



House of Natwari Nritya

HOUSE OF NATWARI NRITYA

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“—
| Bringing learning home

Mentored and Guided By:
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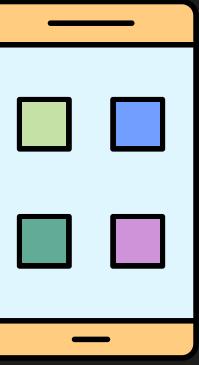
CURRENT SYSTEM



Dance Academy



Youtube Videos



Mobile Apps



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PROPOSED SYSTEM

- Helps an individual explore the classical dance culture free of cost.
- Helps every individual to learn from the basics step by step.
- Corrects the postures and body movements in real-time.





OBJECTIVES

- Dance academies are expensive and the schedule is rigid and uncompromising.
- Dance apps and videos are one-dimensional.

01

Objective is to encourage people to study Indian traditional dance

02

Creating a free, flexible, and easy-to-access classical dance learning app.

03

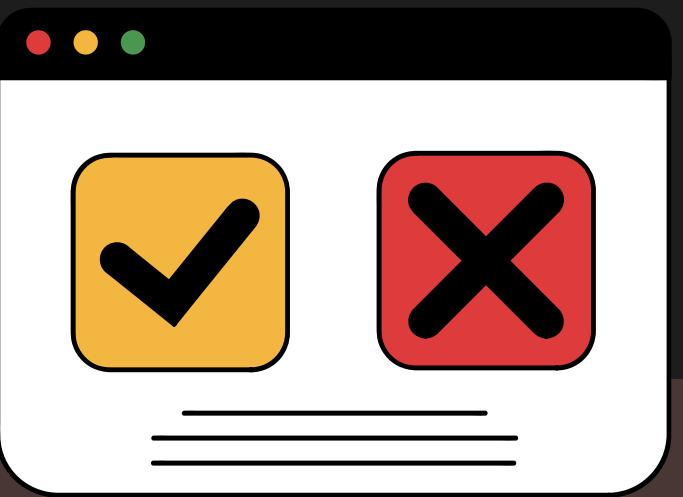
Objective is to encourage people to study Indian traditional dance



