Leveraging Unannotated Sign Language Data via a Robust Data Augmentation Method for Contrastive Representation Learning

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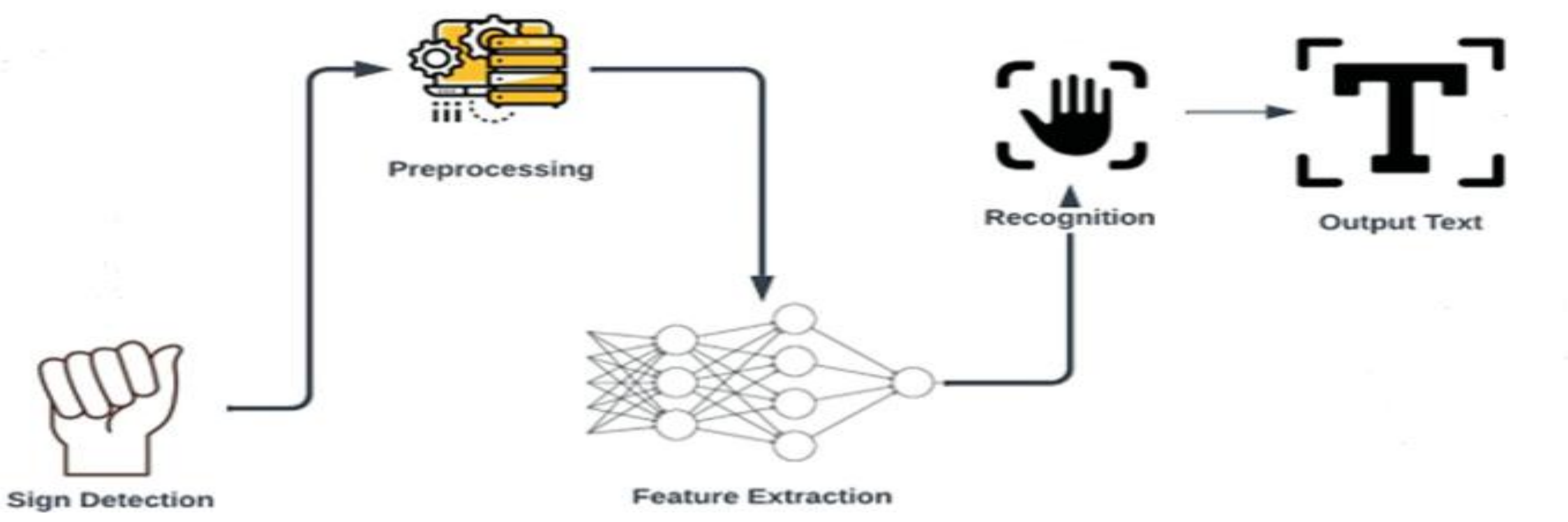
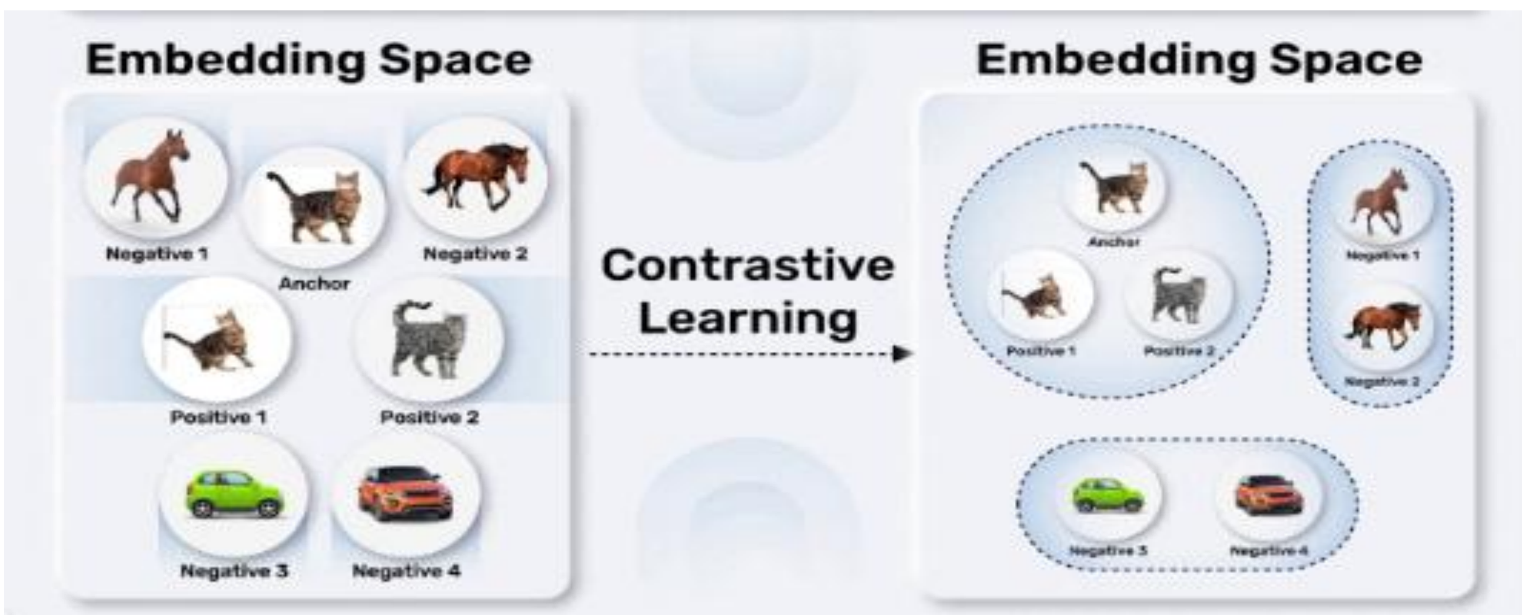
Sign Language Recognition



