

Capstone Project: **ARTIFICIAL INTELLIGENT PERSONAL TRAINER**

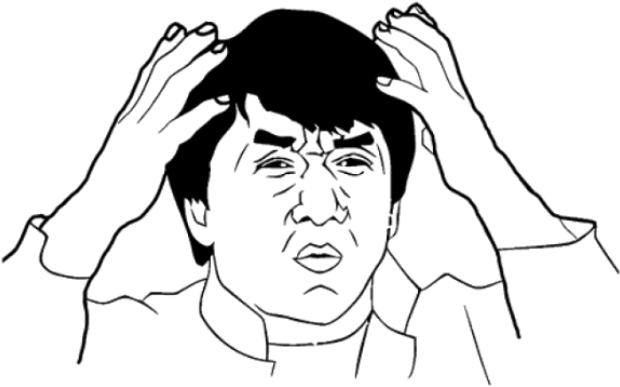
BY: JOHNNY TSENG



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Problem

Statement



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& Load



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&
Adapt



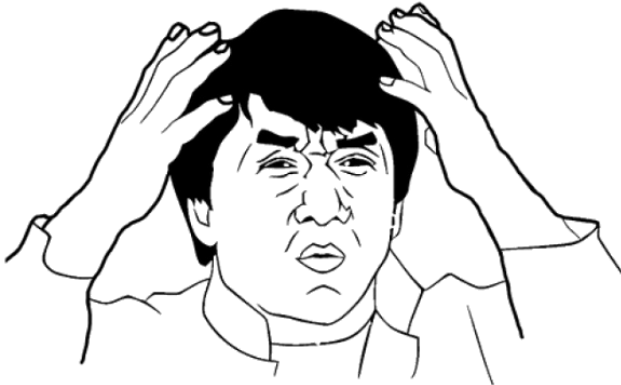
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Extract
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& Load

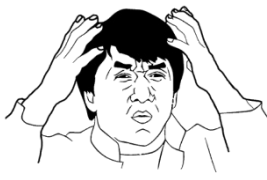


Learn
&
Adapt



Goals
&
Conclusion





Problem Statement

- COVID hits us hard
- Work from Home
- Gyms are closed/restricted
- People misusing their home/HDB gym equipment
- Cost





