Datenanalyse Kompensiert und Nicht Kompensiert

1. DeepMotion Nicht Kompensiert

In [ ]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
from scipy.spatial import distance
from scipy.interpolate import interp1d
from matplotlib.offsetbox import OffsetImage, AnnotationBbox
```

In [ ]:
```
df_deepM_03 = pd.read_csv('../Data/KeypointsBereinigtNichtKompensiert.csv
df_deepM_03.head(5)
```

Out[ ]:

	compensation	frame	path	x_0	
0	0	1	/Users/salomekoller/Library/CloudStorage/OneDr...	0.0000	-1(
1	0	2	/Users/salomekoller/Library/CloudStorage/OneDr...	-3.3216	-1(
2	0	3	/Users/salomekoller/Library/CloudStorage/OneDr...	1.6550	-1(
3	0	4	/Users/salomekoller/Library/CloudStorage/OneDr...	3.9860	-1(
4	0	5	/Users/salomekoller/Library/CloudStorage/OneDr...	5.4320	-1(

5 rows × 102 columns

1.2 Analyse Form

In [ ]:
```
print('Dimension:', df_deepM_03.shape)
print('Number of rows:', df_deepM_03.shape[0])
print('Number of columns:', df_deepM_03.shape[1])
```

```
Dimension: (2495, 102)
Number of rows: 2495
Number of columns: 102
```

1.2 Splitting Frames

In [ ]:
```
# Variablen initiieren
frame_count = 0
frames_until_reset = []

# Iterieren über Dataframe, um Frames mit '1' zu finden
for index, row in df_deepM_03.iterrows():
    frame_count += 1

    if row["frame"] == 1 and frame_count > 1:
        frames_until_reset.append(frame_count -1)
```

```
if frame_count > 0:
    frames_until_reset.append(frame_count)

print("Number of frames until reset for each cycle:", frames_until_reset)
```

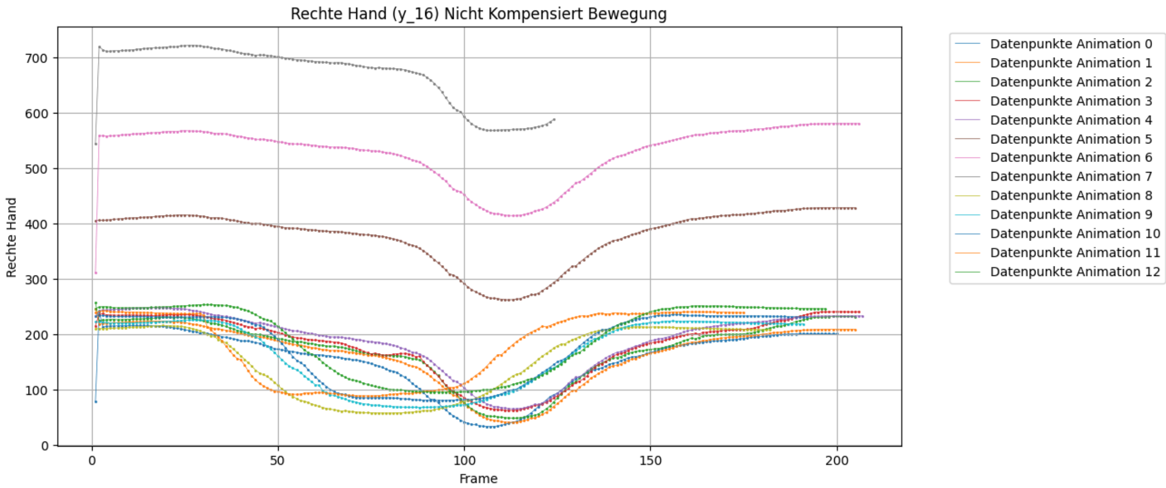
```
Number of frames until reset for each cycle: [200, 405, 610, 816, 1023, 12
28, 1434, 1558, 1740, 1931, 2123, 2298, 2495]
```

In [ ]:
```
# Einzelne Bewegungen werden in verschiedene Dataframes gepackt
dfs = []
start = 0
for end in frames_until_reset:
    dfs.append(df_deepM_03.iloc[start:end])
    start = end

print("Number of splits:", len(dfs))
```

```
Number of splits: 13
```

1.3 Bewegungsanalyse anhand rechter Handbewegung (Nicht Kompensiert)

In [ ]:
```
plt.figure(figsize=(12, 6))
for i, df in enumerate(dfs):
    plt.scatter(df["frame"], df["y_16"], marker='o', color=f'C{i}', s=1)
    plt.plot(df["frame"], df["y_16"], color=f'C{i}', linestyle='-', linew

plt.title("Rechte Hand (y_16) Nicht Kompensiert Bewegung")
plt.xlabel("Frame")
plt.ylabel("Rechte Hand")
plt.grid(True)
plt.legend(bbox_to_anchor=(1.05, 1), loc='upper left')
plt.show()
```



1.3.1 Berechnung des Mean

In [ ]:
```
means03 = []
mean_values_03 = df_deepM_03[['frame', 'x_0', 'y_0', 'z_0', 'x_1', 'y_1',
                             'x_4', 'y_4', 'z_4', 'x_5', 'y_5', 'z_5', 'x_6', 'y_6'
                             'x_8', 'y_8', 'z_8', 'x_9', 'y_9', 'z_9', 'x_10', 'y_1
                             'x_12', 'y_12', 'z_12', 'x_13', 'y_13', 'z_13', 'x_14'
                             'x_16', 'y_16', 'z_16', 'x_17', 'y_17', 'z_17', 'x_18'
                             'x_20', 'y_20', 'z_20', 'x_21', 'y_21', 'z_21', 'x_22'
                             'x_24', 'y_24', 'z_24', 'x_25', 'y_25', 'z_25', 'x_26'
```

```
                         'x_28', 'y_28', 'z_28', 'x_29', 'y_29', 'z_29', 'x_30'
                         'x_32', 'y_32', 'z_32']].groupby('frame').mean()
means03.append(mean_values_03)

mean_values_03.head(5)
```

Out[ ]:

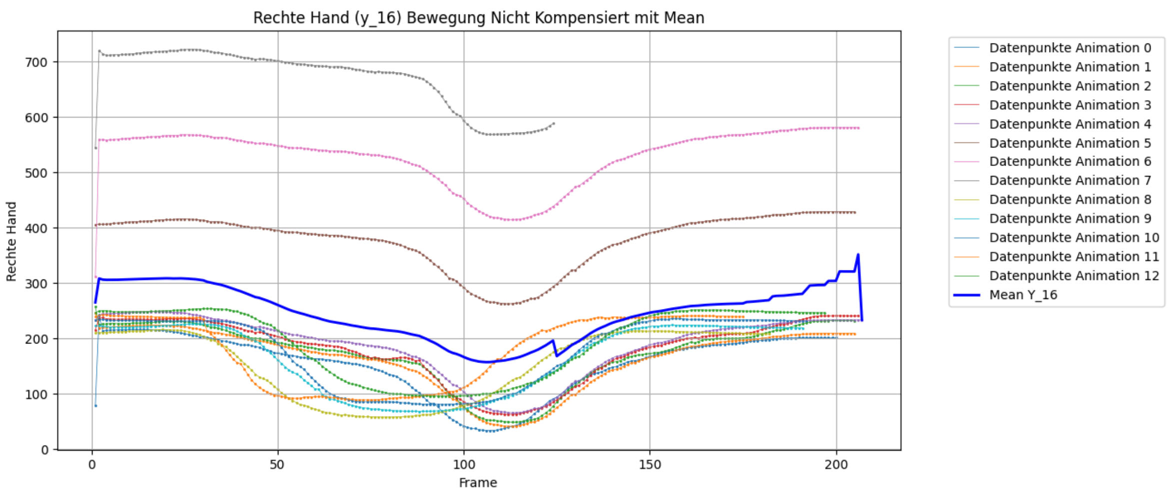
	x_0	y_0	z_0	x_1	y_1	z_1
frame						
1	79.493292	72.779392	-228.744809	-998.361846	-304.775762	-26.98443
2	80.842746	99.829900	-211.074476	-998.361846	-304.775762	-26.98443
3	82.510746	101.002331	-210.113453	-998.361846	-304.775762	-26.98443
4	84.052592	100.255823	-211.267363	-998.361846	-304.775762	-26.98443
5	85.027269	99.980685	-212.000914	-998.361846	-304.775762	-26.98443

5 rows × 99 columns

1.3.2 Bewegungsmuster mit Mean

In [ ]:

