

Auto_factor_per_feature

January 12, 2021

```
[1]: import sys
     sys.path.append("../")
     from ortho_lib3_Copy2 import *

[2]: exercises = Exercises.load('../Pickle/
     ↪def_exercises_sliced_transformed_data_all_categories.pickle')

[3]: # exercises = exercises.drop_category(1)
     # exp = Experiment(exercises, y_condition= lambda y: np.all([y != 'Category_1',
     ↪y != 'Category_2'], axis=0))
     exp = Experiment(exercises, y_condition= lambda y: (y != 'Category_1'))
     columns = exp.cols
     results = exp.fit_inliers_auto_factor_ensemble(columns)
```

VBox(children=(HTML(value=''), IntProgress(value=0, max=78)))

Auto ensemble (67/78): [
'angle_left_shoulder_xz_max_AF',
'angle_right_shoulder_xz_max_AF',
'angle_right_shoulder_xz_max_RF',
'angle_left_shoulder_yz_max_AB',
'angle_right_shoulder_yz_max_AB',
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'diff_x_wrist_std_AF',
'diff_x_wrist_std_RF',
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'diff_y_wrist_std_RF',
'diff_y_wrist_std_AB',
'diff_y_elbow_std_AB',
'diff_z_wrist_std_AB',
'diff_z_wrist_std_AF',

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'diff_z_elbow_std_AB',
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'diff_z_elbow_std_RF',
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'z_elbow_max_AF',
'z_elbow_max_RF',
'z_wrist_max_AF',
'z_wrist_max_RF',
'x_wrist_max_EL',
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'vel_wrists_x_r_std_EL',
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'angular_acc_yz_elbow_l_mean_AB',
'angular_acc_yz_elbow_l_std_AB',
'angular_acc_yz_elbow_r_mean_AB]

```

```
[4]: # results.dump('../Pickle/results_auto_factor_7_12')
# results = Results.load('../Pickle/results_auto_factor_7_12')
```

```
[5]: results.report_auto_factor(sort='recall')
```

```
[5]:
```

	features	factor	recall	precision	accuracy
0	Auto ensemble	-	0.988095	1.0	0.990654
1	diff_y_wrist_std_AB	1.1	0.619048	1.0	0.700935
2	angular_vel_yz_elbow_r_std_AB	1.45	0.571429	1.0	0.663551
3	z_elbow_max_AB	1.45	0.571429	1.0	0.663551
4	angular_vel_xz_elbow_r_std_AF	1.65	0.559524	1.0	0.654206
..
63	z_elbow_max_RF	1.7	0.059524	1.0	0.261682
64	diff_x_shoulder_std_RF	1.2	0.047619	1.0	0.252336
65	diff_x_elbow_std_RF	1.3	0.047619	1.0	0.252336
66	diff_x_elbow_std_EL	1.35	0.035714	1.0	0.242991
67	diff_y_wrist_std_RF	1.55	0.023810	1.0	0.233645

[68 rows x 5 columns]

0.0.1 Excluded features

```
[6]: [item for item in columns if item not in results.auto_factor_ensemble.keys()]
```

```
[6]: ['angle_left_shoulder_xz_max_RF',
'diff_z_shoulder_std_AF',
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'angular_vel_xz_elbow_r_std_RF',
'angular_acc_yz_elbow_r_std_AB']
```

0.0.2 Confusion matrix

```
[7]: results.confusion_matrix()
```

```
total patients for feature 'Auto ensemble': 107 (r: 0.988, p: 1.0, a:
0.991, f1: 0.994)
true positives: 83
true negatives: 23
```

```
false positives: 0
false negatives: 1
```

0.0.3 Non-classified patients

```
[8]: results.get_false_negatives('Auto ensemble')
```

```
[8]: [(327, 'Auto ensemble')]
```

0.0.4 Classified patients per feature

```
[9]: f = results.analyze_ensemble_features()
f
```

```
[9]: {'diff_y_wrist_std_RF': [204, 230],
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```

```
[10]: results.count_ensemble_features()
```

```
[10]: {'diff_y_wrist_std_AB': 52,  
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      'angular_vel_xz_elbow_r_std_AF': 47,  
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      'z_elbow_max_AF': 43,  
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      'angular_vel_yz_elbow_l_std_AB': 42,  
      'diff_x_wrist_std_AF': 41,  
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      'angle_left_shoulder_xz_max_AF': 38,  
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      'acc_elbows_z_r_mean_AB': 37,  
      'angular_acc_xz_elbow_r_std_RF': 37,  
      'diff_y_elbow_std_AB': 36,  
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      'acc_elbows_z_l_std_AF': 36,  
      'angular_acc_xz_elbow_l_std_AF': 36,  
      'acc_elbows_z_l_mean_AF': 34,  
      'acc_elbows_z_r_std_RF': 34,
```

```

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'angular_acc_xz_elbow_l_mean_AF': 28,
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'diff_x_elbow_std_EL': 3,
'diff_y_wrist_std_RF': 2}

```

```
[11]: results.most_obvious(f)
```

```
VBox(children=(HTML(value=''), IntProgress(value=0, max=1)))
```

```
features selected for diff_y_wrist_std_AB: [203, 204, 205, 207, 208, 209, 210,
213, 214, 215, 227, 229, 232, 233, 234, 240, 303, 304, 306, 308, 309, 311, 313,
315, 317, 319, 320, 323, 324, 328, 329, 332, 334, 335, 338, 340, 401, 404, 405,
406, 407, 408, 410, 411, 414, 425, 426, 427, 429, 430, 433, 434]
```

```
[11]: ['diff_y_wrist_std_AB']
```

```
[12]: results.least_obvious(f)
```

```
VBox(children=(HTML(value=''), IntProgress(value=0, max=1)))
```

```
features selected for diff_y_wrist_std_RF: [204, 230]
```

```
[12]: ['diff_y_wrist_std_RF']
```