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SCOPE OF THE PROJECT

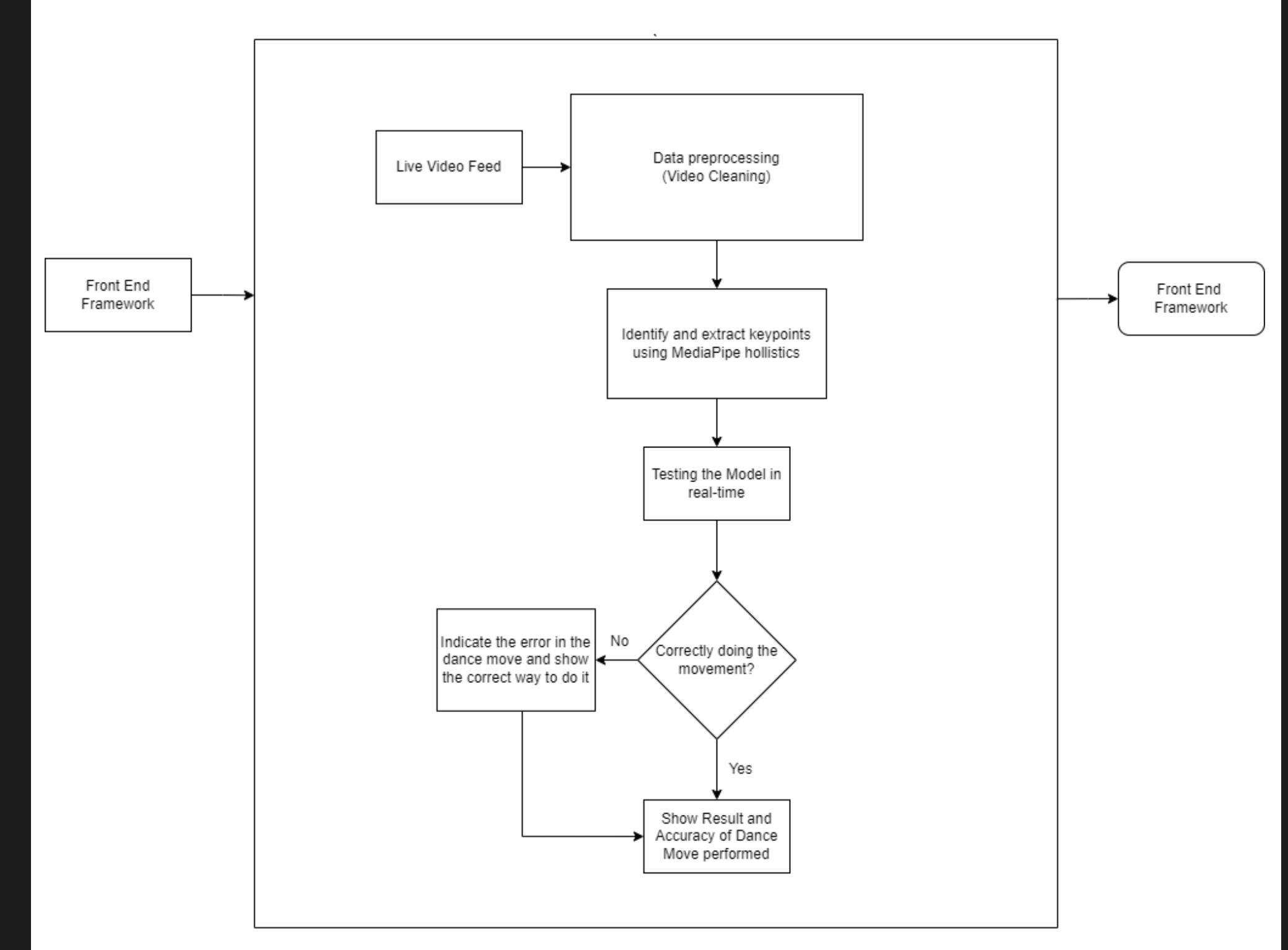


- 01 Give someone instructions on how to perform dance steps at all levels, from beginner to advanced.