Tools That Were Used





Tools That Were Used



Coding





Tools That Were Used



OpenCV



Access Webcam





Tools That Were Used



Machine Learning



Tools That Were Used



MediaPipe

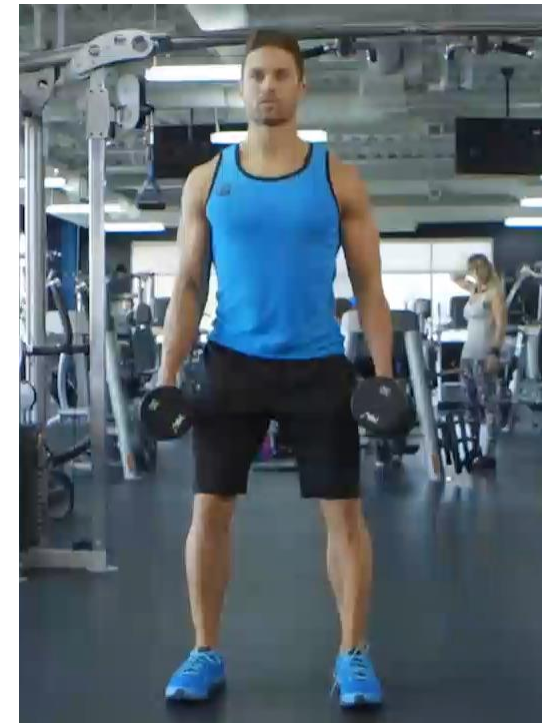


Pose Reference



Extract From

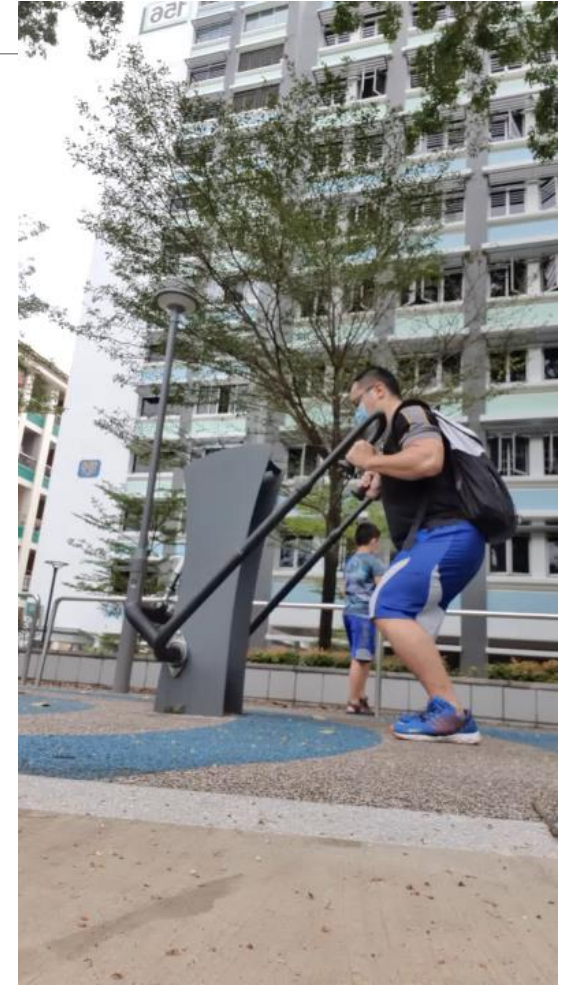
YouTube videos





Extract From

First person video shooting





Extract From

Third person shooting





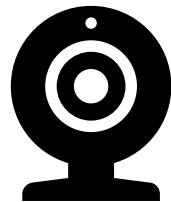
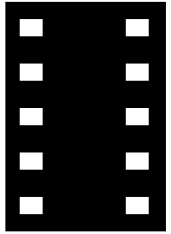
MediaPipe: What is it?

- A Google platform
- fast and accurate
- Combination of Face, Pose and Hands
- End-to-end solution using multiple dependent neural networks

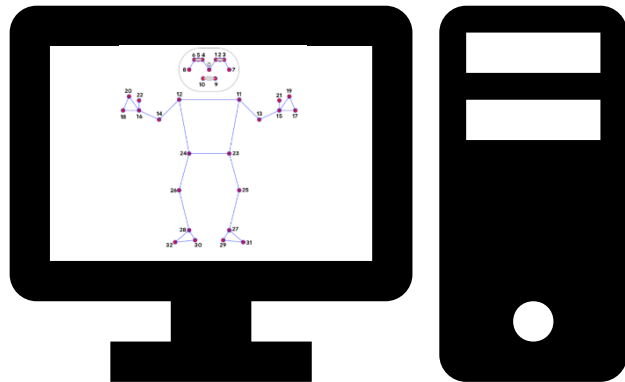
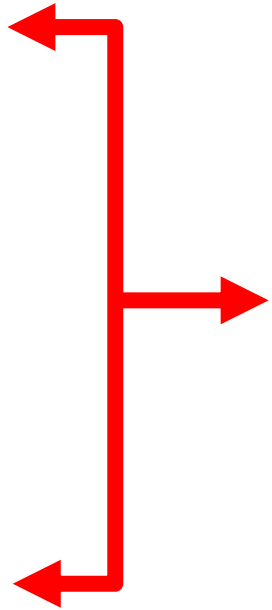




Extract and Export



IMPORT



EXTRACT

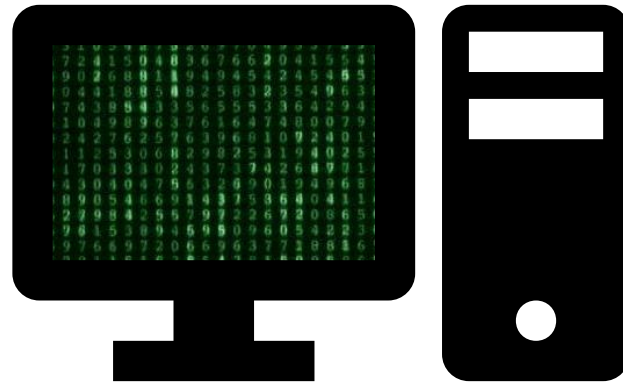




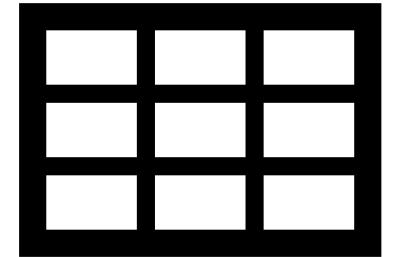
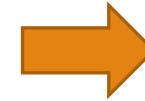
Extract and Export



