

000

054

001

055

002

056

003

057

004

058

005

059

006

060

007

061

008

062

009

063

010

064

011

065

012

066

013

067

014

068

KBody: Towards general, robust, and aligned monocular whole-body estimation

Supplementary Material

Anonymous CVPR submission

Paper ID ****

1. Qualitative Results

Figs. 1 to 25 present 112 qualitative result comparisons between the presented KBody method (rightmost - pink) the optimization-based SMPLify-X [2] (leftmost - light green), and the single-shot models PyMAF-X [3] (middle left - purple) and SHAPY [1] (middle right - green), focusing on pose and shape capturing respectively.

In addition, Figs. 29 to 32 present an extra 32 qualitative results that demonstrate benefits of the asymmetric distance field (ADF), compared to a symmetric variant, when considering clothing robustness gains and unnatural shape captures.

References

- [1] Vasileios Choutas, Lea Müller, Chun-Hao P Huang, Siyu Tang, Dimitrios Tzionas, and Michael J Black. Accurate 3D Body Shape Regression Using Metric and Semantic Attributes. In *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition*, pages 2718–2728, 2022. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29
- [2] Georgios Pavlakos, Vasileios Choutas, Nima Ghorbani, Timo Bolkart, Ahmed AA Osman, Dimitrios Tzionas, and Michael J Black. Expressive body capture: 3d hands, face, and body from a single image. In *Proceedings of the IEEE/CVF conference on computer vision and pattern recognition*, pages 10975–10985, 2019. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29
- [3] Hongwen Zhang, Yating Tian, Yuxiang Zhang, Mengcheng Li, Liang An, Zhenan Sun, and Yebin Liu. PyMAF-X: Towards Well-aligned Full-body Model Regression from Monocular Images. *arXiv preprint arXiv:2207.06400*, 2022. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29

048

102

049

103

050

104

051

105

052

106

053

107

108
109
110
111
112
113
114
115
116
117
118
119
120
121
122
123
124
125
126
127
128
129
130
131
132
133
134
135
136
137
138
139
140
141
142
143
144
145
146
147
148
149
150
151
152
153
154
155
156
157
158
159
160
161



Figure 1. Left-to-right: SMPLify-X [2] (light green), PyMAF-X [3] (purple), SHAPY [1] (green) and KBody (Ours).

216
217
218
219
220
221
222
223
224
225
226
227
228270
271
272
273
274
275
276
277
278
279
280
281
282229
230
231
232
233
234
235
236
237
238
239
240
241283
284
285
286
287
288
289
290
291
292
293
294
295242
243
244
245
246
247
248
249
250
251
252
253
254296
297
298
299
300
301
302
303
304
305
306
307
308255
256
257
258
259
260
261
262
263
264
265
266
267309
310
311
312
313
314
315
316
317
318
319
320
321

SMPLify-X [2]

PyMAF-X [3]

SHAPY [1]

KBody (Ours)

268

Figure 2. Left-to-right: SMPLify-X [2] (light green), PyMAF-X [3] (purple), SHAPY [1] (green) and KBody (pink).



Figure 3. Left-to-right: SMPLify-X [2] (light green), PyMAF-X [3] (purple), SHAPY [1] (green) and KBody (Ours).