- 02 Address any errors that an individual makes when performing dance moves.



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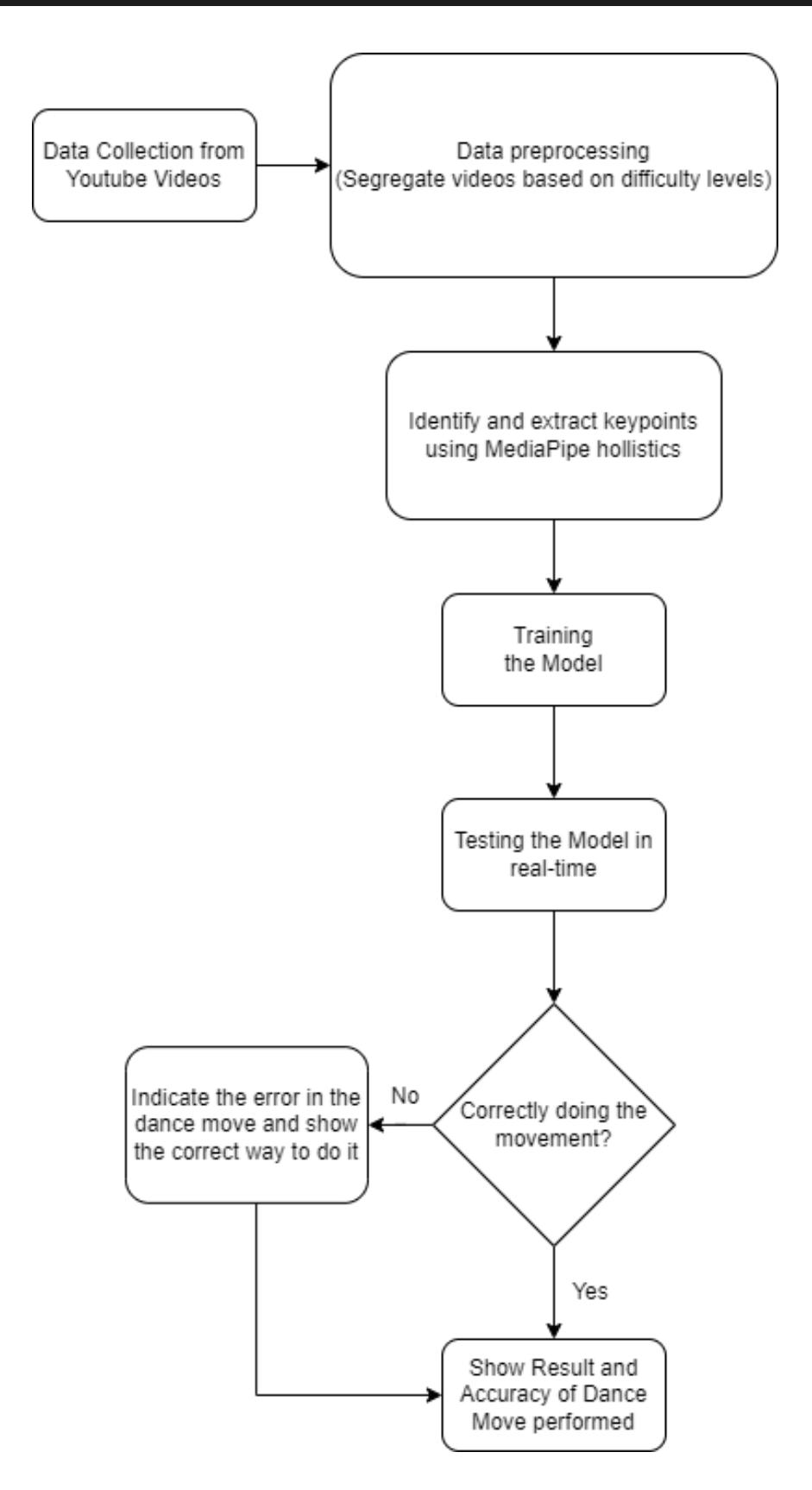
ARCHITECTURAL DIAGRAM





