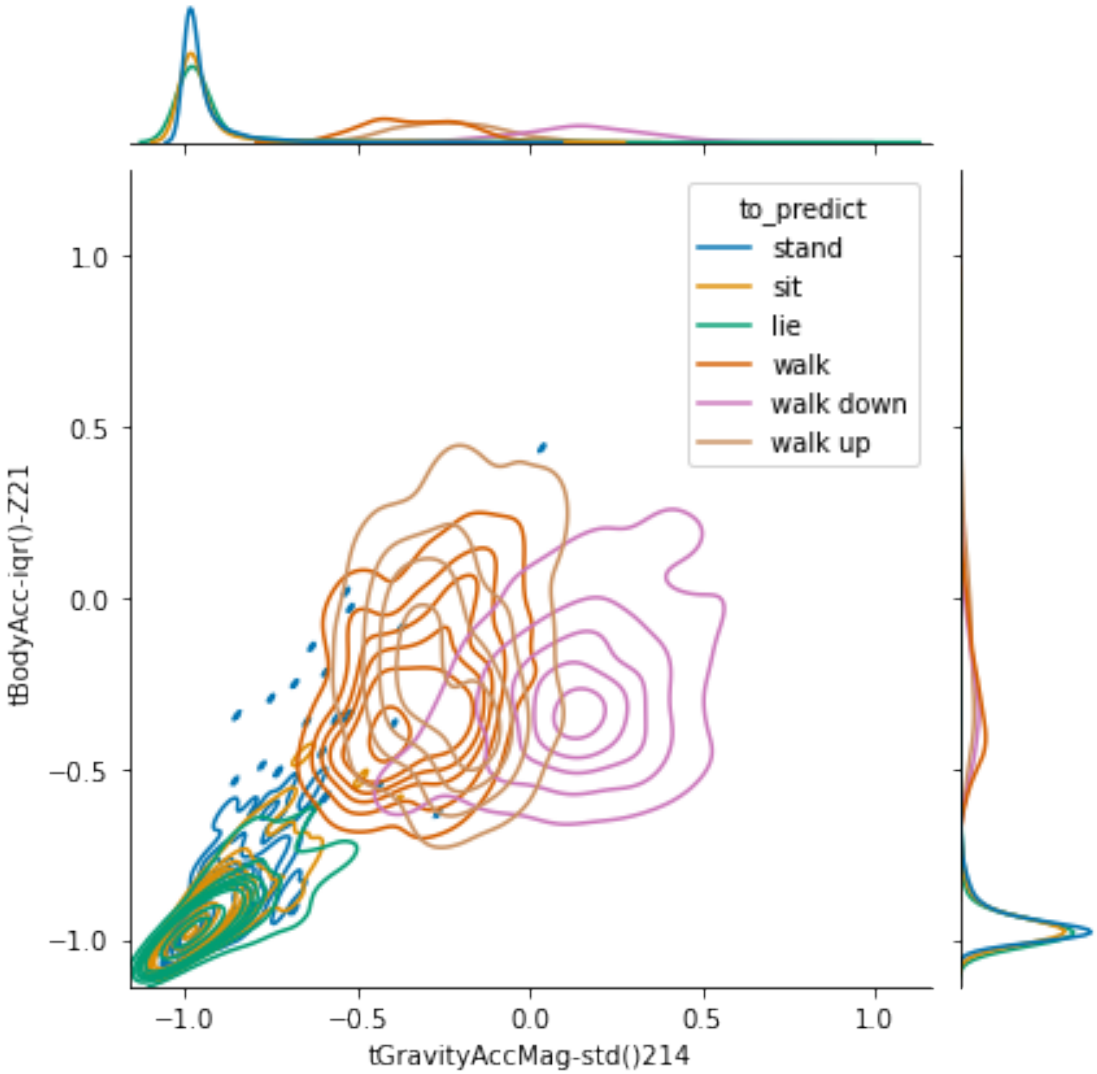
[247]:
```
sns.jointplot(
    data= merged_train,
    x="tGravityAccMag-std()214",
    y='tGravityAccMag-max()216',
    hue="to_predict",
    #kind="kde",
    palette = "colorblind",
    alpha = 0.2
)
```

[247]: <seaborn.axisgrid.JointGrid at 0x7f942e7c8d00>



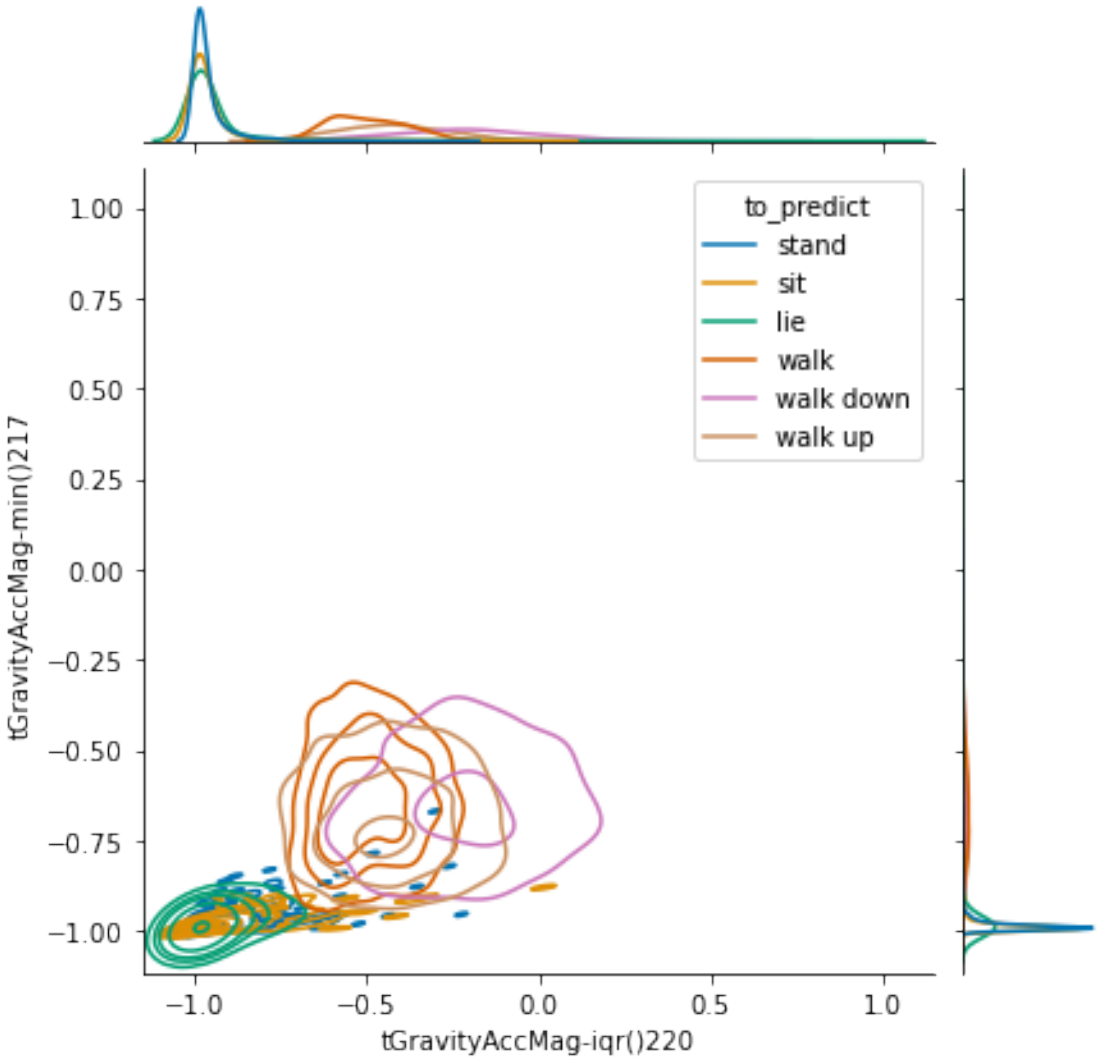
[219]:
```
sns.jointplot(
    data= merged_train,
    x="tGravityAccMag-std()214",
    y='tBodyAcc-iqr()-Z21',
    hue="to_predict",
    kind="kde",
    palette = "colorblind"
)
```

[219]: <seaborn.axisgrid.JointGrid at 0x7f946b863d90>



[220]:
```
sns.jointplot(
    data= merged_train,
    x="tGravityAccMag-iqr()220",
    y='tGravityAccMag-min()217',
    hue="to_predict",
    kind="kde",
    palette = "colorblind"
)
```

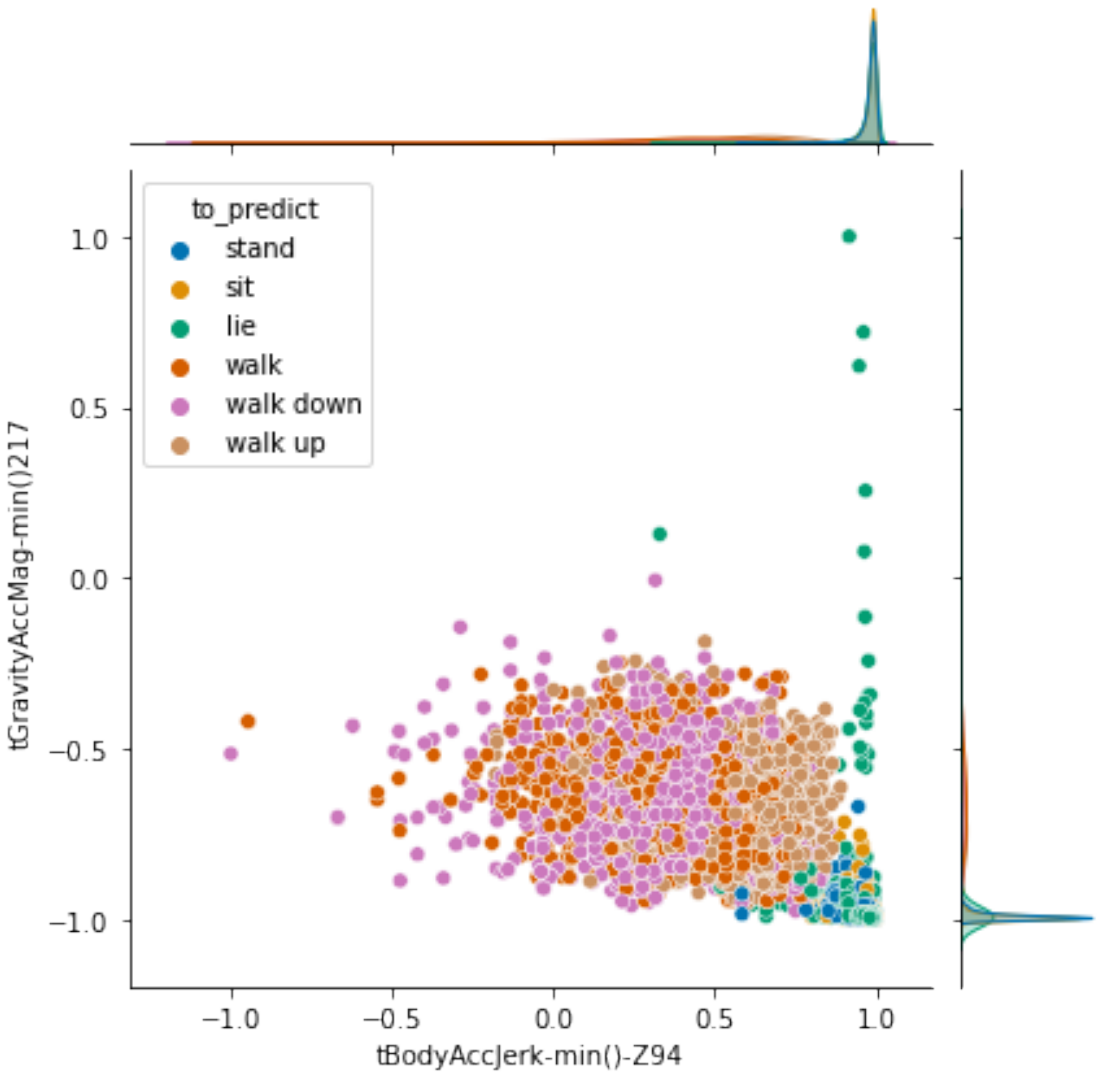
[220]: <seaborn.axisgrid.JointGrid at 0x7f946b6ed5e0>



[221]:
```
sns.jointplot(
    data= merged_train,
    x="tBodyAccJerk-min()-Z94",
    y='tGravityAccMag-min()217',
    hue="to_predict",
    #kind="kde",
    palette = "colorblind",

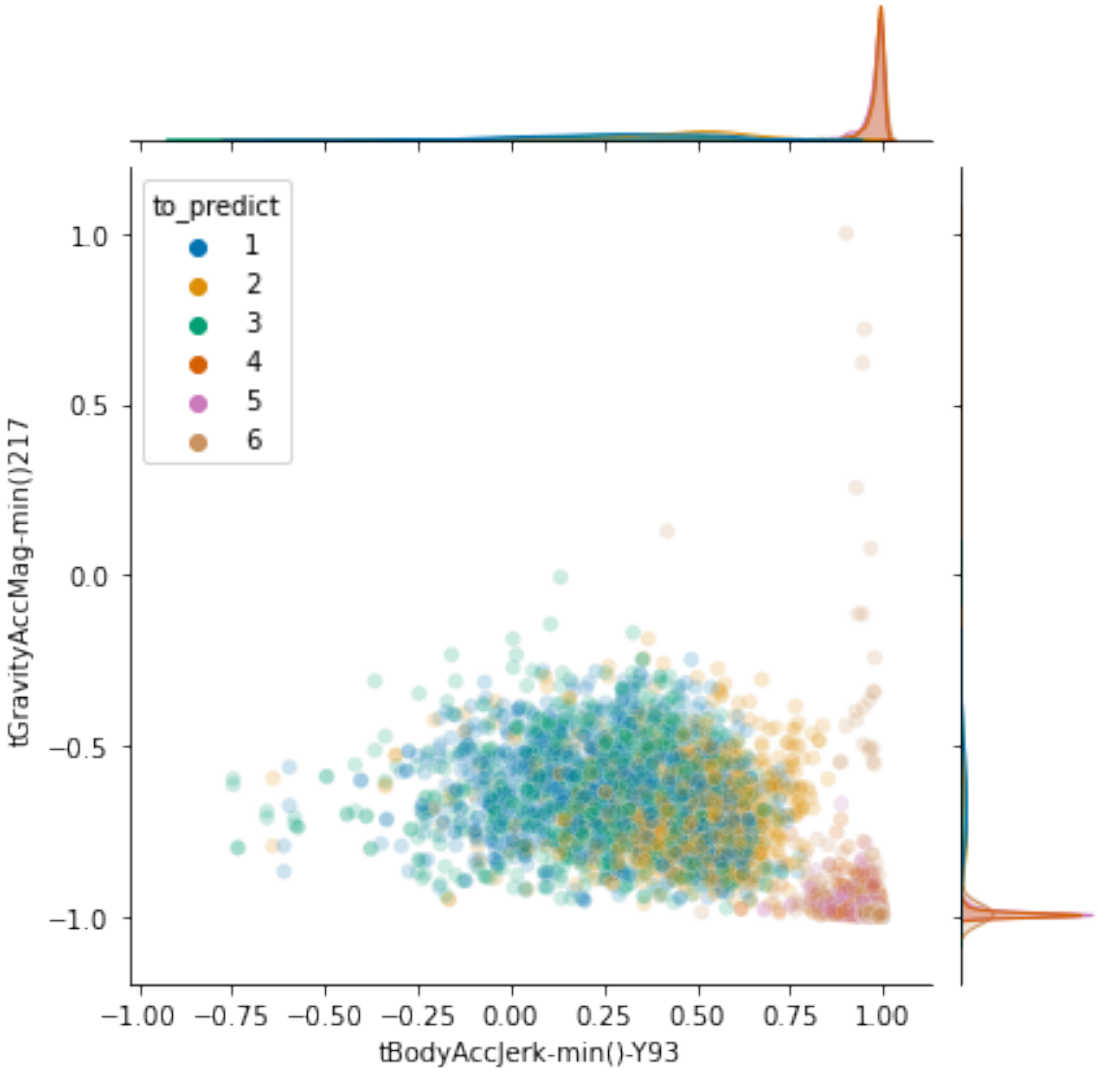
)
```

