

Light Residual Network for Human Activity Recognition using Wearable Sensor Data

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APPENDIX: LOOCV CONFUSION MATRICES

This appendix presents further results on our proposed benchmark based on Leave-One(person)-Out Cross-Validation (LOOCV). Here we present the confusion matrices for each Participant out. This information extends the results of Table 4 in the original paper.

The labels of the activities are:

- WA: Walking
- WU: Walking Upstairs
- WD: Walking Downstairs
- SI: Sitting
- ST: Standing
- LA: Laying

TABLE 1. Confusion matrix LOOCV: Participant 1

	Predicted label						Sup.
	WA	WU	WD	SI	ST	LA	
WA	100.0% 95	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	95
WU	0.0% 0	100.0% 53	0.0% 0	0.0% 0	0.0% 0	0.0% 0	53
WD	0.0% 0	0.0% 0	100.0% 49	0.0% 0	0.0% 0	0.0% 0	49
SI	0.0% 0	0.0% 0	0.0% 0	100.0% 47	0.0% 0	0.0% 0	47
ST	0.0% 0	0.0% 0	0.0% 0	0.0% 0	100.0% 53	0.0% 0	53
LA	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	100.0% 50	50

TABLE 2. Confusion matrix LOOCV: Participant 2

	Predicted label						Sup.
	WA	WU	WD	SI	ST	LA	
WA	100.0% 59	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	59
WU	0.0% 0	100.0% 48	0.0% 0	0.0% 0	0.0% 0	0.0% 0	48
WD	0.0% 0	0.0% 0	100.0% 47	0.0% 0	0.0% 0	0.0% 0	47
SI	0.0% 0	0.0% 0	0.0% 0	95.7% 44	4.3% 2	0.0% 0	46
ST	0.0% 0	0.0% 0	0.0% 0	0.0% 0	100.0% 54	0.0% 0	54
LA	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	100.0% 48	48

TABLE 3. Confusion matrix LOOCV: Participant 3

	Predicted label						Sup.
	WA	WU	WD	SI	ST	LA	
WA	100.0% 58	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	58
WU	0.0% 0	100.0% 59	0.0% 0	0.0% 0	0.0% 0	0.0% 0	59
WD	0.0% 0	0.0% 0	100.0% 49	0.0% 0	0.0% 0	0.0% 0	49
SI	0.0% 0	0.0% 0	0.0% 0	92.3% 48	7.7% 4	0.0% 0	52
ST	0.0% 0	0.0% 0	0.0% 0	1.6% 1	98.4% 60	0.0% 0	61
LA	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	100.0% 62	62

TABLE 4. Confusion matrix LOOCV: Participant 4

	Predicted label						Sup.
	WA	WU	WD	SI	ST	LA	
WA	100.0% 60	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	60
WU	0.0% 0	100.0% 52	0.0% 0	0.0% 0	0.0% 0	0.0% 0	52
WD	0.0% 0	0.0% 0	100.0% 45	0.0% 0	0.0% 0	0.0% 0	45
SI	0.0% 0	0.0% 0	0.0% 0	94.0% 47	6.0% 3	0.0% 0	50
ST	0.0% 0	0.0% 0	0.0% 0	3.6% 2	96.4% 54	0.0% 0	56
LA	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	100.0% 54	54

TABLE 5. Confusion matrix LOOCV: Participant 5

	Predicted label						Sup.
	WA	WU	WD	SI	ST	LA	
WA	92.9% 52	1.8% 1	0.0% 0	5.4% 3	0.0% 0	0.0% 0	56
WU	0.0% 0	100.0% 47	0.0% 0	0.0% 0	0.0% 0	0.0% 0	47
WD	0.0% 0	0.0% 0	100.0% 47	0.0% 0	0.0% 0	0.0% 0	47
SI	0.0% 0	0.0% 0	0.0% 0	97.7% 43	2.3% 1	0.0% 0	44
ST	0.0% 0	0.0% 0	0.0% 0	37.5% 21	62.5% 35	0.0% 0	56
LA	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	100.0% 52	52

TABLE 6. Confusion matrix LOOCV: Participant 6

	Predicted label						Sup.
	WA	WU	WD	SI	ST	LA	
Actual label	WA	100.0% 57	0.0% 0	0.0% 0	0.0% 0	0.0% 0	57
	WU	0.0% 0	100.0% 51	0.0% 0	0.0% 0	0.0% 0	51
	WD	0.0% 0	0.0% 0	100.0% 48	0.0% 0	0.0% 0	48
	SI	0.0% 0	0.0% 0	0.0% 0	90.9% 50	9.1% 5	55
	ST	0.0% 0	0.0% 0	0.0% 0	100.0% 57	0.0% 0	57
	LA	0.0% 0	0.0% 0	0.0% 0	0.0% 0	100.0% 57	57