0.0.5 Classified features per patient

```
[13]: c = results.analyze_tps()
c
```

```
[13]: {409: ['angle_right_shoulder_xz_max_AF', 'Auto ensemble'],
213: ['angle_left_shoulder_xz_max_AF',
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'Auto ensemble'],
238: ['angle_right_shoulder_xz_max_RF', 'z_wrist_max_RF', 'Auto ensemble'],
207: ['diff_y_wrist_std_AB', 'diff_y_elbow_std_AB', 'Auto ensemble'],
308: ['diff_y_wrist_std_AB', 'z_elbow_max_AB', 'Auto ensemble'],
318: ['angle_right_shoulder_xz_max_RF',
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'angular_vel_xz_elbow_l_std_AF',
'Auto ensemble'],
332: ['angle_right_shoulder_xz_max_RF',
'diff_y_wrist_std_AB',
'z_wrist_max_RF',
'Auto ensemble'],
223: ['angle_right_shoulder_yz_max_AB',
'z_elbow_max_AB',
'angular_vel_xz_elbow_l_std_AF',
'Auto ensemble'],
410: ['diff_y_wrist_std_AB',
'diff_y_elbow_std_AB',
'z_elbow_max_AF',
'Auto ensemble'],
235: ['vel_elbows_z_r_std_AF',
'angular_vel_xz_elbow_l_std_AF',
'angular_vel_xz_elbow_r_std_AF',
'Auto ensemble'],
```

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220: ['angle_right_shoulder_xz_max_AF',
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      'x_wrist_max_EL',
      'acc_elbows_z_r_std_RF',
      'Auto ensemble'],
307: ['angle_right_shoulder_xz_max_RF',
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      'acc_wrists_x_l_mean_EL',
      'Auto ensemble'],
239: ['angle_left_shoulder_xz_max_AF',
      'angle_right_shoulder_xz_max_AF',
      'angle_left_shoulder_yz_max_AB',
      'angle_right_shoulder_yz_max_AB',
      'z_elbow_max_AB',
      'Auto ensemble'],
336: ['diff_x_wrist_std_AF',
      'diff_x_elbow_std_AF',
      'vel_wrists_x_l_std_EL',
      'vel_wrists_x_r_std_EL',
      'acc_wrists_x_l_mean_EL',
      'Auto ensemble'],
403: ['angle_left_shoulder_xz_max_AF',
      'angle_right_shoulder_xz_max_AF',
      'angle_right_shoulder_xz_max_RF',
      'angle_right_shoulder_yz_max_AB',
      'z_wrist_max_RF',
      'x_wrist_max_EL',
      'Auto ensemble'],
228: ['angle_right_shoulder_xz_max_AF',
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      'angle_right_shoulder_yz_max_AB',
      'z_elbow_max_AB',
      'z_wrist_max_RF',
      'angular_vel_xz_elbow_l_std_AF',
      'Auto ensemble'],
236: ['angle_left_shoulder_xz_max_AF',
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      'diff_x_wrist_std_AF',
      'diff_y_elbow_std_AB',
      'diff_z_wrist_std_AB',
      'diff_z_elbow_std_AB',
      'diff_z_shoulder_std_AB',
      'Auto ensemble'],
203: ['angle_left_shoulder_xz_max_AF',
      'angle_right_shoulder_xz_max_AF',
      'diff_y_wrist_std_AB',

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'z_elbow_max_AF',
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'Auto ensemble'],
214: ['angle_right_shoulder_yz_max_AB',
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'diff_y_elbow_std_AB',
'diff_z_wrist_std_AB',
'diff_z_elbow_std_AB',
'diff_z_shoulder_std_AB',
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319: ['angle_left_shoulder_xz_max_AF',
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'angle_right_shoulder_yz_max_AB',
'diff_y_wrist_std_AB',
'diff_y_elbow_std_AB',
'diff_z_wrist_std_AB',
'z_elbow_max_AB',
'Auto ensemble'],
309: ['angle_right_shoulder_xz_max_RF',
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'diff_y_wrist_std_AB',
'diff_y_elbow_std_AB',
'diff_z_wrist_std_AB',
'diff_z_elbow_std_AB',
'diff_z_shoulder_std_AB',
'z_elbow_max_AB',
'z_elbow_max_AF',
'Auto ensemble'],
333: ['diff_z_shoulder_std_AB',
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'vel_elbows_z_l_std_AB',
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'vel_elbows_z_r_std_AB',
'acc_elbows_z_r_std_AB',
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'Auto ensemble'],
229: ['angle_right_shoulder_xz_max_RF',
'diff_y_wrist_std_AB',

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'Auto ensemble'],
234: ['angle_left_shoulder_xz_max_AF',
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'z_elbow_max_AF',
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'vel_elbows_z_r_std_AB',
'acc_elbows_z_r_std_AB',
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306: ['angle_left_shoulder_yz_max_AB',
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'diff_y_elbow_std_AB',
'diff_z_wrist_std_AB',
'diff_z_elbow_std_AB',
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'vel_elbows_z_r_std_AB',
'acc_elbows_z_r_std_AB',
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'Auto ensemble'],
205: ['diff_x_wrist_std_EL',
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'diff_y_wrist_std_AB',
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'vel_elbows_z_r_std_AF',
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'acc_elbows_z_r_std_AF',
'angular_vel_xz_elbow_l_std_AF',
'angular_vel_xz_elbow_r_std_AF',
'angular_vel_yz_elbow_l_std_AB',
'angular_vel_yz_elbow_r_std_AB',
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335: ['angle_left_shoulder_xz_max_AF',
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'angle_right_shoulder_yz_max_AB',
'diff_x_wrist_std_AF',
'diff_x_elbow_std_AF',
'diff_x_shoulder_std_AF',
'diff_y_wrist_std_AB',
'diff_z_wrist_std_AF',
'diff_z_elbow_std_AF',
'diff_z_shoulder_std_AB',
'z_elbow_max_AB',
'z_elbow_max_AF',
'z_wrist_max_AF',
'Auto ensemble'],
402: ['angle_left_shoulder_xz_max_AF',
'angle_right_shoulder_xz_max_AF',
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'angle_left_shoulder_yz_max_AB',
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'diff_x_shoulder_std_EL',
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'diff_z_elbow_std_AF',
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'x_wrist_max_EL',
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'Auto ensemble'],
412: ['angle_right_shoulder_xz_max_AF',
'diff_x_wrist_std_EL',
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'x_wrist_max_EL',
'vel_wrists_x_r_std_EL',
'vel_elbows_z_r_std_AF',

