ACCV 2020 Workshop

MLCSA2020

Machine Learning and Computing for Visual Semantic Analysis

BdSL36: A Dataset for Bangladeshi Sign Letters Recognition

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Bangladeshi Sign Language *(BdSL)*

- Commonly used medium of communication for the hearing-impaired people in Bangladesh.

Motivation |

- To build a BdSL letters recognition system for real-life users.

Problem With Existing Works

Additional device for input	Dataset	Methodology	Output
• *Customized gloves*	• *Pre-processing* • *Background & angle variation limitation*	• *Traditional machine learning method* • *Manual feature extraction*	• *Similarities among signs give faulty recognition* • *All of them are not real-time*

| Overview

Challenges |

- Collection of Robust dataset
- Lack of resources in Bangladesh

Our Contribution |

Providing a dataset which -

- Is in-the-wild
- Can be applied robustly

| BdSL36

- Largest in-the-wild dataset for BdSL till date –
  - 10 volunteer participants
  - No additional constraints
  - Verified by two experts on BdSL and ***DHAKA BADHIR HIGH SCHOOL*** (School for deaf and dumb)

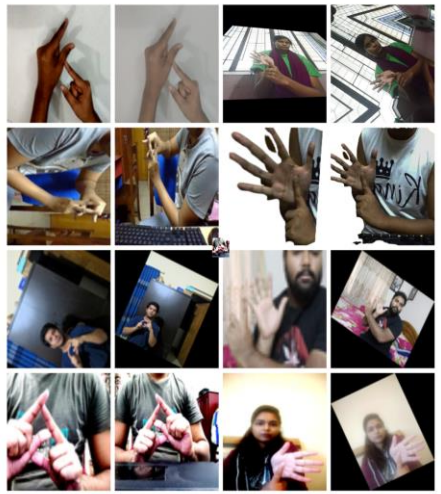
| Comparison | BdSL36 vs Others

Table1: Performance of deep learning classifiers on BdSL36v2 Dataset

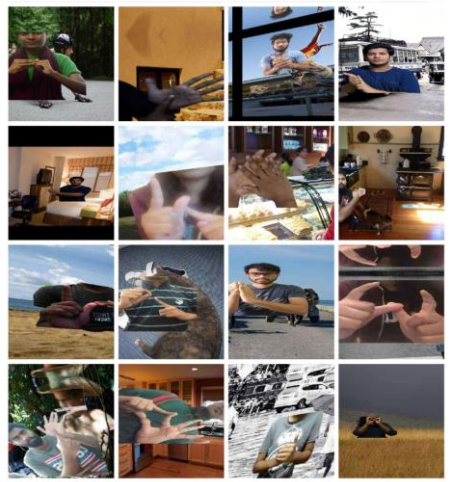
Dataset	Year	Class	Availability	Background Constraints	Bounding Box Label	Total Images	Images /Class
Rahman et al.	2014	10	N	Y	N	360	36
Rahman et al.	2015	10	N	Y	N	100	10
Ahmed et al.	2016	14	N	Y	N	518	37
BdSLImset	2018	10	Y	N	Y	100	10
Ishara-Lipi	2018	36	Y	Y	N	1,800	50
Sadik et al.	2019	10	Y	Y	N	400	40
Urme et al.	2019	36	N	Y	N	74,000	2,000
BdSL36	**2020**	**36**	**Y**	**N**	**Y**	**473,662**	**13,157**

| Dataset Specification

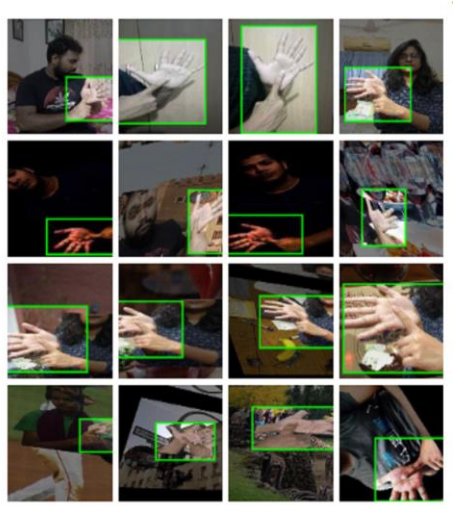
BdSL36x
Number of Total Images: 1200
Images Per Class: 35 (approx.)