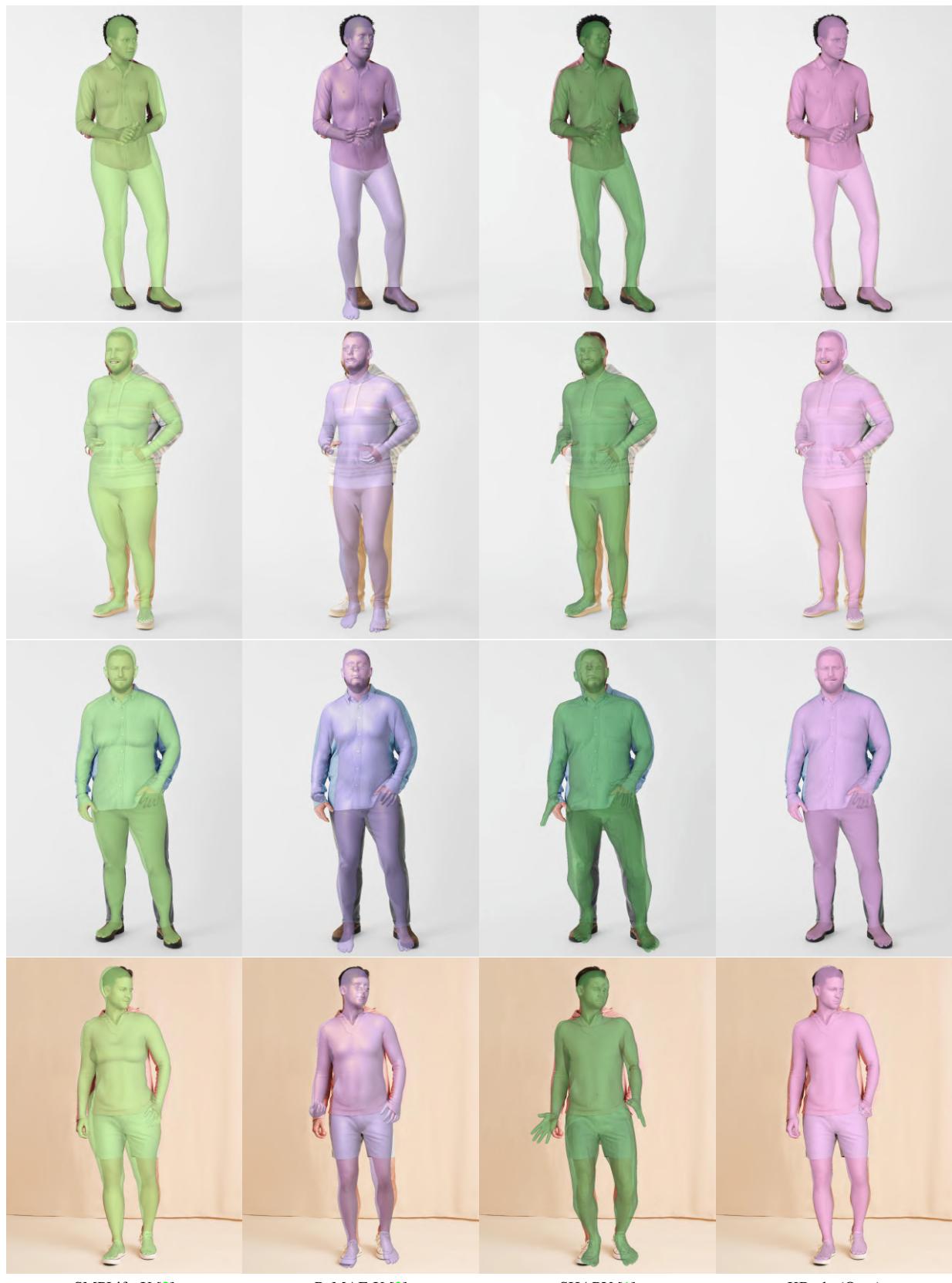


Figure 4. Left-to-right: SMPLify-X [2], PyMAF-X [3], SHAPY [1] and KBody (Ours).

540
541
542
543
544
545
546
547
548
549
550
551
552
553
554
555
556
557
558
559
560
561
562
563
564
565
566
567
568
569
570
571
572
573
574
575
576
577
578
579
580
581
582
583
584
585
586
587
588
589
590
591
592
593



Figure 5. Left-to-right: SMPLify-X [2] (light green), PyMAF-X [3] (purple), SHAPY [1] (green) and KBody (Ours).

648
649
650
651
652
653
654
655
656
657
658
659
660
661
662
663
664
665
666
667
668
669
670
671
672
673
674
675
676
677
678
679
680
681
682
683
684
685
686
687
688
689
690
691
692
693
694
695
696
697
698
699
700
701



Figure 6. Left-to-right: SMPLify-X [2] (light green), PyMAF-X [3] (purple), SHAPY [1] (green) and KBody (Ours).

756
757
758
759
760
761
762
763
764
765
766
767
768
769
770
771
772
773
774
775
776
777
778
779
780
781
782
783
784
785
786
787
788
789
790
791
792
793
794
795
796
797
798
799
800
801
802
803
804
805
806
807
808
809