[221]: <seaborn.axisgrid.JointGrid at 0x7f946b460490>



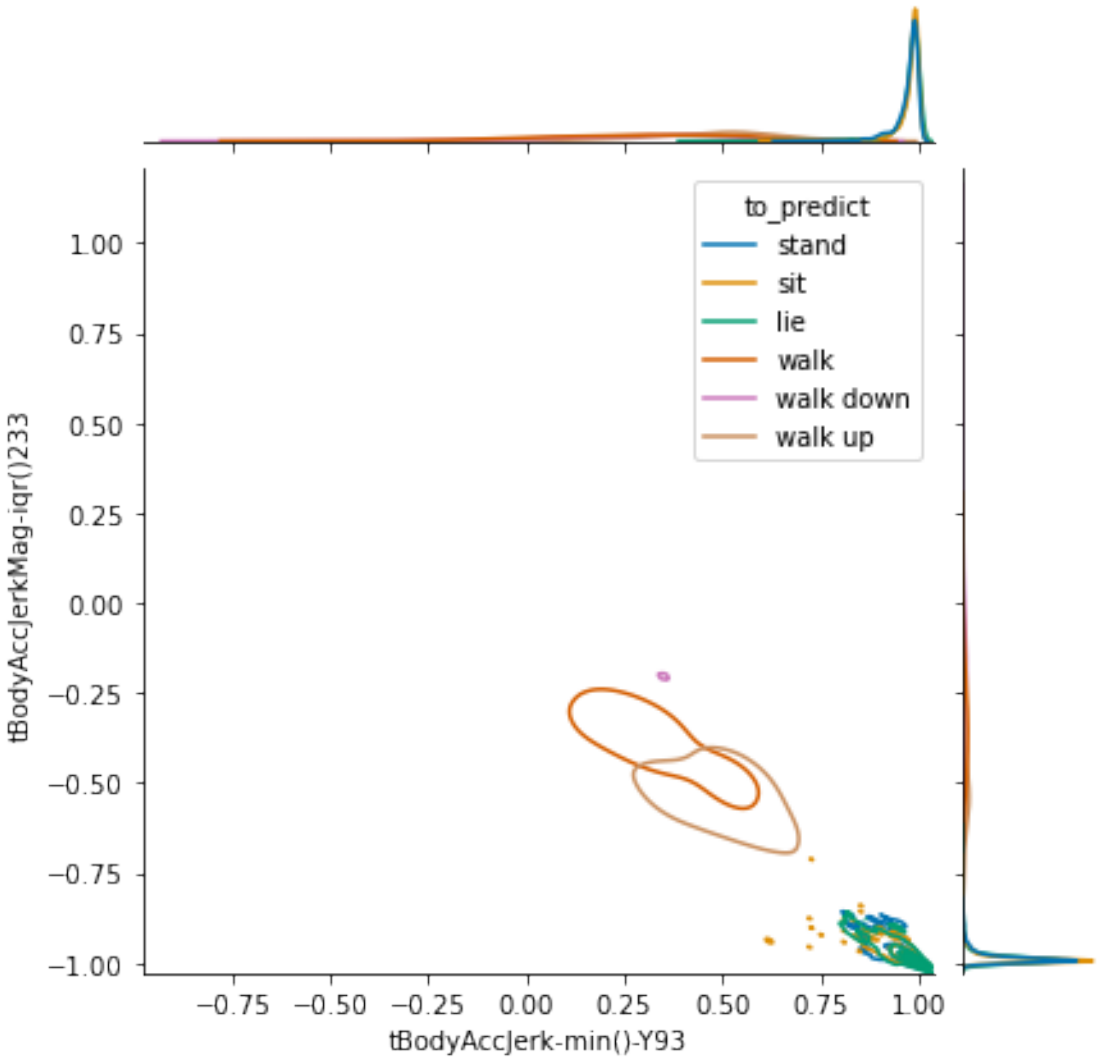
[272]:
```
sns.jointplot(
    data= merged_train,
    x="tBodyAccJerk-min()-Y93",
    y='tGravityAccMag-min()217',
    hue="to_predict",
    #kind="kde",
    alpha = 0.2,
    palette = "colorblind"
)
```

[272]: <seaborn.axisgrid.JointGrid at 0x7f942d5ac100>



[223]:
```
sns.jointplot(
    data= merged_train,
    x="tBodyAccJerk-min()-Y93",
    y='tBodyAccJerkMag-iqr()233',
    hue="to_predict",
    kind="kde",
    palette = "colorblind"
)
```

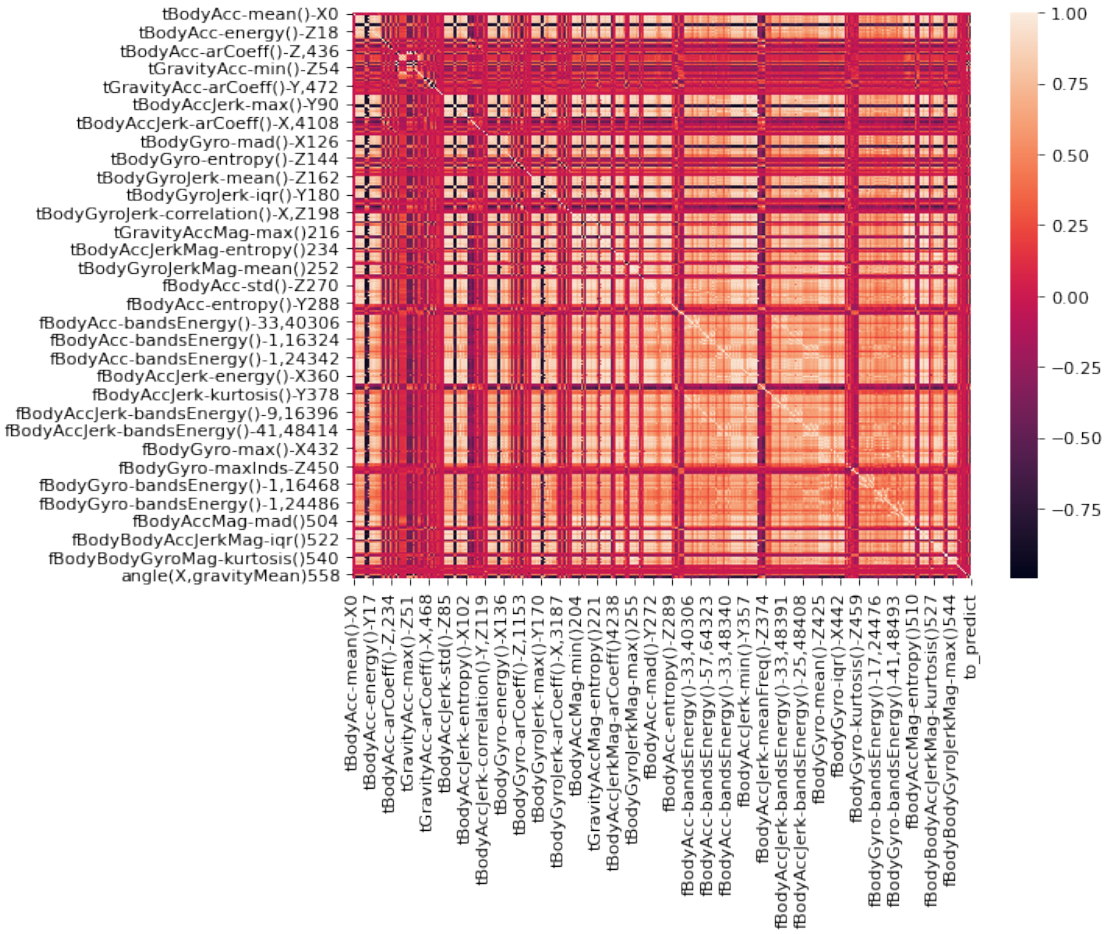
[223]: <seaborn.axisgrid.JointGrid at 0x7f946b474a90>



[58]:
```
import seaborn as sns
```

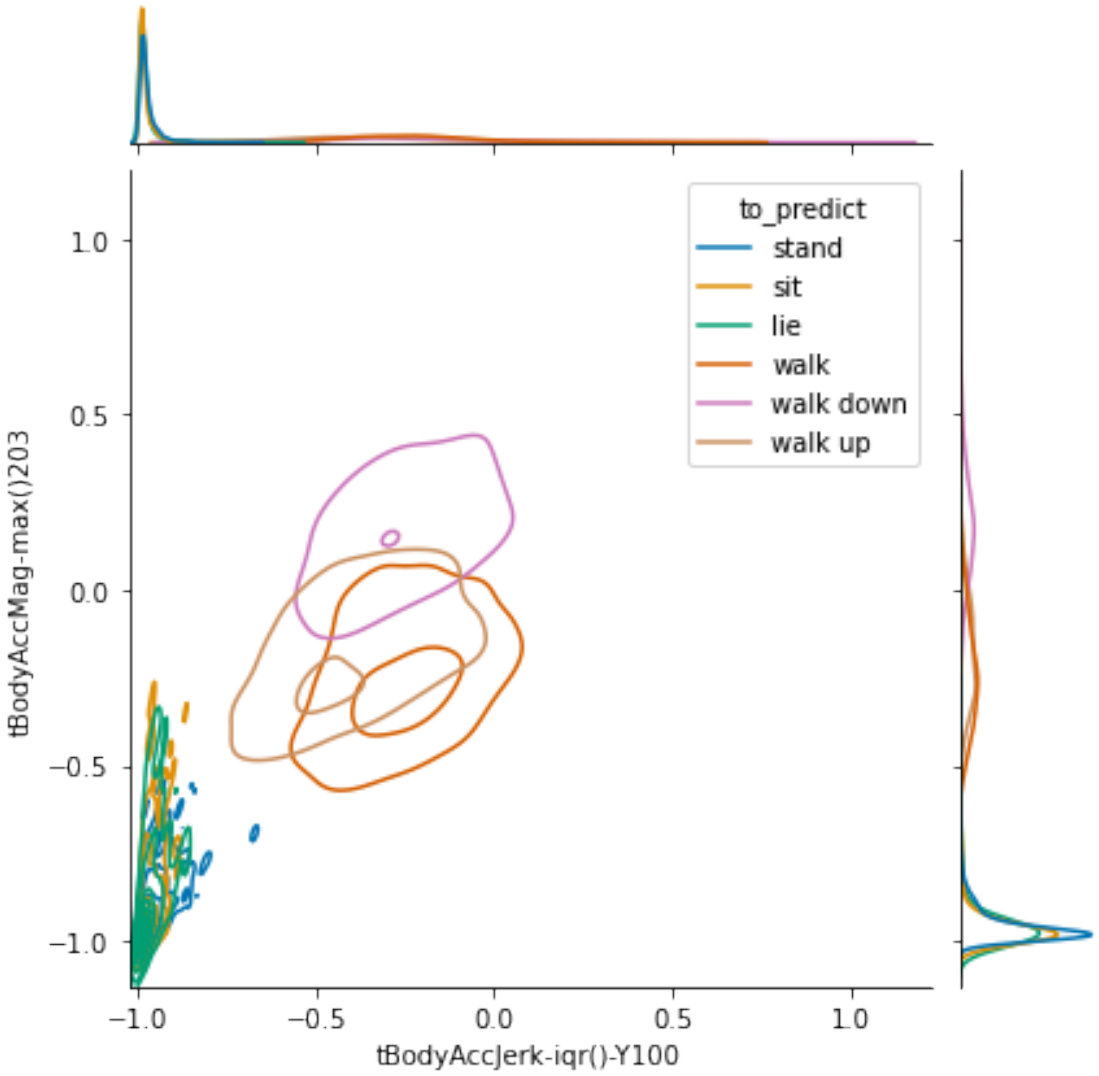
[60]:
```
from matplotlib.pyplot import figure
figure(num=None, figsize=(8, 6), dpi=80)

corrMatrix = merged_train.corr()
sns.heatmap(corrMatrix)
plt.show()
```



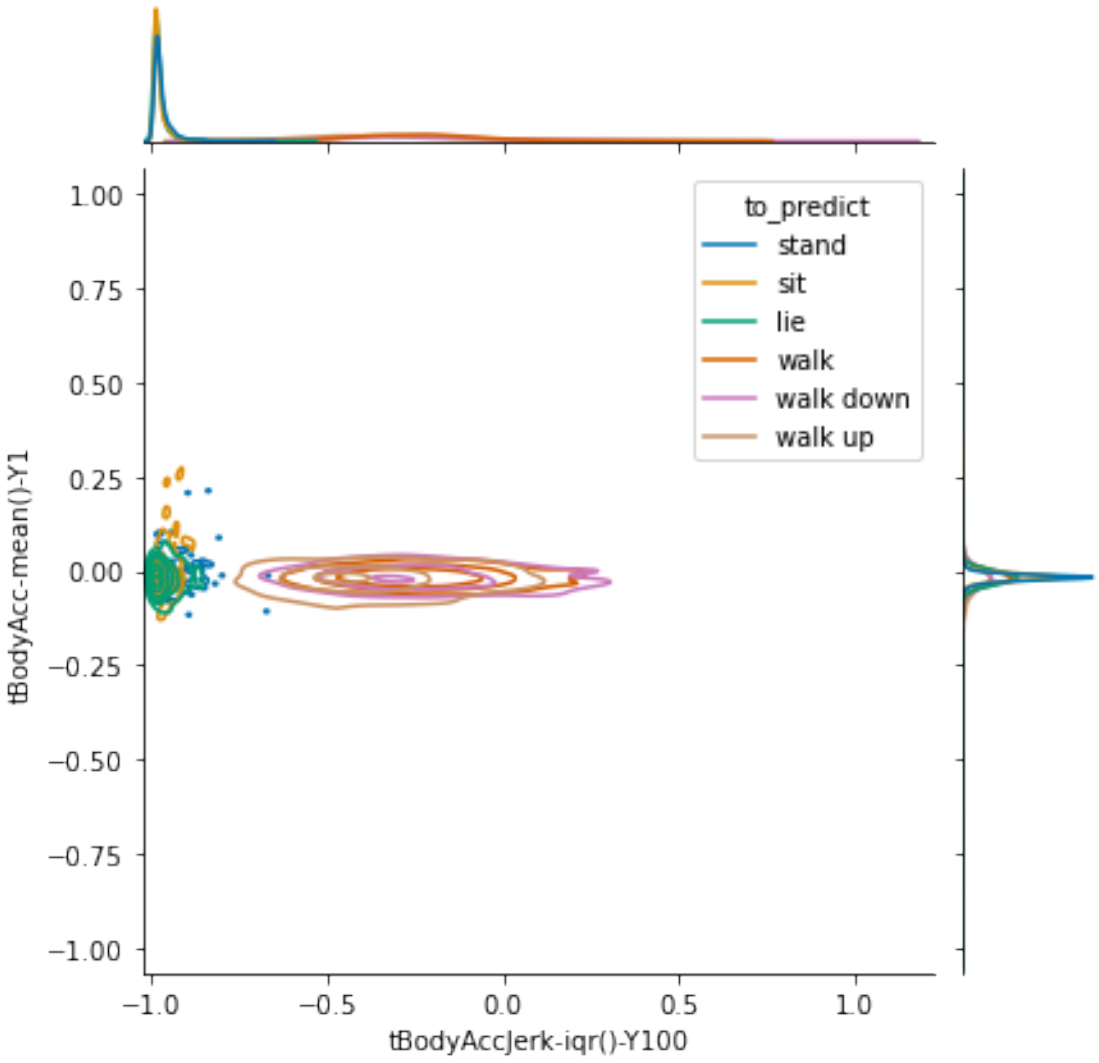
[224]:
```
sns.jointplot(
    data= merged_train,
    x="tBodyAccJerk-iqr()-Y100",
    y='tBodyAccMag-max()203',
    hue="to_predict",
    kind="kde",
    palette = "colorblind"
)
```