Record
Body
Landmarks



Convert
Landmarks to
Coordinates



Export
As
CSV



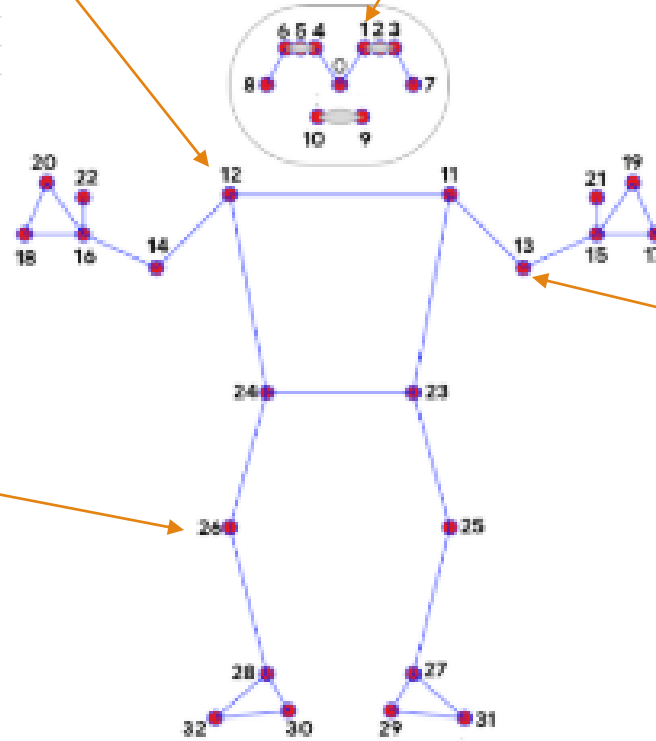
Extract and Export: Sample

body class	x1	y1	z1	v1	x2	y2	z2	v2	x3	y3	z3	v3	x4	y4	z4	v4	x5	y5	z5	v5	x6
Shoulder_Press	0.478224	0.255187	-0.37706	0.999996	0.489583	0.232015	-0.340505	0.999994	0.496801	0.232967	-0.340553	0.999995	0.503638	0.234122	-0.340748	0.999993	0.467374	0.230276	-0.338778	0.999995	0
Shoulder_Press	0.476928	0.251491	-0.23087	0.999996	0.487864	0.22704	-0.200776	0.999995	0.495177	0.227231	-0.200879	0.999995	0.502131	0.228252	-0.201081	0.999993	0.464758	0.227623	-0.197428	0.999995	0
Shoulder_Press	0.475594	0.248745	-0.219432	0.999996	0.486538	0.224268	-0.189226	0.999995	0.49385	0.224175	-0.189338	0.999995	0.500668	0.225091	-0.189563	0.999993	0.462977	0.225623	-0.185953	0.999995	0
Shoulder_Press	0.475613	0.247813	-0.219406	0.999996	0.486554	0.222986	-0.187216	0.999994	0.493846	0.222943	-0.187335	0.999994	0.500672	0.223952	-0.187626	0.999992	0.462853	0.224515	-0.185275	0.999995	0
Shoulder_Press	0.475558	0.24717	-0.225091	0.999996	0.486383	0.222468	-0.193088	0.999993	0.493621	0.222524	-0.193217	0.999994	0.500451	0.223657	-0.193463	0.999992	0.462708	0.223857	-0.191271	0.999995	0
Shoulder_Press	0.475473	0.246921	-0.239924	0.999996	0.48619	0.22232	-0.207455	0.999993	0.4934	0.222405	-0.207564	0.999993	0.500237	0.223577	-0.207814	0.999991	0.462593	0.223618	-0.205597	0.999994	0
Shoulder_Press	0.475296	0.24677	-0.235879	0.999996	0.485892	0.222276	-0.203149	0.999992	0.493066	0.222378	-0.203251	0.999993	0.499919	0.223555	-0.203498	0.999991	0.46242	0.223522	-0.201393	0.999994	0
Shoulder_Press	0.475239	0.246746	-0.217068	0.999996	0.485829	0.222239	-0.184891	0.999992	0.493002	0.222351	-0.184992	0.999992	0.49986	0.223533	-0.185272	0.999991	0.462328	0.223409	-0.183602	0.999994	0
Shoulder_Press	0.475569	0.246783	-0.229436	0.999996	0.485839	0.2223	-0.196488	0.999992	0.493008	0.222425	-0.196598	0.999992	0.499865	0.2236	-0.196847	0.999991	0.462378	0.223424	-0.19559	0.999994	0
Shoulder_Press	0.476004	0.246643	-0.241001	0.999996	0.485956	0.222278	-0.205566	0.999992	0.493124	0.222459	-0.205661	0.999992	0.499949	0.223649	-0.205859	0.999991	0.462537	0.22323	-0.205949	0.999994	0
Shoulder_Press	0.476386	0.246522	-0.277001	0.999996	0.486098	0.22224	-0.238777	0.999992	0.493259	0.222452	-0.238842	0.999992	0.500045	0.223643	-0.239046	0.99999	0.462692	0.223101	-0.238636	0.999994	0
Shoulder_Press	0.476402	0.246179	-0.275288	0.999996	0.486106	0.222168	-0.238462	0.999992	0.493266	0.222414	-0.238531	0.999992	0.50005	0.223627	-0.238742	0.99999	0.462707	0.222876	-0.238252	0.999994	0
Shoulder_Press	0.476187	0.246186	-0.313356	0.999995	0.485709	0.222233	-0.275544	0.999991	0.492815	0.222475	-0.275603	0.999991	0.499659	0.223641	-0.275803	0.99999	0.462541	0.222899	-0.274521	0.999994	0