```
plt.figure(figsize=(12, 6))

for i, df in enumerate(dfs):
    plt.scatter(df["frame"], df["y_16"], marker='o', color=f'C{i}', s=1)
    plt.plot(df["frame"], df["y_16"], color=f'C{i}', linestyle='-', linew

plt.plot(mean_values_03.index, mean_values_03["y_16"], color='b', linesty
plt.title("Rechte Hand (y_16) Bewegung Nicht Kompensiert mit Mean")
plt.xlabel("Frame")
plt.ylabel("Rechte Hand")
plt.legend(bbox_to_anchor=(1.05, 1), loc='upper left')
plt.grid(True)
plt.show()
```

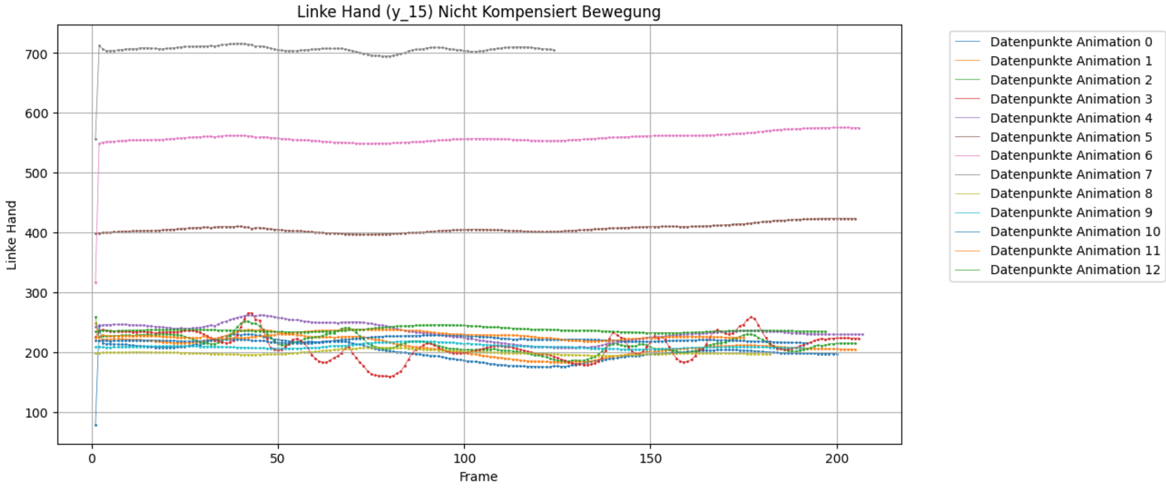


1.4 Linke Handbewegung Nicht Kompensiert

In [ ]:

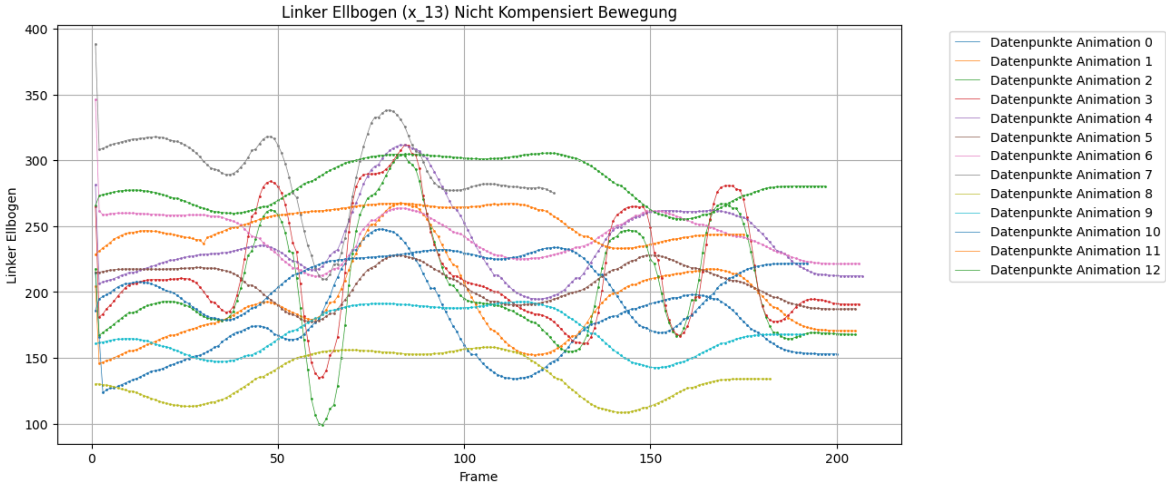
```
plt.figure(figsize=(12, 6))
for i, df in enumerate(dfs):
    plt.scatter(df["frame"], df["y_15"], marker='o', color=f'C{i}', s=1)
    plt.plot(df["frame"], df["y_15"], color=f'C{i}', linestyle='-', linew
```

```python
plt.title("Linke Hand (y_15) Nicht Kompensiert Bewegung")
plt.xlabel("Frame")
plt.ylabel("Linke Hand")
plt.grid(True)
# Move the legend outside of the plot
plt.legend(bbox_to_anchor=(1.05, 1), loc='upper left')

plt.show()
```



1.5 Linker Ellbogen Nicht Kompensiert

In [ ]:
```python
plt.figure(figsize=(12, 6))
for i, df in enumerate(dfs):

    plt.scatter(df["frame"], df["x_13"], marker='o', color=f'C{i}', s=1)
    plt.plot(df["frame"], df["x_13"], color=f'C{i}', linestyle='-', linew


plt.title("Linker Ellbogen (x_13) Nicht Kompensiert Bewegung")
plt.xlabel("Frame")
plt.ylabel("Linker Ellbogen")
plt.grid(True)
# Move the legend outside of the plot
plt.legend(bbox_to_anchor=(1.05, 1), loc='upper left')

plt.show()
```



2. DeepMotion Kompensiert

In [ ]:
```
df_deepM01 = pd.read_csv('../Data/KeypointsBereinigtKompensiert.csv', sep
df_deepM01.head(5)
```

Out[ ]:

	compensation	frame	path	x_0	
0	1	1	/Users/salomekoller/Library/CloudStorage/OneDr...	0.0000	-1(
1	1	2	/Users/salomekoller/Library/CloudStorage/OneDr...	-3.3216	-1(
2	1	3	/Users/salomekoller/Library/CloudStorage/OneDr...	1.6550	-1(
3	1	4	/Users/salomekoller/Library/CloudStorage/OneDr...	3.9860	-1(
4	1	5	/Users/salomekoller/Library/CloudStorage/OneDr...	5.4320	-1(

5 rows × 102 columns

2.1 Analyse Form

In [ ]:
```
print('Dimension:', df_deepM01.shape)
print('Number of rows:', df_deepM01.shape[0])
print('Number of columns:', df_deepM01.shape[1])
```

```
Dimension: (3273, 102)
Number of rows: 3273
Number of columns: 102
```

2.2 Splitting Frames

In [ ]:
```
# Variablen initiieren
frame_count = 0
frames_until_reset = []