[224]: <seaborn.axisgrid.JointGrid at 0x7f946b04a460>



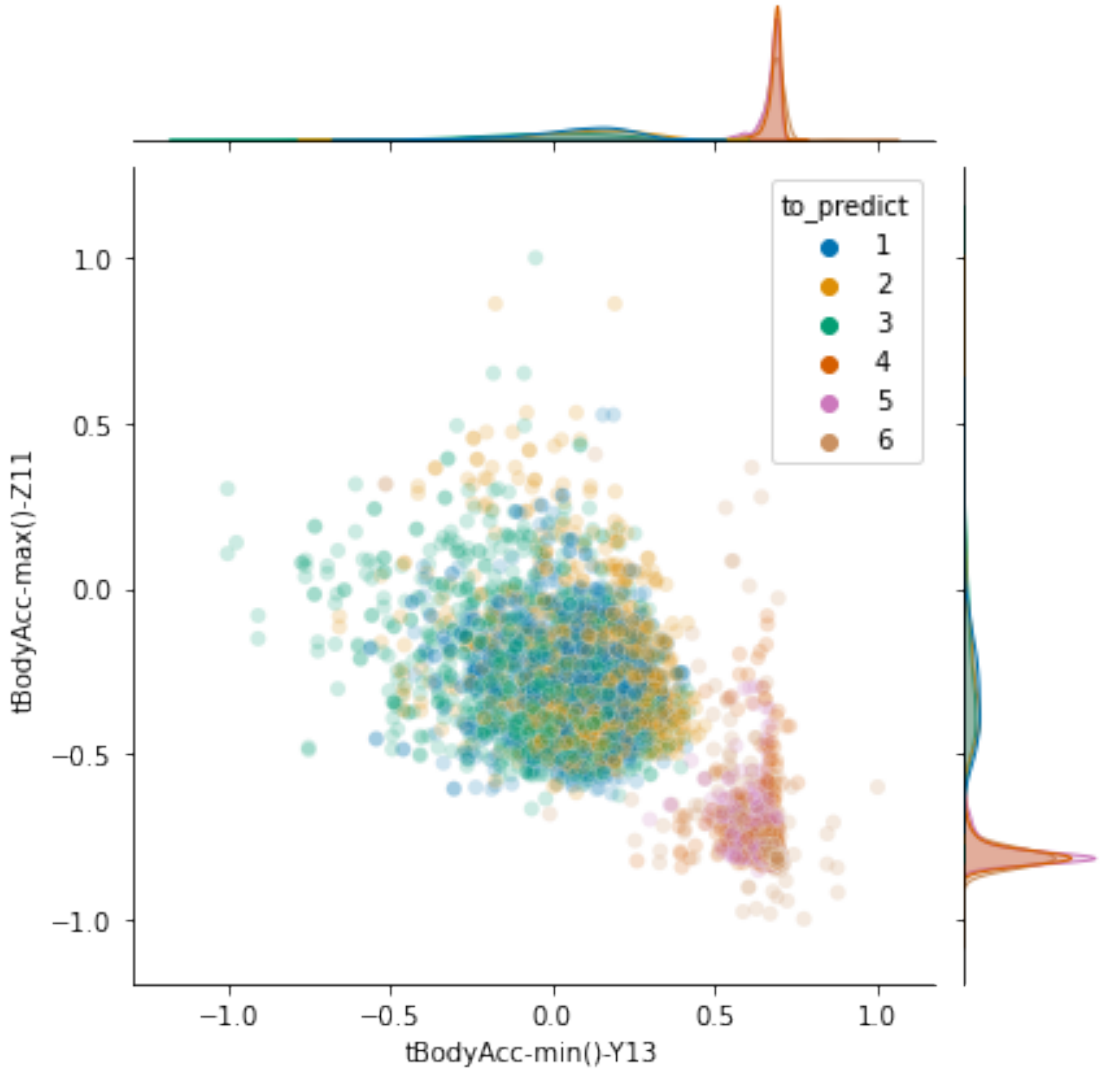
[225]:
```
sns.jointplot(
    data= merged_train,
    x="tBodyAccJerk-iqr()-Y100",
    y='tBodyAcc-mean()-Y1',
    hue="to_predict",
    kind="kde",
    palette = "colorblind"
)
```

[225]: <seaborn.axisgrid.JointGrid at 0x7f946af8a8b0>



[273]:
```
sns.jointplot(
    data= merged_train,
    x="tBodyAcc-min()-Y13",
    y='tBodyAcc-max()-Z11',
    hue="to_predict",
    #kind="kde",
    alpha=0.2,
    palette = "colorblind"
)
```

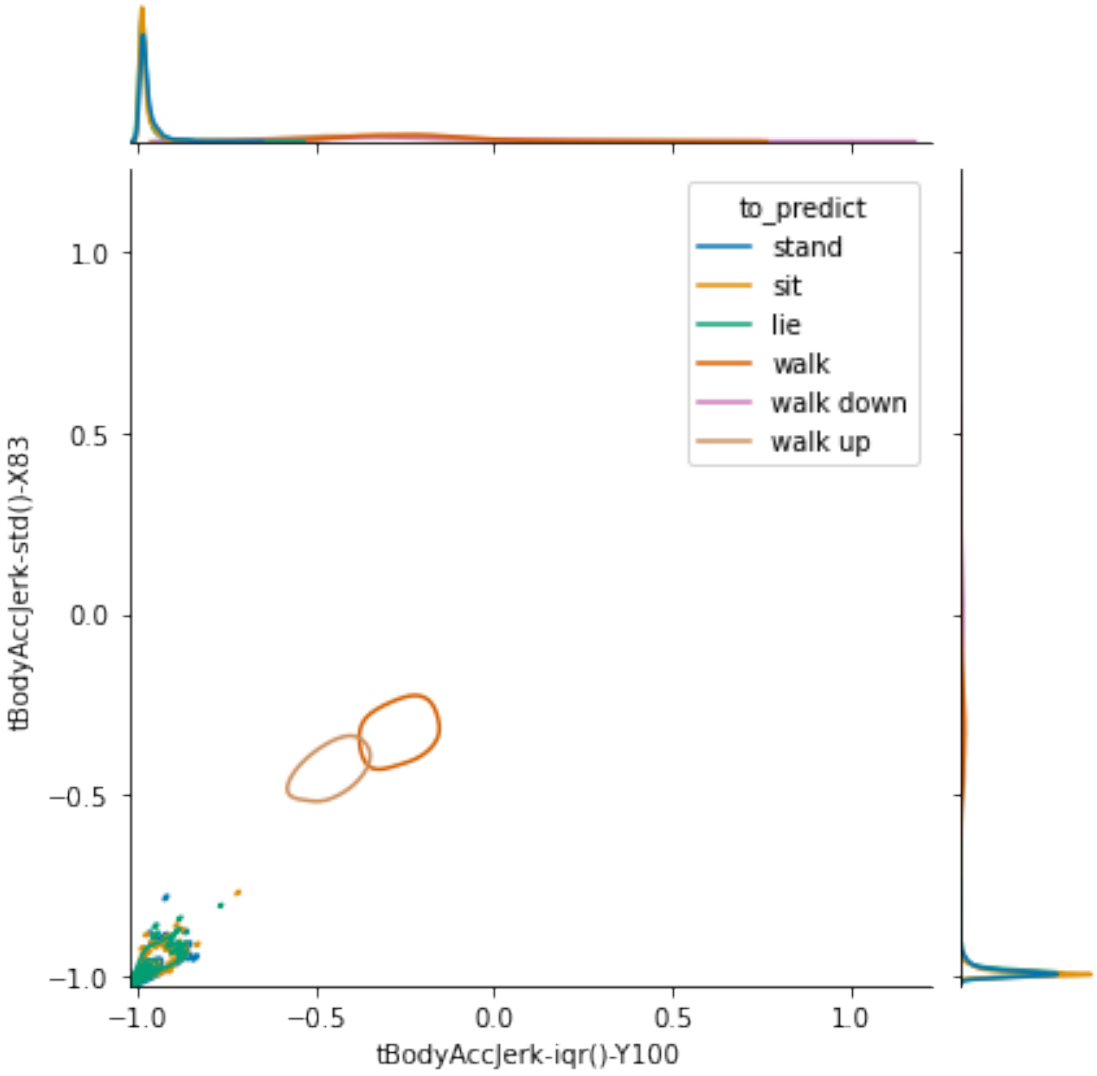
[273]: <seaborn.axisgrid.JointGrid at 0x7f942d5ac820>



[227]:
```
sns.jointplot(
    data= merged_train,
    x="tBodyAccJerk-iqr()-Y100",
    y='tBodyAccJerk-std()-X83',
    hue="to_predict",
    kind="kde",
    palette = "colorblind"
)
```

```
/home/kurowskik/anaconda3/lib/python3.8/site-
packages/seaborn/distributions.py:1181: UserWarning: No contour levels were
found within the data range.
  cset = contour_func(
```

[227]: <seaborn.axisgrid.JointGrid at 0x7f946acec610>

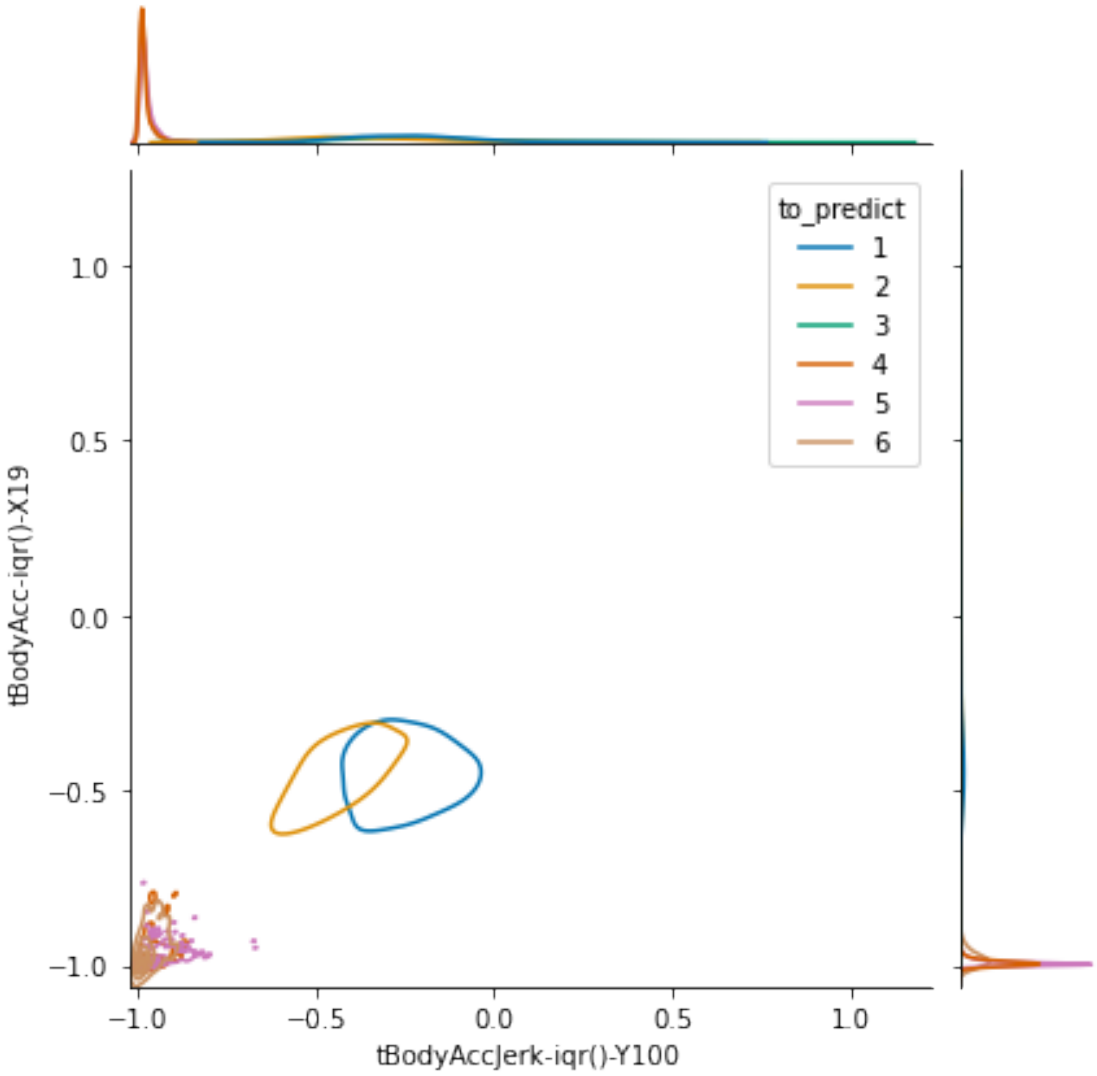


[65]:
```
sns.jointplot(
    data= merged_train,
    x="tBodyAccJerk-iqr()-Y100",
    y='tBodyAcc-iqr()-X19',
    hue="to_predict",
    kind="kde",
    palette = "colorblind"
)
```

```
/home/kurowskik/anaconda3/lib/python3.8/site-
packages/seaborn/distributions.py:1181: UserWarning: No contour levels were
found within the data range.
```