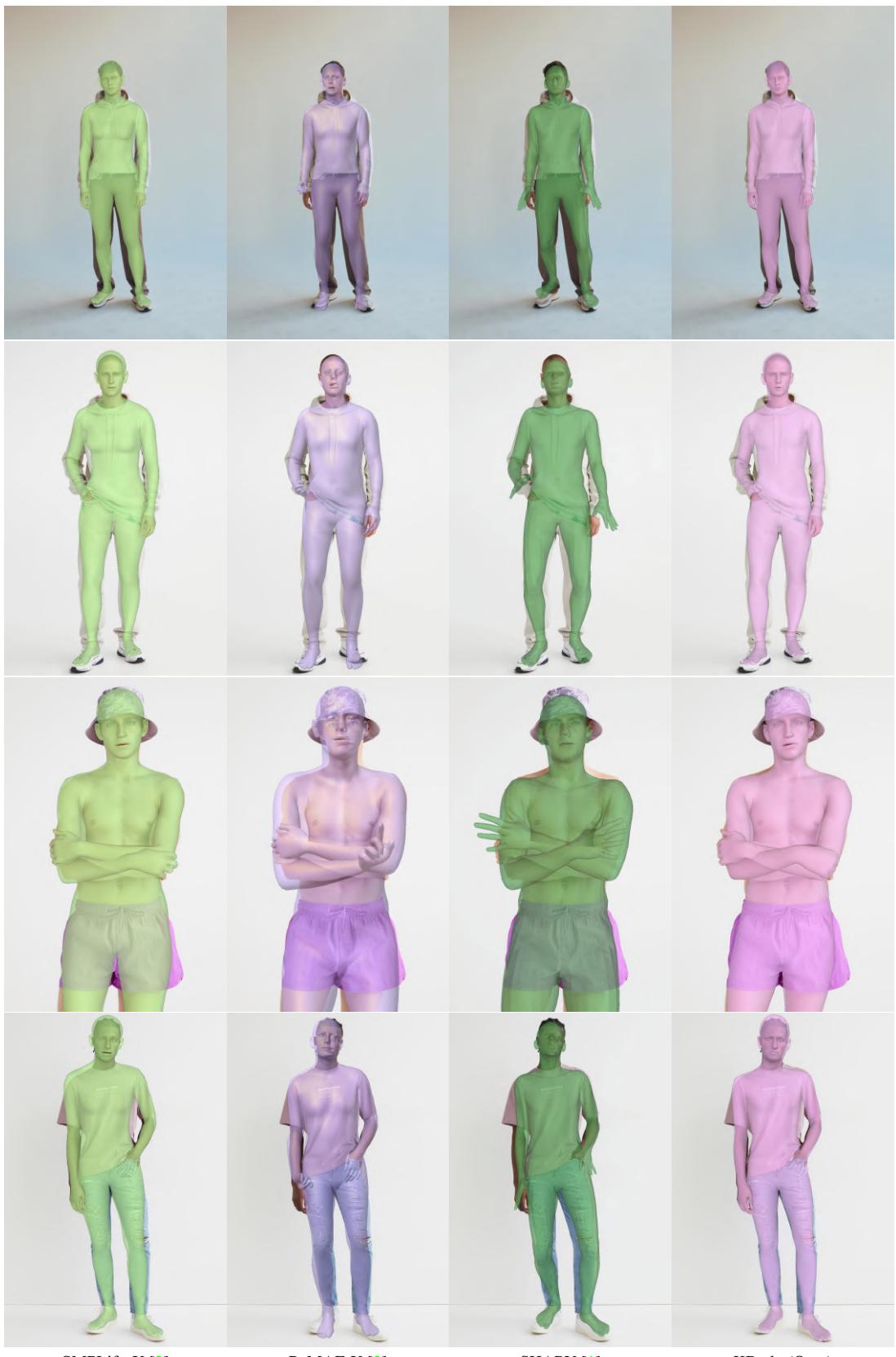


Figure 7. Left-to-right: SMPLify-X [2] (light green), PyMAF-X [3] (purple), SHAPY [1] (green) and KBody (Ours).

864
865
866
867
868
869
870
871
872
873
874
875
876
877
878
879
880
881
882
883
884
885
886
887
888
889
890
891
892
893
894
895
896
897
898
899
900
901
902
903
904
905
906
907
908
909
910
911
912
913
914
915
916
917



SMPLify-X [2] PyMAF-X [3] SHAPY [1] KBody (Ours)

Figure 8. Left-to-right: SMPLify-X [2] (light green), PyMAF-X [3] (purple), SHAPY [1] (green) and KBody (Ours).

972
973
974
975
976
977
978
979
980
981
982
983
984
985
986
987
988
989
990
991
992
993
994
995
996
997
998
999
1000
1001
1002
1003
1004
1005
1006
1007
1008
1009
1010
1011
1012
1013
1014
1015
1016
1017
1018
1019
1020
1021
1022
1023
1024
1025



Figure 9. Left-to-right: SMPLify-X [2] (light green), PyMAF-X [3] (purple), SHAPY [1] (green) and KBody (Ours).

1080
1081
1082
1083
1084
1085
1086
1087
1088
1089
1090
1091
1092
1093
1094
1095
1096
1097
1098
1099
1100
1101
1102
1103
1104
1105
1106
1107
1108
1109
1110
1111
1112
1113
1114
1115
1116
1117
1118
1119
1120
1121
1122
1123
1124
1125
1126
1127
1128
1129
1130
1131
1132
1133

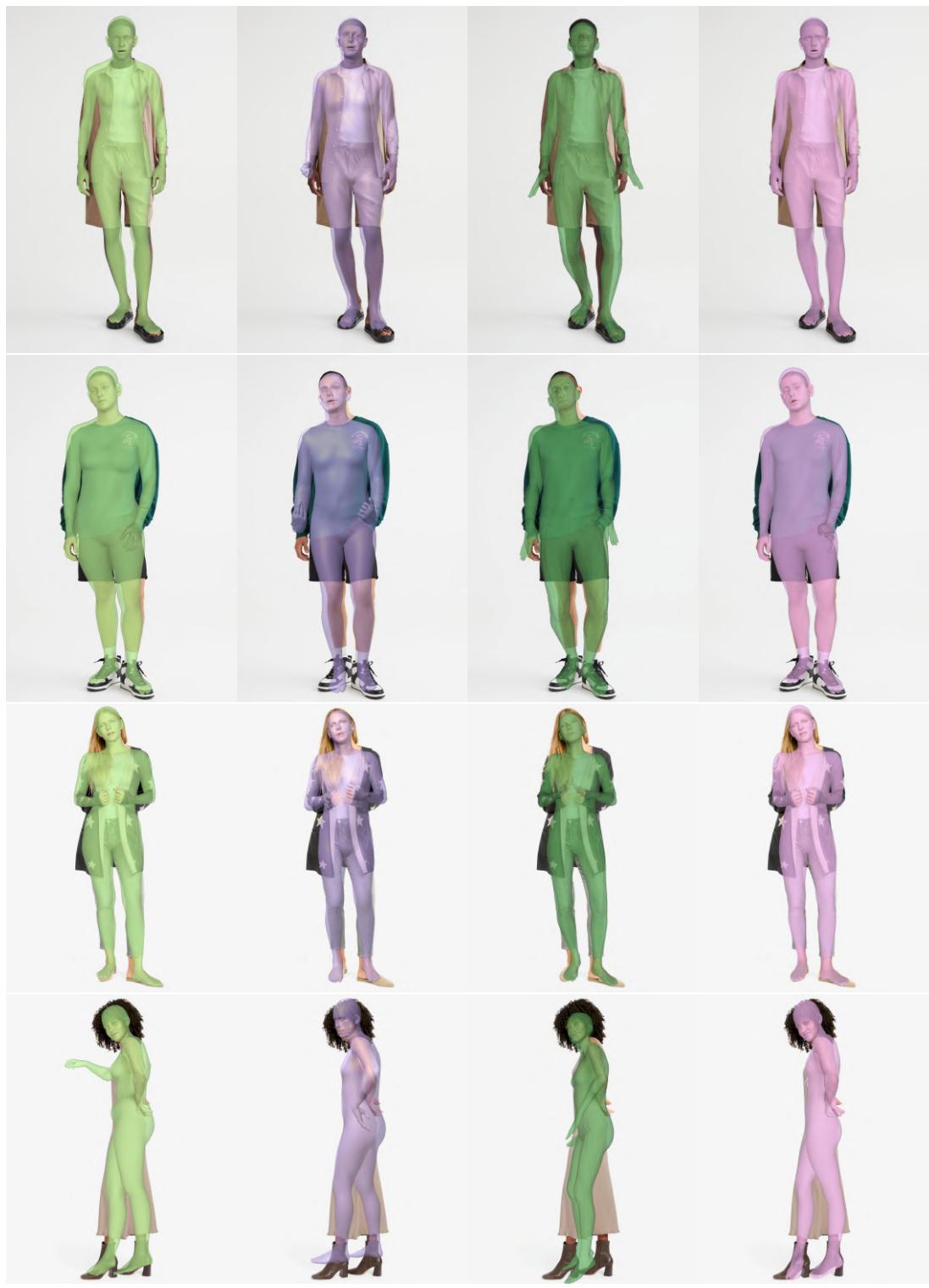


Figure 10. Left-to-right: SMPLify-X [2] (light green), PyMAF-X [3] (purple), SHAPY [1] (green) and KBody (Ours) (pink).