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'vel_elbows_z_r_std_AB',
'acc_elbows_z_l_mean_AF',
'acc_elbows_z_r_mean_AB',
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'angular_vel_xz_elbow_r_std_AF',
'angular_vel_yz_elbow_l_std_AB',
'angular_vel_yz_elbow_r_std_AB',
'Auto ensemble'],
430: ['angle_left_shoulder_xz_max_AF',
'angle_left_shoulder_yz_max_AB',
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'diff_x_elbow_std_AF',
'diff_y_wrist_std_AB',
'diff_y_elbow_std_AB',
'diff_z_wrist_std_AB',
'diff_z_elbow_std_AB',
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'z_wrist_max_RF',
'acc_elbows_z_l_std_AF',
'acc_elbows_z_r_std_AF',
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'Auto ensemble'],
202: ['vel_wrists_x_l_std_EL',
'vel_wrists_x_r_std_EL',
'vel_elbows_z_l_std_AB',
'vel_elbows_z_r_std_AB',
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'acc_elbows_z_r_std_RF',
'acc_elbows_z_r_mean_AB',
'acc_elbows_z_r_std_AB',
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'angular_acc_xz_elbow_r_std_RF',
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'angular_vel_yz_elbow_r_std_AB',
'Auto ensemble'],
334: ['angle_right_shoulder_xz_max_AF',
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'diff_x_elbow_std_AF',
'diff_x_shoulder_std_AF',
'diff_y_wrist_std_AB',
'diff_y_elbow_std_AB',
'diff_z_wrist_std_AB',
'diff_z_wrist_std_AF',

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'diff_z_elbow_std_AB',
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'Auto ensemble'],
311: ['diff_x_shoulder_std_AF',
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'vel_elbows_z_r_std_AF',
'vel_elbows_z_r_std_AB',
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'acc_elbows_z_l_std_AF',
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'angular_vel_xz_elbow_r_std_AF',
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'angular_vel_yz_elbow_r_std_AB',
'Auto ensemble'],
404: ['angle_left_shoulder_xz_max_AF',
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'diff_z_elbow_std_AB',
'diff_z_elbow_std_AF',
'z_elbow_max_AB',
'z_elbow_max_AF',
'z_wrist_max_AF',
'x_wrist_max_EL',
'acc_elbows_z_r_std_AB',
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'angular_acc_xz_elbow_r_std_AF',
'angular_vel_yz_elbow_r_std_AB',
'Auto ensemble'],
414: ['angle_left_shoulder_xz_max_AF',
'angle_right_shoulder_xz_max_AF',
'angle_right_shoulder_xz_max_RF',
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'diff_z_wrist_std_AF',
'diff_z_elbow_std_AF',
'diff_z_shoulder_std_AB',
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'z_wrist_max_AF',
'z_wrist_max_RF',
'x_wrist_max_EL',
'Auto ensemble'],
240: ['angle_right_shoulder_xz_max_AF',
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'diff_z_wrist_std_AF',
'diff_z_wrist_std_RF',
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'diff_z_elbow_std_AF',
'diff_z_elbow_std_RF',
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'z_elbow_max_AF',
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'vel_wrists_x_l_std_EL',
'acc_wrists_x_l_mean_EL',
'angular_vel_yz_elbow_l_std_AB',
'Auto ensemble'],
215: ['angle_left_shoulder_xz_max_AF',
'diff_x_wrist_std_RF',
'diff_x_elbow_std_EL',
'diff_y_wrist_std_AB',
'diff_y_elbow_std_AB',
'diff_z_elbow_std_AB',
'diff_z_elbow_std_AF',
'vel_elbows_z_r_std_AF',
'vel_elbows_z_r_std_AB',
'acc_elbows_z_l_std_AF',
'acc_elbows_z_l_std_AB',
'acc_elbows_z_r_std_AF',

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'Auto ensemble'],
226: ['angle_right_shoulder_xz_max_RF',
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'vel_elbows_z_r_std_AB',
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'angular_vel_xz_elbow_r_std_AF',
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'angular_acc_xz_elbow_r_std_AF',
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'angular_acc_yz_elbow_l_std_AB',
'Auto ensemble'],
315: ['angle_right_shoulder_xz_max_RF',
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'diff_y_wrist_std_AB',
'diff_z_wrist_std_AB',
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'diff_z_elbow_std_AF',
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'vel_elbows_z_r_std_AF',
'acc_wrists_x_l_mean_EL',
'acc_elbows_z_l_mean_AF',
'acc_elbows_z_l_std_AF',
'acc_elbows_z_r_mean_AF',
'acc_elbows_z_r_std_AF',
'acc_elbows_z_r_std_AB',

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'angular_vel_xz_elbow_l_std_AF',
'angular_vel_xz_elbow_r_std_AF',
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'angular_acc_xz_elbow_l_std_AF',
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'angular_acc_xz_elbow_r_std_AF',
'Auto ensemble'],
321: ['vel_wrists_x_l_std_EL',
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'vel_elbows_z_l_std_AB',
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'vel_elbows_z_r_std_AB',
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'angular_vel_xz_elbow_r_std_AF',
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'angular_vel_yz_elbow_r_std_AB',
'angular_acc_yz_elbow_l_std_AB',
'Auto ensemble'],
317: ['angle_right_shoulder_yz_max_AB',
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'diff_x_shoulder_std_AF',
'diff_y_wrist_std_AF',
'diff_y_wrist_std_AB',
'diff_y_elbow_std_AB',
'diff_z_wrist_std_AB',
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'diff_z_elbow_std_AB',
'diff_z_elbow_std_AF',
'diff_z_shoulder_std_AB',
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'acc_elbows_z_l_std_AF',
'acc_elbows_z_r_std_AF',
'acc_elbows_z_r_std_AB',