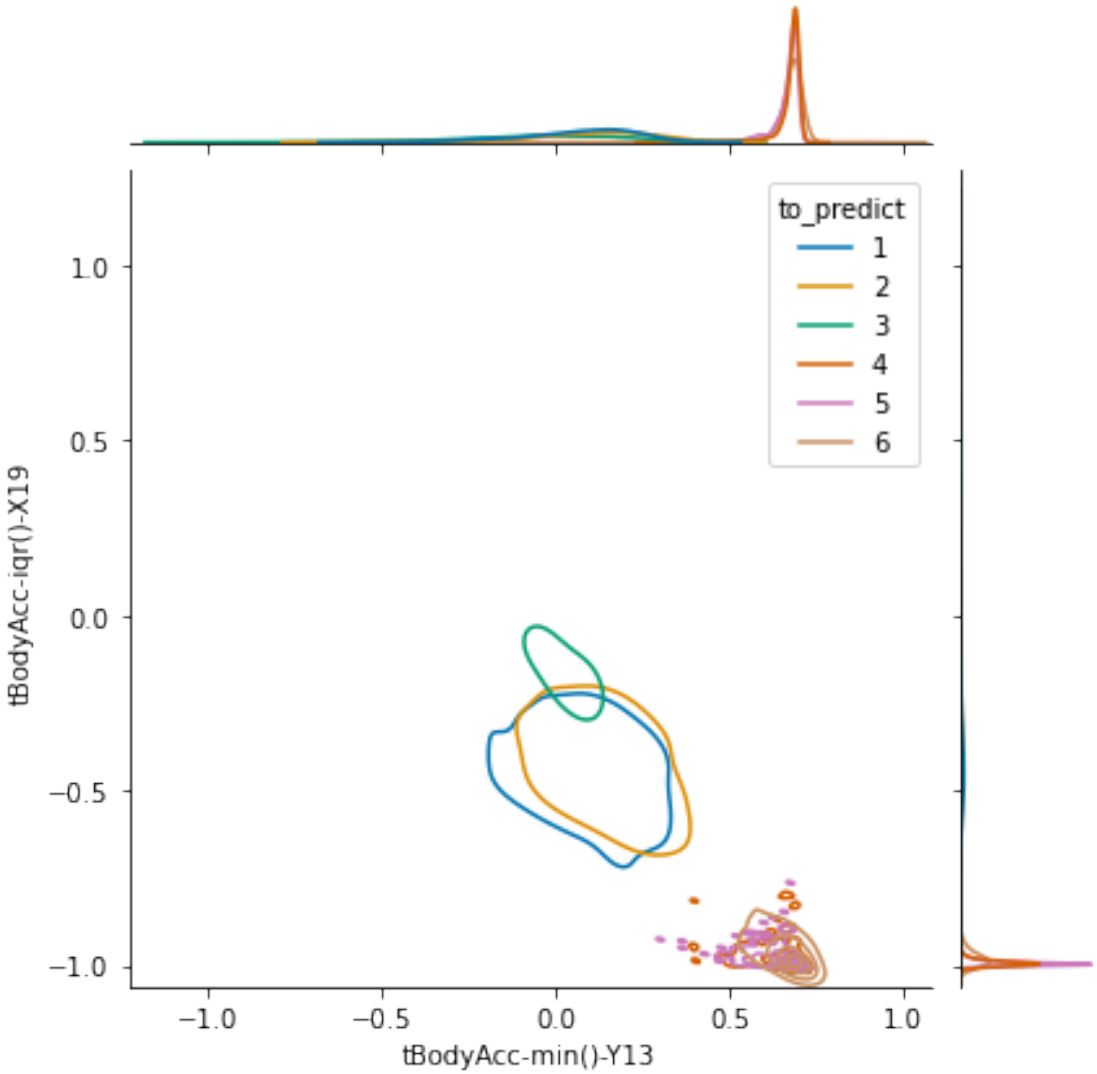
```
    cset = contour_func(
```

[65]: <seaborn.axisgrid.JointGrid at 0x7f94463e1ee0>



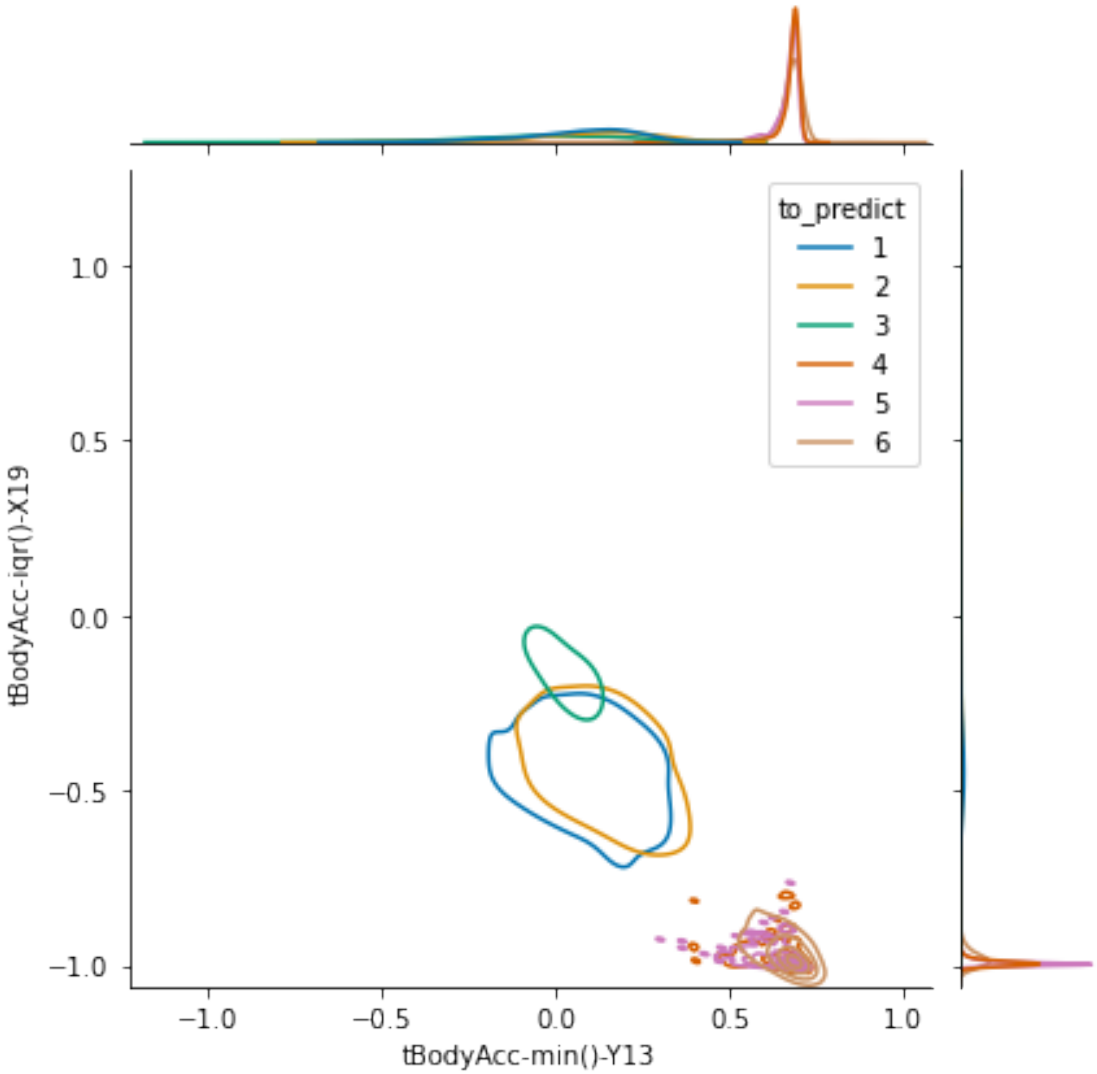
[66]:
```
sns.jointplot(
    data= merged_train,
    x="tBodyAcc-min()-Y13",
    y='tBodyAcc-iqr()-X19',
    hue="to_predict",
    kind="kde",
    palette = "colorblind"
)
```

[66]: <seaborn.axisgrid.JointGrid at 0x7f94462b1e50>



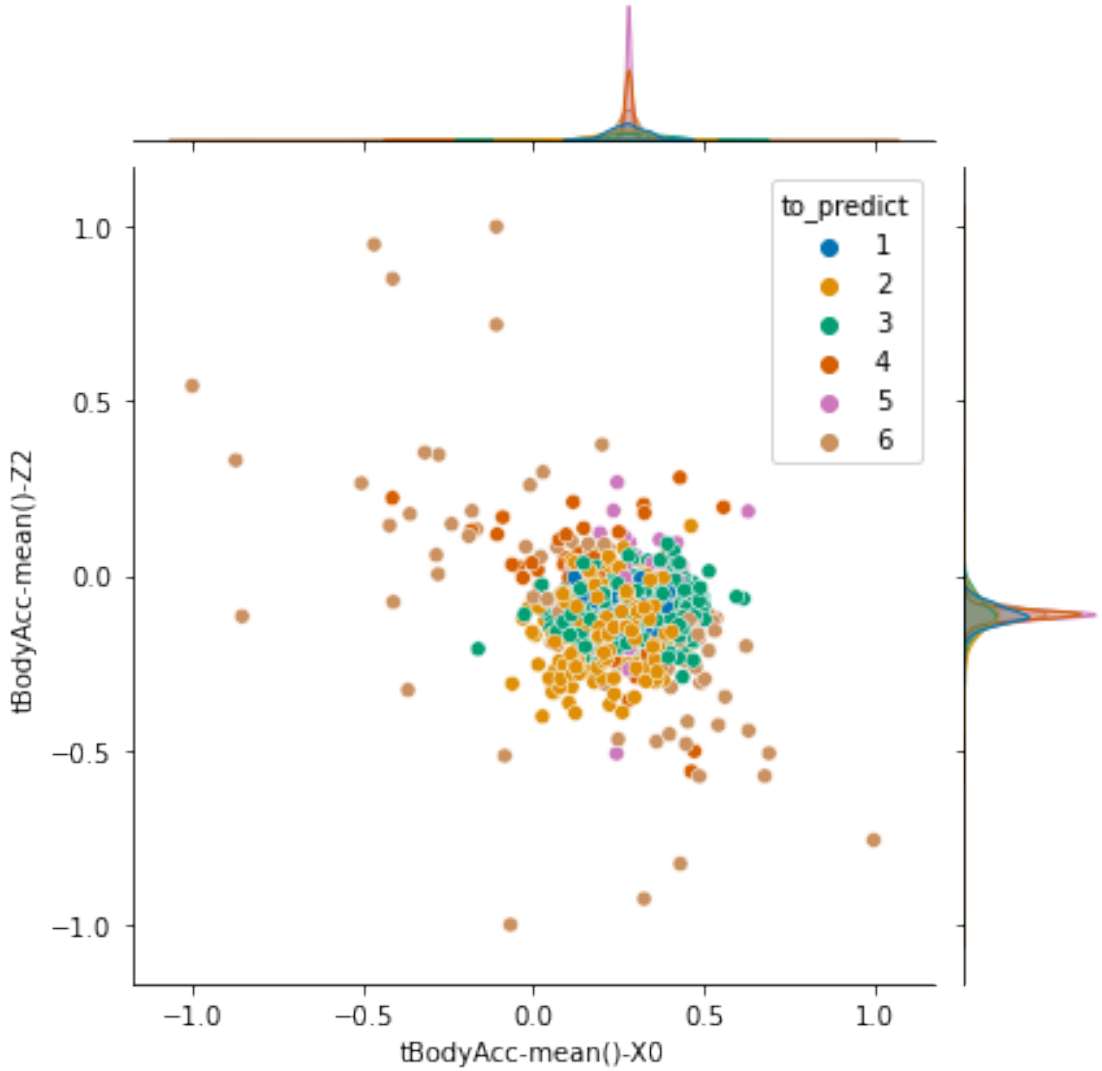
[73]:
```
sns.jointplot(
    data= merged_train,
    x="tBodyAcc-min()-Y13",
    y='tBodyAcc-iqr()-X19',
    hue="to_predict",
   kind="kde",
    palette = "colorblind"
)
```

[73]: <seaborn.axisgrid.JointGrid at 0x7f9444ea8e20>



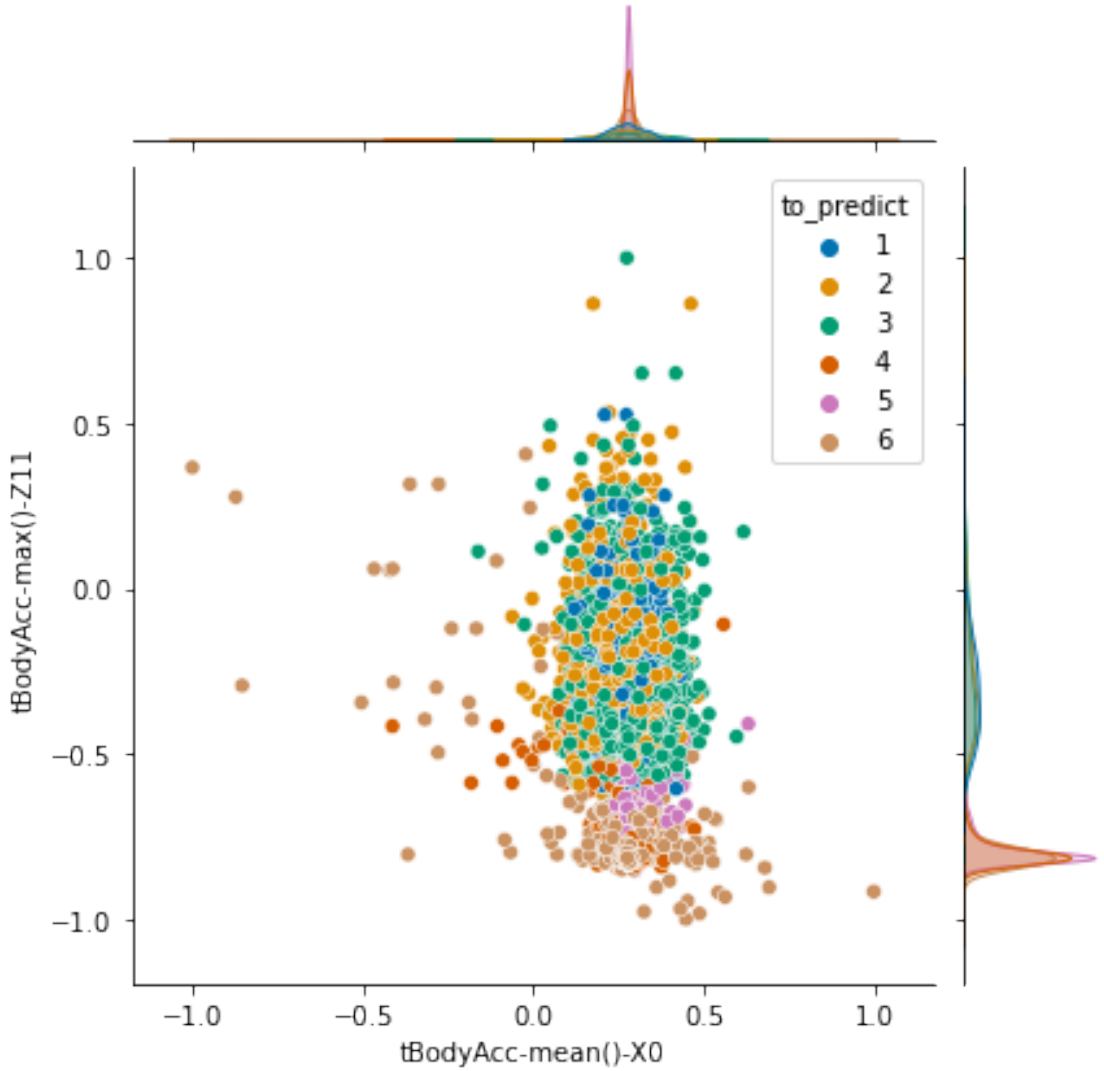
[71]:
```
sns.jointplot(
    data=merged_train,
    x="tBodyAcc-mean()-X0",
    y="tBodyAcc-mean()-Z2",
    hue = "to_predict",
palette = "colorblind",
    #kind = "kde"
)
```

[71]: <seaborn.axisgrid.JointGrid at 0x7f9445112a90>



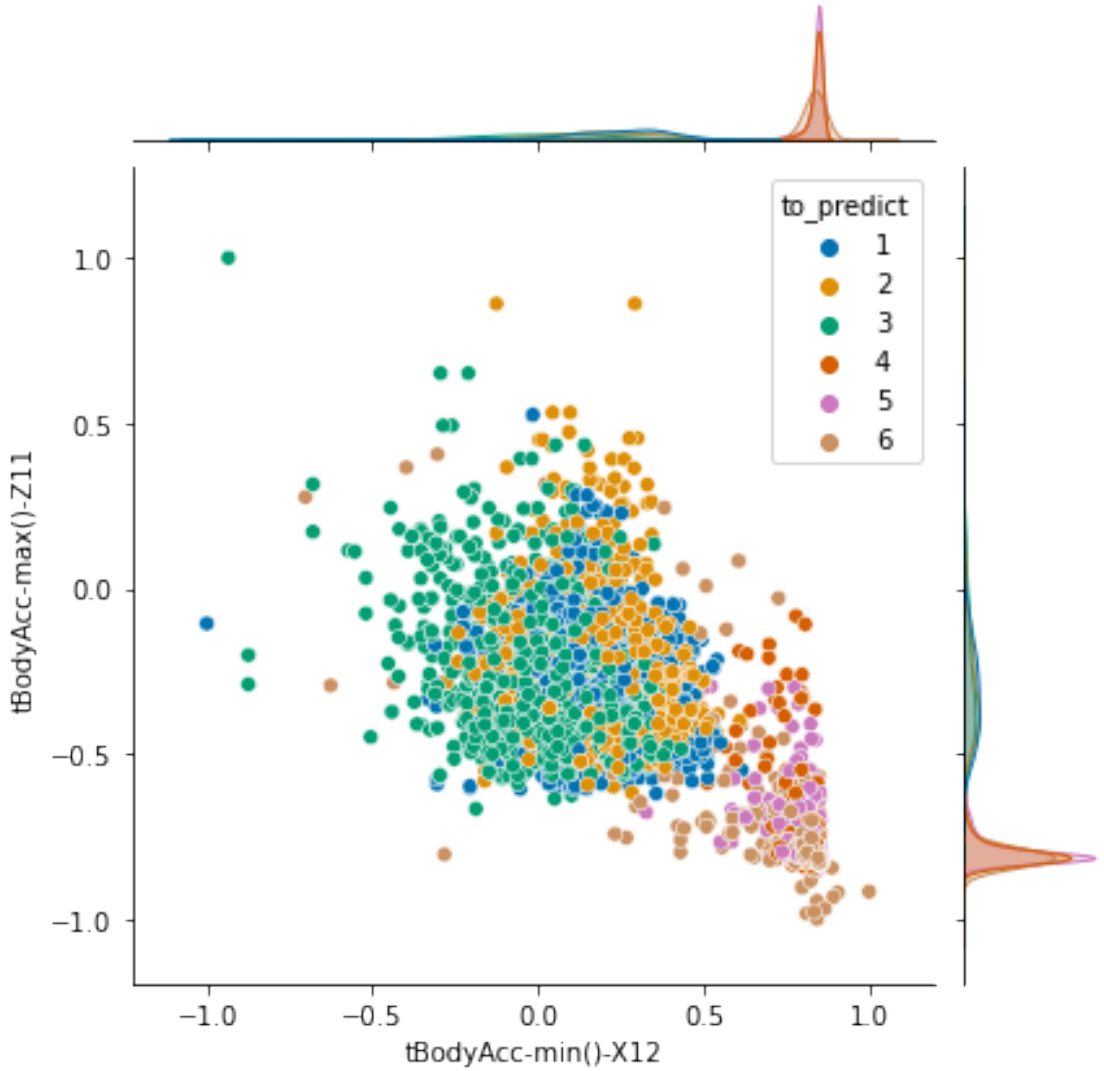
[74]:
```
sns.jointplot(
    data=merged_train,
    x="tBodyAcc-mean()-X0",
    y="tBodyAcc-max()-Z11",
    hue = "to_predict",
palette = "colorblind")
```