# Iterieren über Dataframe, um Frames mit '1' zu finden
for index, row in df_deepM01.iterrows():
    frame_count += 1

    if row["frame"] == 1 and frame_count > 1:
        frames_until_reset.append(frame_count -1)

if frame_count > 0:
    frames_until_reset.append(frame_count)

print("Number of frames until reset for each cycle:", frames_until_reset)
```

```
Number of frames until reset for each cycle: [200, 405, 610, 816, 1023, 12
28, 1434, 1558, 1895, 2234, 2577, 2924, 3273]
```

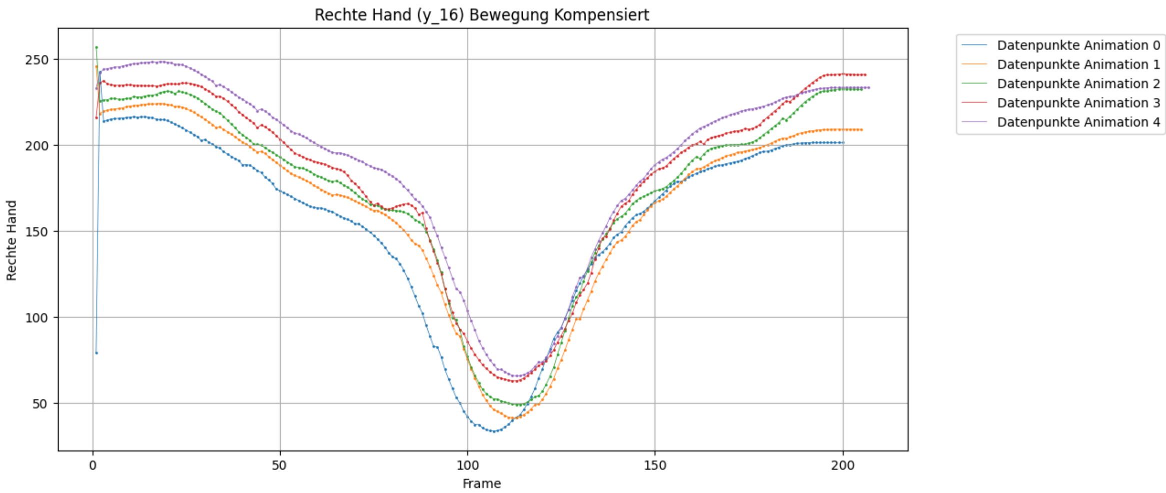
In [ ]:
```
# Einzelne Bewegungen werden in verschiedene Dataframes gepackt
dfsKomp01 = []
start = 0
for end in frames_until_reset:
    dfsKomp01.append(df_deepM01.iloc[start:end])
    start = end
```

```
print("Number of splits:", len(dfsKomp01))
```

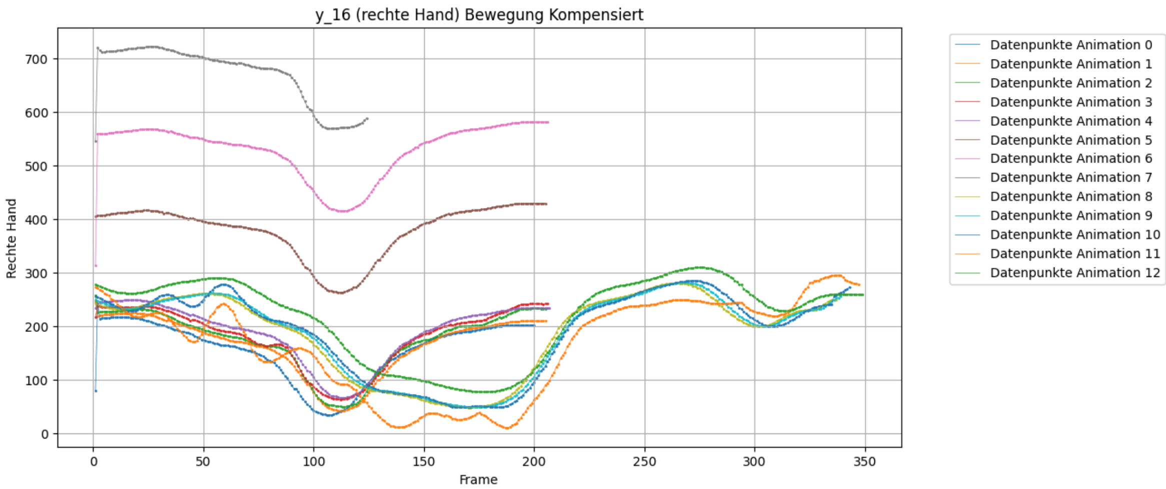
```
Number of splits: 13
```

2.3 Bewegungsanalyse anhand rechte Handbewegung (Kompensiert)

In [ ]:
```
plt.figure(figsize=(12, 6))
for i, df in enumerate(dfsKomp01[:5]):
    plt.scatter(df["frame"], df["y_16"], marker='o', color=f'C{i}', s=1)
    plt.plot(df["frame"], df["y_16"], color=f'C{i}', linestyle='-', linew

plt.title("Rechte Hand (y_16) Bewegung Kompensiert")
plt.xlabel("Frame")
plt.ylabel("Rechte Hand")
plt.grid(True)
plt.legend(bbox_to_anchor=(1.05, 1), loc='upper left')
plt.show()
```



In [ ]:
```
plt.figure(figsize=(12, 6))
for i, df in enumerate(dfsKomp01):
    plt.scatter(df["frame"], df["y_16"], marker='o', color=f'C{i}', s=1)
    plt.plot(df["frame"], df["y_16"], color=f'C{i}', linestyle='-', linew

plt.title("y_16 (rechte Hand) Bewegung Kompensiert")
plt.xlabel("Frame")
plt.ylabel("Rechte Hand")
plt.grid(True)
plt.legend(bbox_to_anchor=(1.05, 1), loc='upper left')
plt.show()
```



2.3.1 Berechnung des Mean

In [ ]:

```
means01 = []
mean_values_01 = df_deepM01[['frame', 'x_0', 'y_0', 'z_0', 'x_1', 'y_1',
                            'x_4', 'y_4', 'z_4', 'x_5', 'y_5', 'z_5', 'x_6', 'y_6'
                            'x_8', 'y_8', 'z_8', 'x_9', 'y_9', 'z_9', 'x_10', 'y_1
                            'x_12', 'y_12', 'z_12', 'x_13', 'y_13', 'z_13', 'x_14'
                            'x_16', 'y_16', 'z_16', 'x_17', 'y_17', 'z_17', 'x_18'
                            'x_20', 'y_20', 'z_20', 'x_21', 'y_21', 'z_21', 'x_22'
                            'x_24', 'y_24', 'z_24', 'x_25', 'y_25', 'z_25', 'x_26'
                            'x_28', 'y_28', 'z_28', 'x_29', 'y_29', 'z_29', 'x_30'
                            'x_32', 'y_32', 'z_32']].groupby('frame').mean()
means01.append(mean_values_01)
mean_values_01.head(5)
```

Out[ ]:

	x_0	y_0	z_0	x_1	y_1	z_1	x
frame							
1	23.146215	69.069492	-202.250882	-1018.37	-302.761877	-24.10581	-1018
2	25.201508	95.652638	-182.959528	-1018.37	-302.761877	-24.10581	-1018
3	27.431054	96.784785	-180.365567	-1018.37	-302.761877	-24.10581	-1018
4	29.857354	96.380038	-179.746803	-1018.37	-302.761877	-24.10581	-1018
5	31.584008	96.531500	-178.454013	-1018.37	-302.761877	-24.10581	-1018

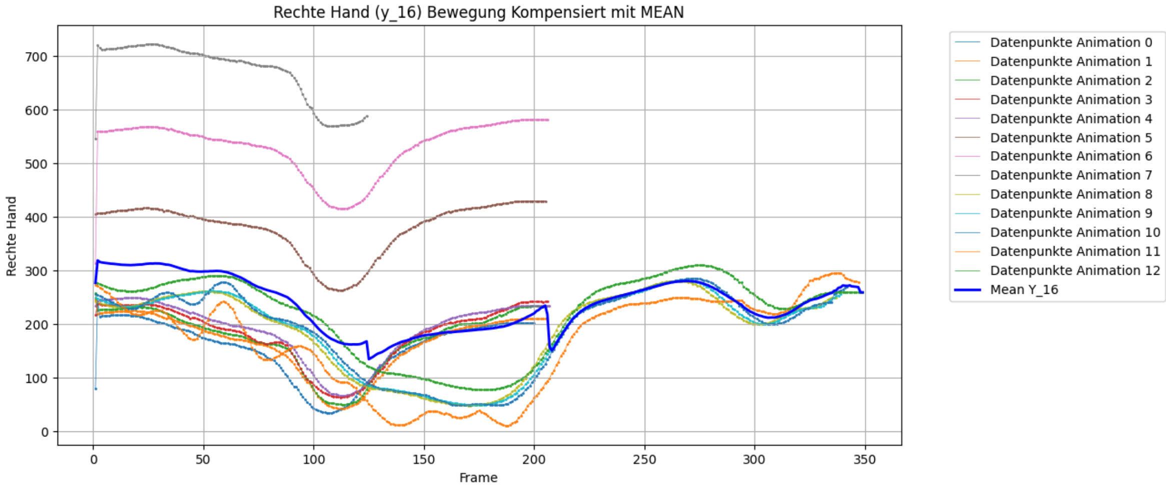
5 rows × 99 columns

2.3.2 Bewegungsmuster mit Mean

In [ ]:

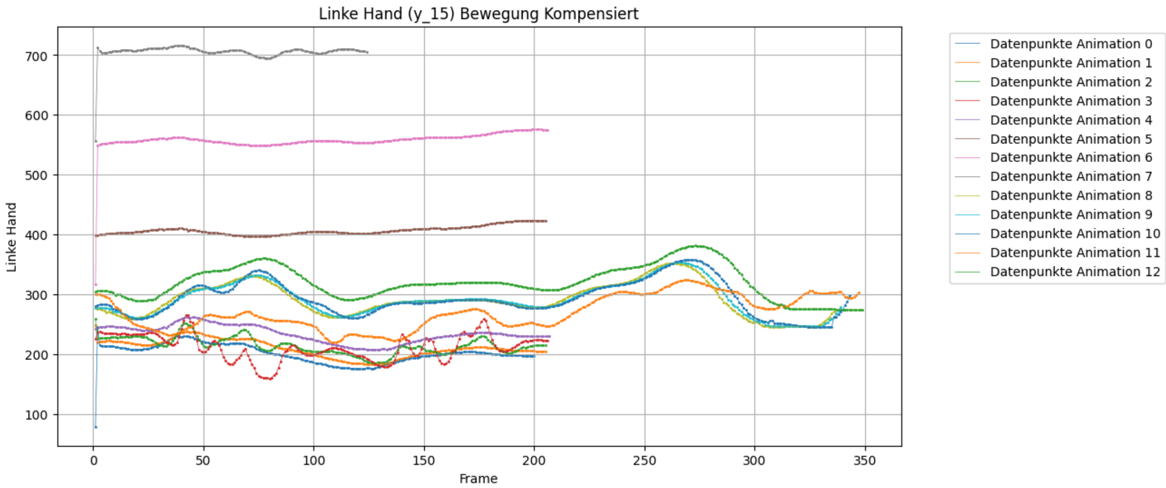
```
plt.figure(figsize=(12, 6))
for i, df in enumerate(dfsKomp01):
    plt.scatter(df["frame"], df["y_16"], marker='o', color=f'C{i}', s=1)
    plt.plot(df["frame"], df["y_16"], color=f'C{i}', linestyle='-', linew

plt.plot(mean_values_01.index, mean_values_01["y_16"], color='b', linesty

plt.title("Rechte Hand (y_16) Bewegung Kompensiert mit MEAN")
plt.xlabel("Frame")
plt.ylabel("Rechte Hand")
plt.grid(True)
```

```
plt.legend(bbox_to_anchor=(1.05, 1), loc='upper left')
plt.show()
```



2.4 Linke Handbewegung Kompensiert

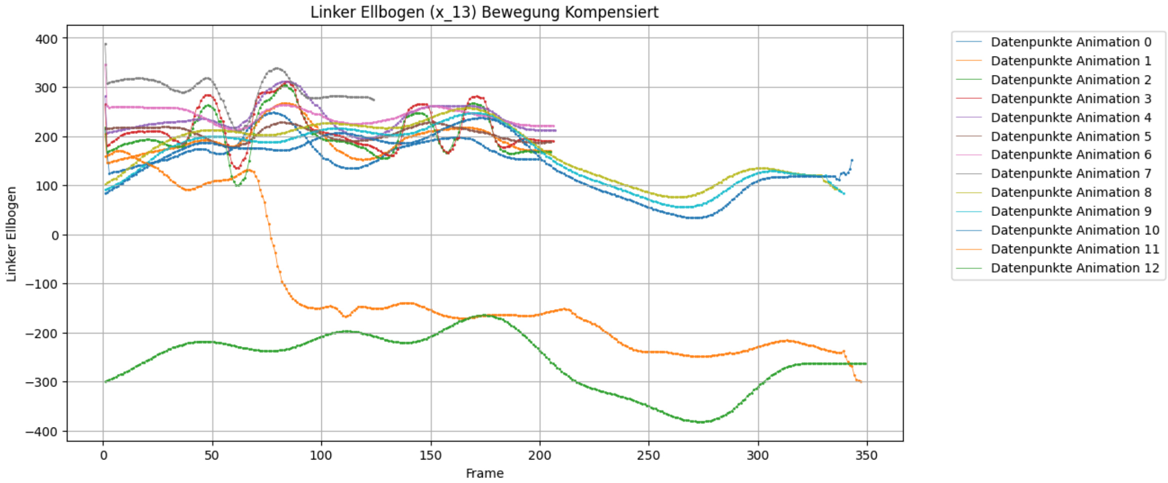
In [ ]:
```
plt.figure(figsize=(12, 6))
for i, df in enumerate(dfsKomp01):
    plt.scatter(df["frame"], df["y_15"], marker='o', color=f'C{i}', s=1)
    plt.plot(df["frame"], df["y_15"], color=f'C{i}', linestyle='-', linew

plt.title("Linke Hand (y_15) Bewegung Kompensiert")
plt.xlabel("Frame")
plt.ylabel("Linke Hand")
plt.grid(True)
plt.legend(bbox_to_anchor=(1.05, 1), loc='upper left')
plt.show()
```



2.5 Linker Ellbogen Kompensiert

In [ ]:
```
plt.figure(figsize=(12, 6))
for i, df in enumerate(dfsKomp01):
    plt.scatter(df["frame"], df["x_13"], marker='o', color=f'C{i}', s=1)
    plt.plot(df["frame"], df["x_13"], color=f'C{i}', linestyle='-', linew

plt.title("Linker Ellbogen (x_13) Bewegung Kompensiert")
plt.xlabel("Frame")
plt.ylabel("Linker Ellbogen")
```

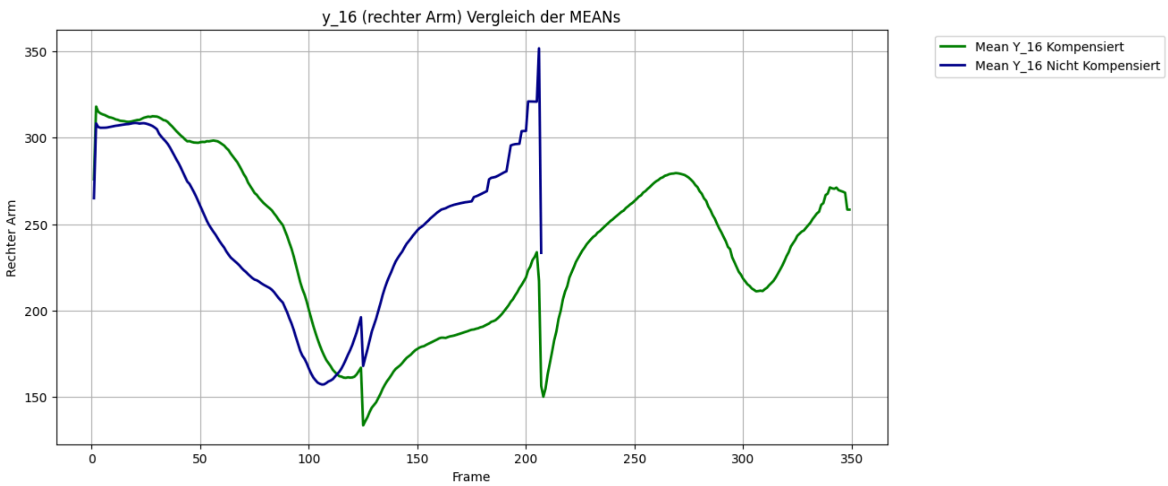
```
plt.grid(True)
# Move the legend outside of the plot
plt.legend(bbox_to_anchor=(1.05, 1), loc='upper left')