TABLE 7. Confusion matrix LOOCV: Participant 7

	Predicted label						Sup.
	WA	WU	WD	SI	ST	LA	
Actual label	WA	100.0% 57	0.0% 0	0.0% 0	0.0% 0	0.0% 0	57
	WU	0.0% 0	100.0% 51	0.0% 0	0.0% 0	0.0% 0	51
	WD	0.0% 0	0.0% 0	100.0% 47	0.0% 0	0.0% 0	47
	SI	0.0% 0	0.0% 0	0.0% 0	87.5% 42	12.5% 6	48
	ST	0.0% 0	0.0% 0	0.0% 0	100.0% 53	0.0% 0	53
	LA	0.0% 0	0.0% 0	0.0% 0	0.0% 0	100.0% 52	52

TABLE 8. Confusion matrix LOOCV: Participant 8

	Predicted label						Sup.
	WA	WU	WD	SI	ST	LA	
Actual label	WA	100.0% 48	0.0% 0	0.0% 0	0.0% 0	0.0% 0	48
	WU	0.0% 0	100.0% 41	0.0% 0	0.0% 0	0.0% 0	41
	WD	0.0% 0	0.0% 0	100.0% 38	0.0% 0	0.0% 0	38
	SI	0.0% 0	0.0% 0	0.0% 0	100.0% 46	0.0% 0	46
	ST	0.0% 0	0.0% 0	0.0% 0	16.7% 9	83.3% 45	54
	LA	0.0% 0	0.0% 0	0.0% 0	0.0% 0	100.0% 54	54

TABLE 9. Confusion matrix LOOCV: Participant 9

	Predicted label						Sup.
	WA	WU	WD	SI	ST	LA	
Actual label	WA	100.0% 52	0.0% 0	0.0% 0	0.0% 0	0.0% 0	52
	WU	4.1% 2	95.9% 47	0.0% 0	0.0% 0	0.0% 0	49
	WD	0.0% 0	0.0% 0	100.0% 42	0.0% 0	0.0% 0	42
	SI	0.0% 0	6.0% 3	0.0% 0	82.0% 41	12.0% 6	50
	ST	0.0% 0	0.0% 0	0.0% 0	11.1% 5	88.9% 40	45
	LA	0.0% 0	0.0% 0	0.0% 0	0.0% 0	100.0% 50	50

TABLE 10. Confusion matrix LOOCV: Participant 10

	Predicted label						Sup.
	WA	WU	WD	SI	ST	LA	
Actual label	WA	79.2% 42	0.0% 0	20.8% 11	0.0% 0	0.0% 0	53
	WU	17.0% 8	48.9% 23	34.0% 16	0.0% 0	0.0% 0	47
	WD	0.0% 0	0.0% 0	100.0% 38	0.0% 0	0.0% 0	38
	SI	0.0% 0	0.0% 0	0.0% 0	64.8% 35	35.2% 19	54
	ST	0.0% 0	0.0% 0	0.0% 0	6.8% 3	93.2% 41	44
	LA	0.0% 0	0.0% 0	0.0% 0	0.0% 0	100.0% 58	58

TABLE 11. Confusion matrix LOOCV: Participant 11

	Predicted label						Sup.
	WA	WU	WD	SI	ST	LA	
Actual label	WA	100.0% 59	0.0% 0	0.0% 0	0.0% 0	0.0% 0	59
	WU	0.0% 0	100.0% 54	0.0% 0	0.0% 0	0.0% 0	54
	WD	0.0% 0	0.0% 0	100.0% 46	0.0% 0	0.0% 0	46
	SI	0.0% 0	0.0% 0	0.0% 0	100.0% 53	0.0% 0	53
	ST	0.0% 0	0.0% 0	0.0% 0	0.0% 0	100.0% 47	47
	LA	0.0% 0	0.0% 0	0.0% 0	0.0% 0	100.0% 57	57

TABLE 12. Confusion matrix LOOCV: Participant 12

	Predicted label						Sup.
	WA	WU	WD	SI	ST	LA	
Actual label	WA	100.0% 50	0.0% 0	0.0% 0	0.0% 0	0.0% 0	50
	WU	0.0% 0	100.0% 52	0.0% 0	0.0% 0	0.0% 0	52
	WD	0.0% 0	0.0% 0	100.0% 46	0.0% 0	0.0% 0	46
	SI	0.0% 0	0.0% 0	0.0% 0	82.4% 42	17.6% 9	51
	ST	0.0% 0	0.0% 0	0.0% 0	0.0% 0	100.0% 61	61
	LA	0.0% 0	0.0% 0	0.0% 0	0.0% 0	100.0% 60	60