1185
1186
1187

1188
1189
1190
1191
1192
1193
1194
1195
1196
1197
1198
1199
1200



1242
1243
1244
1245
1246
1247
1248
1249
1250
1251
1252
1253
1254

1201
1202
1203
1204
1205
1206
1207
1208
1209
1210
1211
1212
1213



1255
1256
1257
1258
1259
1260
1261
1262
1263
1264
1265
1266
1267

1214
1215
1216
1217
1218
1219
1220
1221
1222
1223
1224
1225
1226



1268
1269
1270
1271
1272
1273
1274
1275
1276
1277
1278
1279
1280

1227
1228
1229
1230
1231
1232
1233
1234
1235
1236
1237
1238
1239



1281
1282
1283
1284
1285
1286
1287
1288
1289
1290
1291
1292
1293

1240
1241

SMPLify-X [2]

PyMAF-X [3]

SHAPY [1]

KBody (Ours)

Figure 11. Left-to-right: SMPLify-X [2] (light green), PyMAF-X [3] (purple), SHAPY [1] (green) and KBody (pink).

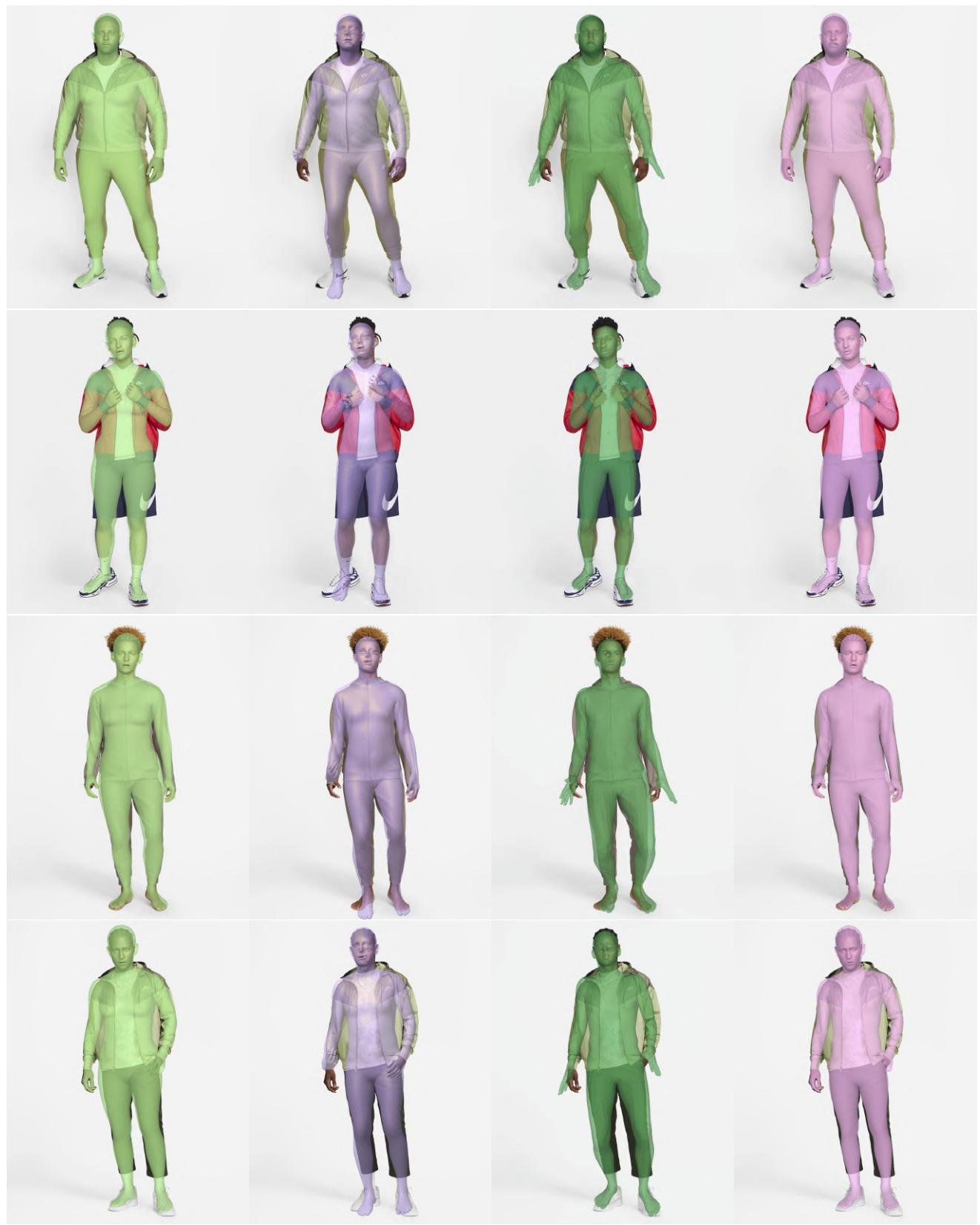


Figure 12. Left-to-right: SMPLify-X [2] (light green), PyMAF-X [3] (purple), SHAPY [1] (green) and KBody (Ours).