Shoulder_Press	0.475656	0.246263	-0.360421	0.999994	0.484833	0.222336	-0.319788	0.999991	0.491766	0.222582	-0.31984	0.99999	0.498678	0.223678	-0.320041	0.999989	0.462081	0.222987	-0.319478	0.999993	0
Shoulder_Press	0.47552	0.24627	-0.296219	0.999994	0.484535	0.222347	-0.250389	0.99999	0.491388	0.222621	-0.250401	0.99999	0.498258	0.223699	-0.250655	0.999988	0.462022	0.222957	-0.25177	0.999993	0
Shoulder_Press	0.476721	0.247921	-0.184372	0.999993	0.484648	0.224068	-0.137572	0.99999	0.491417	0.224681	-0.137607	0.999988	0.498271	0.225924	-0.137932	0.999988	0.462345	0.223774	-0.141329	0.999992	0
Shoulder_Press	0.477819	0.251282	-0.16854	0.999991	0.485707	0.228303	-0.118669	0.999988	0.492045	0.228933	-0.1187	0.999985	0.498769	0.229938	-0.119017	0.999986	0.463828	0.22704	-0.123032	0.99999	0
Shoulder_Press	0.477493	0.252431	-0.162512	0.999985	0.485685	0.228447	-0.114107	0.999983	0.491979	0.229168	-0.114144	0.999975	0.498454	0.230226	-0.114474	0.999979	0.463788	0.227205	-0.11816	0.999985	0
Shoulder_Press	0.474712	0.252918	-0.181064	0.999957	0.484661	0.228583	-0.13467	0.999958	0.49136	0.229354	-0.134717	0.999938	0.497763	0.230325	-0.135044	0.999952	0.462493	0.227356	-0.135755	0.999957	0
Shoulder_Press	0.470436	0.252906	-0.196989	0.999864	0.482176	0.228342	-0.152349	0.99987	0.48953	0.229277	-0.152403	0.999811	0.495919	0.230285	-0.152702	0.999854	0.459176	0.226845	-0.153323	0.999854	0
Shoulder_Press	0.468171	0.252969	-0.204814	0.999624	0.480294	0.228224	-0.16106	0.999625	0.488252	0.229103	-0.16112	0.999473	0.49471	0.229959	-0.16141	0.999605	0.45588	0.226824	-0.161319	0.999534	0
Shoulder_Press	0.467686	0.252769	-0.205119	0.999375	0.479845	0.228057	-0.161907	0.999352	0.487692	0.228887	-0.161967	0.999109	0.494052	0.229664	-0.162294	0.999319	0.455882	0.22681	-0.164688	0.99918	0
Shoulder_Press	0.467307	0.25248	-0.20896	0.999088	0.479089	0.227318	-0.165775	0.999087	0.486871	0.227854	-0.165827	0.998762	0.493224	0.228238	-0.166131	0.999056	0.455336	0.226678	-0.167655	0.998791	0
Shoulder_Press	0.46725	0.252348	-0.221432	0.99873	0.478868	0.226498	-0.176695	0.998792	0.486716	0.226856	-0.176802	0.99839	0.493057	0.227017	-0.177108	0.998761	0.454944	0.226357	-0.181643	0.998373	0
Shoulder_Press	0.46676	0.252709	-0.224304	0.998509	0.478269	0.226482	-0.179822	0.998576	0.486315	0.226832	-0.179932	0.998109	0.492774	0.226979	-0.180235	0.998531	0.454032	0.226431	-0.183239	0.998091	0
Shoulder_Press	0.466456	0.253619	-0.25296	0.998272	0.477777	0.226608	-0.210079	0.998344	0.485894	0.226975	-0.210165	0.997811	0.492496	0.227185	-0.210458	0.99828	0.453667	0.226984	-0.210464	0.997799	0
Shoulder_Press	0.467014	0.254361	-0.260612	0.998377	0.479265	0.226745	-0.216091	0.998442	0.486704	0.227256	-0.216166	0.997931	0.493016	0.227677	-0.216464	0.998375	0.456404	0.227115	-0.215484	0.997930	0