BdSL36v1
Number of Total Images: 26,713
Images Per Class: 700 (approx.)



BdSL36v2
Number of Total Images: 473,662
Images Per Class: 13000 (approx.)



BdSL36v3
Number of Total Images : 45000
Images Per Class: 1250 (approx.)

| Preparation of Dataset

|Steps

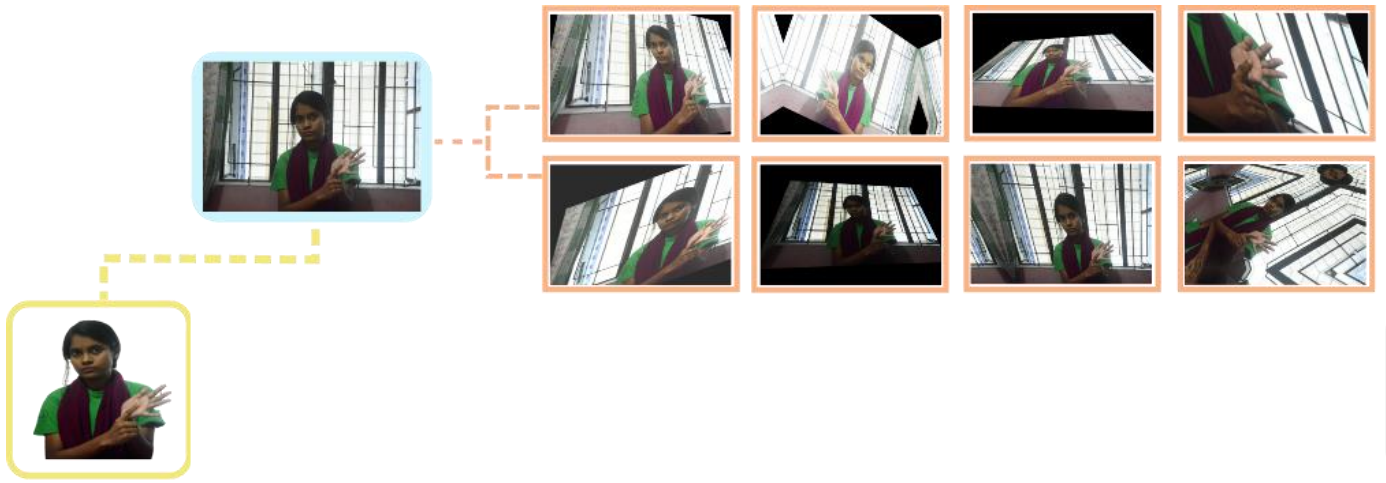
- *Initial Image*

Preparation of Dataset

Steps

- *Initial Image*
- *Augmentation on Initial Image*

Preparation of Dataset



Steps

- *Initial Image*
- *Augmentation on Initial Image*
- *Background Removal*

Preparation of Dataset

Steps

- *Initial Image*
- *Augmentation on Initial Image*
- *Background Removal*
- *Another set of augmentation on background removed image*

Preparation of Dataset

Steps

- *Initial Image*
- *Augmentation on Initial Image*
- *Background Removal*
- *Another set of augmentation on background removed image*
- *Several set of background augmentation on these images*

| Results

| Results on Different Models

Table1: Performance of deep learning classifiers on BdSL36v2 Dataset

Methods	Precision	Recall	FBeta	Accuracy	Loss
ResNet34	98.29	98.28	98.28	98.17	0.059
ResNet50	98.83	98.79	98.8	98.71	0.042
VGG19	99.17	99.17	99.17	99.10	0.028
Densenet169	98.67	98.64	98.64	98.55	0.048
Densenet201	98.70	98.65	98.66	98.56	0.014
Alexnet	84.10	83.90	83.90	83.10	0.580
Squeezenet	44.40	42.40	42.20	41.50	2.150

| Results on Different Models

Table2: Performance of deep learning classifiers on BdSL36v3 Dataset

Methods	Backbone	AP	$AP^{1/2}$	$AP^{1/2}$
FRCNN	VGG16	46.8	81.40	36.59
YOLOv3	ResNet50	28.1	55.30	16.50
SSD300	VGG16	41.2	79.61	36.53