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PROPOSED METHODOLOGY



- MediaPipe is a framework that is used to build machine learning pipelines to process time-series data like audio, video, etc.
- It is a cross-platform framework that works on Android, Desktop/Server, iOS and embedded devices like Raspberry Pi and Jetson Nano.



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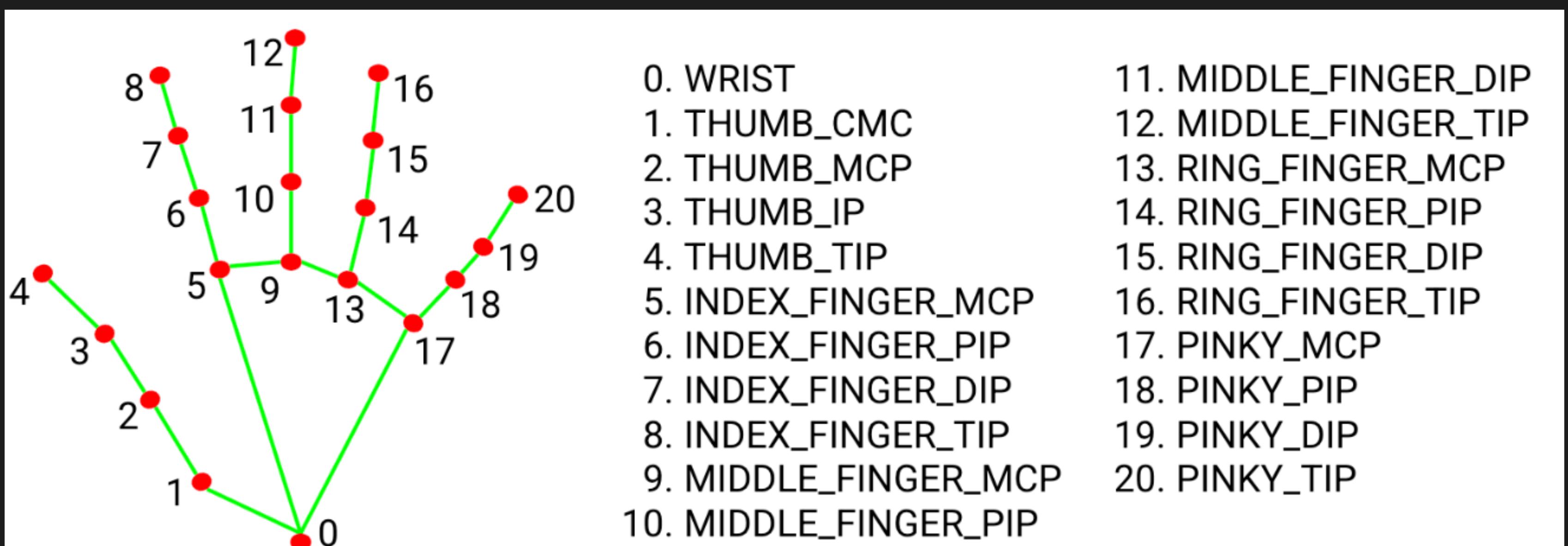


