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EsharaGAN: An Approach to Generate Disentangle Representation of Sign Language using InfoGAN

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>Introduction

- Motivation
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- Proposed Methodology
- Result Analysis
- Conclusion





Sign Language is an imperative methods of communicating with deaf people

> Approximately 13 million people in Bangladesh are suffering from irregular degrees of hearing loss^[1]

> Bangla Sign Language Controls the Visual–manual modality method

> It is important to automatically classify and generate Bangla sign digits for better communication with the deaf people

Various types of classification algorithm and neural network model was employed for this purpose





> Previously, capsule network was developed for classification^[2]

- > For better classification, a large number is needed for the purpose
- For this purpose, generation model plays extensive role in developing images aligned with the dataset
- > EsharaGAN is a Bangla sign digit generation model
- It is based on InfoGAN (Information Maximizing Generative Adversarial Networks)





Well adaptation of automated sign digits classification in the perspective of Bangladesh

> Developing practical application for the deaf people

> On the perspective to the people who are unable speak





- Kingma et al. proposed a model based on a stochastic variational inference that scales to large dataset^[3]. It is a lower bound estimator that can minimize the training time and marginal log-likelihood
- Evtimova et al. implemented a model that intensifies the mutual properties of InfoGAN^[4]. Providing noise to the input data, this model can stabilize its training time. But sometimes adding unreasonable noise to the data can intensify the loss function and generate more noisy and hazy images from the generator.
- Gorijala et al. introduced a model called Variational InfoGAN based on varying the visual descriptions by fixing the latent description^[5]





> EsharaGAN is developed to generate bangla sign digit

It is developed using InfoGAN (Information Maximizing Generative Adversarial Networks)

Maximising the mutual information between latent variables and observational variables is the fundamental working principle of InfoGAN







Absence of Bangla Sign Digit generation Model

- > Absence of Density modeling in sign digit dataset.
- > All the generative models are computationally expensive.





Proposed model is build on InfoGAN model

InfoGAN maximizes the mutual information between the subset of the latent variables and the actual observations

Ensembled with image processing followed by a modified adversarial network

Basic image pre-processing technique is employed to get better noise-free images and then fed into the proposed network

The model constituted 13 network layers with a generator and discriminator



Proposed Methodology (contd.)



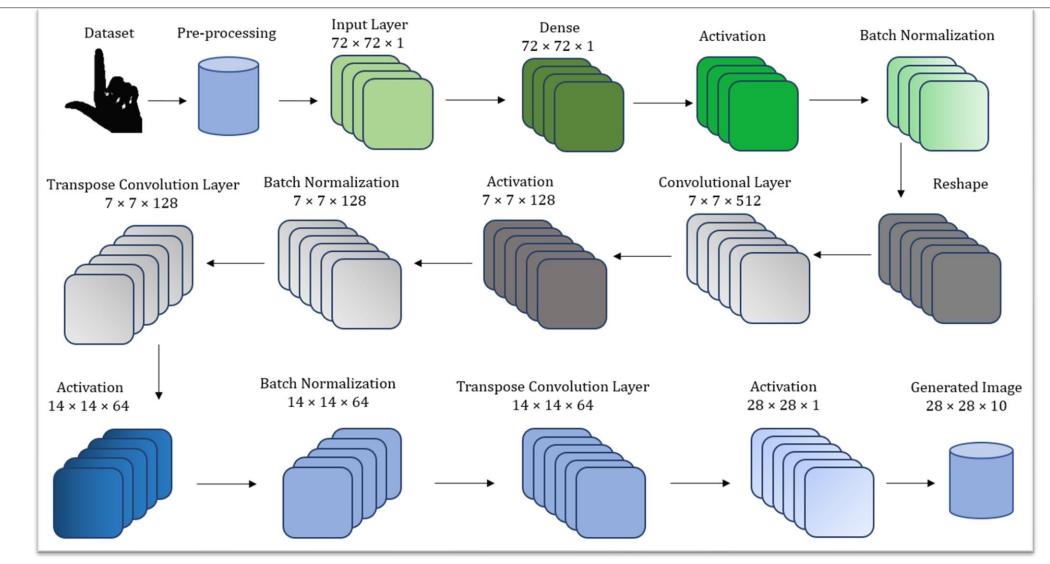


Fig. 1. Proposed Adversarial Network to generate Bangla Sign Digits





- IsharaLipi dataset^[6] is adopted for the proposed model
- Data augmentation such as—translation, scaling, rotation etc. is done on the input data
- After that, some pre-processing technique is employed to get better input images then fed the images into the network after converting it to a vector
- After executing the 13 layers, we get the generated output images from the proposed network architecture





