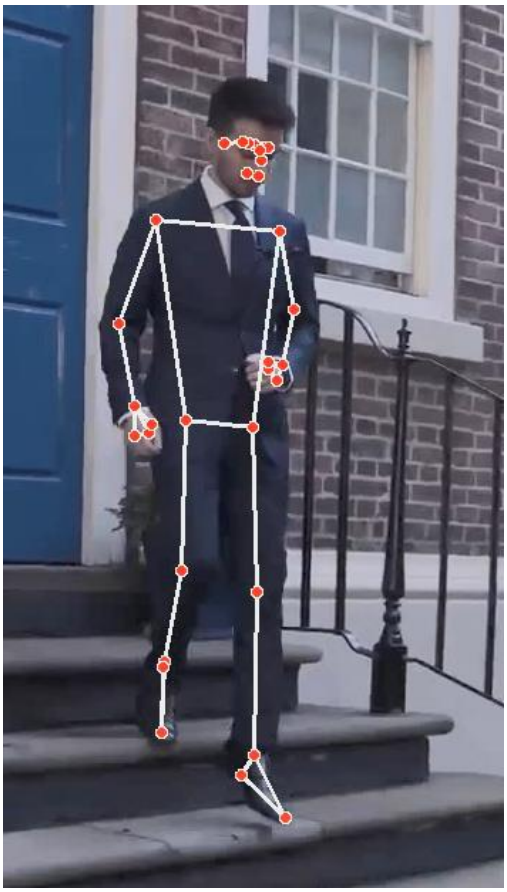
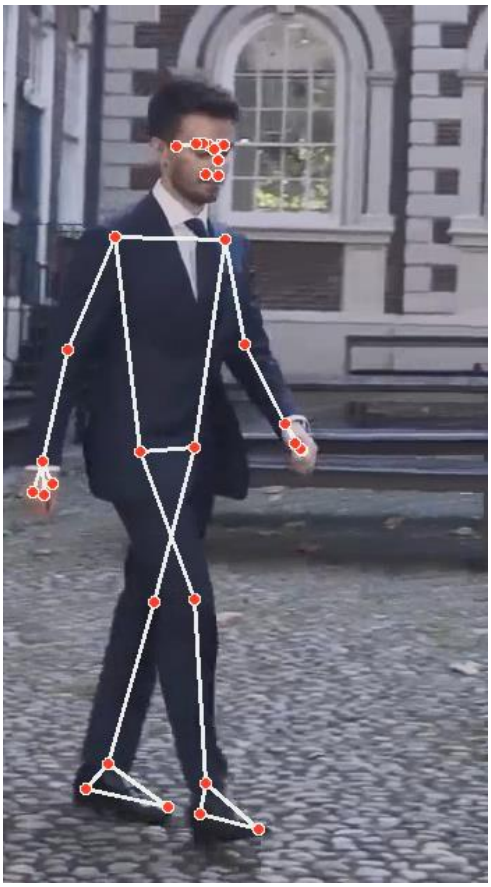
Masoud Nateghi – HW13 – BMI500

Codes for both sections of homework are available at: link

Mediapipe

Results:





MSR Daily Activity 3D Dataset

For the preprocessing stage, we experimented with kernel sizes of 5, 10, and 15, while for segmentation, we tested window lengths of 1, 1.3, and 1.5 seconds. A 2-second window couldn't be applied due to certain recorded signals being shorter than this duration. Additionally, to enhance our feature set, we incorporated minimum and maximum values.

This combination of preprocessing hyperparameters—kernel size, window length, and the inclusion of min and max features—led us to create eight distinct datasets, each detailed below the corresponding table. Our training set comprised subjects 1 through 5, subjects 6 and 7 were reserved for validation, and subjects 8, 9, and 10 were used for testing.

The table summarizes the performance of both neural network and decision tree models after hyperparameter tuning. The hyperparameters were selected automatically based on their performance on the validation data, utilizing a holdout method with subjects 6 and 7 dedicated specifically for validation. The accuracy reported in the table reflects the models' performance on the test subjects.

It's evident from the table that hyperparameters play a crucial role, significantly impacting results. Interestingly, adding more features didn't consistently enhance model performance. Similarly, altering preprocessing parameters didn't always result in performance improvement.

The neural network model achieved the highest performance with hidden layers (100, 50), alpha = 0.001, reaching an accuracy of 54.15%. This result was attained by including min and max features, using a kernel size of 5 for the smoothing filter, and employing a window length of 1.5 seconds. This performance suggests that the model is effectively finding valuable signals for classification among the various classes. With a dataset encompassing 16 distinct classes, a random chance performance would typically hover around 6.25% (1/16). However, the best model's performance reaching approximately 54% strongly supports its ability to find meaningful patterns beyond random chance.

	Neural Network			Random Forest			
	Hyperparameters		Accuracy	Hyperparameters			Accuracy
	Hidden layers	alpha		n_estimaor	min_sample	max_depth	
Dataset1	(100, 50)	0.001	0.5000	50	5	5	0.4420
Dataset2	(100, 50)	0.01	0.5181	50	5	5	0.4506
Dataset3	(100, 50)	0.01	0.5406	30	5	3	0.4342
Dataset4	(40, 20)	0.01	0.5138	30	5	4	0.4463
Dataset5	(100, 50)	0.01	0.5051	50	5	3	0.4377
Dataset6	(40, 20)	0.01	0.4896	20	5	2	0.4515
Dataset7	(100, 50)	0.01	0.4818	20	5	2	0.4524
Dataset8	**(100, 50)**	**0.001**	**0.5415**	**50**	**5**	**4**	**0.4662**

Dataset1: mean, std/ kernel = 5, win_len = 1

Dataset2: mean, std/ kernel = 10, win_len = 1.3

Dataset3: mean, std/ kernel = 15, win_len = 1.5

Dataset4: mean, std/ kernel = 5, win_len = 1.5

Dataset5: mean, std, min, max/ kernel = 5, win_len = 1

Dataset6: mean, std, min, max/ kernel = 10, win_len = 1.3

Dataset7: mean, std, min, max/ kernel = 15, win_len = 1.5

Dataset8: mean, std, min, max/ kernel = 5, win_len = 1.5