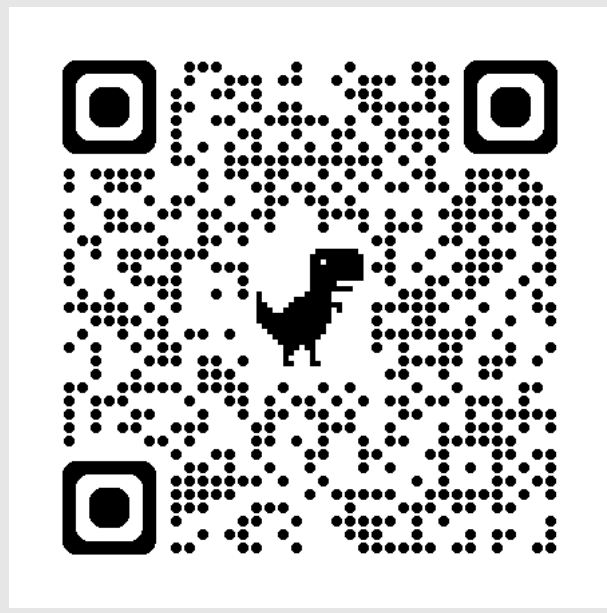


# iSign: A Benchmark for Indian Sign Language Processing



Abhinav Joshi† Romit Mohanty† Mounika Kanakanti¶†  
Andesha Mangla★ Sudeep Choudhary♦ Monali Barbate♦  
Ashutosh Modi†

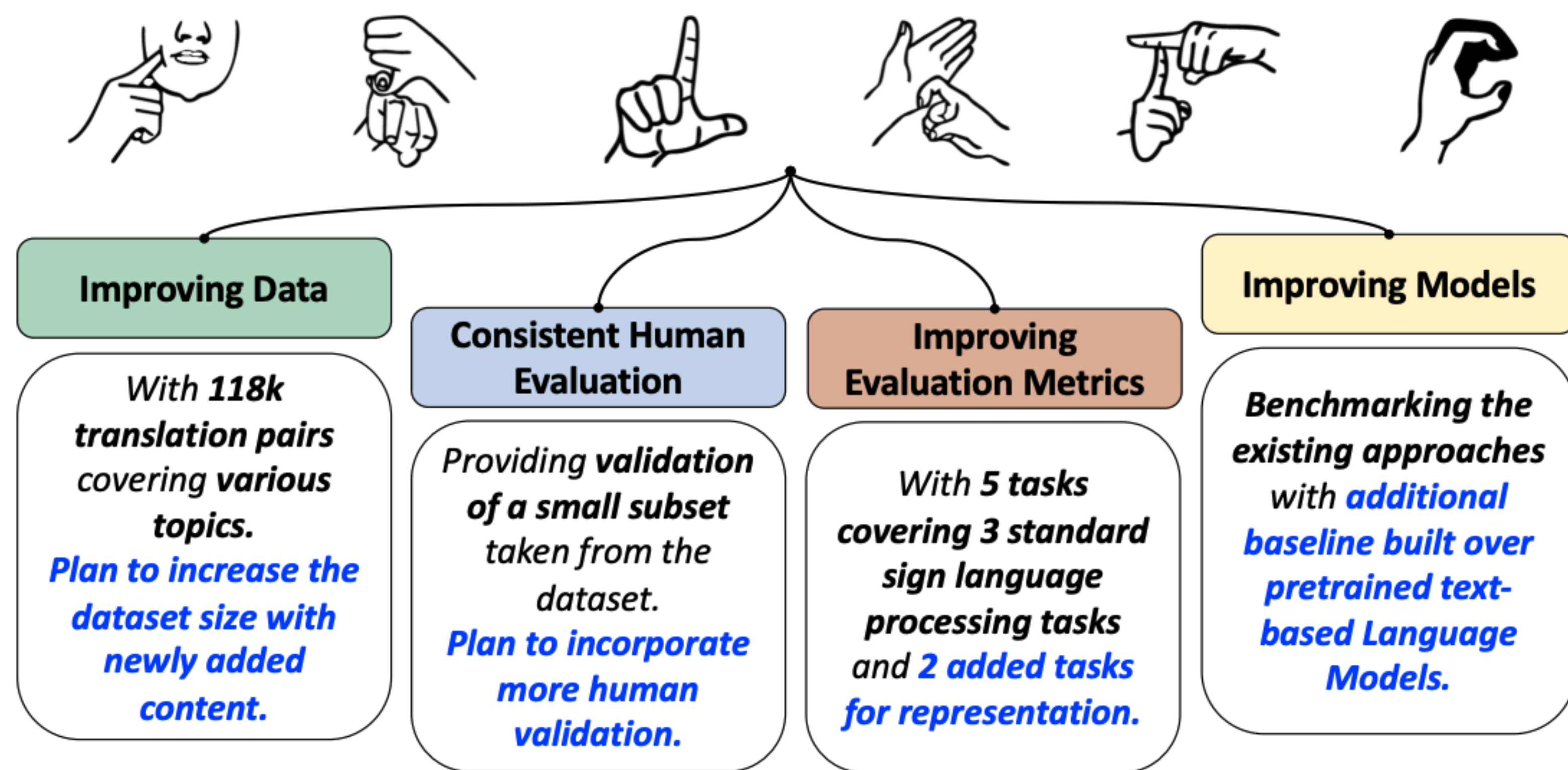


†IIT Kanpur ¶Max Planck Institute for Psycholinguistics ★ISLRTC ♦Microsoft IDC India

