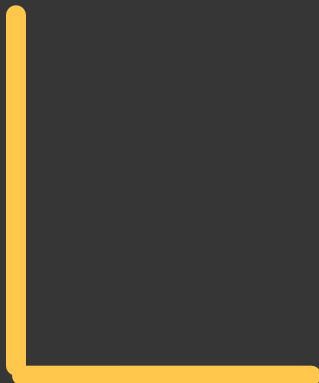# TRANSFERÊNCIA DE CONHECIMENTO (TRANSFER LEARNING)

DEEP LEARNING PARA CLASSIFICAÇÃO DE GESTOS DE MÃO COM TRANSFER LEARNING

Introdução

- Pessoas com deficiência;
- Interação com robôs;
- Eletromiografia;
- CNN.

Datasets

- Myo dataset;
  - 19 e 17 participantes;
  - Maior dataset publicado utilizando o Myo Armband;
- NinaPro DB5;
  - 10 participantes;
  - Utilizado para benchmark;

Transfer Learning

- Alinhamento automático;
- Progressive Neural Networks (PNN);
- Adaptive Batch Normalization;
- Uso de duas redes.

Comparação dos classificadores

	Raw	Raw + TL	Spectrogram	Spectrogram + TL	CWT	CWT + TL
4 Cycles	97.08%	**97.39%**	97.14%	**97.85%**	97.95%	**98.31%**
STD	4.94%	**4.07%**	2.85%	**2.45%**	2.49%	**2.16%**
H0 (p-value)	0 (0.02187)	-	0 (0.00030)	-	0 (0.00647)	-
3 Cycles	96.22%	**96.95%**	96.33%	**97.40%**	97.22%	**97.82%**
STD	6.49%	**4.88%**	3.49%	**2.91%**	3.46%	**2.41%**
H0 (p-value)	0 (0.00155)	-	0 (0.00018)	-	0 (0.00113)	-
2 Cycles	94.53%	**95.49%**	94.19%	**96.05%**	95.17%	**96.63%**
STD	9.63%	**7.26%**	5.95%	**6.00%**	5.77%	**4.54%**
H0 (p-value)	0 (0.00430)	-	0 (0.00015)	-	0 (0.00030)	-
1 Cycle	89.04%	**92.46%**	88.51%	**93.93%**	89.02%	**94.69%**
STD	10.63%	**7.79%**	8.37%	**6.56%**	10.24%	**5.58%**
H0 (p-value)	0 (0.00018)	-	0 (0.00015)	-	0 (0.00015)	-

* The *one-tail Wilcoxon signed rank test* is applied to compare the ConvNet enhanced with the proposed TL algorithm to their non-augmented counterpart. Null hypothesis is rejected when $H_0 = 0$ ($p < 0.05$).

**The STD represents the pooled standard variation in accuracy for the 20 runs over the 17 participants.

	Raw	Raw + TL	Spectrogram	Spectrogram + TL	CWT	CWT + TL
4 Repetitions	66.32%	**68.98%**	63.60%	**65.10%**	61.89%	**65.57%**
STD	3.94%	**4.46%**	3.94%	**3.99%**	4.12%	**3.68%**
H0 (p-value)	0 (0.00253)	-	0 (0.00253)	-	0 (0.00253)	-
3 Repetitions	61.91%	**65.16%**	60.09%	**61.70%**	58.37%	**62.21%**
STD	3.94%	**4.46%**	4.03%	**4.29%**	4.19%	**3.93%**
H0 (p-value)	0 (0.00253)	-	0 (0.00253)	-	0 (0.00253)	-
2 Repetitions	55.67%	**60.12%**	55.35%	**57.19%**	53.32%	**57.53%**
STD	4.38%	**4.79%**	4.50%	**4.71%**	3.72%	**3.69%**
H0 (p-value)	0 (0.00253)	-	0 (0.00253)	-	0 (0.00253)	-
1 Repetitions	46.06%	**49.41%**	45.59%	**47.39%**	42.47%	**48.33%**
STD	6.09%	**5.82%**	5.58%	**5.30%**	7.04%	**5.07%**
H0 (p-value)	0 (0.00467)	-	0 (0.00467)	-	0 (0.00253)	-

* The *Wilcoxon signed rank test* is applied to compare the ConvNet enhanced with the proposed TL algorithm to their non-augmented counterpart. Null hypothesis is rejected when $H_0 = 0$ ($p < 0.05$).