Figure 13. Left-to-right: SMPLify-X [2] (light green), PyMAF-X [3] (purple), SHAPY [1] (green) and KBody (Ours).

1512
1513
1514
1515
1516
1517
1518
1519
1520
1521
1522
1523
15241566
1567
1568
1569
1570
1571
1572
1573
1574
1575
1576
1577
15781525
1526
1527
1528
1529
1530
1531
1532
1533
1534
1535
1536
15371579
1580
1581
1582
1583
1584
1585
1586
1587
1588
1589
1590
15911538
1539
1540
1541
1542
1543
1544
1545
1546
1547
1548
1549
15501592
1593
1594
1595
1596
1597
1598
1599
1600
1601
1602
1603
16041551
1552
1553
1554
1555
1556
1557
1558
1559
1560
1561
1562
15631605
1606
1607
1608
1609
1610
1611
1612
1613
1614
1615
1616
1617

SMPLify-X [2]

PyMAF-X [3]

SHAPY [1]

KBody (Ours)

Figure 14. Left-to-right: SMPLify-X [2] (light green), PyMAF-X [3] (purple), SHAPY [1] (green) and KBody (pink).

1620
1621
1622
1623
1624
1625
1626
1627
1628
1629
1630
1631
1632
1633
1634
1635
1636
1637
1638
1639
1640
1641
1642
1643
1644
1645
1646
1647
1648
1649
1650
1651
1652
1653
1654
1655
1656
1657
1658
1659
1660
1661
1662
1663
1664
1665
1666
1667
1668
1669
1670
1671
1672
1673



Figure 15. Left-to-right: SMPLify-X [2] (light green), PyMAF-X [3] (purple), SHAPY [1] (green) and KBody (Ours).

1728
1729
1730
1731
1732
1733
1734
1735
1736
1737
1738
1739
1740
1741
1742
1743
1744
1745
1746
1747
1748
1749
1750
1751
1752
1753
1754
1755
1756
1757
1758
1759
1760
1761
1762
1763
1764
1765
1766
1767
1768
1769
1770
1771
1772
1773
1774
1775
1776
1777
1778
1779
1780
1781

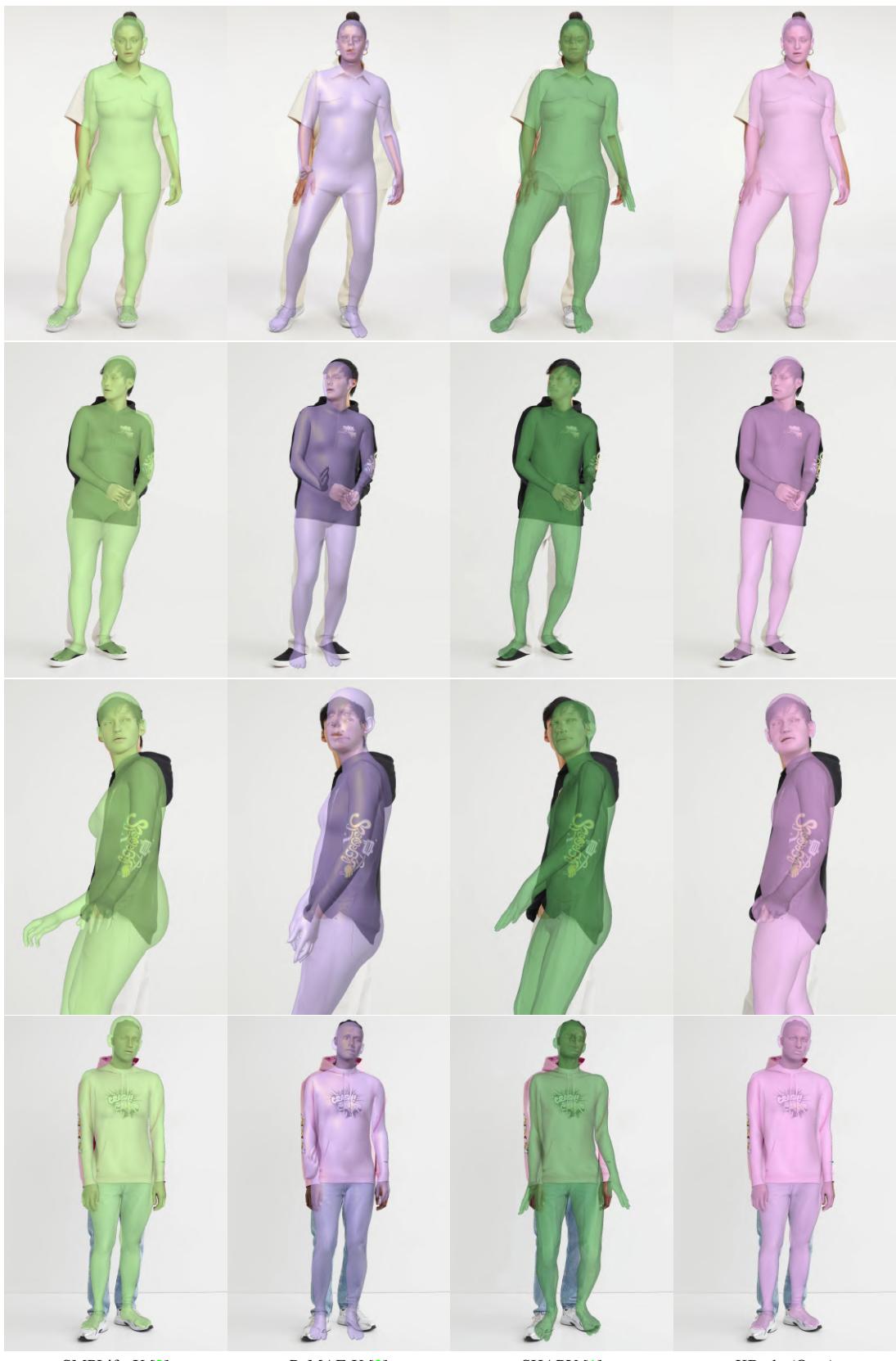


Figure 16. Left-to-right: SMPLify-X [2] (light green), PyMAF-X [3] (purple), SHAPY [1] (green) and KBody (Ours) (pink).