## Motivation

- Indian Sign Language has limited resources for developing machine learning and data-driven approaches for automated language processing.
- In this work, we propose iSign: a benchmark for Indian Sign Language (ISL) Processing.
- We propose multiple NLP-specific tasks (including SignVideo2Text, SignPose2Text, Text2Pose, Word Prediction, and Sign Semantics) and benchmark them with the baseline models.
- We provide linguistic insights into the functioning of ISL, covering various aspects like structural differences, the use of space, the use of fingerspelling and coreference, and role shifts.

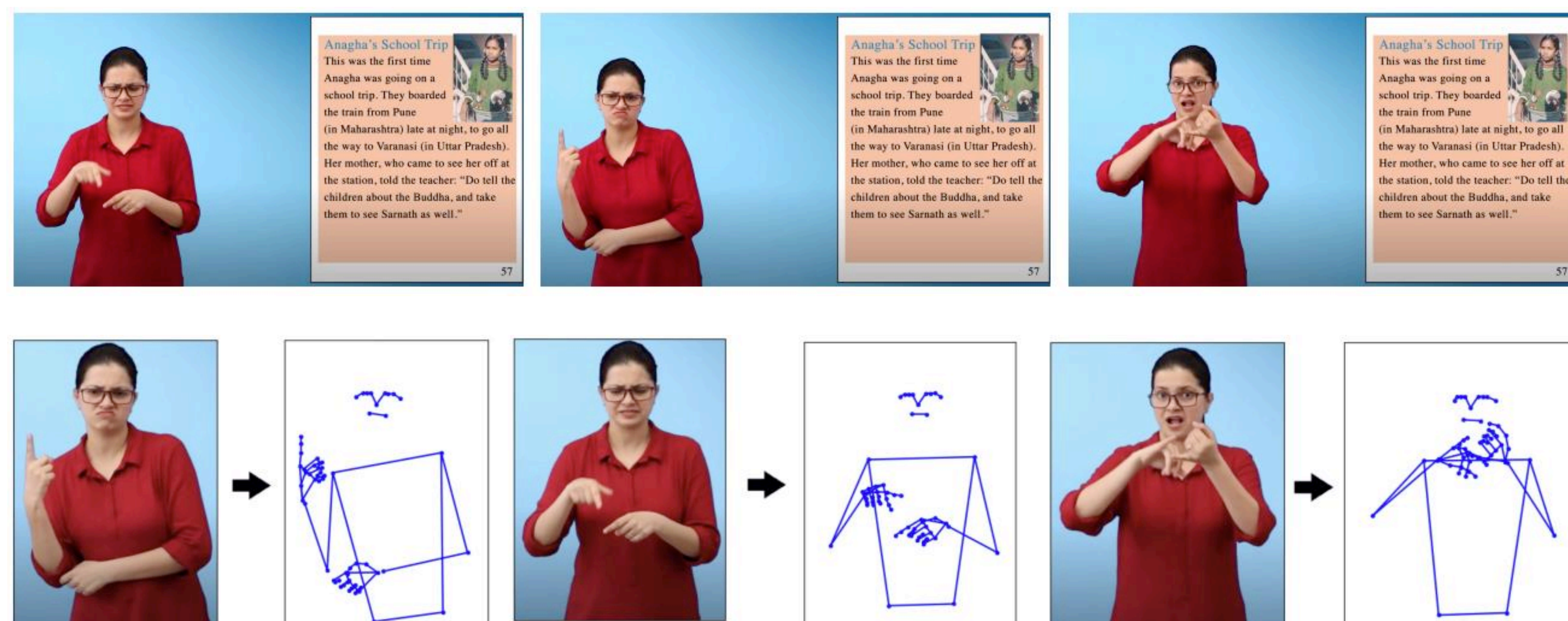
## iSign Benchmark



## Comparison with Existing Datasets

Dataset	Language	Sentences	Vocab. (corresponding Text)	Hours
Purdue RVL-SLLL (Martinez et al., 2002a)	ASL	2.5k	104	-
Boston 104 (Dreuw et al., 2007)	ASL	201	103	-
How2Sign (Duarte et al., 2021)	ASL	35k	16k	79
OpenASL (Shi et al., 2022)	ASL	98k	33k	288
YouTube-ASL (Shi et al., 2022)	ASL	610k	60k	984
AfriSign (Gueuwou et al., 2023)	KSL, ZSL, SASL GSL, NSL, ZISL	98k	20k	-
BOBSL (Albanie et al., 2021)	BSL	993k	72k	1447
CSL Daily (Zhou et al., 2021)	CSL	20.6k	2k	23
Phoenix-2014T (Camgoz et al., 2018a)	DGS	8.2k	3K	11
SWISSTXT-Weather (Camgöz et al., 2021)	DSGS	811	1k	-
SWISSTXT-News (Camgöz et al., 2021)	DSGS	6k	10k	-
KETI (Ko et al., 2018)	KSL	14.6k	419	28
VRT-News (Camgöz et al., 2021)	VGT	7.1k	7k	100
ISL-CSLRT (Elakkiya and Natarajan, 2021)	ISL	100	-	-
ISLTranslate (Joshi et al., 2023)	ISL	31k	11k	55
iSign (ours)	ISL	118k	40k	252