[74]: <seaborn.axisgrid.JointGrid at 0x7f9444e80400>



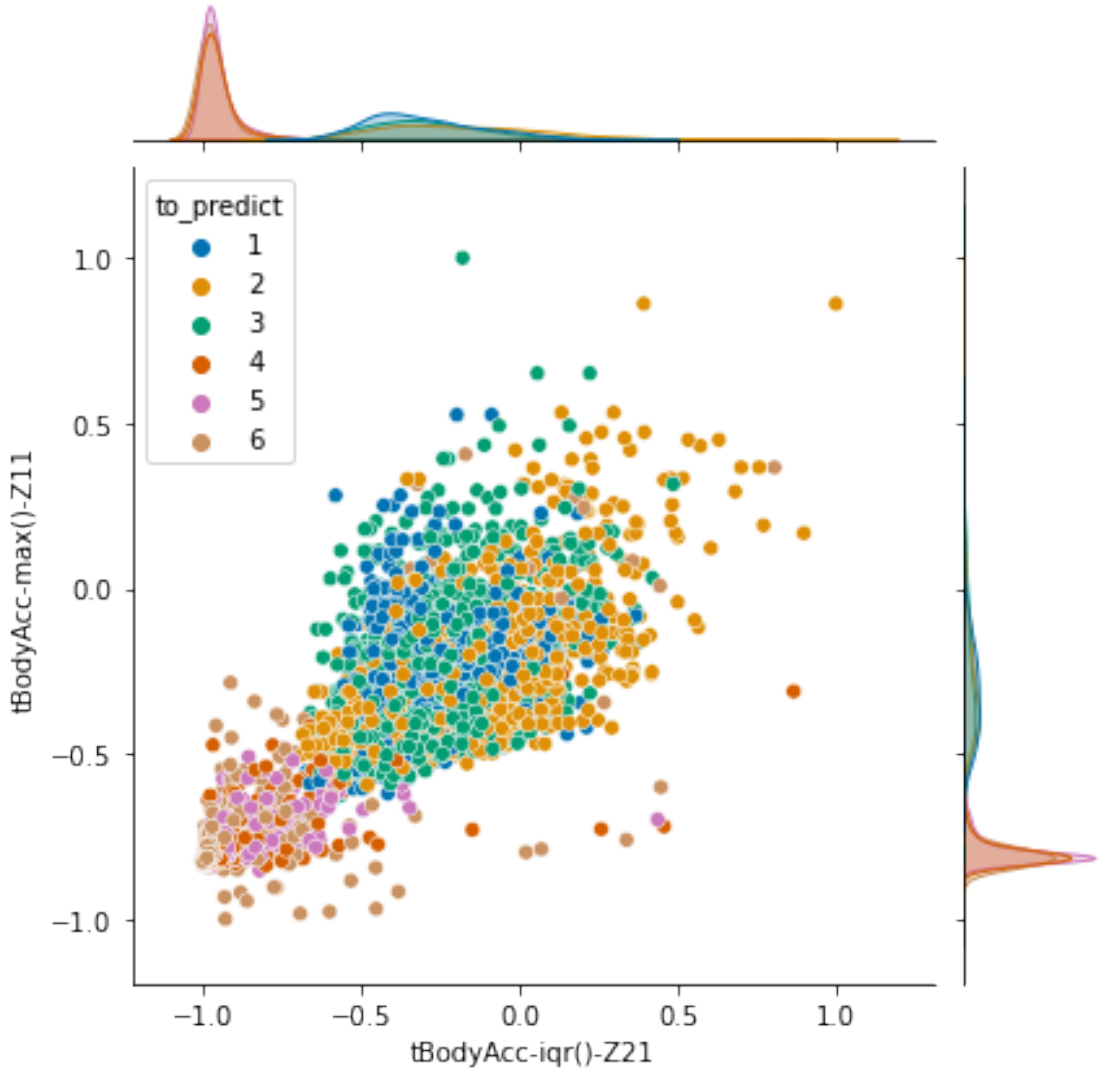
[79]:
```
sns.jointplot(
    data=merged_train,
    x="tBodyAcc-min()-X12",
    y="tBodyAcc-max()-Z11",
    hue = "to_predict",
    palette = "colorblind",
   # kind = "kde"
)
```

[79]: <seaborn.axisgrid.JointGrid at 0x7f9443f4b100>



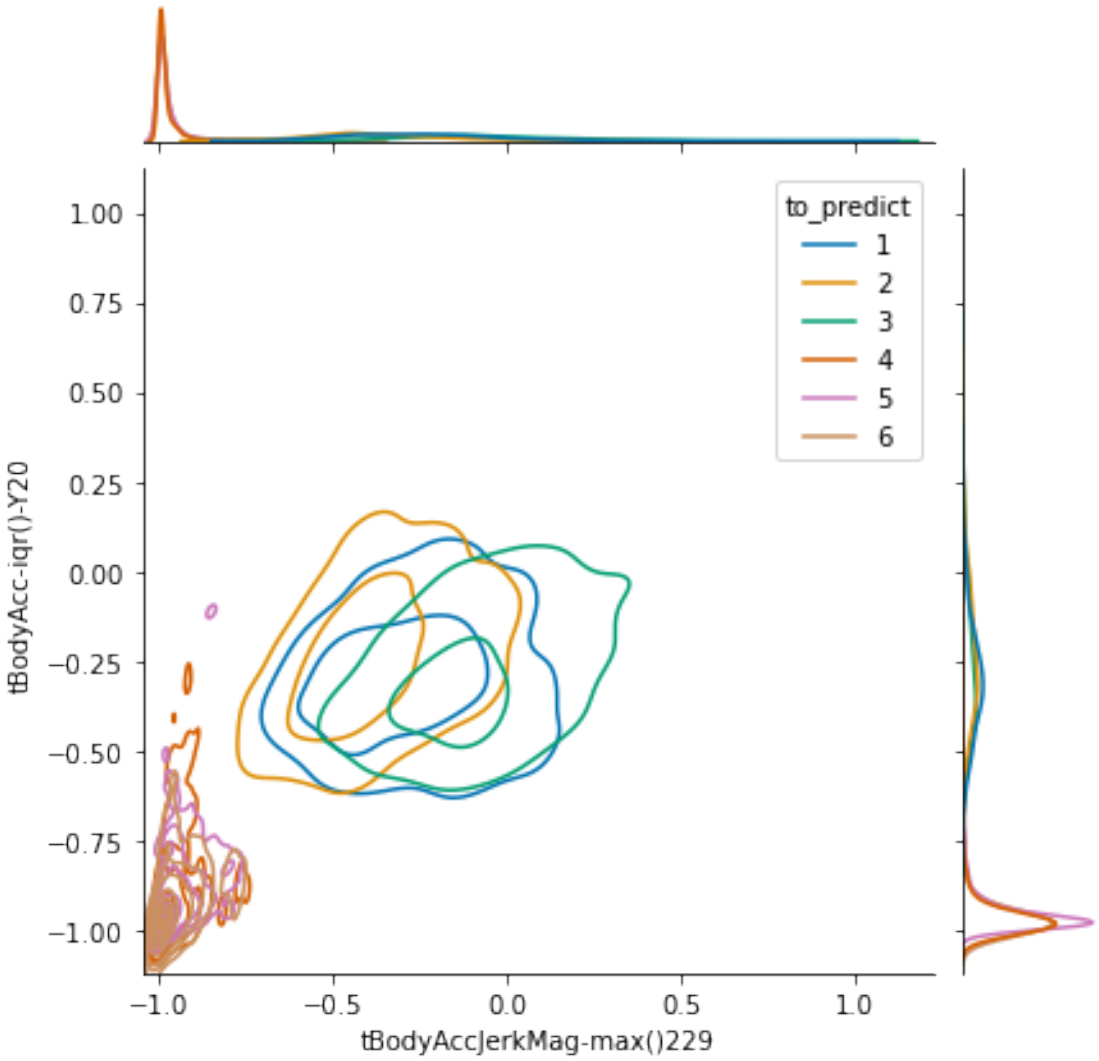
[83]:
```
sns.jointplot(
    data=merged_train,
    x="tBodyAcc-iqr()-Z21",
    y="tBodyAcc-max()-Z11",
    hue = "to_predict",
palette = "colorblind",
    #kind = "kde"
)
```

[83]: <seaborn.axisgrid.JointGrid at 0x7f94439ee3a0>



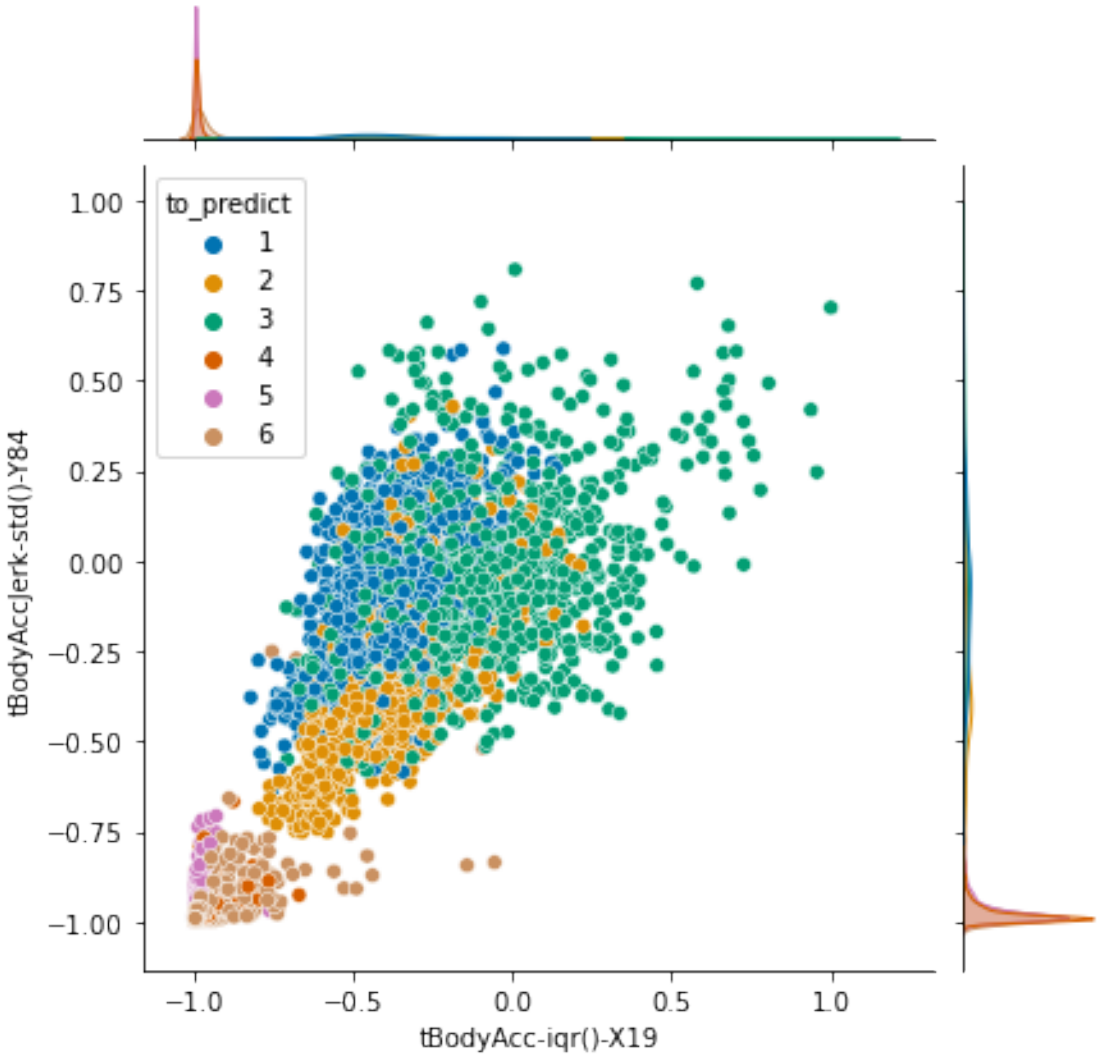
[87]:
```
sns.jointplot(
    data=merged_train,
    x="tBodyAccJerkMag-max()229",
    y="tBodyAcc-iqr()-Y20",
    hue = "to_predict",
palette = "colorblind",
kind = "kde"
)
```