x12	y12	z12	v12
0.565572	0.376904	-0.062582	0.999754
0.565601	0.376903	-0.013519	0.999753
0.565601	0.376898	-0.006592	0.999749
0.565621	0.376936	-0.004953	0.999724
0.565622	0.377331	-0.006655	0.999697
0.565622	0.377352	-0.012652	0.999676
0.565603	0.377556	-0.011353	0.999664
0.565577	0.377594	-0.003293	0.999659
0.565485	0.377053	-0.006764	0.999656
0.565472	0.375102	-0.016319	0.99965
0.565428	0.373588	-0.039147	0.999642

x1	y1	z1	v1
0.478224	0.255187	-0.37706	0.999996
0.476928	0.251491	-0.23087	0.999996
0.475594	0.248745	-0.219432	0.999996
0.475613	0.247813	-0.219406	0.999996
0.475558	0.24717	-0.225091	0.999996
0.475473	0.246921	-0.239924	0.999996
0.475296	0.24677	-0.235879	0.999996
0.475239	0.246746	-0.217068	0.999996



x26	y26	z26	v26
0.533088	0.986889	-0.067151	0.812369
0.533977	0.997067	-0.072986	0.824969
0.533975	0.996501	-0.069374	0.835725
0.533793	0.99678	-0.078936	0.842386
0.533548	0.996455	-0.083114	0.850547
0.533131	0.996216	-0.083631	0.855277
0.533111	0.99609	-0.083386	0.860102
0.532728	0.995989	-0.082703	0.864542
0.53253	0.996953	-0.08718	0.869299

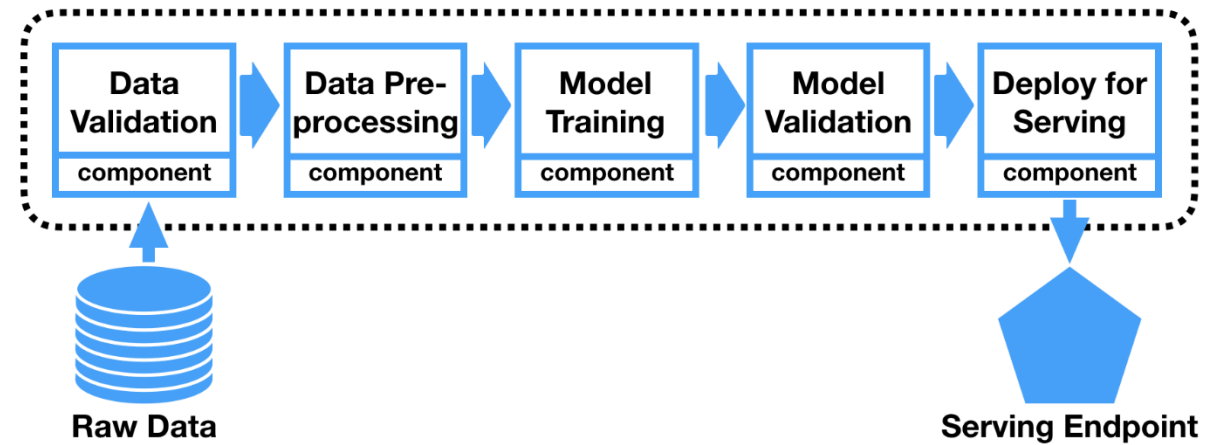
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0.379271	0.376257	-0.05637	0.999795
0.379151	0.378034	0.001381	0.999796
0.378665	0.378724	0.007282	0.999797
0.378485	0.379078	0.005498	0.999785
0.378349	0.379459	0.001921	0.999774
0.378272	0.379652	-0.002255	0.99977
0.378131	0.380065	-0.000913	0.999767
0.378002	0.380219	0.005335	0.999762
0.378033	0.380244	0.001337	0.999756
0.378111	0.380019	-0.008888	0.99975
0.378087	0.378094	-0.026474	0.999738
0.378014	0.376748	-0.025097	0.999729
0.378119	0.374289	-0.05048	0.999725
0.378449	0.371286	-0.076159	0.999712