## Dataset Creation



## Results/Findings

### Human Validation

Dataset Translations	ISL-Signer Translations (references)
Where are you going to, man? I said.	Where are you going to, man? I asked.
Where are you going this fine day? I said to the puppy.	Where are you going on this special day? I asked the puppy.
and name your dog.	name your dog.
You might begin. I am a little brown dog.	What do you begin? I am a little brown dog.
Not I.	Not, I did not come.
I said to the horse as he went by.	I asked the horse as he went by.
as he went by, up in the hills	I asked the puppy as he went by.
Autobiography	to tell your life story in your own language.
Page 117. It was impossible for me to...	Page 117. The two fences
climb because every step was 6 feet high.	were impossible for me to climb because they were 6 ft high.
60 feet above the ground.	I was high above the ground at
and blew my hair aside to get a better view of my face.	He blew my hair aside to get a better view of my face.
Each minister looked at the line and was puzzled.	Each minister looked at the line and was puzzled.
No one could think of any way to make it longer.	No one could think of any way to make it longer.
I turned back to join the crew.	Gulliver turned back to join his crew.
Dinner was brought for the farmer in a dish.	A farmer brought food in a dish
Land with no vegetation.	meaning is no vegetation.
and some had wells to supply water.	and some had wells to supply water.
My wife and my children.	wife and my children. had covered drains.

Metric	BLEU-1	BLEU-2	BLEU-3	BLEU-4	METEOR	WER	ROUGE-L	ROUGE-1	ROUGE-2	ROUGE-L-SUM
Score	76.3	73.42	71.2	69.3	73.83	33.83	81.9	82.2	64.4	81.8

### iSign Tasks

Task ID	Task Name	# Samples
1.	ISL-to-English Translation	118, 228
2.	English-to-ISL Pose Generation	118, 228
3.	Word/Gloss Recognition	7, 050
4.	Word Presence Prediction	1, 523
5.	Semantic Similarity Prediction	593

## Baseline Results

Neural Machine Translation					
Task	Source Language	Target Language	Model	BLEU-4	ROUGE-L
SignVideo-to-Text	ISL	English	Camgoz et al. (2020)	0.56	19.58
SignVideo-to-Text	ISL	English	T5(small)+I3D(2000)	0.24	11.41
SignPose-to-Text	ISL	English	Camgoz et al. (2020)	0.77	9.52
SignPose-to-Text	ISL	English	T5(large)+Mediapipe(75)	0.09	19.11
SignPose-to-Text	ISL	English	T5(small)+Mediapipe(75)	0.8	16.46
SignPose-to-Text	ISL	English	T5(base)+Mediapipe(75)	1.47	16.67
SignPose-to-Text	ISL	English	SLT+Mediapipe(75)	0.36	7.60
Sign Language Generation					
Task	Source Language	Target Language	Model	DTW	
Text-to-SignPose	English	ISL	Saunders et al. (2020c)	22.69	
Word Level Translation/Gloss Prediction					
Task	Source Language	Target Language	Model	Acc. (Top-1%)	Acc. (Top-5%)
ISLR	ISL	English/Gloss	Joshi et al. (2022)	16.81	20.04
Sign Representation Learning					
Task	Query	Candidate	Model	Top 5% Acc.	Rank (Avg.)
Word Presence	word	example sentence	T5-base + I3D	52	193/1523
Semantic Similarity	word	description sentence	T5-base + I3D	67	44/593

## ISL Linguistics

- Structural Differences
- Significance of Non-Manual Markers
- Use of Space in ISL
- Fingerspelling and Co-reference
- Role Shifts in ISL
- Demographics and Dialects
- Extended Usage of Verbs and Nouns
- Use of Classifiers
- Simultaneous Articulation

- Kenneth Li, Aspen K Hopkins, David Bau, Fernanda Viégas, Hanspeter Pfister, and Martin Wattenberg. 2023. Emergent world representations: Exploring a sequence model trained on a synthetic task.
- Adam Karvonen. 2024. Emergent world models and latent variable estimation in chess-playing language models.
- Neel Nanda, Andrew Lee, and Martin Wattenberg. 2023. Emergent linear representations in world models of self-supervised sequence models.
- Guillaume Alain and Yoshua Bengio. 2018. Understanding intermediate layers using linear classifier probes.
- Yonatan Belinkov. 2022. Probing classifiers: Promises, shortcomings, and advances.