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'angular_acc_xz_elbow_l_mean_AF',
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'angular_vel_yz_elbow_l_std_AB',
'Auto ensemble'],
208: ['angle_right_shoulder_xz_max_AF',
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'diff_x_elbow_std_AF',
'diff_x_shoulder_std_RF',
'diff_y_wrist_std_AB',
'diff_y_elbow_std_AB',
'diff_z_wrist_std_AB',
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'acc_elbows_z_l_std_AB',
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'acc_elbows_z_r_std_AB',
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'angular_vel_xz_elbow_r_std_AF',
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'angular_vel_yz_elbow_r_std_AB',
'angular_acc_yz_elbow_l_std_AB',
'Auto ensemble'],
231: ['diff_x_shoulder_std_EL',
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'vel_elbows_z_r_std_AB',
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'angular_vel_xz_elbow_r_std_AF',
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'angular_acc_xz_elbow_l_std_AF',
'angular_acc_xz_elbow_r_mean_AF',

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'angular_acc_xz_elbow_r_std_AF',
'angular_acc_xz_elbow_r_std_RF',
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'angular_vel_yz_elbow_r_std_AB',
'angular_acc_yz_elbow_l_std_AB',
'Auto ensemble'],
227: ['angle_left_shoulder_xz_max_AF',
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'diff_y_wrist_std_AB',
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'diff_z_elbow_std_AB',
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'z_wrist_max_RF',
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'vel_elbows_z_r_std_AF',
'acc_elbows_z_l_std_AF',
'acc_elbows_z_r_std_AF',
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'angular_vel_xz_elbow_r_std_AF',
'angular_acc_xz_elbow_l_std_AF',
'angular_acc_xz_elbow_r_mean_AF',
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'Auto ensemble'],
303: ['angle_left_shoulder_xz_max_AF',
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'diff_y_elbow_std_AB',
'diff_z_wrist_std_AB',
'diff_z_elbow_std_AB',
'diff_z_shoulder_std_AB',
'z_elbow_max_AB',
'z_elbow_max_AF',
'z_wrist_max_AF',
'x_wrist_max_EL',
'vel_elbows_z_l_std_AB',
'acc_elbows_z_l_mean_AF',
'acc_elbows_z_l_std_AF',
'acc_elbows_z_r_mean_AF',

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'acc_elbows_z_r_std_AF',
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'angular_vel_xz_elbow_r_std_AF',
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'angular_acc_xz_elbow_r_mean_AF',
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'angular_vel_yz_elbow_l_std_AB',
'Auto ensemble'],
407: ['angle_left_shoulder_xz_max_AF',
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'diff_y_wrist_std_AB',
'diff_y_elbow_std_AB',
'diff_z_wrist_std_AB',
'diff_z_wrist_std_AF',
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'diff_z_elbow_std_AF',
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'z_wrist_max_RF',
'x_wrist_max_EL',
'vel_elbows_z_r_std_AF',
'acc_elbows_z_r_mean_AF',
'acc_elbows_z_r_std_AF',
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'angular_acc_xz_elbow_r_std_RF',
'Auto ensemble'],
411: ['angle_left_shoulder_xz_max_AF',
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'diff_y_wrist_std_AB',
'diff_y_elbow_std_AB',
'diff_z_wrist_std_AB',
'diff_z_wrist_std_AF',
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'diff_z_elbow_std_AF',
'diff_z_shoulder_std_AB',
'z_elbow_max_AB',

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'vel_elbows_z_r_std_AB',
'acc_elbows_z_r_std_AF',
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'angular_acc_yz_elbow_r_mean_AB',
'Auto ensemble'],
201: ['diff_x_wrist_std_AF',
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'diff_z_shoulder_std_RF',
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'vel_wrists_x_r_std_EL',
'vel_elbows_z_l_std_AB',
'vel_elbows_z_r_std_AB',
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'angular_acc_xz_elbow_r_mean_RF',
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'angular_vel_yz_elbow_r_std_AB',
'Auto ensemble'],
219: ['angle_right_shoulder_xz_max_RF',
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'x_wrist_max_EL',
'vel_elbows_z_l_std_AB',
'vel_elbows_z_r_std_AF',
'vel_elbows_z_r_std_AB',

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'acc_elbows_z_l_std_RF',
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'acc_elbows_z_r_std_RF',
'acc_elbows_z_r_mean_AB',
'acc_elbows_z_r_std_AB',
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'angular_vel_yz_elbow_r_std_AB',
'angular_acc_yz_elbow_l_std_AB',
'angular_acc_yz_elbow_r_mean_AB',
'Auto ensemble'],
406: ['angle_left_shoulder_xz_max_AF',
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'diff_x_elbow_std_AF',
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'diff_y_elbow_std_AB',
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'diff_z_shoulder_std_AB',
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'z_wrist_max_AF',
'x_wrist_max_EL',
'vel_elbows_z_r_std_AF',
'acc_elbows_z_l_mean_RF',
'acc_elbows_z_l_std_RF',
'acc_elbows_z_r_std_RF',
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'angular_acc_xz_elbow_l_std_RF',
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'angular_vel_yz_elbow_r_std_AB',
'Auto ensemble'],
331: ['angle_left_shoulder_yz_max_AB',
'angle_right_shoulder_yz_max_AB',
'diff_x_wrist_std_AF',
'diff_x_elbow_std_AF',