Machine Learning Through Different Classifiers

Machine Learning Pipeline

- Logistic Regression (lr)
- Ridge Classifier (rc)
- Random Forrest (rf)
- Gradient Boosting (gb)

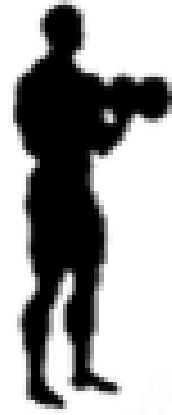




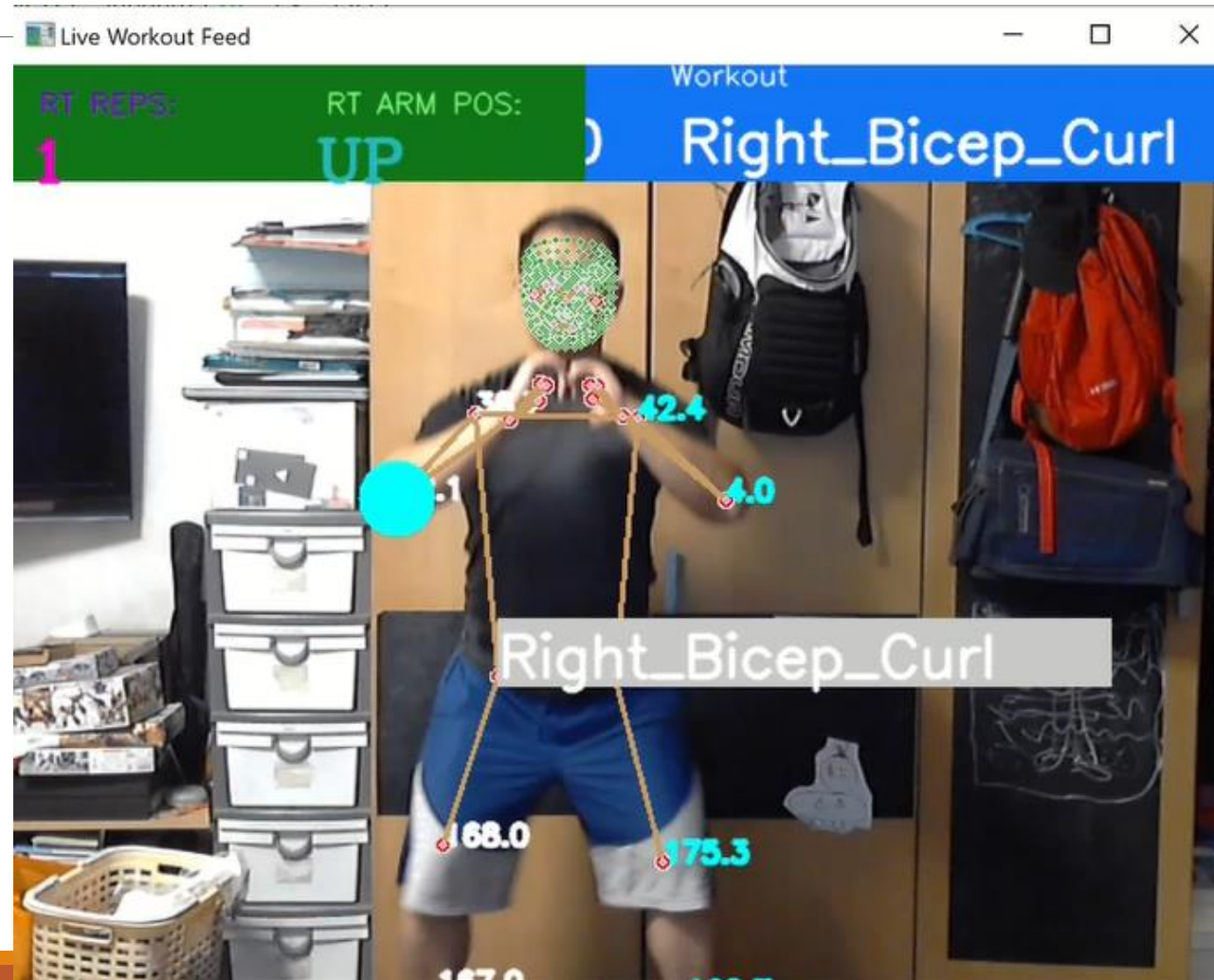
Demonstration of Individual

The Four Basics:

- Bicep Curls
- Lateral Raise
- Shoulder Press
- Squats



Current Progress with Complete AI PT





Difficulties

- Landmarks is about 80 to 90% accurate in position
- Recording in profile point of view skew the result
- Recording must show face
- Have to add more data into the CSV file to make it more robust