plt.show()
```



Berechnung Euclidean Distances

1. Analyse der Kompensierten und nicht Komptensierten Mean Werte

In [ ]:
```
plt.figure(figsize=(12, 6))

plt.plot(mean_values_01.index, mean_values_01["y_16"], color='green', lin
plt.plot(mean_values_03.index, mean_values_03["y_16"], color='darkblue',

plt.title("y_16 (rechter Arm) Vergleich der MEANs")
plt.xlabel("Frame")
plt.ylabel("Rechter Arm")
plt.grid(True)
plt.legend(bbox_to_anchor=(1.05, 1), loc='upper left')
plt.show()
```



2. Vergleich Werte Kompensiert und Nicht Kompensiert anhand Euclidean Distances

In [ ]:

```
# Definition von Kolonnen
columns = ['frame', 'x_0', 'y_0', 'z_0', 'x_11', 'y_11', 'z_11',
           'x_12', 'y_12', 'z_12', 'x_13', 'y_13', 'z_13', 'x_14', 'y_14'
           'x_16', 'y_16', 'z_16', 'x_17', 'y_17', 'z_17', 'x_18', 'y_18'
           'x_20', 'y_20', 'z_20', 'x_21', 'y_21', 'z_21', 'x_22', 'y_22'
           'x_24', 'y_24', 'z_24', 'x_25', 'y_25', 'z_25', 'x_26', 'y_26'
           'x_28', 'y_28', 'z_28', 'x_31', 'y_31', 'z_31', 'x_32', 'y_32'

# Kalkulieren von euclidean Distance
euclidean_distances_03 = {}

common_frames = mean_values_03.index.intersection(mean_values_01.index)

for frame in common_frames:
    euclidean_distances_03[frame] = []
    for col in columns[1:]:
        point_1 = (frame, mean_values_03.loc[frame, col])
        point_2 = (frame, mean_values_01.loc[frame, col])
        euclidean_distance_03 = distance.euclidean(point_1, point_2)
        euclidean_distances_03[frame].append(euclidean_distance_03)

euclidean_df_03 = pd.DataFrame.from_dict(euclidean_distances_03, orient='
euclidean_df_03.head(5)
```

Out[ ]:

	x_0	y_0	z_0	x_11	y_11	z_11	x_12
1	56.347077	3.709900	26.493928	61.694015	0.853769	31.509481	61.518769
2	55.641238	4.177262	28.114948	61.163600	1.457569	32.761196	60.991808
3	55.079692	4.217546	29.747885	60.736092	1.626208	34.037398	60.571785
4	54.195238	3.875785	31.520561	60.052254	1.431562	35.427136	59.887723
5	53.443262	3.449185	33.546902	59.460269	1.182000	36.979316	59.304600

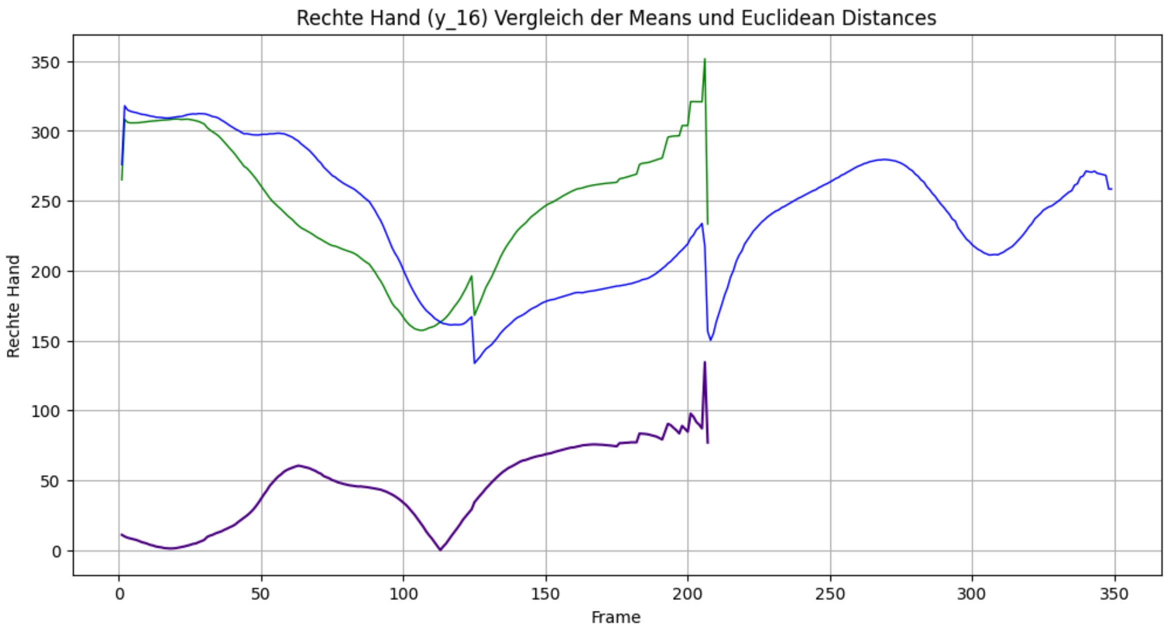
5 rows × 63 columns

2.1 Vergleich Rechte Hand

In [ ]:

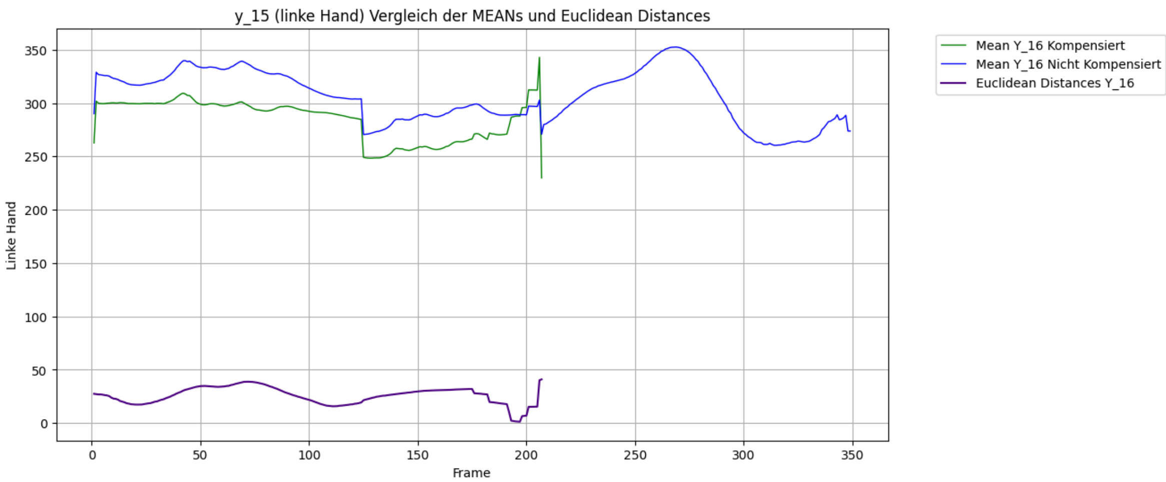
```
plt.figure(figsize=(12, 6))

# Plot the mean values for DeepMotion 01
plt.plot(mean_values_03.index, mean_values_03["y_16"], color='green', lin

# Plot the mean values for Mediapipe 01
plt.plot(mean_values_01.index, mean_values_01["y_16"], color='blue', line

# Plot the Euclidean distances for the last calculated column
plt.plot(euclidean_df_03.index, euclidean_df_03["y_16"], color='indigo',


plt.title("Rechte Hand (y_16) Vergleich der Means und Euclidean Distances
plt.xlabel("Frame")
plt.ylabel("Rechte Hand")
plt.grid(True)
plt.legend(bloc='best')
plt.show()
```