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'diff_x_shoulder_std_EL',
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'diff_y_wrist_std_AF',
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'vel_wrists_x_r_std_EL',
'vel_elbows_z_l_std_RF',
'acc_wrists_x_l_mean_EL',
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'acc_elbows_z_r_std_AF',
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'Auto ensemble'],
323: ['angle_left_shoulder_xz_max_AF',
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'diff_x_elbow_std_AF',
'diff_x_shoulder_std_AF',
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'z_elbow_max_AF',
'z_wrist_max_AF',
'z_wrist_max_RF',
'x_wrist_max_EL',
'vel_elbows_z_r_std_AB',
'acc_elbows_z_r_std_RF',

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'acc_elbows_z_r_mean_AB',
'acc_elbows_z_r_std_AB',
'angular_vel_xz_elbow_r_std_AF',
'angular_acc_xz_elbow_r_std_RF',
'angular_vel_yz_elbow_r_std_AB',
'Auto ensemble'],
209: ['angle_right_shoulder_xz_max_AF',
'angle_right_shoulder_xz_max_RF',
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'diff_x_wrist_std_AF',
'diff_x_shoulder_std_AF',
'diff_y_wrist_std_AB',
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'z_wrist_max_RF',
'x_wrist_max_EL',
'vel_elbows_z_l_std_AB',
'vel_elbows_z_r_std_AF',
'vel_elbows_z_r_std_AB',
'acc_elbows_z_l_mean_AF',
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'acc_elbows_z_r_std_AF',
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'acc_elbows_z_r_std_AB',
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'angular_vel_xz_elbow_r_std_AF',
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'angular_acc_xz_elbow_r_std_AF',
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'angular_acc_yz_elbow_l_std_AB',
'angular_acc_yz_elbow_r_mean_AB',
'Auto ensemble'],
313: ['angle_right_shoulder_xz_max_RF',
'diff_x_shoulder_std_EL',
'diff_x_shoulder_std_AF',
'diff_y_wrist_std_AB',
'z_wrist_max_RF',
'x_wrist_max_EL',
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'vel_elbows_z_r_std_AF',
'vel_elbows_z_r_std_AB',
'acc_elbows_z_l_mean_AF',
'acc_elbows_z_l_std_AF',

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'acc_elbows_z_l_mean_AB',
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'angular_vel_xz_elbow_r_std_AF',
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'angular_acc_xz_elbow_r_mean_RF',
'angular_acc_xz_elbow_r_std_RF',
'angular_vel_yz_elbow_l_std_AB',
'angular_vel_yz_elbow_r_std_AB',
'angular_acc_yz_elbow_l_std_AB',
'angular_acc_yz_elbow_r_mean_AB',
'Auto ensemble'],
221: ['diff_x_wrist_std_AF',
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'diff_y_wrist_std_AF',
'diff_z_wrist_std_AF',
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'vel_elbows_z_r_std_AB',
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'acc_elbows_z_l_std_AF',
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'acc_elbows_z_r_std_AB',
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'angular_vel_xz_elbow_r_std_AF',
'angular_acc_xz_elbow_l_std_AF',
'angular_acc_xz_elbow_l_mean_RF',
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'angular_acc_xz_elbow_r_std_AF',
'angular_acc_xz_elbow_r_mean_RF',
'angular_acc_xz_elbow_r_std_RF',
'angular_vel_yz_elbow_l_std_AB',
'angular_vel_yz_elbow_r_std_AB',

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'angular_acc_yz_elbow_l_std_AB',
'Auto ensemble'],
320: ['angle_right_shoulder_xz_max_AF',
'angle_right_shoulder_xz_max_RF',
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'diff_z_wrist_std_AB',
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'diff_z_shoulder_std_AB',
'vel_elbows_z_l_std_AB',
'vel_elbows_z_r_std_AF',
'vel_elbows_z_r_std_AB',
'acc_elbows_z_l_mean_AF',
'acc_elbows_z_l_std_AF',
'acc_elbows_z_l_std_RF',
'acc_elbows_z_l_mean_AB',
'acc_elbows_z_l_std_AB',
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'acc_elbows_z_r_std_RF',
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'acc_elbows_z_r_std_AB',
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'angular_acc_xz_elbow_r_std_RF',
'angular_vel_yz_elbow_l_std_AB',
'angular_vel_yz_elbow_r_std_AB',
'angular_acc_yz_elbow_l_std_AB',
'angular_acc_yz_elbow_r_mean_AB',
'Auto ensemble'],
324: ['angle_right_shoulder_xz_max_AF',
'angle_right_shoulder_xz_max_RF',
'angle_right_shoulder_yz_max_AB',
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'diff_x_wrist_std_RF',
'diff_x_elbow_std_AF',
'diff_x_elbow_std_RF',
'diff_x_shoulder_std_AF',
'diff_y_wrist_std_AB',
'diff_y_elbow_std_AB',
'diff_z_wrist_std_AB',
'diff_z_wrist_std_AF',
'diff_z_elbow_std_AB',

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'diff_z_elbow_std_AF',
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'z_elbow_max_AF',
'z_elbow_max_RF',
'z_wrist_max_AF',
'z_wrist_max_RF',
'x_wrist_max_EL',
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'acc_elbows_z_l_std_AF',
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'angular_acc_xz_elbow_l_std_AF',
'angular_vel_yz_elbow_l_std_AB',
'angular_acc_yz_elbow_l_std_AB',
'Auto ensemble'],
232: ['angle_left_shoulder_xz_max_AF',
'angle_right_shoulder_xz_max_AF',
'angle_right_shoulder_xz_max_RF',
'angle_left_shoulder_yz_max_AB',
'angle_right_shoulder_yz_max_AB',
'diff_x_wrist_std_AF',
'diff_y_wrist_std_AB',
'diff_z_wrist_std_AB',
'diff_z_elbow_std_AB',
'diff_z_elbow_std_AF',
'diff_z_shoulder_std_AB',
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'z_elbow_max_AF',
'z_wrist_max_AF',
'z_wrist_max_RF',
'vel_elbows_z_l_std_AB',
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'acc_elbows_z_l_std_AF',
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'acc_elbows_z_r_std_AF',
'acc_elbows_z_r_std_AB',
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'angular_vel_xz_elbow_r_std_AF',
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'angular_acc_xz_elbow_r_mean_RF',
'angular_acc_xz_elbow_r_std_RF',
'angular_vel_yz_elbow_l_std_AB',
'angular_acc_yz_elbow_l_mean_AB',

