18CSC402 – DEEP LEARNING

Problem: Add noise to the malayalam handwritten character dataset, and denoise the noisy input by constructing a denoising autoencoder.

Noise used: Salt & pepper noise

Type of autoencoder: Convolutional autoencoder

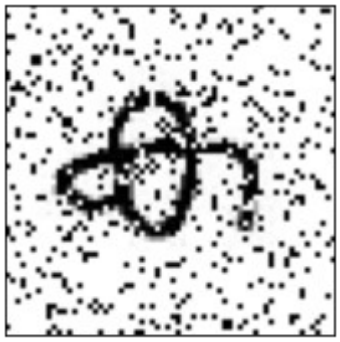
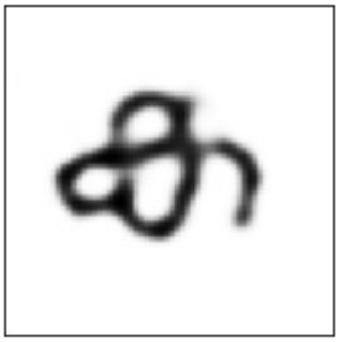
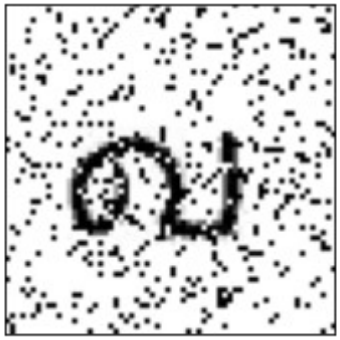
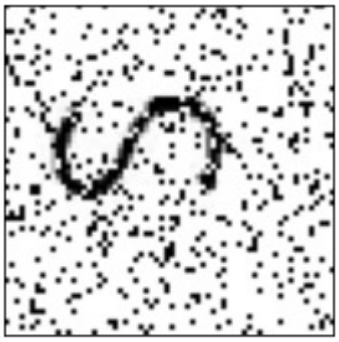
Approach: The noise is added to 300 images from each of the 15 characters (total 4500 images) using the function random_noise from skimage. The images which were initially 86x86x3 are reshaped to 64x64x1. The train and validation split is done in the ratio 80:20. Summary of the symmetric structure of the constructed convolutional autoencoder is given below:

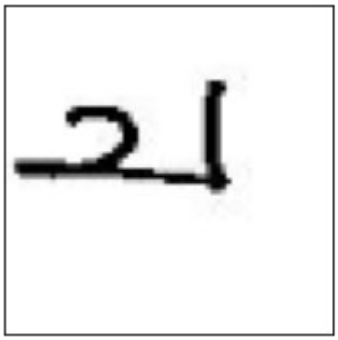
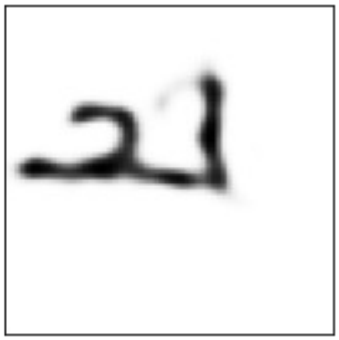
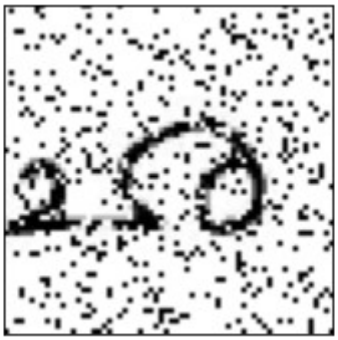
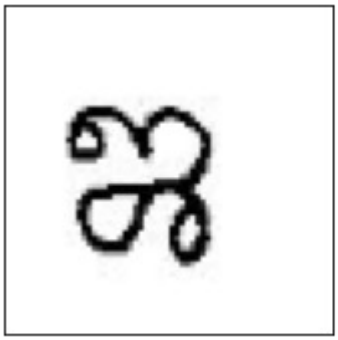
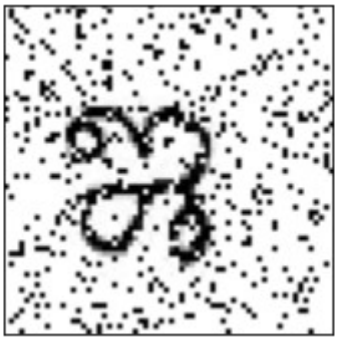
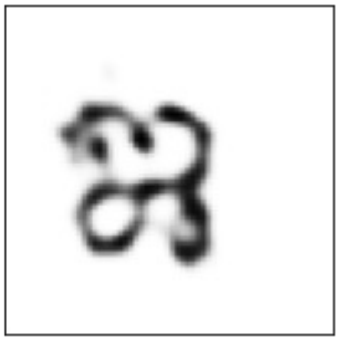
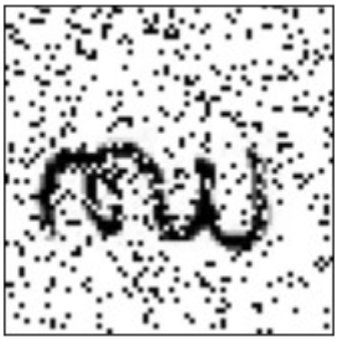
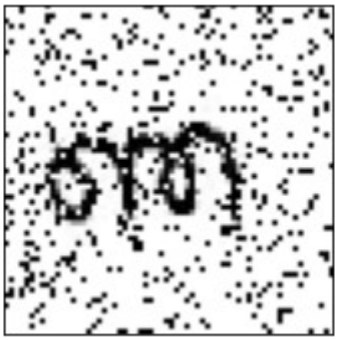
```
Model: "model_3"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
input_2 (InputLayer)         [(None, 64, 64, 1)]       0
_________________________________________________________________
conv2d_5 (Conv2D)            (None, 64, 64, 64)        640
_________________________________________________________________
max_pooling2d_2 (MaxPooling2 (None, 32, 32, 64)        0
_________________________________________________________________
conv2d_6 (Conv2D)            (None, 32, 32, 32)        18464
_________________________________________________________________
max_pooling2d_3 (MaxPooling2 (None, 16, 16, 32)        0
_________________________________________________________________
conv2d_7 (Conv2D)            (None, 16, 16, 16)        4624
_________________________________________________________________
conv2d_8 (Conv2D)            (None, 16, 16, 32)        4640
_________________________________________________________________
up_sampling2d_2 (UpSampling2 (None, 32, 32, 32)        0
_________________________________________________________________
conv2d_9 (Conv2D)            (None, 32, 32, 64)        18496
_________________________________________________________________
up_sampling2d_3 (UpSampling2 (None, 64, 64, 64)        0
_________________________________________________________________
conv2d_10 (Conv2D)           (None, 64, 64, 1)         577
=================================================================
Total params: 47,441
Trainable params: 47,441
Non-trainable params: 0
_________________________________________________________________
```

The model is fit to the noisy data as input and clean data as the expected output, for 50 epochs with a batch size of 128 to obtain a training loss of 0.0672 and validation loss of 0.0674.

Predicting with unseen data: A subset of the original dataset with one sample image from each of the 15 character sets (first 15 consonants) is then used to analyse the reconstruction power of the model on unseen data.

Results:

Clean Image	Noisy Input	Reconstructed Output
		
		
		
		
		

Clean Image	Noisy Input	Reconstructed Output
		
		
		
		
		

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