TABLE 13. Confusion matrix LOOCV: Participant 13

	Predicted label						Sup.
	WA	WU	WD	SI	ST	LA	
Actual label	WA	100.0% 57	0.0% 0	0.0% 0	0.0% 0	0.0% 0	57
	WU	0.0% 0	100.0% 55	0.0% 0	0.0% 0	0.0% 0	55
	WD	0.0% 0	0.0% 0	100.0% 47	0.0% 0	0.0% 0	47
	SI	0.0% 0	0.0% 0	0.0% 0	98.0% 48	2.0% 1	49
	ST	0.0% 0	0.0% 0	0.0% 0	0.0% 0	100.0% 57	57
	LA	0.0% 0	0.0% 0	0.0% 0	0.0% 0	100.0% 62	62

TABLE 14. Confusion matrix LOOCV: Participant 14

	Predicted label						
	WA	WU	WD	SI	ST	LA	Sup.
WA	0.0% 0	100.0% 59	0.0% 0	0.0% 0	0.0% 0	0.0% 0	59
WU	0.0% 0	100.0% 54	0.0% 0	0.0% 0	0.0% 0	0.0% 0	54
WD	0.0% 0	0.0% 0	100.0% 45	0.0% 0	0.0% 0	0.0% 0	45
SI	0.0% 0	0.0% 0	0.0% 0	77.8% 42	22.2% 12	0.0% 0	54
ST	0.0% 0	0.0% 0	0.0% 0	0.0% 0	100.0% 60	0.0% 0	60
LA	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	100.0% 51	51

TABLE 18. Confusion matrix LOOCV: Participant 18

	Predicted label						
	WA	WU	WD	SI	ST	LA	Sup.
WA	100.0% 56	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	56
WU	0.0% 0	100.0% 58	0.0% 0	0.0% 0	0.0% 0	0.0% 0	58
WD	0.0% 0	0.0% 0	100.0% 55	0.0% 0	0.0% 0	0.0% 0	55
SI	0.0% 0	0.0% 0	0.0% 0	100.0% 57	0.0% 0	0.0% 0	57
ST	0.0% 0	0.0% 0	0.0% 0	2.7% 2	97.3% 71	0.0% 0	73
LA	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	100.0% 65	65

TABLE 15. Confusion matrix LOOCV: Participant 15

	Predicted label						
	WA	WU	WD	SI	ST	LA	Sup.
WA	100.0% 54	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	54
WU	0.0% 0	100.0% 48	0.0% 0	0.0% 0	0.0% 0	0.0% 0	48
WD	0.0% 0	0.0% 0	100.0% 42	0.0% 0	0.0% 0	0.0% 0	42
SI	0.0% 0	0.0% 0	0.0% 0	98.3% 58	1.7% 1	0.0% 0	59
ST	0.0% 0	0.0% 0	0.0% 0	0.0% 0	100.0% 53	0.0% 0	53
LA	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	100.0% 72	72

TABLE 19. Confusion matrix LOOCV: Participant 19

	Predicted label						
	WA	WU	WD	SI	ST	LA	Sup.
WA	100.0% 52	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	52
WU	0.0% 0	100.0% 40	0.0% 0	0.0% 0	0.0% 0	0.0% 0	40
WD	0.0% 0	0.0% 0	100.0% 39	0.0% 0	0.0% 0	0.0% 0	39
SI	0.0% 0	0.0% 0	0.0% 0	98.6% 72	0.0% 0	1.4% 1	73
ST	0.0% 0	0.0% 0	0.0% 0	0.0% 0	100.0% 73	0.0% 0	73
LA	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	100.0% 83	83

TABLE 16. Confusion matrix LOOCV: Participant 16

	Predicted label						
	WA	WU	WD	SI	ST	LA	Sup.
WA	100.0% 51	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	51
WU	0.0% 0	100.0% 51	0.0% 0	0.0% 0	0.0% 0	0.0% 0	51
WD	0.0% 0	0.0% 0	100.0% 47	0.0% 0	0.0% 0	0.0% 0	47
SI	0.0% 0	0.0% 0	0.0% 0	91.3% 63	8.7% 6	0.0% 0	69
ST	0.0% 0	0.0% 0	0.0% 0	25.6% 20	74.4% 58	0.0% 0	78
LA	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	100.0% 70	70