1782
1783
1784
1785
1786
1787
1788
1789
1790
1791
1792
1793
1794
1795
1796
1797
1798
1799
1800
1801
1802
1803
1804
1805
1806
1807
1808
1809
1810
1811
1812
1813
1814
1815
1816
1817
1818
1819
1820
1821
1822
1823
1824
1825
1826
1827
1828
1829
1830
1831
1832
1833
1834
1835

1836
1837
1838
1839
1840
1841
1842
1843
1844
1845
1846
1847
1848
1849
1850
1851
1852
1853
1854
1855
1856
1857
1858
1859
1860
1861
1862
1863
1864
1865
1866
1867
1868
1869
1870
1871
1872
1873
1874
1875
1876
1877
1878
1879
1880
1881
1882
1883
1884
1885
1886
1887
1888
1889



Figure 17. Left-to-right: SMPLify-X [2] (light green), PyMAF-X [3] (purple), SHAPY [1] (green) and KBody (Ours) (pink).

1944
1945
1946
1947
1948
1949
1950
1951
1952
1953
1954
1955
1956
1957
1958
1959
1960
1961
1962
1963
1964
1965
1966
1967
1968
1969
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997



Figure 18. Left-to-right: SMPLify-X [2] (light green), PyMAF-X [3] (purple), SHAPY [1] (green) and KBody (Ours).

1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
2036
2037
2038
2039
2040
2041
2042
2043
2044
2045
2046
2047
2048
2049
2050
2051

2052
2053
2054
2055
2056
2057
2058
2059
2060
2061
2062
2063
2064



2106
2107
2108
2109
2110
2111
2112
2113
2114
2115
2116
2117
2118

2065
2066
2067
2068
2069
2070
2071
2072
2073
2074
2075
2076
2077



2119
2120
2121
2122
2123
2124
2125
2126
2127
2128
2129
2130
2131

2078
2079
2080
2081
2082
2083
2084
2085
2086
2087
2088
2089
2090



2132
2133
2134
2135
2136
2137
2138
2139
2140
2141
2142
2143
2144

2091
2092
2093
2094
2095
2096
2097
2098
2099
2100
2101
2102
2103
2104
2105



2145
2146
2147
2148
2149
2150
2151
2152
2153
2154
2155
2156
2157
2158
2159

Figure 19. Left-to-right: SMPLify-X [2] (light green), PyMAF-X [3] (purple), SHAPY [1] (green) and KBody (Ours) (pink).



Figure 20. Left-to-right: SMPLify-X [2] (light green), PyMAF-X [3] (purple), SHAPY [1] (green) and KBody (Ours).

2268
2269
2270
2271
2272
2273
2274
2275
2276
2277
2278
2279
2280

2322
2323
2324
2325
2326
2327
2328
2329
2330
2331
2332
2333
2334

2281
2282
2283
2284
2285
2286
2287
2288
2289
2290
2291
2292
2293

2335
2336
2337
2338
2339
2340
2341
2342
2343
2344
2345
2346
2347

2294
2295
2296
2297
2298
2299
2300
2301
2302
2303
2304
2305
2306

2348
2349
2350
2351
2352
2353
2354
2355
2356
2357
2358
2359
2360

2307
2308
2309
2310
2311
2312
2313
2314
2315
2316
2317
2318
2319

2361
2362
2363
2364
2365
2366
2367
2368
2369
2370
2371
2372
2373

2320
2321

2374
2375



Figure 21. Left-to-right: SMPLify-X [2] (light green), PyMAF-X [3] (purple), SHAPY [1] (green) and KBody (Ours).

2376
2377
2378
2379
2380
2381
2382
2383
2384
2385
2386
2387
2388



2389
2390
2391
2392
2393
2394
2395
2396
2397
2398
2399
2400
2401



2402
2403
2404
2405
2406
2407
2408
2409
2410
2411
2412
2413
2414



2415
2416
2417
2418
2419
2420
2421
2422
2423
2424
2425
2426
2427



2428
2429

Figure 22. Left-to-right: SMPLify-X [2] (light green), PyMAF-X [3] (purple), SHAPY [1] (green) and KBody (Ours) (pink).

PyMAF-X [3]

SHAPY [1]

KBody (Ours)

2484
2485
2486
2487
2488
2489
2490
2491
2492
2493
2494
2495
2496

2497
2498
2499
2500
2501
2502
2503
2504
2505
2506
2507
2508
2509

2510
2511
2512
2513
2514
2515
2516
2517
2518
2519
2520
2521
2522

2523

2524

2525

2526

2527

2528

2529

2530

2531

2532

2533

2534

2535

2536

2537



2538
2539
2540
2541
2542
2543
2544
2545
2546
2547
2548
2549
2550



2551
2552
2553
2554
2555
2556
2557
2558
2559
2560
2561
2562
2563



2564
2565
2566
2567
2568
2569
2570
2571
2572
2573
2574
2575
2576
2577
2578
2579
2580
2581
2582
2583
2584
2585
2586
2587
2588
2589
2590
2591



SMPLify-X [2]

PyMAF-X [3]

SHAPY [1]

KBody (Ours)

Figure 23. Left-to-right: SMPLify-X [2] (light green), PyMAF-X [3] (purple), SHAPY [1] (green) and KBody (pink).