```
---------------------------------------------------------------------------
TypeError                                 Traceback (most recent call last)
Cell In[97], line 17
     15 plt.ylabel("Rechte Hand")
     16 plt.grid(True)
---> 17 plt.legend(bloc='best')
     18 plt.show()

File /Library/Frameworks/Python.framework/Versions/3.11/lib/python3.11/site-packages/matplotlib/pyplot.py:2710, in legend(*args, **kwargs)
   2708 @_copy_docstring_and_deprecators(Axes.legend)
   2709 def legend(*args, **kwargs):
-> 2710     return gca().legend(*args, **kwargs)

File /Library/Frameworks/Python.framework/Versions/3.11/lib/python3.11/site-packages/matplotlib/axes/_axes.py:318, in Axes.legend(self, *args, **kwargs)
    316 if len(extra_args):
    317     raise TypeError('legend only accepts two non-keyword arguments')
--> 318 self.legend_ = mlegend.Legend(self, handles, labels, **kwargs)
    319 self.legend_._remove_method = self._remove_legend
    320 return self.legend_

File /Library/Frameworks/Python.framework/Versions/3.11/lib/python3.11/site-packages/matplotlib/_api/deprecation.py:454, in make_keyword_only.<locals>.wrapper(*args, **kwargs)
    448 if len(args) > name_idx:
    449     warn_deprecated(
    450         since, message="Passing the %(name)s %(obj_type)s "
    451         "positionally is deprecated since Matplotlib %(since)s; the "
    452         "parameter will become keyword-only %(removal)s.",
    453         name=name, obj_type=f"parameter of {func.__name__}()")
--> 454 return func(*args, **kwargs)

TypeError: Legend.__init__() got an unexpected keyword argument 'bloc'
```



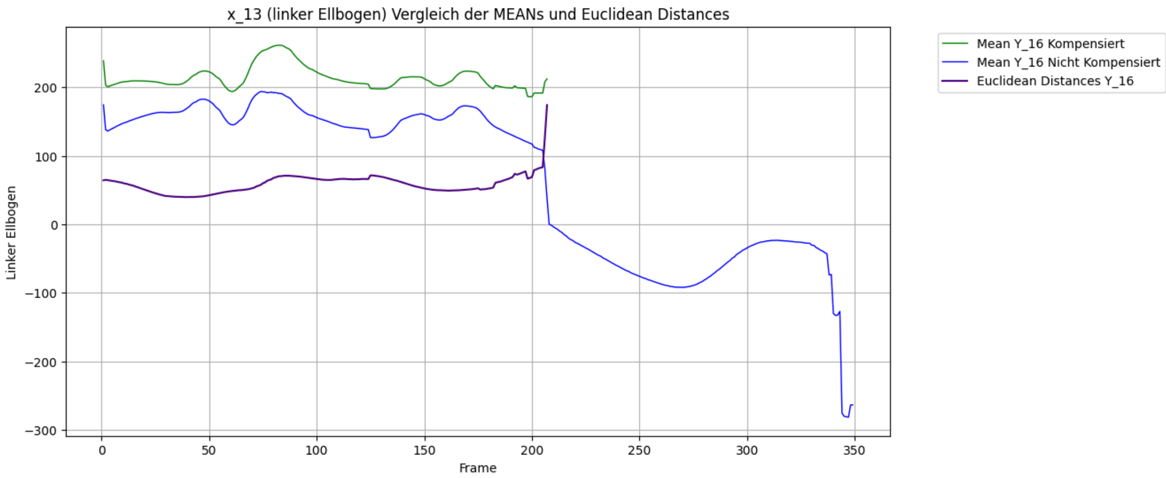
2.2 Vergleich Linke Hand

In [ ]:
```
plt.figure(figsize=(12, 6))

# Plot the mean values for DeepMotion 01
plt.plot(mean_values_03.index, mean_values_03["y_15"], color='green', lin

# Plot the mean values for Mediapipe 01
plt.plot(mean_values_01.index, mean_values_01["y_15"], color='blue', line

# Plot the Euclidean distances for the last calculated column
plt.plot(euclidean_df_03.index, euclidean_df_03["y_15"], color='indigo',


plt.title("Linke Hand (y_15) Vergleich der Means und Euclidean Distances"
plt.xlabel("Frame")
plt.ylabel("Linke Hand")
plt.grid(True)
plt.legend(loc='best')
plt.show()
```



2.3 Vergleich linker Ellbogen

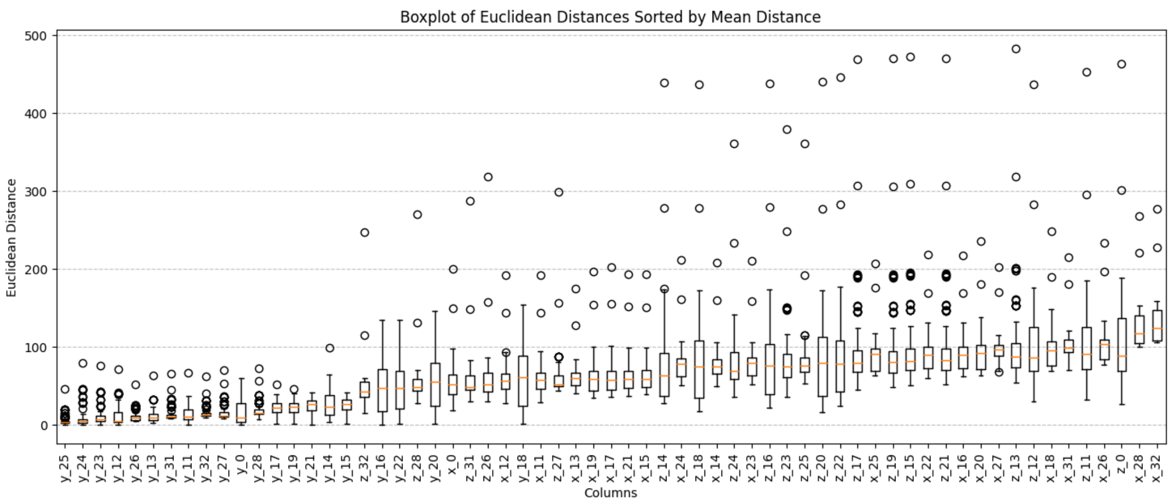
In [ ]:
```
plt.figure(figsize=(12, 6))

# Plot the mean values for DeepMotion 01
plt.plot(mean_values_03.index, mean_values_03["x_13"], color='green', lin

# Plot the mean values for Mediapipe 01
plt.plot(mean_values_01.index, mean_values_01["x_13"], color='blue', line

# Plot the Euclidean distances for the last calculated column
plt.plot(euclidean_df_03.index, euclidean_df_03["x_13"], color='indigo',


plt.title("Linker Ellbogen (x_13) Vergleich der Means und Euclidean Dista
plt.xlabel("Frame")
plt.ylabel("Linker Ellbogen")
plt.grid(True)
plt.legend(loc='best')
plt.show()
```



3. Analyse Euclidean Distances

In [ ]:

```
mean_distances = euclidean_df_03.mean()
sorted_df = euclidean_df_03[mean_distances.sort_values().index]

plt.figure(figsize=(16, 6))
plt.boxplot(sorted_df.values)
plt.xticks(range(1, len(sorted_df.columns) + 1), sorted_df.columns, rotat
plt.title('Boxplot of Euclidean Distances Sorted by Mean Distance')
plt.xlabel('Columns')
plt.ylabel('Euclidean Distance')
plt.grid(axis='y', linestyle='--', alpha=0.7)
plt.show()
```

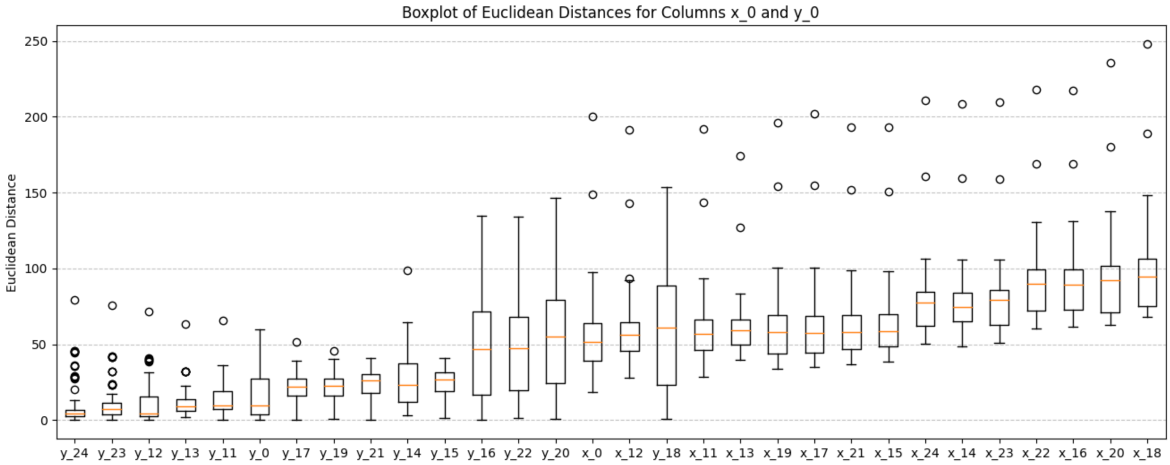


3.1 Analyse Euclidean Distances ohne Z Werte

In [ ]:

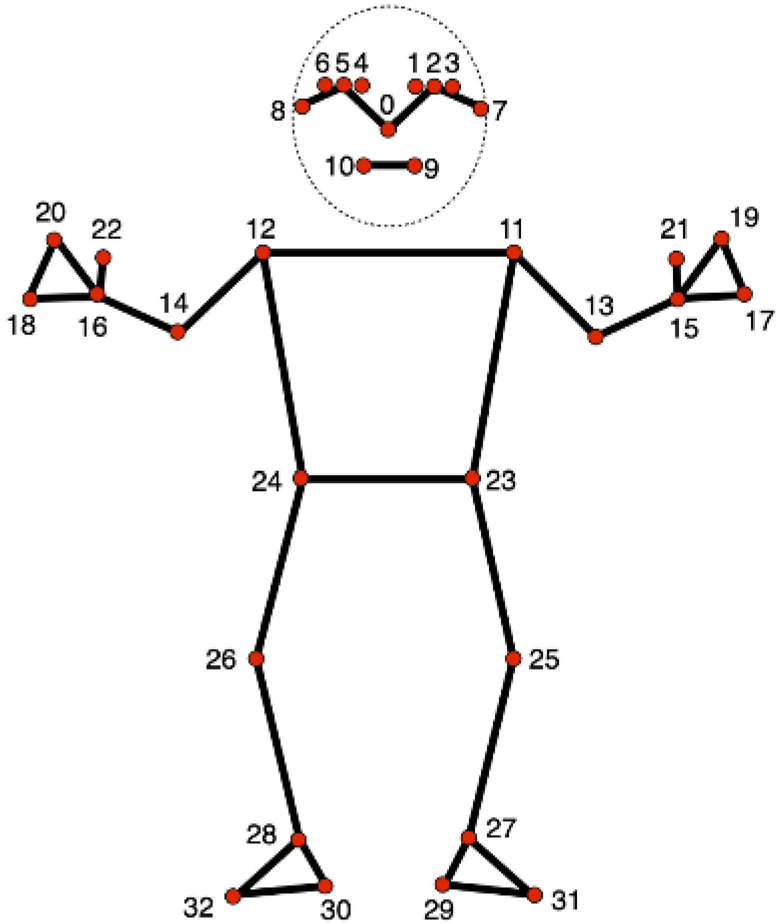
```
# Select only the 'x_0' and 'y_0' columns from the sorted DataFrame
selected_columns = ['x_0', 'x_11', 'x_12', 'x_13',
                    'x_14', 'x_15', 'x_16', 'x_17',
                    'x_18', 'x_19', 'x_20', 'x_21',
                    'x_22', 'x_23', 'x_24', 'y_0',
                    'y_11', 'y_12', 'y_13',
                    'y_14', 'y_15', 'y_16', 'y_17',
                    'y_18', 'y_19', 'y_20', 'y_21',
                    'y_22', 'y_23', 'y_24']

# Calculate the mean of Euclidean distances for each column
```

```python
mean_distances = euclidean_df_03[selected_columns].mean()

# Sort the DataFrame by the mean distance in ascending order
sorted_df = euclidean_df_03[mean_distances.sort_values().index]

# Plotting the box plot
plt.figure(figsize=(16, 6))
plt.boxplot(sorted_df.values)
plt.xticks(range(1, len(sorted_df.columns) + 1), sorted_df.columns)
plt.title('Boxplot of Euclidean Distances for Columns x_0 and y_0')
plt.ylabel('Euclidean Distance')
plt.grid(axis='y', linestyle='--', alpha=0.7)
plt.show()
```



4. Vergleich ganzer Oberkörper

In [ ]:
```python
# Inserting an image
img = plt.imread('Pictures/landmark.png')  # Replace 'landmark.png' with
im = OffsetImage(img, zoom=0.2)  # Adjust the zoom level as needed
ab = AnnotationBbox(im, (0.5, 0.5), frameon=False)
plt.gca().add_artist(ab)

# Remove axis
plt.axis('off')

plt.show()
```



In [ ]:

```
selected_columns = ['x_0', 'y_0', 'z_0', 'x_11', 'y_11', 'z_11',
                    'x_12', 'y_12', 'z_12', 'x_13', 'y_13', 'z_13',
                    'x_14', 'y_14', 'z_14', 'x_15', 'y_15', 'z_15',
                    'x_16', 'y_16', 'z_16', 'x_17', 'y_17', 'z_17',
                    'x_18', 'y_18', 'z_18', 'x_19', 'y_19', 'z_19',
                    'x_20', 'y_20', 'z_20', 'x_21', 'y_21', 'z_21',
                    'x_22', 'y_22', 'z_22', 'x_23', 'y_23', 'z_23',
                    'x_24', 'y_24', 'z_24']

difference_in_mean_upper_body_01 = mean_values_01[selected_columns].mean(
print(f"Mean Value: {difference_in_mean_upper_body_01}")
```