DATASET

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A
333	x1	y1	x1	v1	x2	y2	x2	v2	x3	y3	x3	v3	x4	y4	x4	y4	x5	y5	x5	v5	x6	y6	x6	y6	x7	y7
vandraku	0.12963	0.9073	2.42E-07	0	0.23521	0.8877	-0.06529	0	0.33218	0.79311	-0.08272	0	0.40003	0.71375	-0.09008	0	0.4583	0.66718	-0.09265	0	0.27857	0.61296	-0.0501	0	0.31303	0.4
vandraku	0.12316	0.91333	-1.47E-07	0	0.23303	0.88159	-0.05202	0	0.33511	0.76522	-0.05515	0	0.39549	0.69875	-0.04904	0	0.4459	0.65394	-0.05747	0	0.2727	0.5872	-0.03927	0	0.3108	0
vandraku	0.11803	0.91111	-2.11E-07	0	0.22912	0.8768	-0.04627	0	0.33365	0.77345	-0.05171	0	0.3964	0.69036	-0.05188	0	0.44864	0.64966	-0.04754	0	0.27454	0.5803	-0.03043	0	0.3127	0.4
vandraku	0.1165	0.9013	-2.26E-07	0	0.23068	0.8596	-0.0457	0	0.33269	0.76341	-0.04746	0	0.39748	0.682	-0.04328	0	0.44806	0.63959	-0.03342	0	0.2761	0.56492	-0.02536	0	0.31446	0.4
vandraku	0.20522	0.80985	1.15E-06	0	0.29217	0.77782	-0.06999	0	0.35948	0.70341	-0.08949	0	0.41264	0.64204	-0.09073	0	0.4655	0.60166	-0.08815	0	0.27211	0.60567	-0.0491	0	0.28861	0
vandraku	0.19111	0.79665	5.22E-07	0	0.2748	0.79903	-0.07243	0	0.35691	0.71668	-0.10418	0	0.41752	0.63978	-0.12195	0	0.47259	0.60255	-0.14137	0	0.27657	0.56319	-0.09243	0	0.29657	0.4
vandraku	0.14726	0.81308	3.90E-07	0	0.24324	0.81632	-0.06312	0	0.3389	0.72053	-0.08417	0	0.40755	0.64432	-0.09615	0	0.4684	0.60635	-0.10811	0	0.27772	0.55076	-0.05698	0	0.31254	0.4
vandraku	0.17522	0.78652	3.37E-07	0	0.26622	0.7834	-0.05119	0	0.35866	0.69542	-0.0694	0	0.42507	0.62558	-0.08218	0	0.47833	0.58848	-0.09584	0	0.30628	0.54055	-0.04922	0	0.3407	0.4
vandraku	0.17819	0.79708	9.31E-08	0	0.27079	0.77972	-0.04591	0	0.36032	0.6931	-0.06192	0	0.42308	0.62026	-0.07417	0	0.4788	0.5859	-0.08664	0	0.30974	0.51525	-0.04282	0	0.34825	0.3
vandraku	0.19031	0.78664	2.60E-07	0	0.27762	0.76686	-0.04585	0	0.36658	0.68319	-0.06216	0	0.42712	0.61459	-0.07466	0	0.47682	0.58063	-0.08705	0	0.31187	0.51892	-0.04472	0	0.34393	0.3
vandraku	0.19133	0.77544	2.79E-07	0	0.2773	0.75902	-0.04457	0	0.36464	0.67949	-0.06158	0	0.42563	0.6106	-0.07531	0	0.47628	0.5759	-0.08921	0	0.31365	0.51794	-0.04314	0	0.34697	0.3
vandraku	0.21487	0.74323	2.42E-07	0	0.29086	0.73614	-0.0396	0	0.3717	0.66119	-0.05584	0	0.4244	0.59932	-0.06876	0	0.47302	0.56917	-0.08275	0	0.32431	0.51971	-0.04338	0	0.35386	0
vandraku	0.22554	0.72975	2.86E-07	0	0.29501	0.72449	-0.03879	0	0.37414	0.65173	-0.05287	0	0.42661	0.59268	-0.06295	0	0.47188	0.56568	-0.07379	0	0.32661	0.52504	-0.04106	0	0.3539	0.4
vandraku	0.22495	0.72245	2.72E-07	0	0.29627	0.7198	-0.03777	0	0.3747	0.65221	-0.05196	0	0.42547	0.59347	-0.06255	0	0.47155	0.56722	-0.07421	0	0.33182	0.51985	-0.03605	0	0.35814	0.4
vandraku	0.24099	0.70296	2.60E-07	0	0.31188	0.69848	-0.03426	0	0.38748	0.63463	-0.04687	0	0.43396	0.58107	-0.05646	0	0.47517	0.56213	-0.06673	0	0.34625	0.50727	-0.03302	0	0.37381	0.3
vandraku	0.24443	0.70259	2.05E-07	0	0.31692	0.69993	-0.03361	0	0.38833	0.63355	-0.04642	0	0.43574	0.58136	-0.05678	0	0.47852	0.56218	-0.06845	0	0.35196	0.49905	-0.03	0	0.37848	0.3
vandraku	0.25075	0.69572	2.49E-07	0	0.31961	0.69456	-0.03475	0	0.39364	0.63057	-0.04646	0	0.44031	0.57948	-0.05483	0	0.48161	0.55997	-0.06393	0	0.35398	0.50752	-0.03333	0	0.37967	0.4
vandraku	0.25659	0.69885	2.40E-07	0	0.32661	0.69542	-0.03313	0	0.40062	0.63665	-0.04228	0	0.44436	0.58421	-0.04759	0	0.47789	0.55977	-0.0534	0	0.35765	0.50758	-0.02787	0	0.38217	0.4
vandraku	0.25723	0.69908	2.32E-07	0	0.32703	0.69974	-0.03276	0	0.4025	0.6391	-0.04044	0	0.44553	0.58595	-0.04397	0	0.47736	0.56291	-0.04821	0	0.35819	0.51476	-0.02841	0	0.38254	0.4
vandraku	0.25664	0.70555	2.19E-07	0	0.32607	0.7061	-0.03265	0	0.40078	0.64438	-0.04291	0	0.44335	0.58914	-0.05008	0	0.47913	0.56746	-0.05817	0	0.35953	0.51811	-0.03065	0	0.38421	0.4
vandraku	0.25626	0.71694	2.34E-07	0	0.32533	0.71427	-0.03515	0	0.39908	0.64791	-0.04718	0	0.44308	0.59245	-0.05536	0	0.48208	0.5727	-0.06428	0	0.35749	0.52248	-0.03289	0	0.3827	0.4
vandraku	0.25698	0.71753	2.11E-07	0	0.326	0.7146	-0.03402	0	0.39959	0.64588	-0.04432	0	0.4421	0.58988	-0.05033	0	0.47959	0.56953	-0.05713	0	0.35464	0.52088	-0.03299	0	0.38166	0.4
vandraku	0.25431	0.7178	2.38E-07	0	0.32407	0.71459	-0.03424	0	0.39853	0.6461	-0.04602	0	0.4429	0.59017	-0.05457	0	0.48165	0.57048	-0.06415	0	0.35683	0.52261	-0.0321	0	0.38075	0.4
vandraku	0.25152	0.71717	1.90E-07	0	0.32385	0.71684	-0.03179	0	0.39783	0.64535	-0.04216	0	0.44238	0.58883	-0.04965	0	0.48013	0.56703	-0.05879	0	0.35641	0.51487	-0.02973	0	0.38227	0.4
vandraku	0.25088	0.71825	2.43E-07	0	0.32155	0.71417	-0.03489	0	0.3976	0.64371	-0.04815															