2592
2593
2594
2595
2596
2597
2598
2599
2600
2601
2602
2603
2604



2646
2647
2648
2649
2650
2651
2652
2653
2654
2655
2656
2657
2658

2605
2606
2607
2608
2609
2610
2611
2612
2613
2614
2615
2616
2617



2659
2660
2661
2662
2663
2664
2665
2666
2667
2668
2669
2670
2671

2618
2619
2620
2621
2622
2623
2624
2625
2626
2627
2628
2629
2630



2672
2673
2674
2675
2676
2677
2678
2679
2680
2681
2682
2683
2684

2631
2632
2633
2634
2635
2636
2637
2638
2639
2640
2641
2642
2643



2685
2686
2687
2688
2689
2690
2691
2692
2693
2694
2695
2696
2697
2698
2699

Figure 24. Left-to-right: SMPLify-X [2] (light green), PyMAF-X [3] (purple), SHAPY [1] (green) and KBody (Ours) (pink).

2700
2701
2702
2703
2704
2705
2706
2707
2708
2709
2710
2711
2712
2713
2714
2715
2716
2717
2718
2719
2720
2721
2722
2723
2724
2725
2726
2727
2728
2729
2730
2731
2732
2733
2734
2735
2736
2737
2738
2739
2740
2741
2742
2743
2744
2745
2746
2747
2748
2749
2750
2751
2752
2753



Figure 25. Left-to-right: SMPLify-X [2] (light green), PyMAF-X [3] (purple), SHAPY [1] (green) and KBody (Ours).

2808
2809
2810
2811
2812
2813
2814
2815
2816
2817
2818
2819
2820



2862
2863
2864
2865
2866
2867
2868
2869
2870
2871
2872
2873
2874

2821
2822
2823
2824
2825
2826
2827
2828
2829
2830
2831
2832
2833



2875
2876
2877
2878
2879
2880
2881
2882
2883
2884
2885
2886
2887

2834
2835
2836
2837
2838
2839
2840
2841
2842
2843
2844
2845
2846



2888
2889
2890
2891
2892
2893
2894
2895
2896
2897
2898
2899
2900

2847
2848
2849
2850
2851
2852
2853
2854
2855
2856
2857
2858
2859



2901
2902
2903
2904
2905
2906
2907
2908
2909
2910
2911
2912
2913

2860
2861

SMPLify-X [2] PyMAF-X [3] SHAPY [1] KBody (Ours)

2916
2917
2918
2919
2920
2921
2922
2923
2924
2925
2926
2927
2928
2929
2930
2931
2932
2933
2934
2935
2936
2937
2938
2939
2940
2941
2942
2943
2944
2945
2946
2947
2948
2949
2950
2951
2952
2953
2954
2955
2956
2957
2958
2959
2960
2961
2962
2963
2964
2965
2966
2967
2968
2969



Figure 27. Left-to-right: SMPLify-X [2] (light green), PyMAF-X [3] (purple), SHAPY [1] (green) and KBody (Ours) (pink).