Current Progress

Use hardcoded angle to indicate proper movements

Visual indication for each proper rep

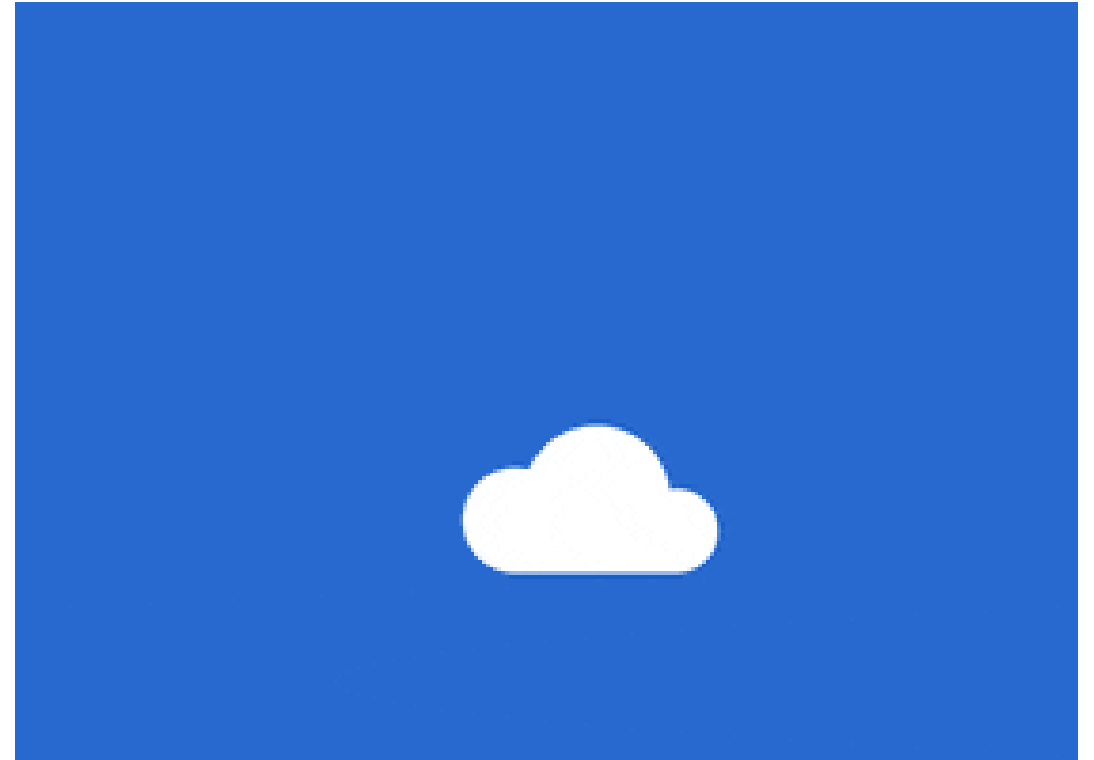
Text indication





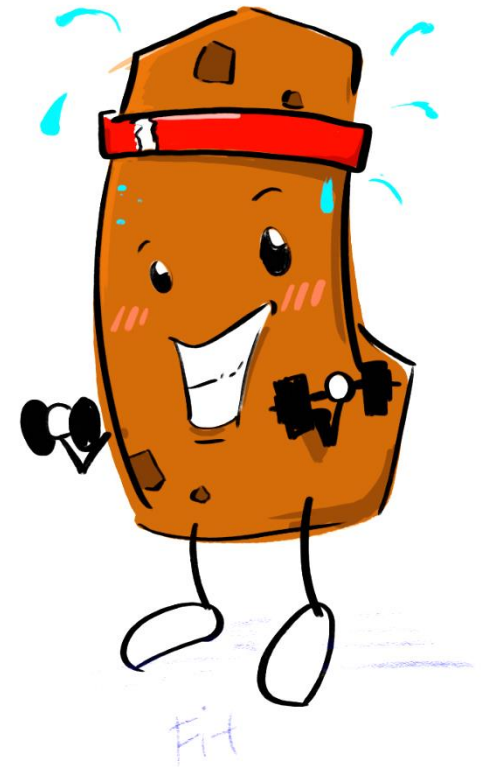
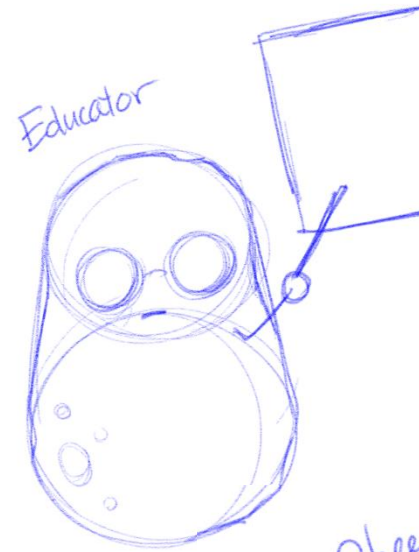
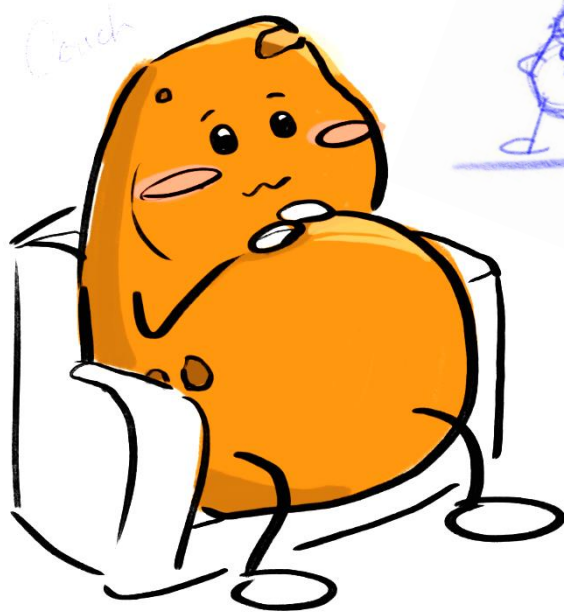
Future Goals

- Continue to expand the number of workout manoeuvres
- Continue to build the database
- Increase accuracy
- Use Tkinter to create GUI



Potato Mascots

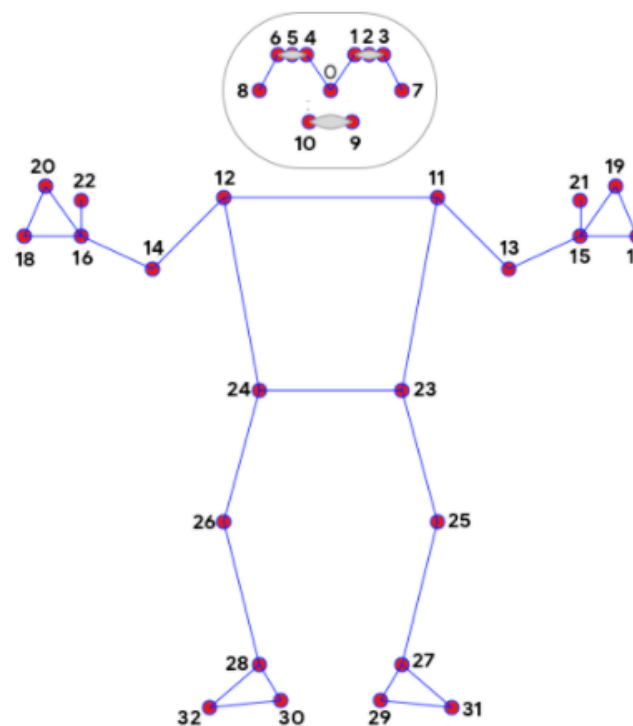
Concept Sketches for the GUI platform





Recommendation

- Request Google to upgrade the landmarks
- Better equip setup
- Faster and stronger CPU



- | | |
|--------------------|----------------------|
| 0. nose | 17. left_pinky |
| 1. left_eye_inner | 18. right_pinky |
| 2. left_eye | 19. left_index |
| 3. left_eye_outer | 20. right_index |
| 4. right_eye_inner | 21. left_thumb |
| 5. right_eye | 22. right_thumb |
| 6. right_eye_outer | 23. left_hip |
| 7. left_ear | 24. right_hip |
| 8. right_ear | 25. left_knee |
| 9. mouth_left | 26. right_knee |
| 10. mouth_right | 27. left_ankle |
| 11. left_shoulder | 28. right_ankle |
| 12. right_shoulder | 29. left_heel |
| 13. left_elbow | 30. right_heel |
| 14. right_elbow | 31. left_foot_index |
| 15. left_wrist | 32. right_foot_index |
| 16. right_wrist | |



Conclusion

- This is the beginning stage
- The implementation in Singapore's HPB
- The implementation in gyms
- User-Friendly platform to keep people healthy



QUESTIONS