[87]: <seaborn.axisgrid.JointGrid at 0x7f944489c220>



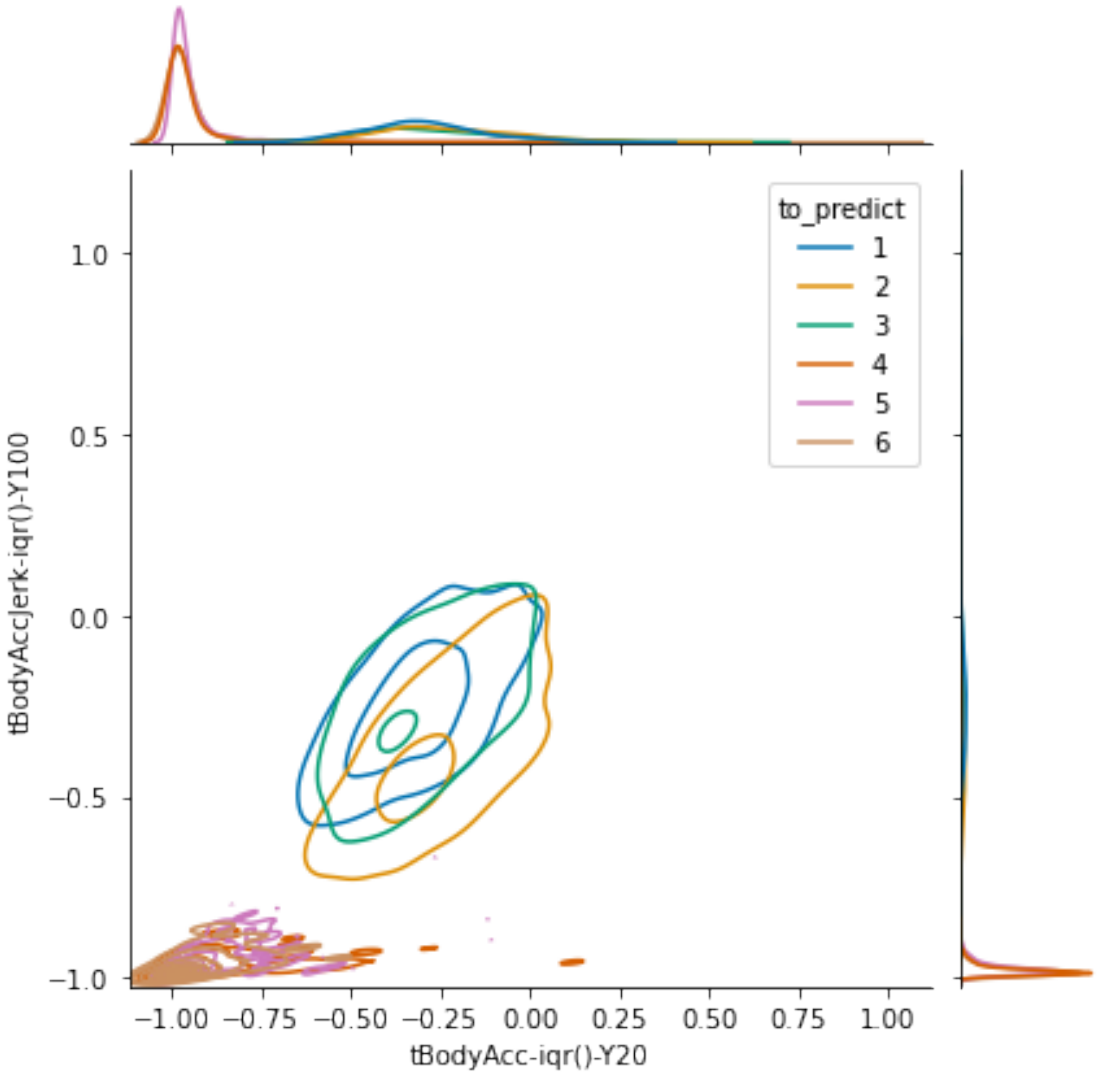
[90]:
```
sns.jointplot(
    data=merged_train,
    x="tBodyAcc-iqr()-X19",
    y="tBodyAccJerk-std()-Y84",
    hue = "to_predict",
palette = "colorblind",
#kind = "kde"
)
```

[90]: <seaborn.axisgrid.JointGrid at 0x7f9444ecfd60>



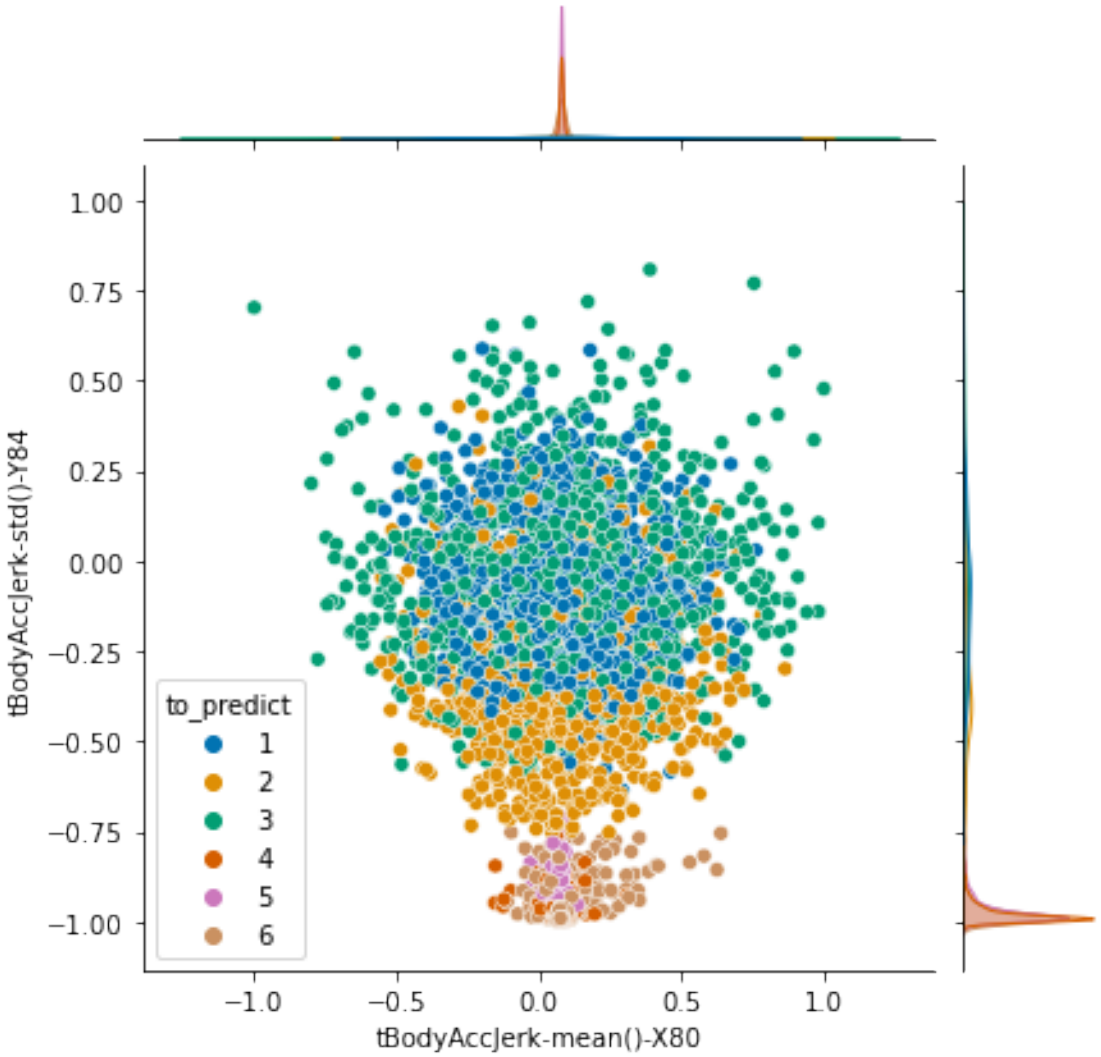
[92]:
```
sns.jointplot(
    data=merged_train,
    x="tBodyAcc-iqr()-Y20",
    y="tBodyAccJerk-iqr()-Y100",
    hue = "to_predict",
palette = "colorblind",
kind = "kde")
```

[92]: <seaborn.axisgrid.JointGrid at 0x7f9444eaba30>



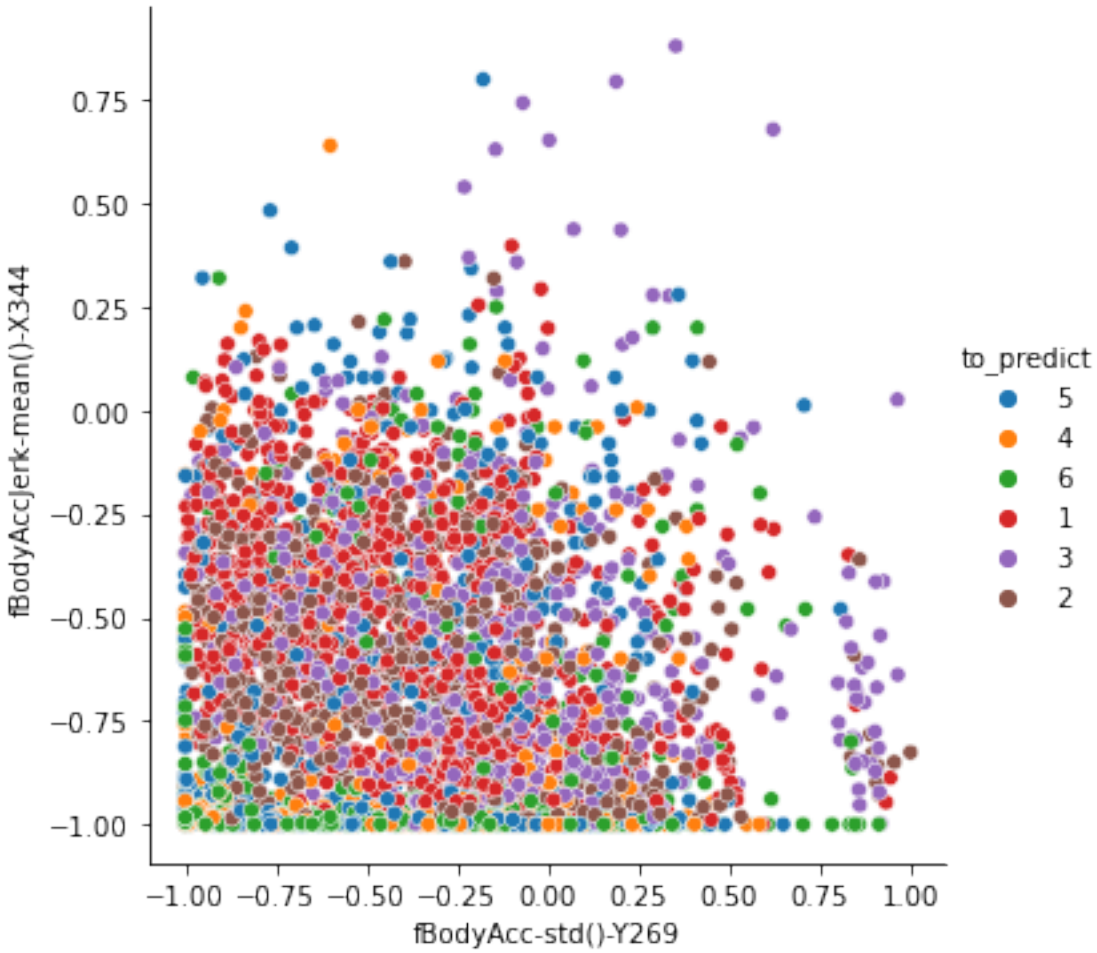
[96]:
```
sns.jointplot(
    data=merged_train,
    x="tBodyAccJerk-mean()-X80",
    y="tBodyAccJerk-std()-Y84",
    hue = "to_predict",
palette = "colorblind"
)
```

[96]: <seaborn.axisgrid.JointGrid at 0x7f9445be7190>



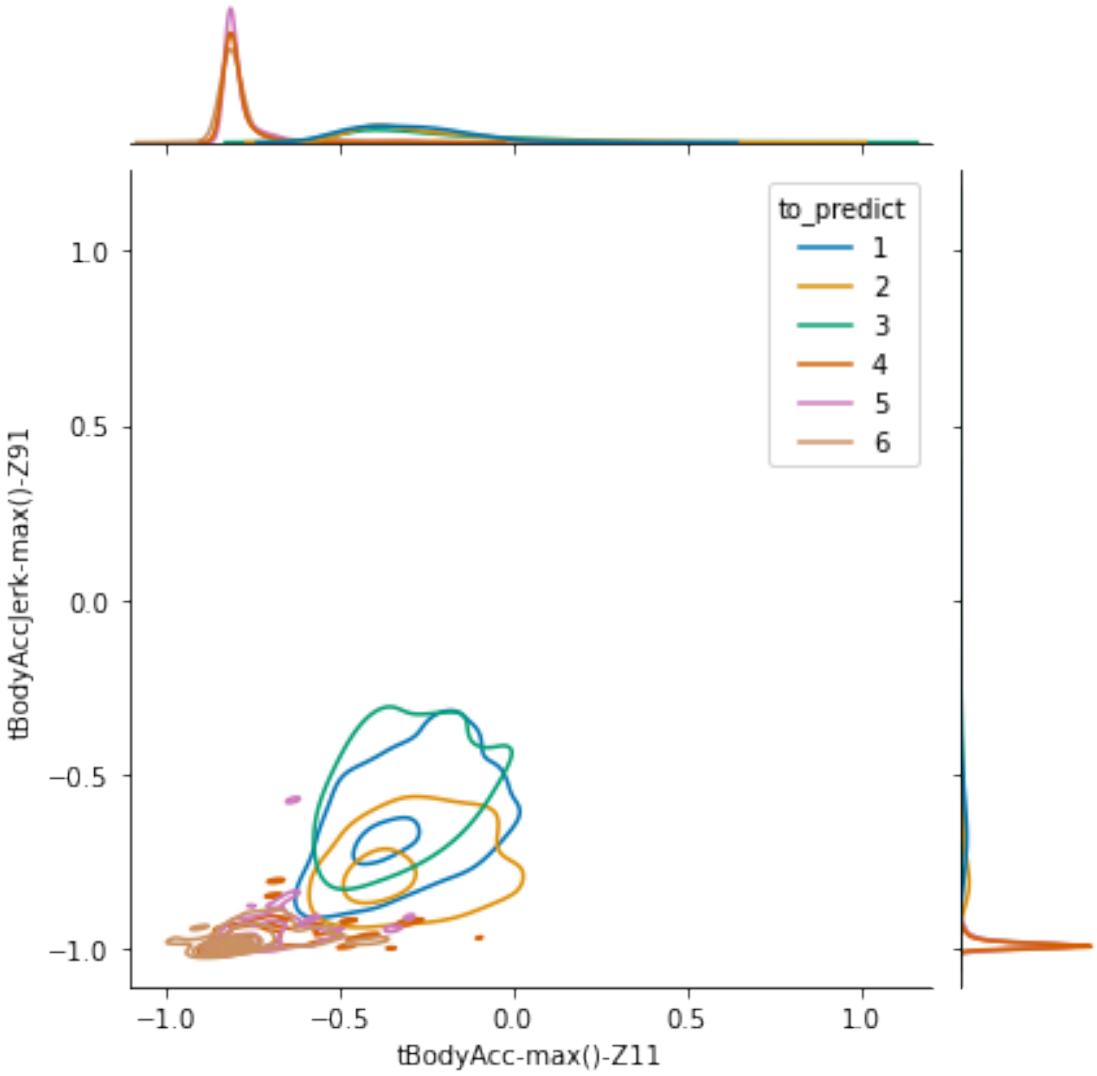
[102]:
```
sns.relplot(
    data=only_fBodyAcc,
    x="fBodyAcc-std()-Y269",
    y="fBodyAccJerk-mean()-X344",
    hue = "to_predict")
```