IMPLEMENTATION:





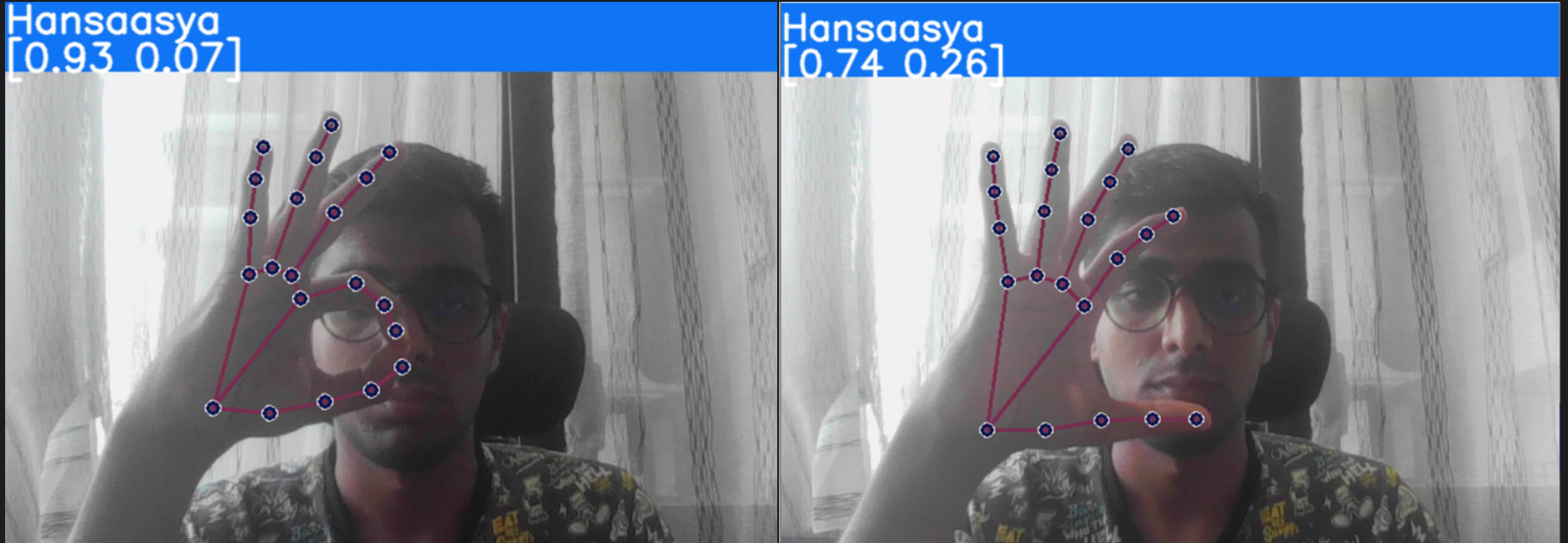
IMPLEMENTATION

- We use Random Forest Classifier, Logistic Regression and Ridge Classifier on the dataset for training our model. Later, these three models are compared by testing to determine which model best suits our purpose.
- Random Forest Classifier works better than Logistic Regression and Ridge Classifier as the model is being trained on high-dimensional data. As Random Forest Classifier is based on trees, it doesn't matter by the variables scale. Bagging and random subspace method are used to prevent overfitting. It also supports automatic feature selection. Due to the above-mentioned reasons, Random Forest Classifier is best suited for this project.
- Accuracy received after training and testing models are:
- Logistic Regression - 0.92
- Ridge Classifier - 0.91
- Random Forest Classifier - 0.95
-





REAL TIME TESTING



Right Hand Hansaasya Mudra





RESULTS

TABLE I
TRAINING ACCURACY (IN %) OF VARIOUS MUDRAS USING ML MODELS

Mudras	Logistic Regres-sion	Ridge Classi-fier	Random Forest Classifier	Gradient Boosting Classifier
Pataka	99.22%	99.22%	99.09%	99.74%
Chandrakala	98.78%	98.17%	99.09%	98.78%
Hansaasya	98.56%	98.33%	99.76%	99.74%
Kapitth	99.49%	99.75%	99.75%	99.62%
Kartarimukh	99.49%	99.11%	99.62%	99.36%
Padmakosh	99.88%	98.54%	99.77%	99.88%
Soochi	98.92%	98.43%	99.39%	99.39%
Tamrachud	98.92%	98.43%	99.52%	99.39%