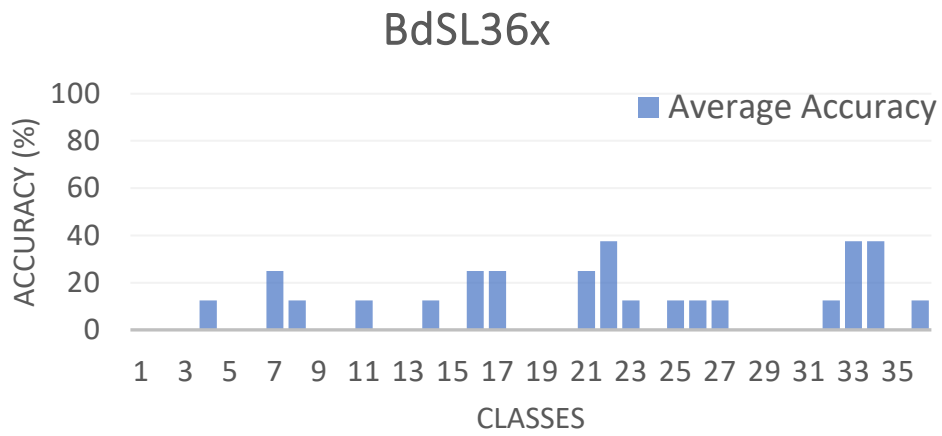
| Real Time Testing

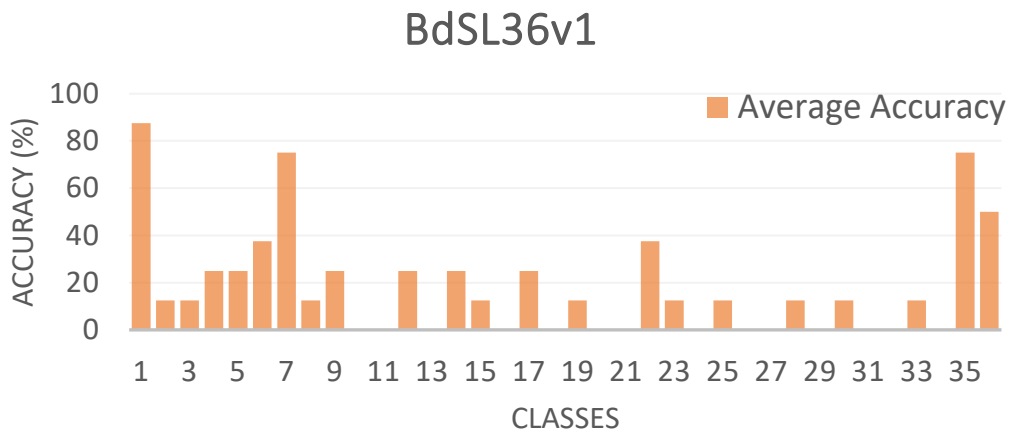
| here class *16* and *36* are the letters 'ঙ' and 'ঃ' respectively