[102]: <seaborn.axisgrid.FacetGrid at 0x7f27198596a0>



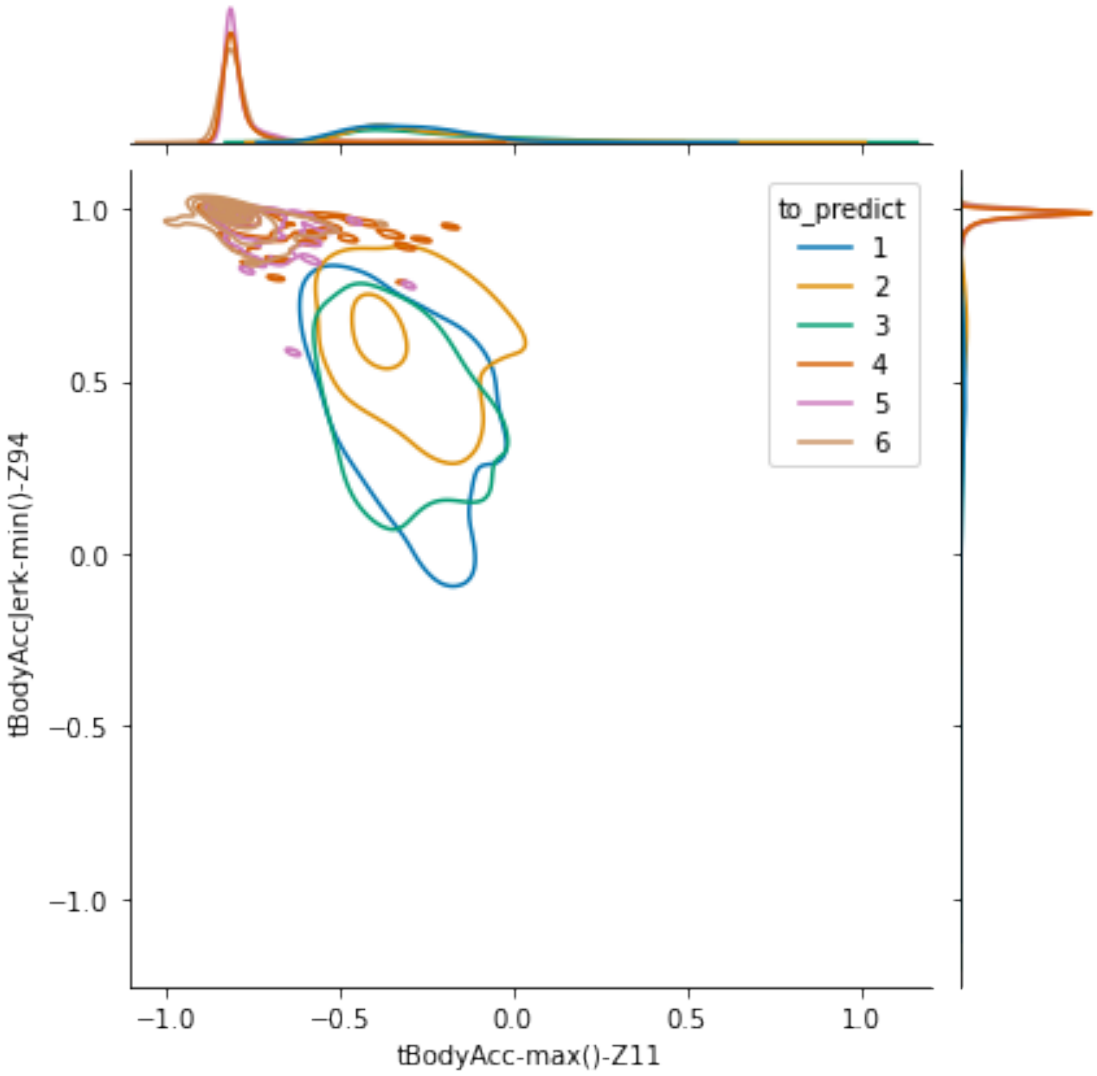
[107]:
```
sns.jointplot(
    data=merged_train,
    x="tBodyAcc-max()-Z11",
    y='tBodyAccJerk-max()-Z91',
    hue = "to_predict",
palette = "colorblind",
kind = "kde")
```

[107]: <seaborn.axisgrid.JointGrid at 0x7f9442603b50>



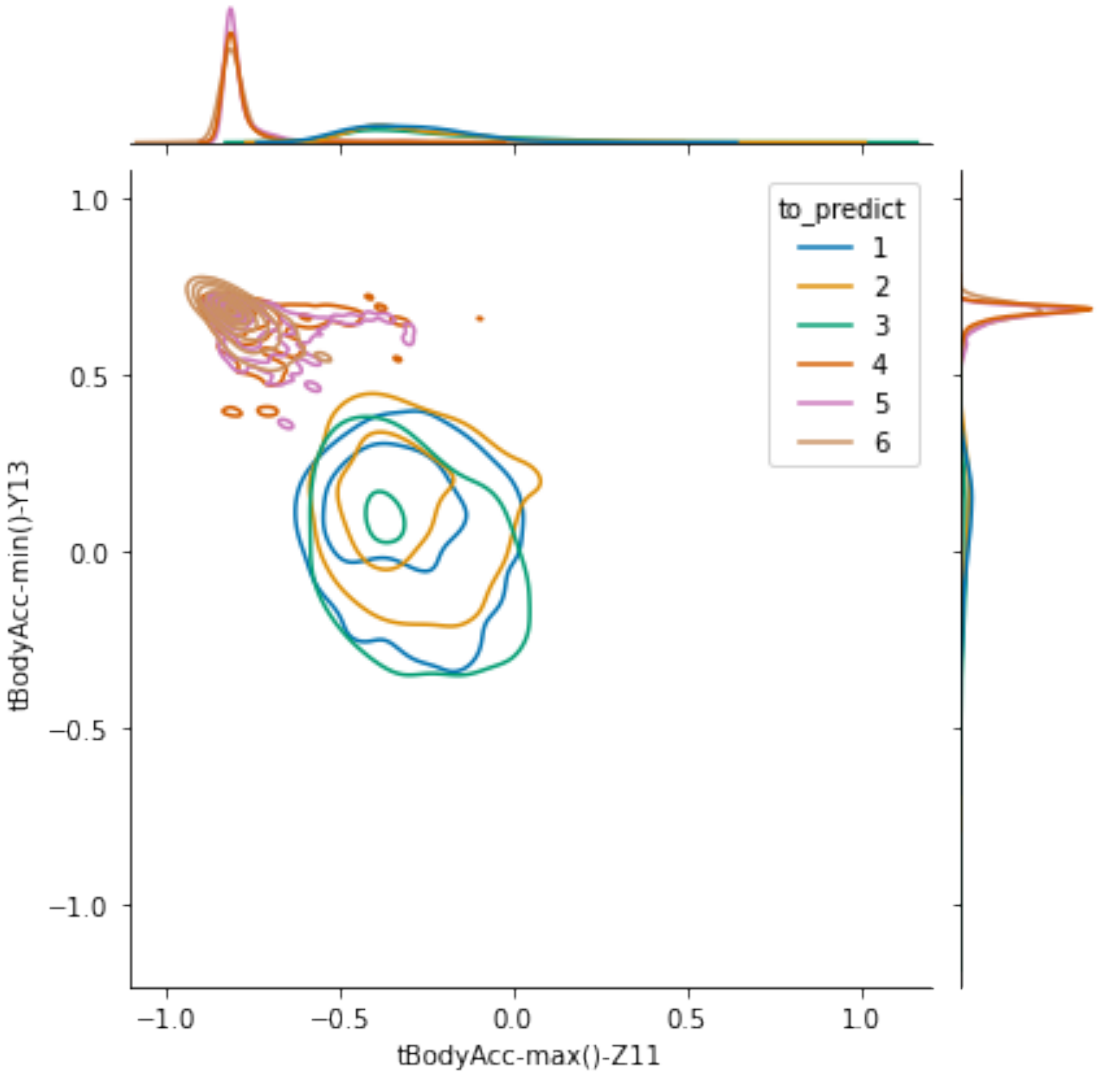
[109]:
```
sns.jointplot(
    data= merged_train,
    x="tBodyAcc-max()-Z11",
    y='tBodyAccJerk-min()-Z94',
    hue = "to_predict",
    palette = "colorblind",
    kind = "kde"
)
```

[109]: <seaborn.axisgrid.JointGrid at 0x7f944237d430>



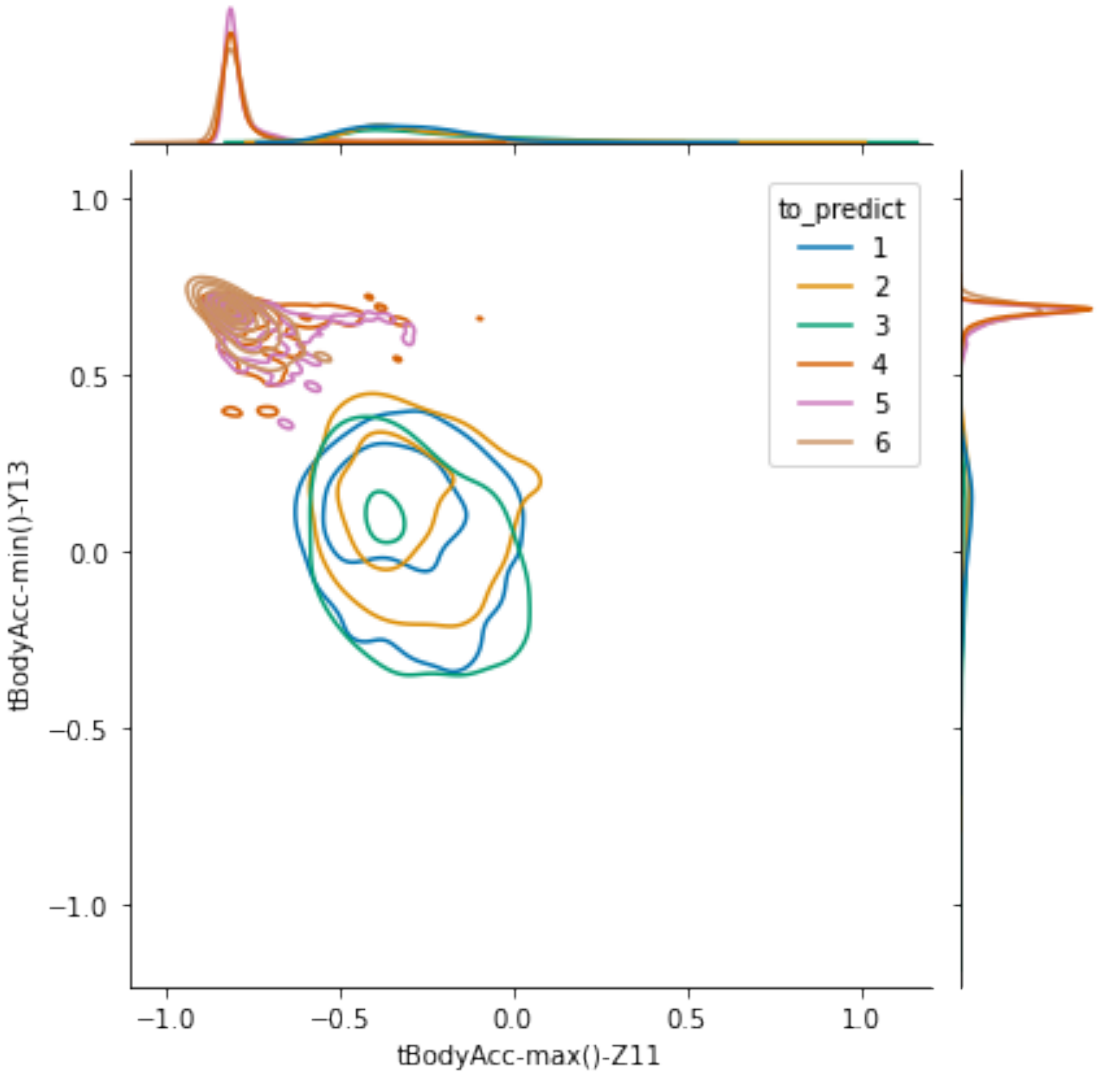
[112]:
```
sns.jointplot(
    data=merged_train,
    x="tBodyAcc-max()-Z11",
    y='tBodyAcc-min()-Y13',
    hue = "to_predict",
    palette = "colorblind",
    kind = "kde"
)
```

[112]: <seaborn.axisgrid.JointGrid at 0x7f9441ed3370>



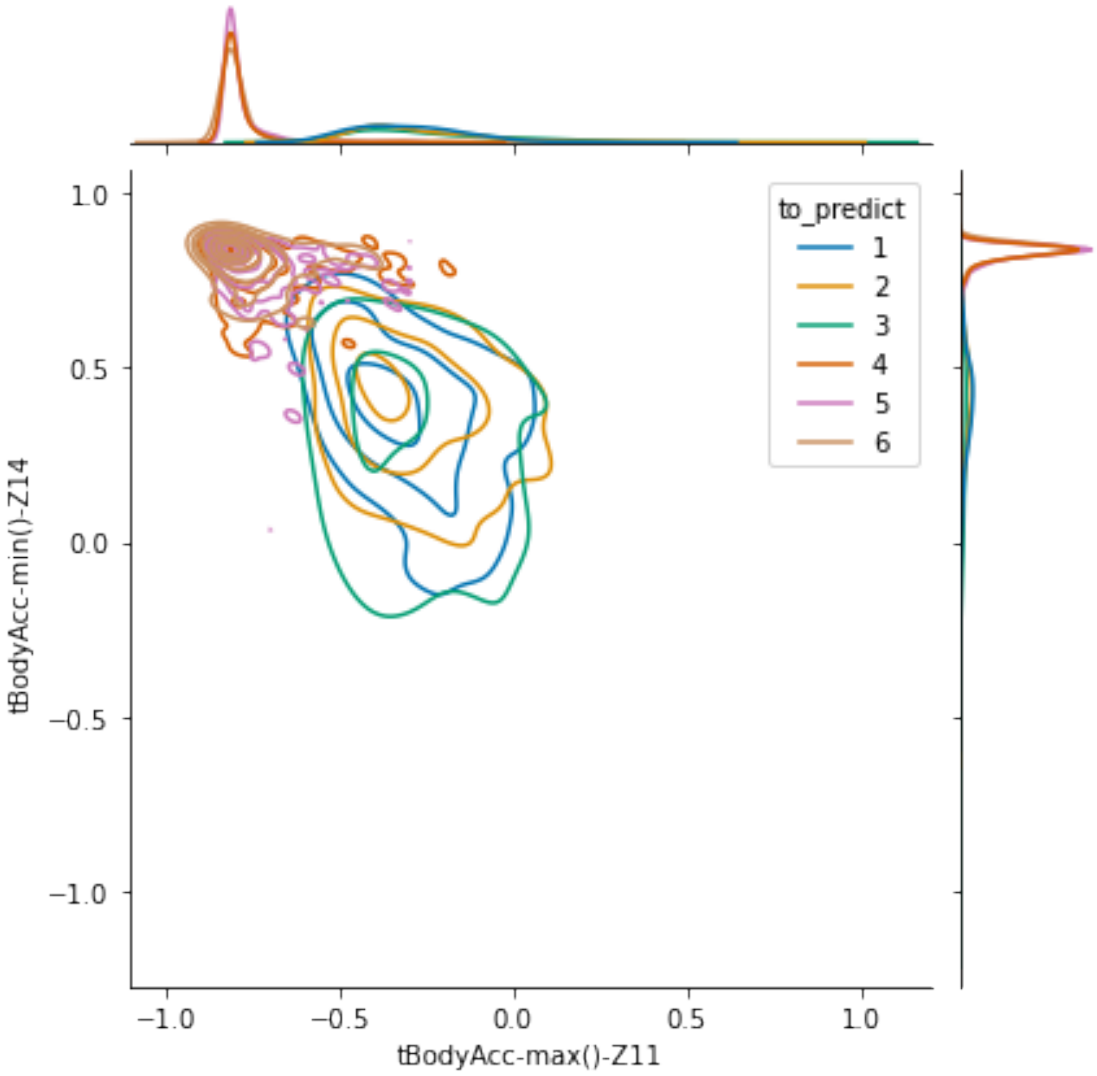
[113]:
```
sns.jointplot(
    data=merged_train,
    x="tBodyAcc-max()-Z11",
    y='tBodyAcc-min()-Y13',
    hue = "to_predict",kind="kde",
palette = "colorblind",
    #kind = "kde"
)
```