TABLE 20. Confusion matrix LOOCV: Participant 20

	Predicted label						
	WA	WU	WD	SI	ST	LA	Sup.
WA	100.0% 51	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	51
WU	0.0% 0	100.0% 51	0.0% 0	0.0% 0	0.0% 0	0.0% 0	51
WD	0.0% 0	0.0% 0	100.0% 45	0.0% 0	0.0% 0	0.0% 0	45
SI	0.0% 0	0.0% 0	0.0% 0	100.0% 66	0.0% 0	0.0% 0	66
ST	0.0% 0	0.0% 0	0.0% 0	0.0% 0	100.0% 73	0.0% 0	73
LA	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	100.0% 68	68

TABLE 17. Confusion matrix LOOCV: Participant 17

	Predicted label						
	WA	WU	WD	SI	ST	LA	Sup.
WA	100.0% 61	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	61
WU	0.0% 0	100.0% 48	0.0% 0	0.0% 0	0.0% 0	0.0% 0	48
WD	0.0% 0	0.0% 0	100.0% 46	0.0% 0	0.0% 0	0.0% 0	46
SI	0.0% 0	0.0% 0	0.0% 0	85.9% 55	14.1% 9	0.0% 0	64
ST	0.0% 0	0.0% 0	0.0% 0	2.6% 2	97.4% 76	0.0% 0	78
LA	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	100.0% 71	71

TABLE 21. Confusion matrix LOOCV: Participant 21

	Predicted label						
	WA	WU	WD	SI	ST	LA	Sup.
WA	100.0% 52	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	52
WU	0.0% 0	100.0% 47	0.0% 0	0.0% 0	0.0% 0	0.0% 0	47
WD	0.0% 0	0.0% 0	100.0% 45	0.0% 0	0.0% 0	0.0% 0	45
SI	0.0% 0	0.0% 0	0.0% 0	85.9% 73	14.1% 12	0.0% 0	85
ST	0.0% 0	0.0% 0	0.0% 0	0.0% 0	100.0% 89	0.0% 0	89
LA	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	100.0% 90	90

TABLE 22. Confusion matrix LOOCV: Participant 22

	Predicted label						Sup.
	WA	WU	WD	SI	ST	LA	
Actual label	WA	100.0% 46	0.0% 0	0.0% 0	0.0% 0	0.0% 0	46
	WU	0.0% 0	100.0% 42	0.0% 0	0.0% 0	0.0% 0	42
	WD	0.0% 0	0.0% 0	100.0% 36	0.0% 0	0.0% 0	36
	SI	0.0% 0	0.0% 0	0.0% 0	98.4% 61	1.6% 1	62
	ST	0.0% 0	0.0% 0	0.0% 0	100.0% 63	0.0% 0	63
	LA	0.0% 0	0.0% 0	0.0% 0	0.0% 0	100.0% 72	72

TABLE 26. Confusion matrix LOOCV: Participant 26

	Predicted label						Sup.
	WA	WU	WD	SI	ST	LA	
Actual label	WA	100.0% 59	0.0% 0	0.0% 0	0.0% 0	0.0% 0	59
	WU	0.0% 0	100.0% 55	0.0% 0	0.0% 0	0.0% 0	55
	WD	0.0% 0	0.0% 0	100.0% 50	0.0% 0	0.0% 0	50
	SI	0.0% 0	0.0% 0	0.0% 0	100.0% 78	0.0% 0	78
	ST	0.0% 0	0.0% 0	0.0% 0	100.0% 74	0.0% 0	74
	LA	0.0% 0	0.0% 0	0.0% 0	0.0% 0	100.0% 76	76

TABLE 23. Confusion matrix LOOCV: Participant 23

	Predicted label						Sup.
	WA	WU	WD	SI	ST	LA	
Actual label	WA	100.0% 59	0.0% 0	0.0% 0	0.0% 0	0.0% 0	59
	WU	0.0% 0	100.0% 51	0.0% 0	0.0% 0	0.0% 0	51
	WD	0.0% 0	0.0% 0	100.0% 54	0.0% 0	0.0% 0	54
	SI	0.0% 0	0.0% 0	0.0% 0	100.0% 68	0.0% 0	68
	ST	0.0% 0	0.0% 0	0.0% 0	19.1% 13	80.9% 55	68
	LA	0.0% 0	0.0% 0	0.0% 0	0.0% 0	100.0% 72	72