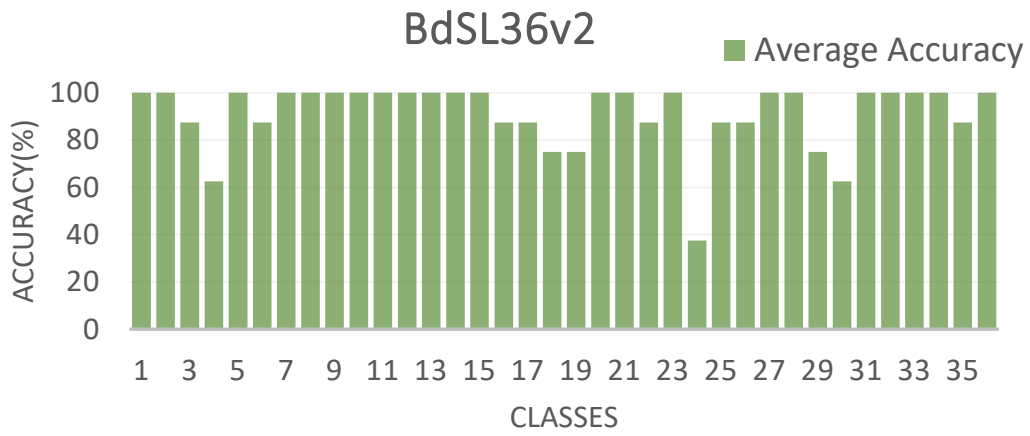
| Real Time Testing

| here class *16* and *36* are the letters 'ঠ' and 'ঃ' respectively

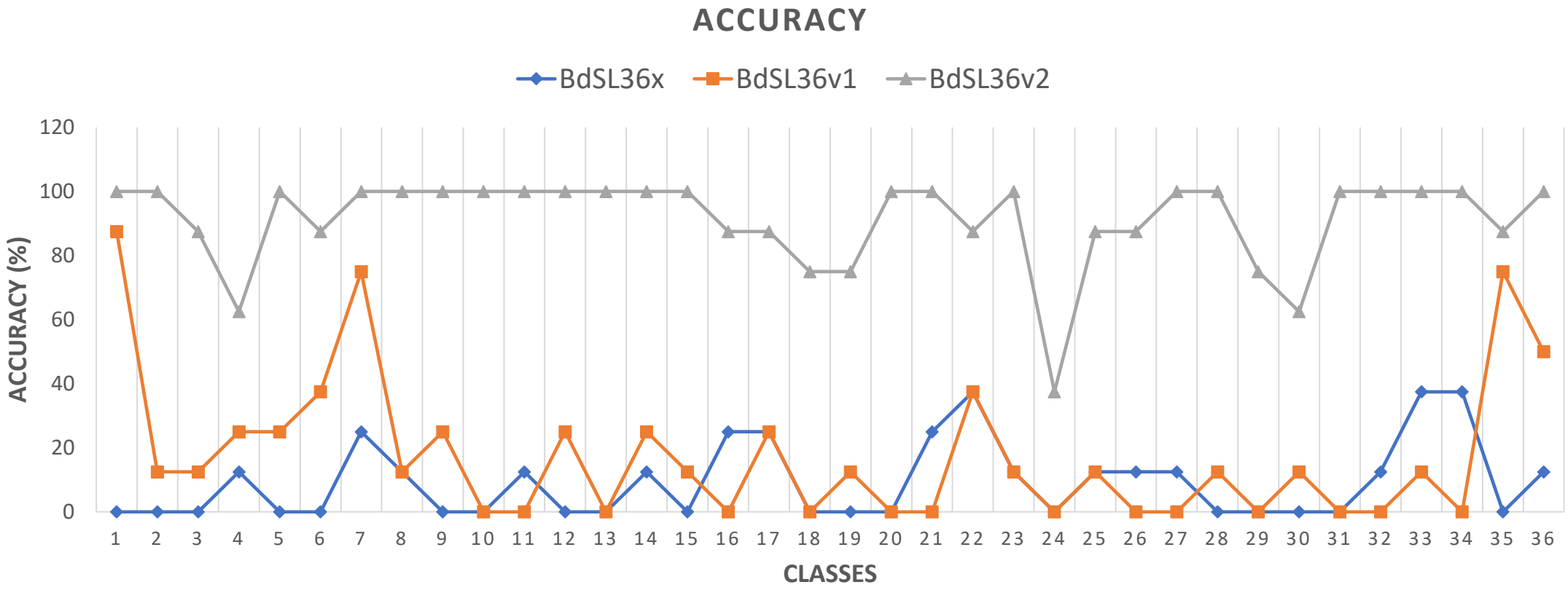
| Results | BdSL36x vs BdSL36v1 vs BdSL36v2 | Accuracy