IMPLEMENTATION

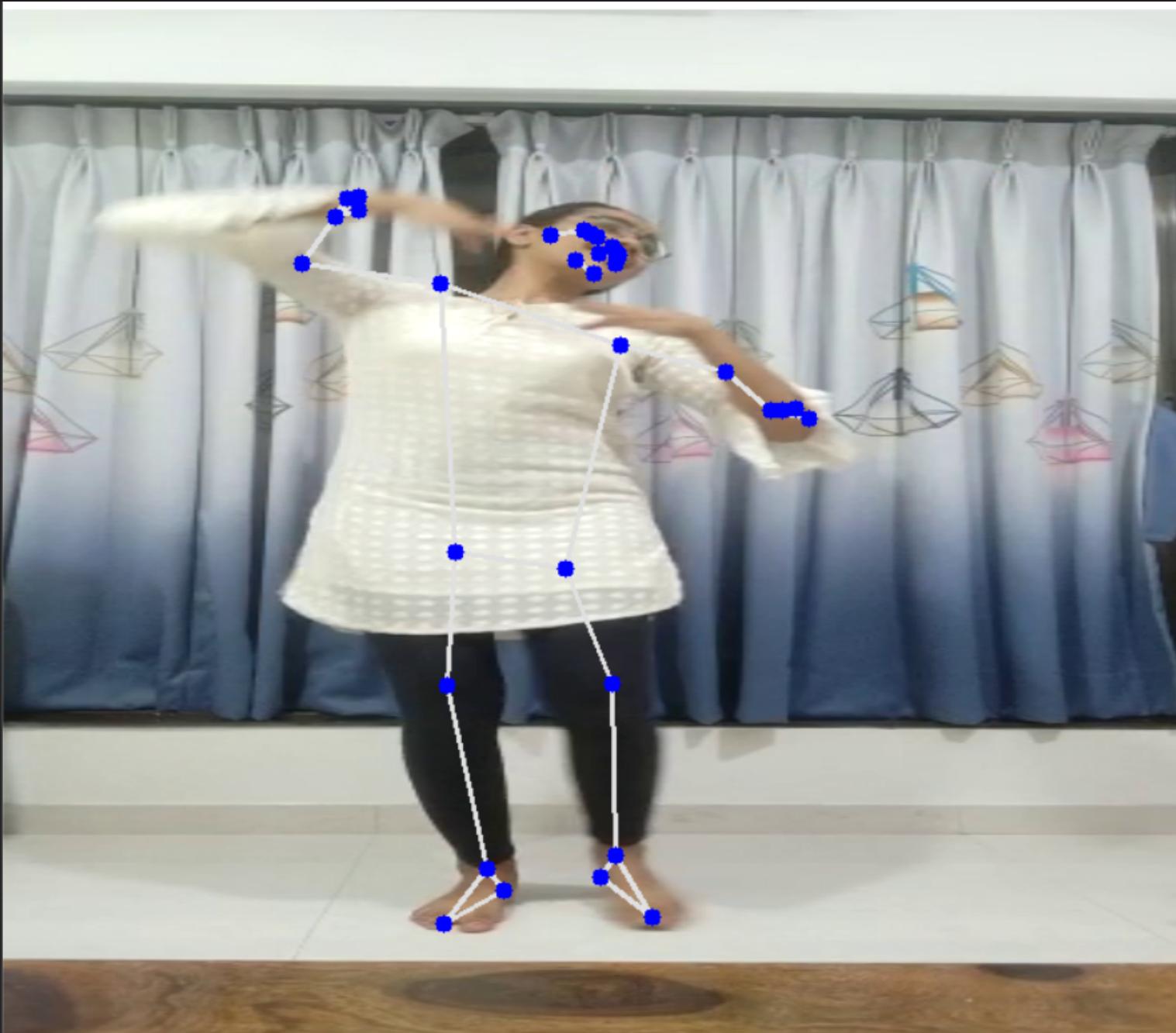
- MediaPipe Framework will extract the key points of various body parts from the user's video or live feed.
- In addition to calculating critical aspects, the angle between different body parts is computed.
- We use Fast Dynamic Time Warping with Cosine distance as a measure of similarity to compare motions. Fast Dynamic Time Warping (Fast DTW) compares two variable-speed temporal time series sequences.
- It employs the method of dynamic programming to identify the optimal temporal fit between the components of two-time series. Fast DTW could identify similarities in walking, for instance, even if one individual was walking faster than the other or if accelerations and decelerations occurred during an observation.
- Using Cosine distance without Fast DTW, we compare the amplitudes of two time series at time T using Cosine distance.
- Suppose both time series are highly similar in form but out of phase in time. In that case, the score for comparison and similarity will be low.
- Fast DTW compares the amplitude of the first time series at time T to the amplitude of the second time series at times T+1 and T-1 or T+2 and T-2.