**The STD represents the pooled standard variation in accuracy for the 20 runs over the 17 participants.
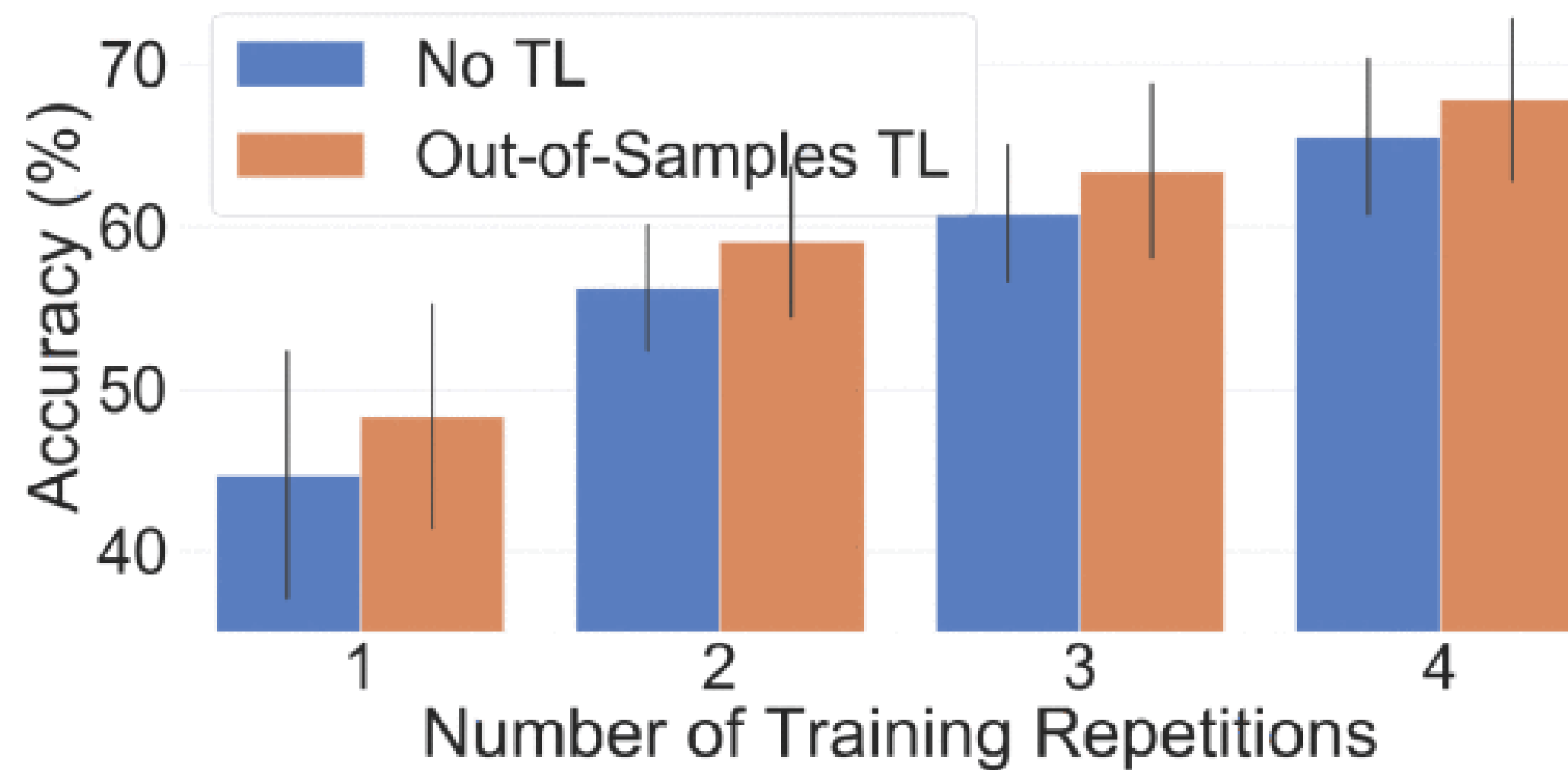
Referência

COTE-ALLARD, Ulysse; FALL, Cheikh Latyr; DROUIN, Alexandre; CAMPEAU-LECOURS, Alexandre; GOSSELIN, Clement; GLETTE, Kyrre; LAVIOLETTE, Francois; GOSSELIN, Benoit. Deep Learning for Electromyographic Hand Gesture Signal Classification Using Transfer Learning. Ieee Transactions On Neural Systems And Rehabilitation Engineering, [S.L.], v. 27, n. 4, p. 760-771, abr. 2019. Institute of Electrical and Electronics Engineers (IEEE). http://dx.doi.org/10.1109/tnsre.2019.2896269.