Contrastive Learning



A novel Data Augmentation For Contrastive Learning in SLR

Algorithm 1: Proposed Augmentation

Data: $\mathcal{X} = \{x_1, x_2, \ldots, x_N\}$: set of signs
Result: $\mathcal{X}'$: augmented sequences

for $x \in \mathcal{X}$ **do**
- $x^r, x^{nr} \leftarrow$ relevant&non_relevant_parts(x)
- $x^f, x^l \leftarrow x^{nr}$
- $A_1 \leftarrow t_1 \circ g_1$
- $A_2 \leftarrow t_2 \circ g_2$
- $x_1 \leftarrow \pi_1(x^f) \parallel A_1(x^r) \parallel \pi_2(x^l)$
- $x_2 \leftarrow \pi_1'(x^f) \parallel A_2(x^r) \parallel \pi_2'(x^l)$
- Add (x_1, x_2) to $\mathcal{X}'$

return $\mathcal{X}'$

Results

Method	Dataset	SimCLR	MoCo	SimSiam	BYOL	SL-FPN
Linear Evaluation Results						
Madjoukeng et al. (2026)	LSFB	14.16% ± 0.24	13.68% ± 0.48	15.26% ± 0.67	14.72% ± 0.65	23.73% ± 0.53
	ASL	14.13% ± 0.42	14.69% ± 0.35	15.91% ± 0.56	16.43% ± 0.96	20.46% ± 1.21
	GSL	34.19% ± 0.85	36.15% ± 0.69	32.01% ± 0.54	34.09% ± 0.93	47.76% ± 0.79
	LSA	34.02% ± 1.24	35.69% ± 1.06	30.06% ± 2.14	37.47% ± 1.51	41.74% ± 1.08
Ours	LSFB	**16.89%** ± 0.33	**16.13%** ± 0.81	**16.77%** ± 0.39	**17.71%** ± 0.10	23.90% ± 0.81
	ASL	**16.28%** ± 0.39	**17.09%** ± 0.30	16.17% ± 0.56	**18.39%** ± 0.20	**22.13%** ± 0.63
	GSL	**36.23%** ± 0.51	**37.14%** ± 0.17	**35.57%** ± 0.59	**36.17%** ± 0.69	48.57% ± 0.42
	LSA	**37.08%** ± 1.13	36.21% ± 0.89	32.22% ± 0.19	38.58% ± 1.11	**43.98%** ± 0.88
Partial Fine-tuning						
Madjoukeng et al. (2026)	LSFB	42.69% ± 2.50	42.23% ± 2.14	43.69% ± 2.69	41.40% ± 2.04	49.93% ± 2.98
	ASL	47.43% ± 0.77	47.49% ± 0.54	47.23% ± 0.63	47.02% ± 0.51	49.28% ± 0.79
	GSL	78.82% ± 2.96	77.42% ± 2.87	77.02% ± 2.95	78.04% ± 2.65	83.86% ± 2.01
	LSA	87.69% ± 1.48	88.04% ± 1.69	87.96% ± 0.06	88.64% ± 1.36	92.76% ± 1.63
Ours	LSFB	**44.57**% ± 1.16	**44.09**% ± 0.98	**48.03**% ± 1.07	44.14% ± 1.14	**51.97**% ± 0.51
	ASL	47.21% ± 0.19	**48.05**% ± 0.34	**48.13**% ± 0.31	**48.14**% ± 0.99	**52.56**% ± 0.98
	GSL	79.33% ± 1.14	78.41% ± 0.59	**79.07**% ± 1.19	**80.05**% ± 1.02	83.07% ± 0.60
	LSA	**89.01**% ± 0.17	88.96% ± 0.56	**88.57**% ± 0.36	**89.17**% ± 0.51	92.88% ± 0.11

Madjoukeng, Basso Ariel, SSL-SLR: Self-supervised learning for sign language recognition, TMLR 2026.

N Kamble, et al,, Deep learning-based sign language recognition and translation.

Conclusion and Further works

To learn relevant representations, contrastive approaches require task-specific augmentation methods. By leveraging the proposed augmentation, contrastive approaches can learn more useful representations. As further work, we plan to extend this to continuous sign language.

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