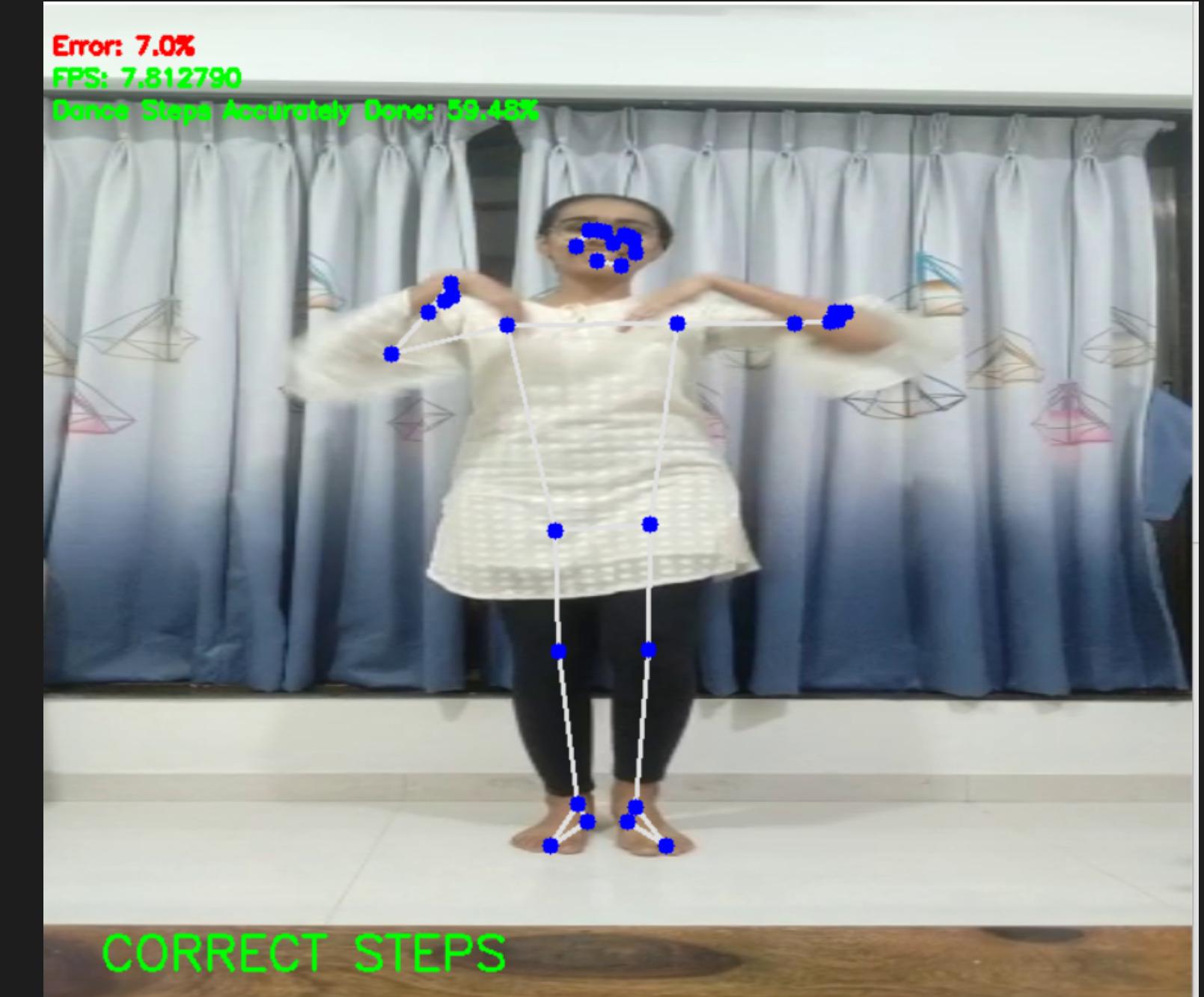
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REAL TIME TESTING



Frame of Benchmark Video

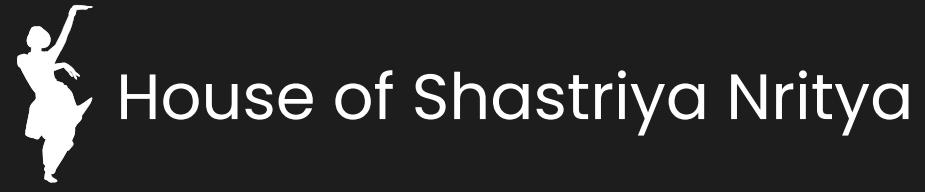


Frame of User Video



CONCLUSION

- Current options are only joining Dance Academy or learning through Youtube Videos.
- The former is expensive and inconvenient due to time constraints while the latter is not reliable.
- The proposed solution eliminates the above issues and incorporates both of their benefits.



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