> We adopted IsharaLipi Dataset for the proposed generative model

- > A total of 1000 images partitioning into 10 classes each of 100 images
- > All images are converted into 28×28 pixels
- Images are labeled after binarization
- Converted the image pixels into a CSV file

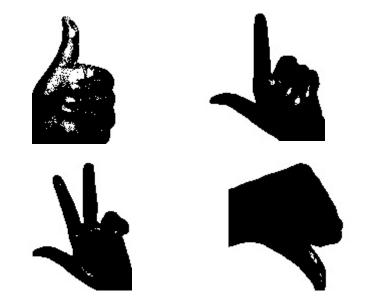


Fig. 2. Some images from the IsharaLipi Dataset





For training the model, we need to set the hyper-parameter of the model accurately

No	Hyper-parameter	Value
1	Initialization_kernel	glorot_uniform
2	Initialization_bias	Zeros
3	Learning_rate	0.001
4	Optimizer	Adam
5	Batch size	64
6	Epoch	10000
7	Latent Dimension	62

Table I: Hyper-parameter of the proposed architecture





For the evaluation of the model, a loss function is generated from the model

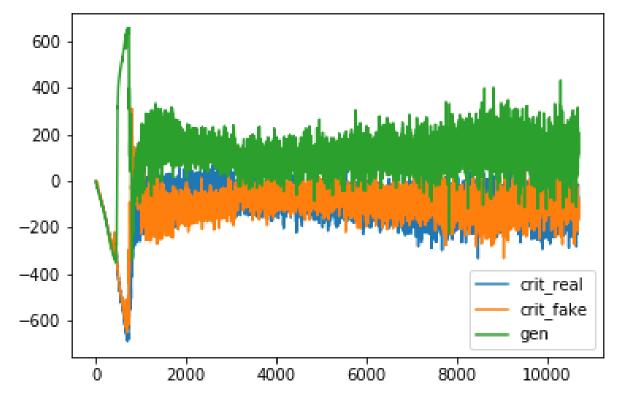


Fig. 3. Loss function curve of the proposed architecture





- Inception score (IS) is an objective function to evaluate the generated images
- > The inception score of the model is **8.77** for 10 class





Executing the proposed 13 layer architecture, the output from the architecture will be the generated synthetic images

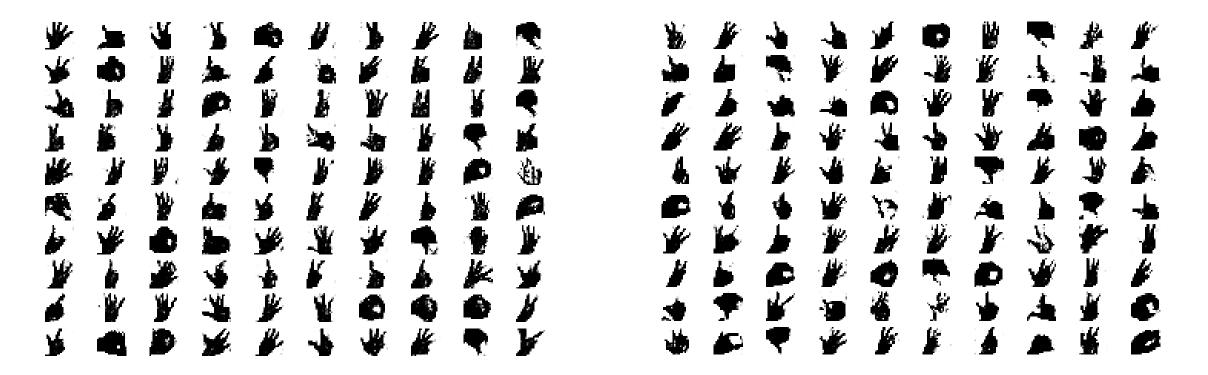


Fig. 4. Generated images from the proposed model







> Here we proposed a novel model to generate Bangla Sign Digit images .

The model gives us an exceptional result as the inception score is 8.77.

➢ In the future, we will elaborate on the working procedure of the model on the video field and engage the spatial relationship of the pixels.







Thank you

SESSION NAME, SPEAKER NAME, SHORT PAPER TITLE







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[2] Hossain, Tonmoy & Shishir, Fairuz & Shah, Faisal. (2019). A Novel Approach to Classify Bangla Sign Digits using Capsule Network. 10.1109/ICCIT48885.2019.9038609.

[3] Kingma, D. P., & Welling, M. (2013). Auto-encoding variational bayes. arXiv preprint arXiv:1312.6114.

[4] Evtimova, K., & Drozdov, A. (2016). Understanding mutual information and its use in infogan.

[5] Gorijala, M., & Dukkipati, A. (2017). Image generation and editing with variational info generative AdversarialNetworks. arXiv preprint arXiv:1701.04568.

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