```
Mean Value: x_0    -147.400673
y_0       -4.531935
z_0      178.774507
x_11    -149.795352
y_11     -11.713364
z_11     171.212613
x_12    -149.280201
y_12     -15.069126
z_12     165.919668
x_13    -147.136210
y_13     -16.865248
z_13     170.188276
x_14    -164.884046
y_14     -32.208482
z_14     119.634339
x_15    -139.602184
y_15      21.121775
z_15     162.195464
x_16    -194.758924
y_16      -9.453361
z_16     141.700297
x_17    -132.880172
y_17      15.957865
z_17     158.530291
x_18    -206.325952
y_18      -8.033598
z_18     143.186552
x_19    -133.569279
y_19      17.433462
z_19     158.954701
x_20    -201.656343
y_20      -7.284322
z_20     148.614966
x_21    -138.473776
y_21      20.348651
z_21     163.258594
x_22    -195.118314
y_22      -8.354448
z_22     146.409882
x_23    -163.812389
y_23     -20.549169
z_23     133.983561
x_24    -163.654302
y_24     -24.459143
z_24     127.893144
dtype: float64
```

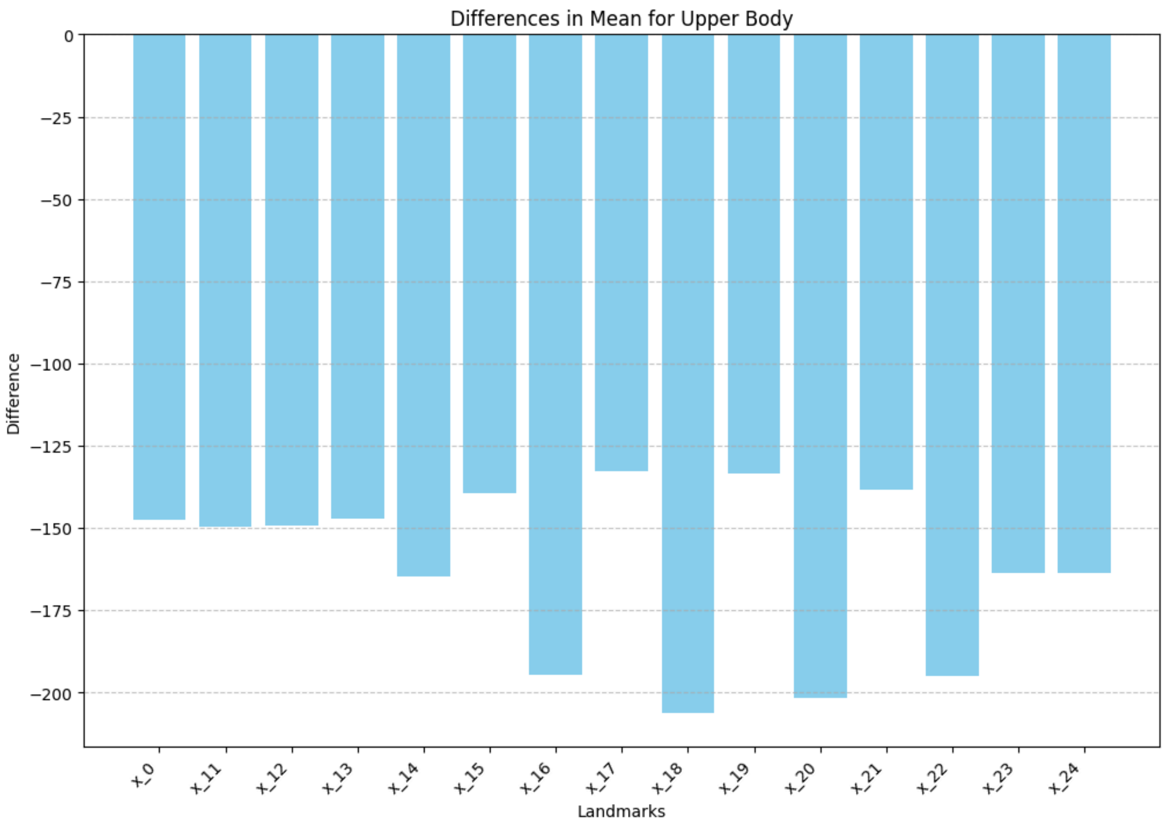
In [ ]:

```
selected_columns_X = ['x_0', 'x_11', 'x_12', 'x_13',
                      'x_14', 'x_15', 'x_16', 'x_17',
                      'x_18', 'x_19', 'x_20', 'x_21',
                      'x_22', 'x_23', 'x_24']

selected_columns_Y = ['y_0', 'y_11', 'y_12', 'y_13',
                      'y_14', 'y_15', 'y_16', 'y_17',
                      'y_18', 'y_19', 'y_20', 'y_21',
                      'y_22', 'y_23', 'y_24']

selected_columns_Z = ['z_0', 'z_11', 'z_12', 'z_13',
                      'z_14', 'z_15', 'z_16', 'z_17',
                      'z_18', 'z_19', 'z_20', 'z_21',
```

```
                    'z_22', 'z_23', 'z_24']

difference_in_mean_upper_body_01_X = difference_in_mean_upper_body_01[sel
difference_in_mean_upper_body_01_Y = difference_in_mean_upper_body_01[sel
difference_in_mean_upper_body_01_Z = difference_in_mean_upper_body_01[sel
```

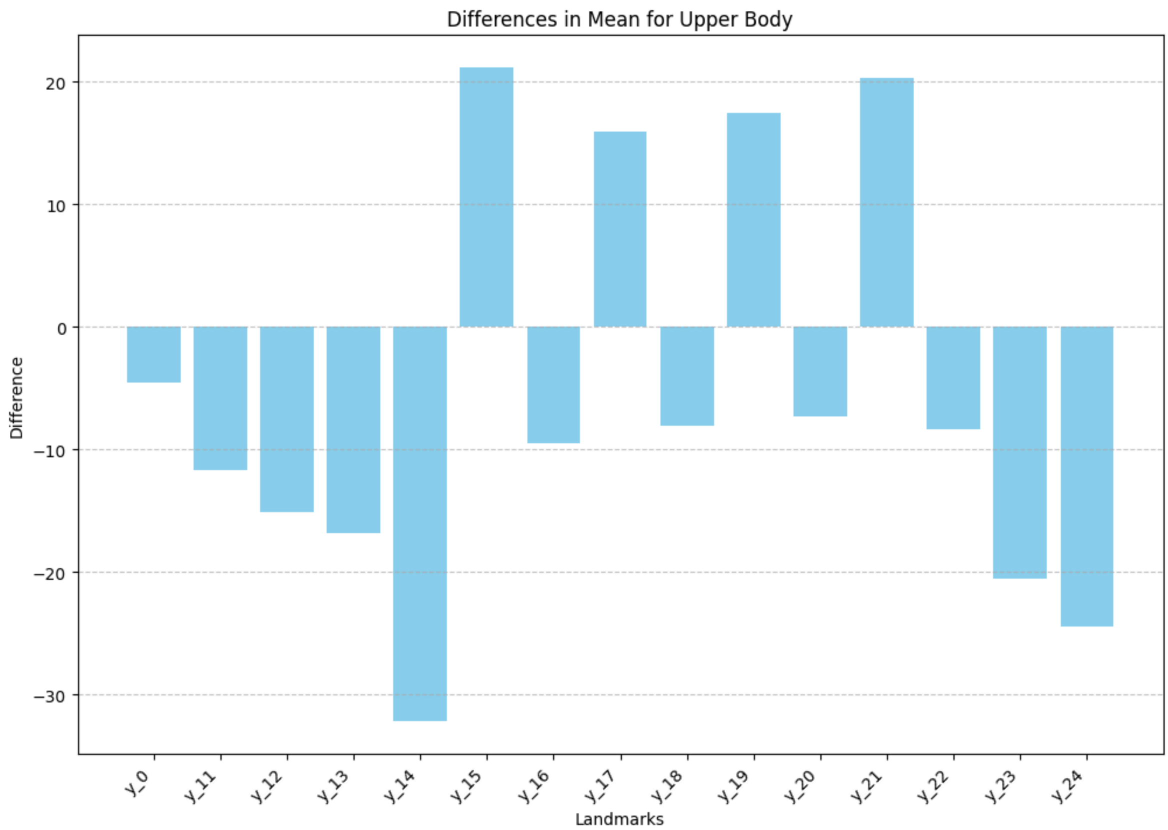
In [ ]:

```
plt.figure(figsize=(12, 8))
plt.bar(difference_in_mean_upper_body_01_X.index, difference_in_mean_uppe
plt.title('Differences in Mean for Upper Body')
plt.xlabel('Landmarks')
plt.ylabel('Difference')
plt.xticks(rotation=45, ha='right')
plt.grid(axis='y', linestyle='--', alpha=0.7)
plt.show()
```



In [ ]:

```
plt.figure(figsize=(12, 8))
plt.bar(difference_in_mean_upper_body_01_Y.index, difference_in_mean_uppe
plt.title('Differences in Mean for Upper Body')
plt.xlabel('Landmarks')
plt.ylabel('Difference')
plt.xticks(rotation=45, ha='right')
plt.grid(axis='y', linestyle='--', alpha=0.7)
plt.show()
```



In [ ]:

```
plt.figure(figsize=(12, 8))
plt.bar(difference_in_mean_upper_body_01_Z.index, difference_in_mean_uppe
plt.title('Differences in Mean for Upper Body')
plt.xlabel('Landmarks')
plt.ylabel('Difference')
plt.xticks(rotation=45, ha='right')
plt.grid(axis='y', linestyle='--', alpha=0.7)
plt.show()
```