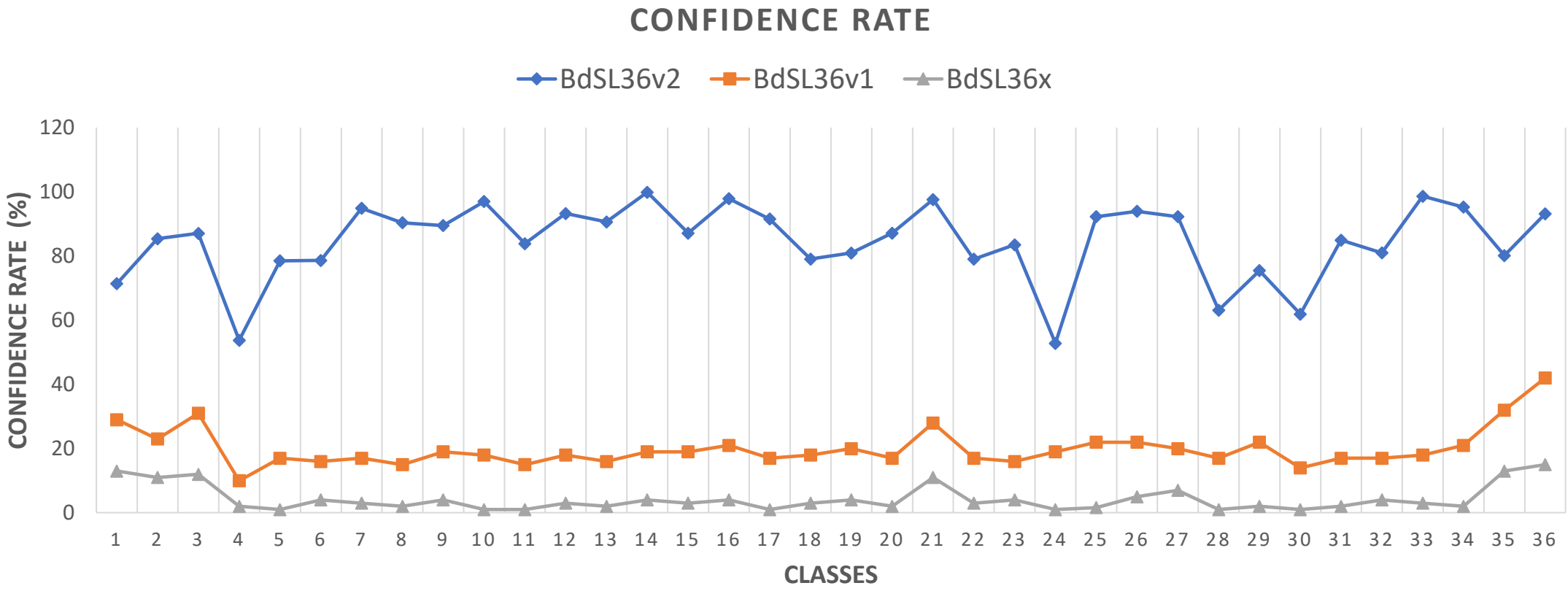




| Results | BdSL36**x** vs BdSL36**v1** vs BdSL36**v2** | Accuracy



| Results | BdSL36**x** vs BdSL36**v1** vs BdSL36**v2** | Confidence



| Result Evaluation

| here class *24* and *14* are extremely similar

| Result Evaluation

| here class *1* and *29* are extremely similar

| Result Evaluation

| here class *4* and *6* are extremely similar

| Results | Real-time

Thank You