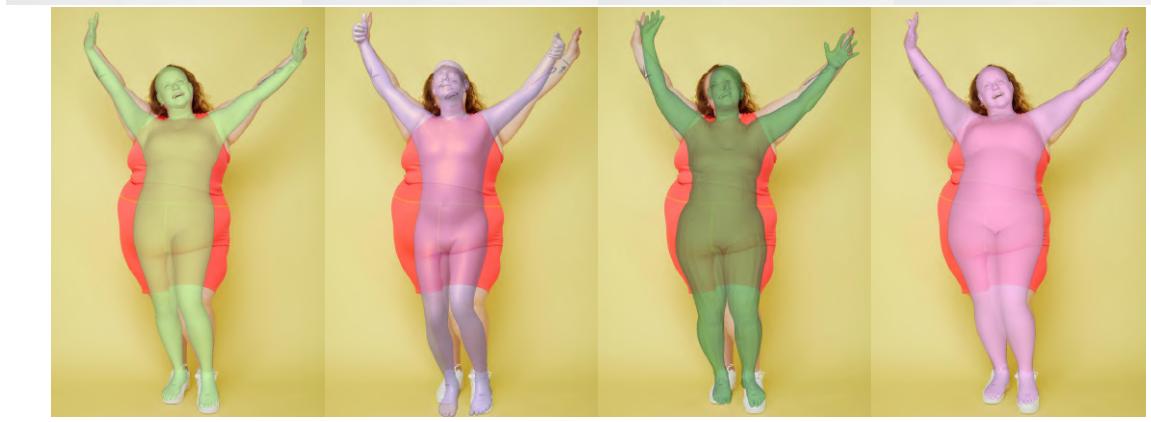
3024
3025
3026
3027
3028
3029
3030



3031
3032
3033
3034
3035
3036
3037
3038
3039
3040
3041
3042
3043



3044
3045
3046
3047
3048
3049
3050
3051
3052
3053
3054
3055
3056

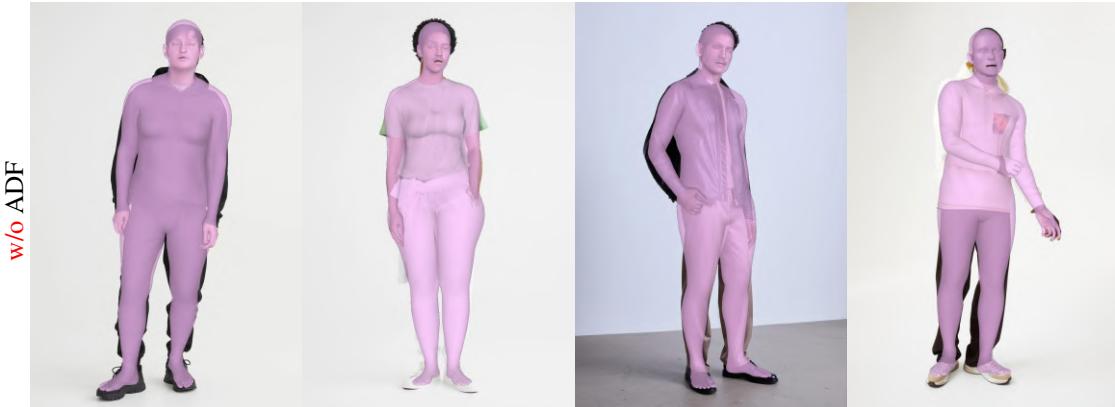


3057
3058
3059
3060
3061
3062
3063
3064
3065
3066
3067
3068
3069

3078
3079
3080
3081
3082
3083
3084
3085
3086
3087
3088
3089
3090
3091
3092
3093
3094
3095
3096
3097
3098
3099
3100
3101
3102
3103
3104
3105
3106
3107
3108
3109
3110
3111
3112
3113
3114
3115
3116
3117
3118
3119
3120
3121
3122
3123

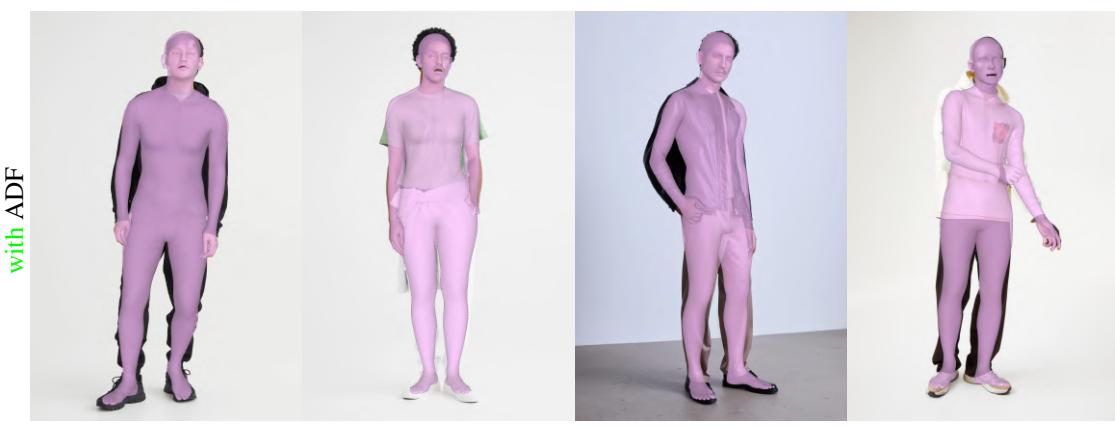
Figure 28. Left-to-right: SMPLify-X [2] (light green), PyMAF-X [3] (purple), SHAPY [1] (green) and KBody (pink).

3132
3133
3134
3135
3136
3137
3138
3139
3140
3141
3142
3143
3144
3145



3186
3187
3188
3189
3190
3191
3192
3193
3194
3195
3196
3197
3198
3199

3146
3147
3148
3149
3150
3151
3152
3153
3154
3155
3156
3157
3158
3159



3200
3201
3202
3203
3204
3205
3206
3207
3208
3209
3210
3211
3212
3213

3160
3161
3162
3163
3164
3165
3166
3167
3168
3169
3170
3171
3172
3173



3214
3215
3216
3217
3218
3219
3220
3221
3222
3223
3224
3225
3226
3227

3174
3175
3176
3177
3178
3179
3180
3181
3182
3183
3184
3185



3228
3229
3230
3231
3232
3233
3234
3235
3236
3237
3238
3239

Figure 29. KBody fitting results **without** ADF on each even row and **with** ADF on each odd row.

3240
3241
3242
3243
3244
3245
3246
3247
3248
3249
3250
3251
3252
3253



3294
3295
3296
3297
3298
3299
3300
3301
3302
3303
3304
3305
3306
3307

3254
3255
3256
3257
3258
3259
3260
3261
3262
3263
3264
3265
3266
3267



3308
3309
3310
3311
3312
3313
3314
3315
3316
3317
3318
3319
3320
3321

3268
3269
3270
3271
3272
3273
3274
3275
3276
3277
3278
3279
3280
3281



3322
3323
3324
3325
3326
3327
3328
3329
3330
3331
3332
3333
3334
3335

3282
3283
3284
3285
3286
3287
3288
3289
3290
3291
3292
3293



3336
3337
3338
3339
3340
3341
3342
3343
3344
3345
3346
3347

Figure 30. KBody fitting results without ADF on each even row and with ADF on each odd row.



3456
3457
3458
3459
3460
3461
3462
3463
3464
3465
3466
3467
3468
3469



3510
3511
3512
3513
3514
3515
3516
3517
3518
3519
3520
3521
3522
3523

3470
3471
3472
3473
3474
3475
3476
3477
3478
3479
3480
3481
3482
3483



3524
3525
3526
3527
3528
3529
3530
3531
3532
3533
3534
3535
3536
3537

3484
3485
3486
3487
3488
3489
3490
3491
3492
3493
3494
3495



3538
3539
3540
3541
3542
3543
3544
3545
3546
3547
3548
3549

3496
3497
3498
3499
3500
3501
3502
3503
3504
3505
3506
3507
3508
3509



3550
3551
3552
3553
3554
3555
3556
3557
3558
3559
3560
3561
3562
3563

Figure 32. KBody fitting results **without** ADF on each even row and **with** ADF on each odd row.