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    'angular_acc_yz_elbow_l_std_AB',
    'Auto ensemble'],
340: ['angle_left_shoulder_xz_max_AF',
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    'diff_x_elbow_std_AF',
    'diff_x_shoulder_std_AF',
    'diff_y_wrist_std_AF',
    'diff_y_wrist_std_AB',
    'diff_y_elbow_std_AB',
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    'diff_z_wrist_std_AF',
    'diff_z_elbow_std_AB',
    'diff_z_elbow_std_AF',
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    'z_elbow_max_AF',
    'z_elbow_max_RF',
    'z_wrist_max_AF',
    'z_wrist_max_RF',
    'vel_elbows_z_l_std_AB',
    'vel_elbows_z_r_std_AF',
    'vel_elbows_z_r_std_AB',
    'acc_elbows_z_l_std_AB',
    'acc_elbows_z_r_std_AF',
    'acc_elbows_z_r_mean_AB',
    'acc_elbows_z_r_std_AB',
    'angular_vel_xz_elbow_r_std_AF',
    'angular_acc_xz_elbow_r_std_RF',
    'angular_vel_yz_elbow_l_std_AB',
    'angular_vel_yz_elbow_r_std_AB',
    'angular_acc_yz_elbow_l_std_AB',
    'Auto ensemble'],
401: ['angle_left_shoulder_xz_max_AF',
    'angle_right_shoulder_xz_max_AF',
    'angle_left_shoulder_yz_max_AB',
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    'diff_x_shoulder_std_AF',
    'diff_y_wrist_std_AB',
    'diff_y_elbow_std_AB',
    'diff_z_wrist_std_AB',
    'diff_z_elbow_std_AB',
    'diff_z_elbow_std_AF',
    'diff_z_shoulder_std_AB',
    'diff_z_shoulder_std_RF',
    'z_elbow_max_AB',

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'z_elbow_max_AF',
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'acc_elbows_z_l_mean_AF',
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'acc_elbows_z_r_std_AF',
'acc_elbows_z_r_mean_RF',
'acc_elbows_z_r_std_RF',
'acc_elbows_z_r_mean_AB',
'acc_elbows_z_r_std_AB',
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'angular_acc_xz_elbow_l_std_RF',
'angular_acc_xz_elbow_r_mean_RF',
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'angular_vel_yz_elbow_r_std_AB',
'angular_acc_yz_elbow_r_mean_AB',
'Auto ensemble'],
329: ['angle_left_shoulder_xz_max_AF',
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'diff_y_wrist_std_AB',
'diff_y_elbow_std_AB',
'diff_z_wrist_std_AB',
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'acc_elbows_z_r_mean_AB',
'acc_elbows_z_r_std_AB',
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'angular_acc_xz_elbow_l_std_RF',
'angular_acc_xz_elbow_r_std_RF',
'angular_vel_yz_elbow_l_std_AB',
'angular_acc_yz_elbow_l_std_AB',
'Auto ensemble'],
433: ['angle_left_shoulder_xz_max_AF',
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'diff_z_wrist_std_AB',
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'diff_z_elbow_std_AF',
'diff_z_shoulder_std_AB',
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'z_wrist_max_RF',
'x_wrist_max_EL',
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'acc_elbows_z_r_std_AF',
'acc_elbows_z_r_std_RF',
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'acc_elbows_z_r_std_AB',
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'angular_acc_xz_elbow_l_std_AF',
'angular_acc_xz_elbow_r_mean_AF',
'angular_acc_xz_elbow_r_std_AF',
'angular_vel_yz_elbow_r_std_AB',
'angular_acc_yz_elbow_r_mean_AB',
'Auto ensemble'],
230: ['angle_right_shoulder_xz_max_RF',
'diff_x_wrist_std_RF',
'diff_y_wrist_std_RF',
'diff_y_elbow_std_AB',
'vel_wrists_x_l_std_EL',
'vel_wrists_x_r_std_EL',
'vel_elbows_z_l_std_AB',
'vel_elbows_z_r_std_AF',

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'vel_elbows_z_r_std_AB',
'acc_wrists_x_l_mean_EL',
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'acc_elbows_z_l_std_AF',
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'acc_elbows_z_r_mean_AF',
'acc_elbows_z_r_std_AF',
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'acc_elbows_z_r_std_RF',
'acc_elbows_z_r_mean_AB',
'acc_elbows_z_r_std_AB',
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'angular_acc_xz_elbow_r_mean_RF',
'angular_acc_xz_elbow_r_std_RF',
'angular_vel_yz_elbow_l_std_AB',
'angular_vel_yz_elbow_r_std_AB',
'angular_acc_yz_elbow_l_std_AB',
'Auto ensemble'],
314: ['diff_x_wrist_std_AF',
'vel_wrists_x_l_std_EL',
'vel_wrists_x_r_std_EL',
'vel_elbows_z_l_std_RF',
'vel_elbows_z_l_std_AB',
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'acc_elbows_z_r_mean_RF',
'acc_elbows_z_r_std_RF',
'acc_elbows_z_r_mean_AB',
'acc_elbows_z_r_std_AB',

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'angular_vel_xz_elbow_l_std_AF',
'angular_vel_xz_elbow_r_std_AF',
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'angular_vel_yz_elbow_r_std_AB',
'angular_acc_yz_elbow_l_std_AB',
'angular_acc_yz_elbow_r_mean_AB',
'Auto ensemble'],
222: ['vel_wrists_x_l_std_EL',
'vel_wrists_x_r_std_EL',
'vel_elbows_z_l_std_RF',
'vel_elbows_z_l_std_AB',
'vel_elbows_z_r_std_AF',
'vel_elbows_z_r_std_AB',
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'acc_elbows_z_r_std_AB',
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'angular_acc_yz_elbow_l_mean_AB',