TABLE 27. Confusion matrix LOOCV: Participant 27

	Predicted label						Sup.
	WA	WU	WD	SI	ST	LA	
Actual label	WA	100.0% 57	0.0% 0	0.0% 0	0.0% 0	0.0% 0	57
	WU	0.0% 0	100.0% 51	0.0% 0	0.0% 0	0.0% 0	51
	WD	0.0% 0	0.0% 0	100.0% 44	0.0% 0	0.0% 0	44
	SI	0.0% 0	0.0% 0	0.0% 0	98.6% 69	1.4% 1	70
	ST	0.0% 0	0.0% 0	0.0% 0	100.0% 80	0.0% 0	80
	LA	0.0% 0	0.0% 0	0.0% 0	0.0% 0	100.0% 74	74

TABLE 24. Confusion matrix LOOCV: Participant 24

	Predicted label						Sup.
	WA	WU	WD	SI	ST	LA	
Actual label	WA	100.0% 58	0.0% 0	0.0% 0	0.0% 0	0.0% 0	58
	WU	0.0% 0	100.0% 59	0.0% 0	0.0% 0	0.0% 0	59
	WD	0.0% 0	0.0% 0	100.0% 55	0.0% 0	0.0% 0	55
	SI	0.0% 0	0.0% 0	0.0% 0	100.0% 68	0.0% 0	68
	ST	0.0% 0	0.0% 0	0.0% 0	0.0% 0	100.0% 69	69
	LA	0.0% 0	0.0% 0	0.0% 0	0.0% 0	100.0% 72	72

TABLE 28. Confusion matrix LOOCV: Participant 28

	Predicted label						Sup.
	WA	WU	WD	SI	ST	LA	
Actual label	WA	100.0% 54	0.0% 0	0.0% 0	0.0% 0	0.0% 0	54
	WU	0.0% 0	100.0% 51	0.0% 0	0.0% 0	0.0% 0	51
	WD	0.0% 0	0.0% 0	100.0% 46	0.0% 0	0.0% 0	46
	SI	0.0% 0	0.0% 0	0.0% 0	62.5% 45	37.5% 27	72
	ST	0.0% 0	0.0% 0	0.0% 0	100.0% 79	0.0% 0	79
	LA	0.0% 0	0.0% 0	0.0% 0	0.0% 0	100.0% 80	80

TABLE 25. Confusion matrix LOOCV: Participant 25

	Predicted label						Sup.
	WA	WU	WD	SI	ST	LA	
Actual label	WA	100.0% 74	0.0% 0	0.0% 0	0.0% 0	0.0% 0	74
	WU	0.0% 0	100.0% 65	0.0% 0	0.0% 0	0.0% 0	65
	WD	0.0% 0	0.0% 0	96.6% 56	3.4% 2	0.0% 0	58
	SI	0.0% 0	0.0% 0	0.0% 0	89.2% 58	10.8% 7	65
	ST	0.0% 0	0.0% 0	0.0% 0	25.7% 19	74.3% 55	74
	LA	0.0% 0	0.0% 0	0.0% 0	0.0% 0	100.0% 73	73

TABLE 29. Confusion matrix LOOCV: Participant 29

	Predicted label						Sup.
	WA	WU	WD	SI	ST	LA	
Actual label	WA	100.0% 53	0.0% 0	0.0% 0	0.0% 0	0.0% 0	53
	WU	0.0% 0	100.0% 49	0.0% 0	0.0% 0	0.0% 0	49
	WD	0.0% 0	0.0% 0	100.0% 48	0.0% 0	0.0% 0	48
	SI	0.0% 0	0.0% 0	0.0% 0	100.0% 60	0.0% 0	60
	ST	0.0% 0	0.0% 0	0.0% 0	3.1% 2	96.9% 63	65
	LA	0.0% 0	0.0% 0	0.0% 0	0.0% 0	100.0% 69	69

TABLE 30. Confusion matrix LOOCV: Participant 30

	Predicted label						Sup.
	WA	WU	WD	SI	ST	LA	
Actual label	WA	100.0% 65	0.0% 0	0.0% 0	0.0% 0	0.0% 0	65
	WU	0.0% 0	100.0% 65	0.0% 0	0.0% 0	0.0% 0	65
	WD	0.0% 0	0.0% 0	100.0% 62	0.0% 0	0.0% 0	62
	SI	0.0% 0	0.0% 0	100.0% 62	0.0% 0	0.0% 0	62
	ST	0.0% 0	0.0% 0	0.0% 0	100.0% 59	0.0% 0	59
	LA	0.0% 0	0.0% 0	0.0% 0	0.0% 0	100.0% 70	70