[113]: <seaborn.axisgrid.JointGrid at 0x7f9441d43910>



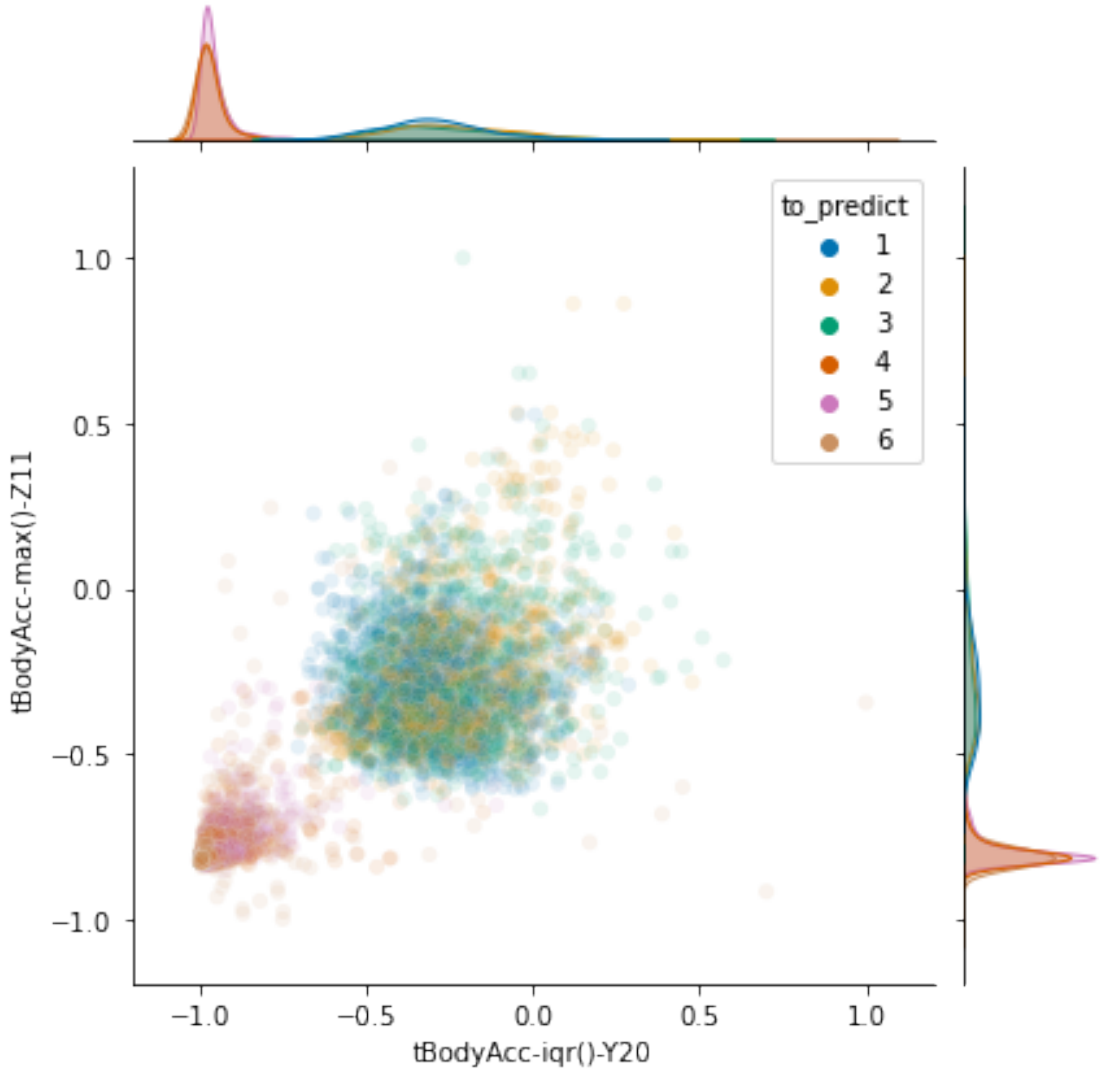
[114]:
```
sns.jointplot(
    data=merged_train,
    x="tBodyAcc-max()-Z11",
    y='tBodyAcc-min()-Z14',
    hue = "to_predict",
palette = "colorblind",
    kind = "kde"
)
```

[114]: <seaborn.axisgrid.JointGrid at 0x7f9441b59730>



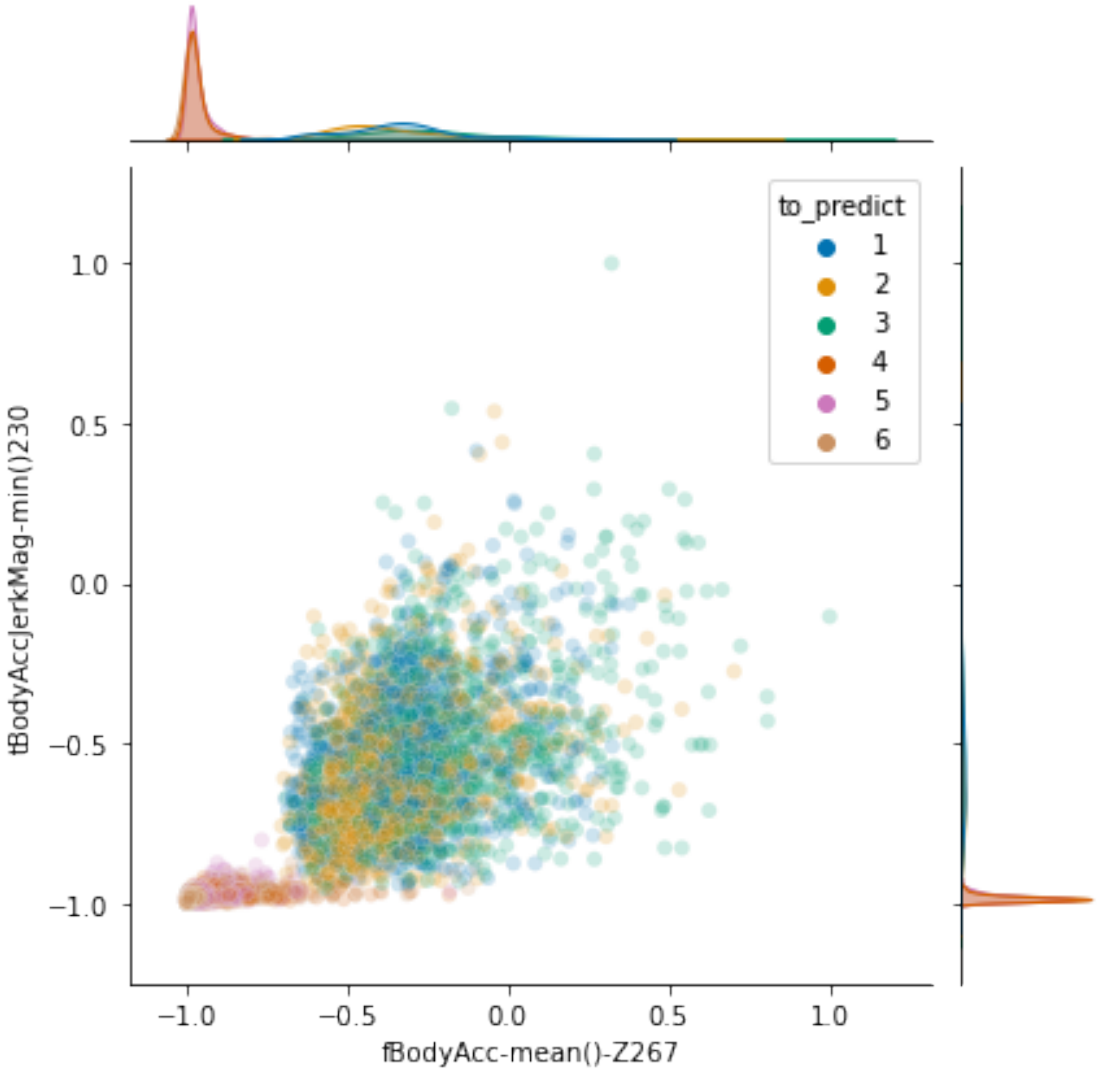
[120]:
```
sns.jointplot(
    data=merged_train,
    x="tBodyAcc-iqr()-Y20",
    y='tBodyAcc-max()-Z11',
    hue = "to_predict",
palette = "colorblind",
   # kind = "kde"
    alpha = 0.1
)
```

[120]: <seaborn.axisgrid.JointGrid at 0x7f94415847f0>



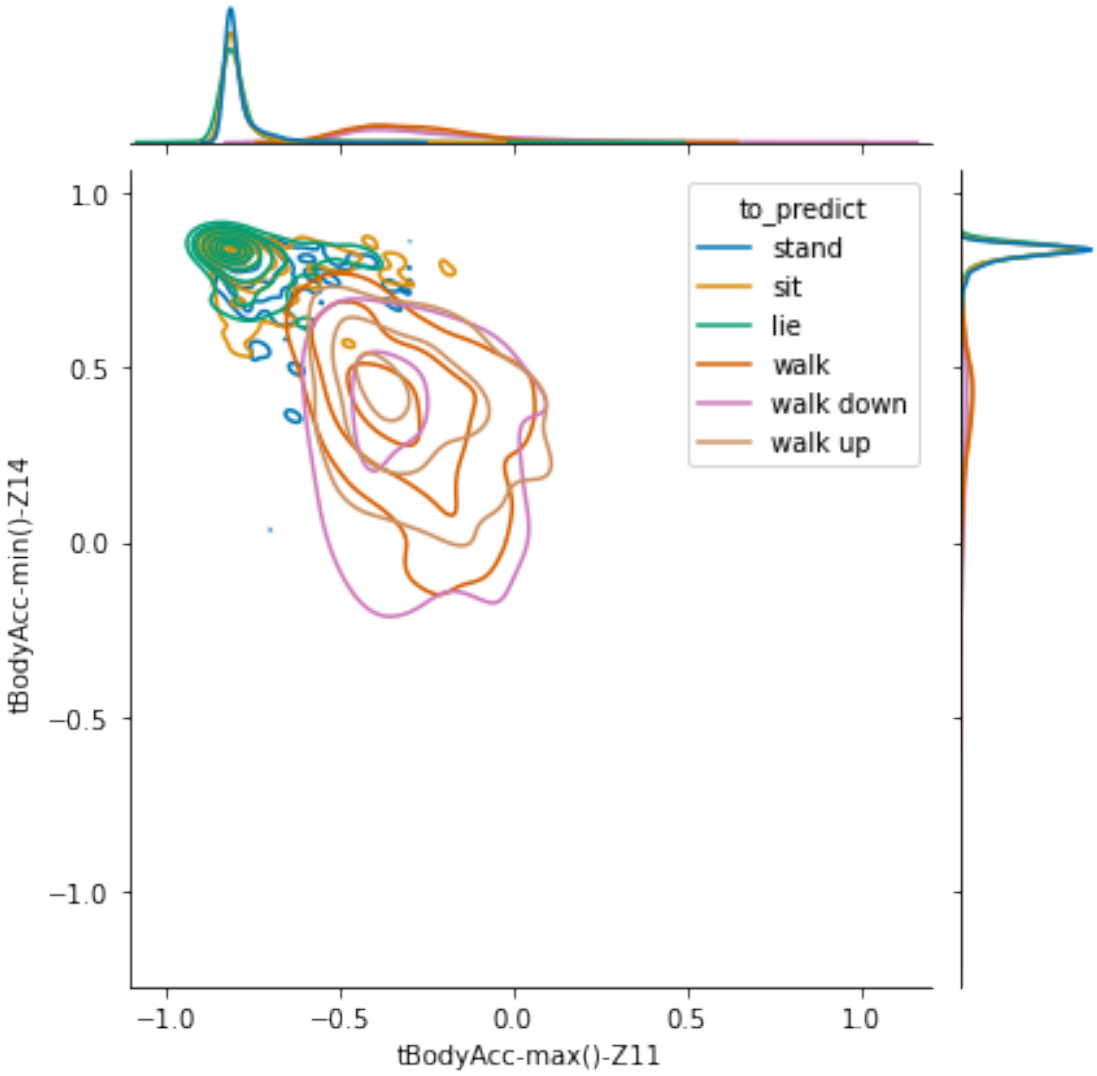
[122]:
```
sns.jointplot(
    data=merged_train,
    x="fBodyAcc-mean()-Z267",
    y='tBodyAccJerkMag-min()230',
    hue = "to_predict",
palette = "colorblind",
    #kind = "kde"
    alpha = 0.2
)
```

[122]: <seaborn.axisgrid.JointGrid at 0x7f94412cbc10>



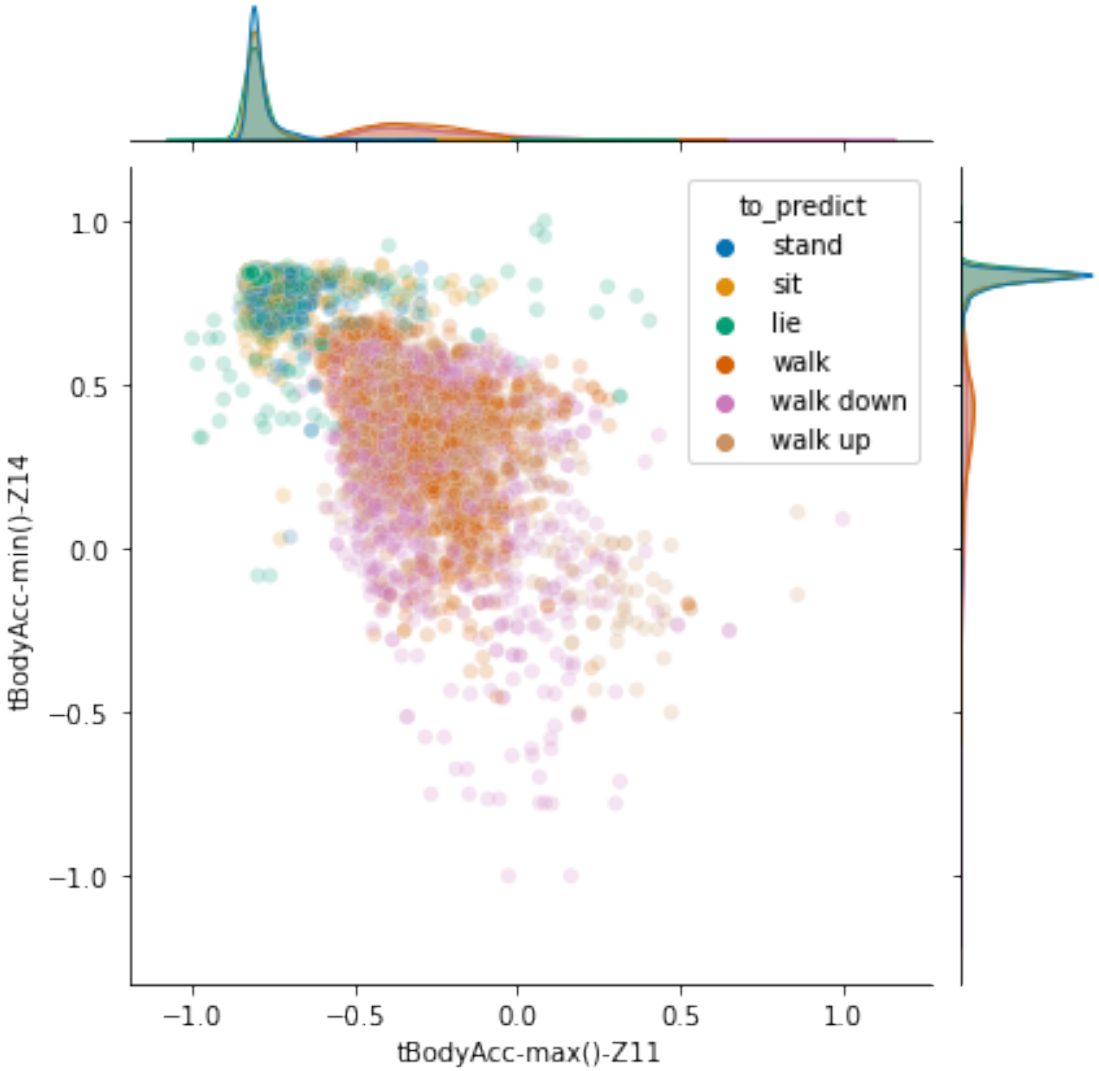
[251]:
```
sns.jointplot(
    data=merged_train,
    x="tBodyAcc-max()-Z11",
    y='tBodyAcc-min()-Z14',
    hue = "to_predict",
    kind="kde",
    palette = "colorblind"
)
```

[251]: <seaborn.axisgrid.JointGrid at 0x7f942e4f89a0>



[254]:
```
sns.jointplot(
    data=merged_train,
    x="tBodyAcc-max()-Z11",
    y='tBodyAcc-min()-Z14',
    hue = "to_predict",
    #kind="kde",
    alpha = 0.2,
    palette = "colorblind"
)
```

[254]: <seaborn.axisgrid.JointGrid at 0x7f942e36b520>


to_predict
stand
sit
lie
walk
walk down
walk up
1.0
0.5
0.0
−0.5
−1.0
tBodyAcc-min()-Z14
−1.0
−0.5
0.0
0.5
1.0
tBodyAcc-max()-Z11