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'angular_acc_yz_elbow_l_std_AB',
'angular_acc_yz_elbow_r_mean_AB',
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427: ['angle_left_shoulder_xz_max_AF',
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'diff_z_elbow_std_AB',
'diff_z_shoulder_std_AB',
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'vel_wrists_x_r_std_EL',
'vel_elbows_z_r_std_AF',
'vel_elbows_z_r_std_AB',
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'acc_elbows_z_r_std_AF',
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'acc_elbows_z_r_std_AB',
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'angular_acc_xz_elbow_r_std_RF',
'angular_vel_yz_elbow_r_std_AB',
'angular_acc_yz_elbow_r_mean_AB',
'Auto ensemble'],
328: ['angle_right_shoulder_xz_max_RF',
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'diff_x_wrist_std_EL',
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'diff_y_wrist_std_AF',
'diff_y_wrist_std_AB',
'diff_z_wrist_std_AB',

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'angular_acc_yz_elbow_l_mean_AB',
'angular_acc_yz_elbow_l_std_AB',
'Auto ensemble'],
435: ['angle_left_shoulder_xz_max_AF',
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'Auto ensemble'],
216: ['angle_right_shoulder_xz_max_RF',
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'z_wrist_max_RF',
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'angular_acc_xz_elbow_r_mean_AF',
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'angular_acc_xz_elbow_r_mean_RF',
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'angular_acc_yz_elbow_l_mean_AB',
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'angular_acc_yz_elbow_r_mean_AB',
'Auto ensemble'],
438: ['diff_x_wrist_std_AF',
'diff_x_shoulder_std_EL',
'diff_x_shoulder_std_RF',
'diff_y_wrist_std_EL',
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'angular_acc_yz_elbow_r_mean_AB',
'Auto ensemble'],
210: ['angle_left_shoulder_xz_max_AF',
'angle_right_shoulder_xz_max_RF',

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431: ['diff_x_shoulder_std_EL',
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'diff_y_wrist_std_EL',
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'vel_elbows_z_l_std_RF',
'vel_elbows_z_l_std_AB',
'vel_elbows_z_r_std_AF',
'vel_elbows_z_r_std_AB',

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405: ['angle_left_shoulder_xz_max_AF',
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'Auto ensemble'],
426: ['angle_left_shoulder_xz_max_AF',
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434: ['angle_left_shoulder_xz_max_AF',
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'angular_acc_yz_elbow_l_std_AB',
'angular_acc_yz_elbow_r_mean_AB',
'Auto ensemble'],
338: ['angle_left_shoulder_xz_max_AF',
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'Auto ensemble'],
408: ['angle_left_shoulder_xz_max_AF',
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'vel_elbows_z_r_std_AB',
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'angular_vel_yz_elbow_r_std_AB',
'angular_acc_yz_elbow_r_mean_AB',

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'Auto ensemble'],
233: ['angle_left_shoulder_xz_max_AF',
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'angular_acc_yz_elbow_r_mean_AB',
'Auto ensemble'],
425: ['angle_left_shoulder_xz_max_AF',

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'angle_left_shoulder_yz_max_AB',
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'Auto ensemble'],

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204: ['angle_left_shoulder_xz_max_AF',
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      'acc_elbows_z_r_std_AB',
      'angular_vel_xz_elbow_l_std_AF',
      'angular_vel_xz_elbow_r_std_AF',
      'angular_acc_xz_elbow_l_std_AF',
      'angular_acc_xz_elbow_l_mean_RF',
      'angular_acc_xz_elbow_l_std_RF',
      'angular_acc_xz_elbow_r_mean_AF',
      'angular_acc_xz_elbow_r_std_AF',
      'angular_acc_xz_elbow_r_mean_RF',
      'angular_acc_xz_elbow_r_std_RF',
      'angular_vel_yz_elbow_l_std_AB',
      'angular_vel_yz_elbow_r_std_AB',
      'angular_acc_yz_elbow_l_std_AB',

```



```

'angular_acc_yz_elbow_r_mean_AB',
'Auto ensemble'],
429: ['angle_left_shoulder_xz_max_AF',
'angle_right_shoulder_xz_max_AF',
'angle_left_shoulder_yz_max_AB',
'angle_right_shoulder_yz_max_AB',
'diff_x_wrist_std_AF',
'diff_x_elbow_std_AF',
'diff_y_wrist_std_AB',
'diff_z_wrist_std_AB',
'diff_z_wrist_std_AF',
'diff_z_elbow_std_AB',
'diff_z_elbow_std_AF',
'z_elbow_max_AB',
'z_elbow_max_AF',
'z_wrist_max_AF',
'z_wrist_max_RF',
'vel_wrists_x_l_std_EL',
'vel_wrists_x_r_std_EL',
'vel_elbows_z_l_std_AB',
'vel_elbows_z_r_std_AF',
'vel_elbows_z_r_std_AB',
'acc_wrists_x_l_mean_EL',
'acc_elbows_z_l_mean_AF',
'acc_elbows_z_l_std_AF',
'acc_elbows_z_l_mean_RF',
'acc_elbows_z_l_std_RF',
'acc_elbows_z_l_mean_AB',
'acc_elbows_z_l_std_AB',
'acc_elbows_z_r_mean_AF',
'acc_elbows_z_r_std_AF',
'acc_elbows_z_r_mean_RF',
'acc_elbows_z_r_std_RF',
'acc_elbows_z_r_mean_AB',
'acc_elbows_z_r_std_AB',
'angular_vel_xz_elbow_l_std_AF',
'angular_vel_xz_elbow_r_std_AF',
'angular_acc_xz_elbow_l_mean_AF',
'angular_acc_xz_elbow_l_std_AF',
'angular_acc_xz_elbow_l_mean_RF',
'angular_acc_xz_elbow_l_std_RF',
'angular_acc_xz_elbow_r_mean_AF',
'angular_acc_xz_elbow_r_std_AF',
'angular_acc_xz_elbow_r_mean_RF',
'angular_acc_xz_elbow_r_std_RF',
'angular_vel_yz_elbow_l_std_AB',
'angular_vel_yz_elbow_r_std_AB',

```

```

'angular_acc_yz_elbow_l_mean_AB',
'angular_acc_yz_elbow_l_std_AB',
'angular_acc_yz_elbow_r_mean_AB',
'Auto ensemble'],
304: ['angle_left_shoulder_xz_max_AF',
'angle_right_shoulder_xz_max_AF',
'angle_right_shoulder_xz_max_RF',
'angle_right_shoulder_yz_max_AB',
'diff_x_wrist_std_AF',
'diff_x_elbow_std_AF',
'diff_x_elbow_std_RF',
'diff_x_shoulder_std_AF',
'diff_x_shoulder_std_RF',
'diff_y_wrist_std_EL',
'diff_y_wrist_std_AB',
'diff_y_elbow_std_AB',
'diff_z_wrist_std_AB',
'diff_z_wrist_std_AF',
'diff_z_elbow_std_AB',
'diff_z_elbow_std_AF',
'diff_z_shoulder_std_AB',
'z_elbow_max_AB',
'z_elbow_max_AF',
'z_wrist_max_AF',
'x_wrist_max_EL',
'vel_wrists_x_l_std_EL',
'vel_elbows_z_l_std_AB',
'vel_elbows_z_r_std_AF',
'vel_elbows_z_r_std_AB',
'acc_wrists_x_l_mean_EL',
'acc_elbows_z_l_mean_AF',
'acc_elbows_z_l_std_AF',
'acc_elbows_z_l_std_RF',
'acc_elbows_z_l_mean_AB',
'acc_elbows_z_l_std_AB',
'acc_elbows_z_r_mean_AF',
'acc_elbows_z_r_std_AF',
'acc_elbows_z_r_mean_RF',
'acc_elbows_z_r_std_RF',
'acc_elbows_z_r_mean_AB',
'acc_elbows_z_r_std_AB',
'angular_vel_xz_elbow_l_std_AF',
'angular_vel_xz_elbow_r_std_AF',
'angular_acc_xz_elbow_l_mean_AF',
'angular_acc_xz_elbow_l_std_AF',
'angular_acc_xz_elbow_l_std_RF',
'angular_acc_xz_elbow_r_mean_AF',

```

```

'angular_acc_xz_elbow_r_std_AF',
'angular_acc_xz_elbow_r_mean_RF',
'angular_acc_xz_elbow_r_std_RF',
'angular_vel_yz_elbow_l_std_AB',
'angular_vel_yz_elbow_r_std_AB',
'angular_acc_yz_elbow_l_mean_AB',
'angular_acc_yz_elbow_l_std_AB',
'angular_acc_yz_elbow_r_mean_AB',
'Auto ensemble']}]

```

[14]: results.most_obvious(c)

```

VBox(children=(HTML(value=''), IntProgress(value=0, max=1)))

features selected for 304: ['angle_left_shoulder_xz_max_AF',
'angle_right_shoulder_xz_max_AF', 'angle_right_shoulder_xz_max_RF',
'angle_right_shoulder_yz_max_AB', 'diff_x_wrist_std_AF', 'diff_x_elbow_std_AF',
'diff_x_elbow_std_RF', 'diff_x_shoulder_std_AF', 'diff_x_shoulder_std_RF',
'diff_y_wrist_std_EL', 'diff_y_wrist_std_AB', 'diff_y_elbow_std_AB',
'diff_z_wrist_std_AB', 'diff_z_wrist_std_AF', 'diff_z_elbow_std_AB',
'diff_z_elbow_std_AF', 'diff_z_shoulder_std_AB', 'z_elbow_max_AB',
'z_elbow_max_AF', 'z_wrist_max_AF', 'x_wrist_max_EL', 'vel_wrists_x_l_std_EL',
'vel_elbows_z_l_std_AB', 'vel_elbows_z_r_std_AF', 'vel_elbows_z_r_std_AB',
'acc_wrists_x_l_mean_EL', 'acc_elbows_z_l_mean_AF', 'acc_elbows_z_l_std_AF',
'acc_elbows_z_l_std_RF', 'acc_elbows_z_l_mean_AB', 'acc_elbows_z_l_std_AB',
'acc_elbows_z_r_mean_AF', 'acc_elbows_z_r_std_AF', 'acc_elbows_z_r_mean_RF',
'acc_elbows_z_r_std_RF', 'acc_elbows_z_r_mean_AB', 'acc_elbows_z_r_std_AB',
'angular_vel_xz_elbow_l_std_AF', 'angular_vel_xz_elbow_r_std_AF',
'angular_acc_xz_elbow_l_mean_AF', 'angular_acc_xz_elbow_l_std_AF',
'angular_acc_xz_elbow_l_std_RF', 'angular_acc_xz_elbow_r_mean_AF',
'angular_acc_xz_elbow_r_std_AF', 'angular_acc_xz_elbow_r_mean_RF',
'angular_acc_xz_elbow_r_std_RF', 'angular_vel_yz_elbow_l_std_AB',
'angular_vel_yz_elbow_r_std_AB', 'angular_acc_yz_elbow_l_mean_AB',
'angular_acc_yz_elbow_l_std_AB', 'angular_acc_yz_elbow_r_mean_AB', 'Auto
ensemble']

```

[14]: [304]

[15]: results.least_obvious(c)

```

VBox(children=(HTML(value=''), IntProgress(value=0, max=1)))

features selected for 409: ['angle_right_shoulder_xz_max_AF', 'Auto ensemble']

```

[15]: [409]

[]: