18CSC402 – DEEP LEARNING (EVALUATION LAB 3)
DENOISING AUTOENCODER (12-11-2021)

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Tamil letters dataset - எ ஏ ஐ ஒ ஓ ஔ

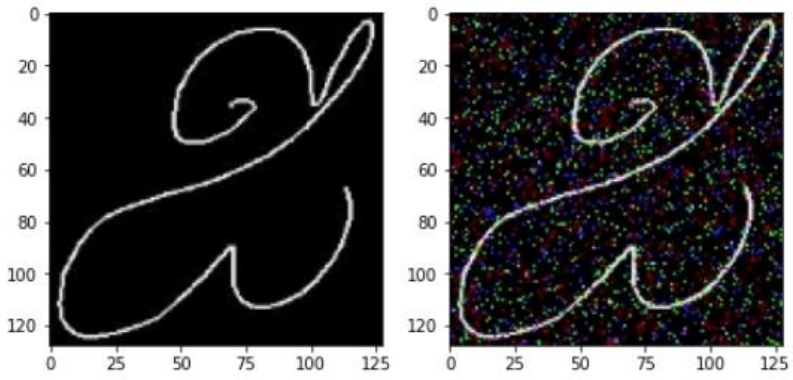
Train-test split

The data was split in 80:20 ratios.

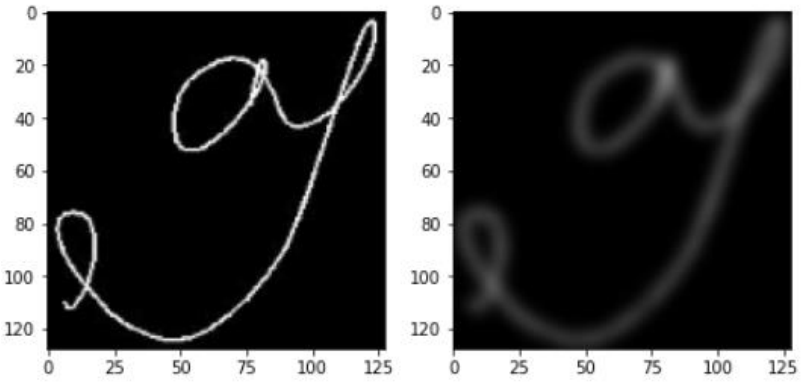
- Original size of the dataset – 1456
- Size of train data – 1164
- Size of test data – 292
- Size of validation data – 292

Noise chosen

- ***Impulse noise -*** Impulse noise usually corrupts images due to a defect in the device's hardware or in the camera's sensor. Impulse noise replaces some of the pixels in the original image.



- ***Blur noise -*** Happens when there is a defect int the camera lens. Basic blur operation. The radius argument defines the size of the area to sample, and the sigma defines the standard deviation.



Model

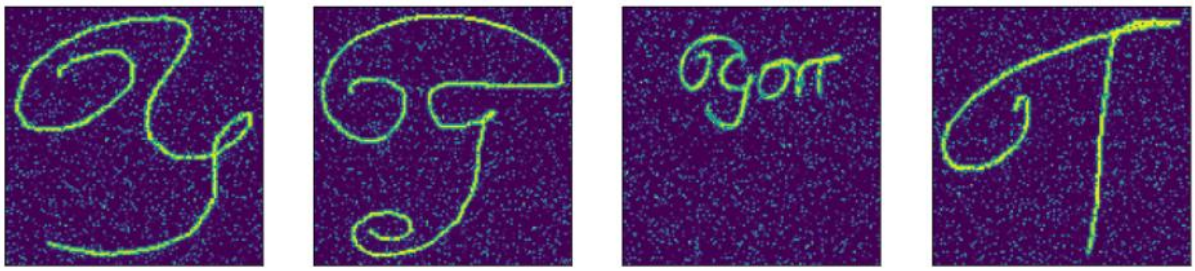
```
input_img = keras.Input(shape=(128, 128, 1))
#encoder
conv1 = Conv2D(32, (3, 3), activation='relu', padding='same')(input_img)
pool1 = MaxPooling2D(pool_size=(2, 2))(conv1)
conv2 = Conv2D(16, (3, 3), activation='relu', padding='same')(pool1)
pool2 = MaxPooling2D(pool_size=(2, 2))(conv2)
conv3 = Conv2D(8, (3, 3), activation='relu', padding='same')(pool2)

#decoder
conv4 = Conv2D(8, (3, 3), activation='relu', padding='same')(conv3)
up1 = UpSampling2D((2,2))(conv4)
conv5 = Conv2D(16, (3, 3), activation='relu', padding='same')(up1)
up2 = UpSampling2D((2,2))(conv5)
decoded = Conv2D(1, (3, 3), activation='sigmoid', padding='same')(up2)

autoencoder = keras.Model(input_img, decoded)
autoencoder.compile(loss='binary_crossentropy', optimizer = 'adam', metrics=['accuracy'])
autoencoder.summary()
```

Results

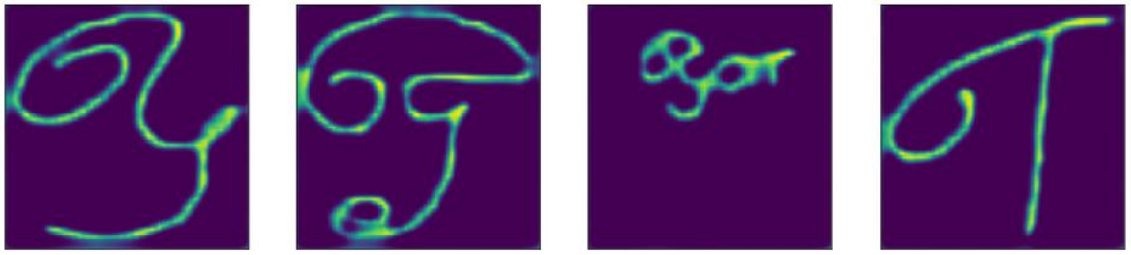
NOISE	EPOCHS	LOSS	ACCURACY
Impulse (Batch size = 75 & 100)	10	0.1109	65.71%
	20	0.0857	65.89%
	25	0.0770	65.93%
	40	0.0756	65.94%
	50	0.0717	65.95%
Blur (Batch size = 75 & 100)	10	0.1200	65.46%
	20	0.0957	65.80%
	25	0.0821	65.87%
	40	0.0805	65.87%
	50	0.0744	65.90%

Output

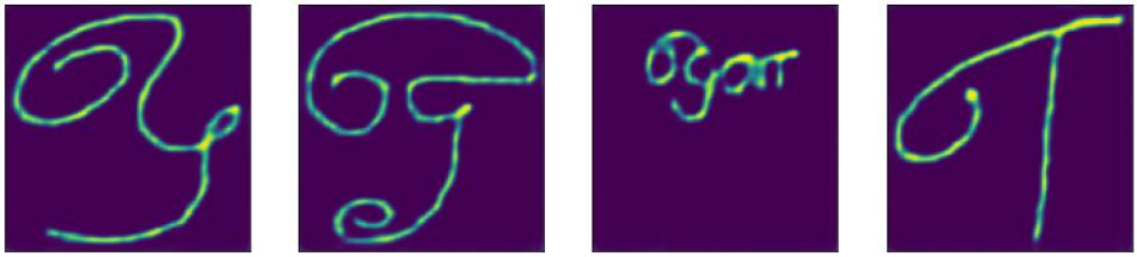
Images with noise ***(Impulse noise)*** –



Predicted images ***(Impulse noise)*** –



10 epochs



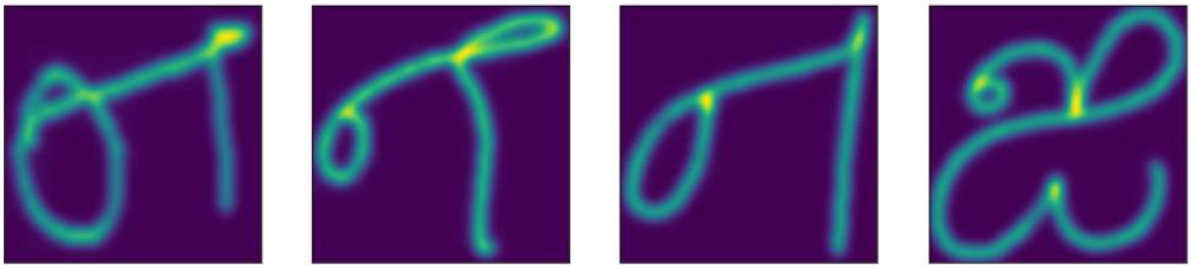
20 epochs

25 epochs

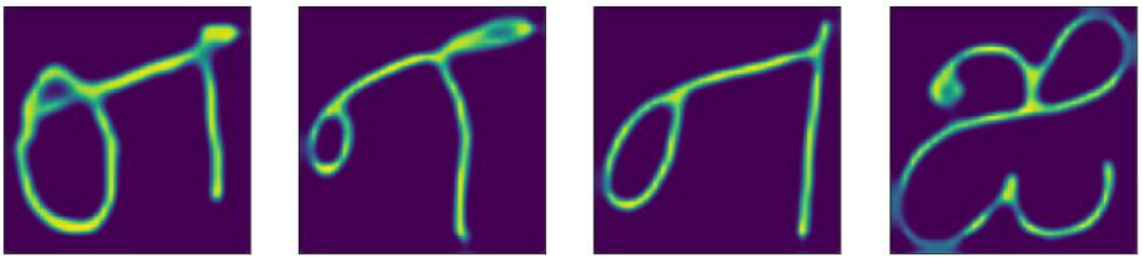
40 epochs

50 epochs

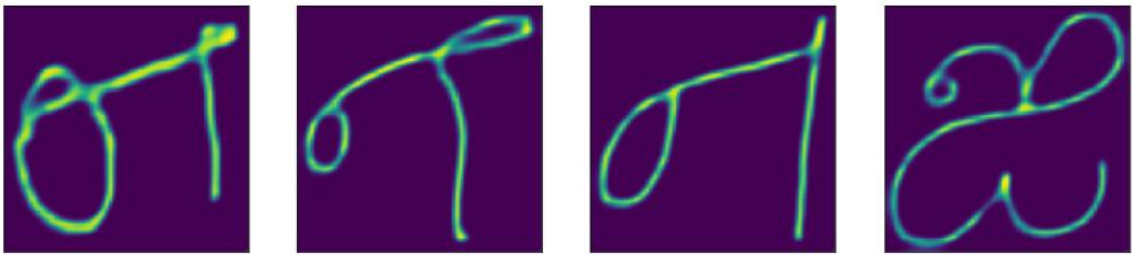
Images with noise ***(Blur noise)*** –



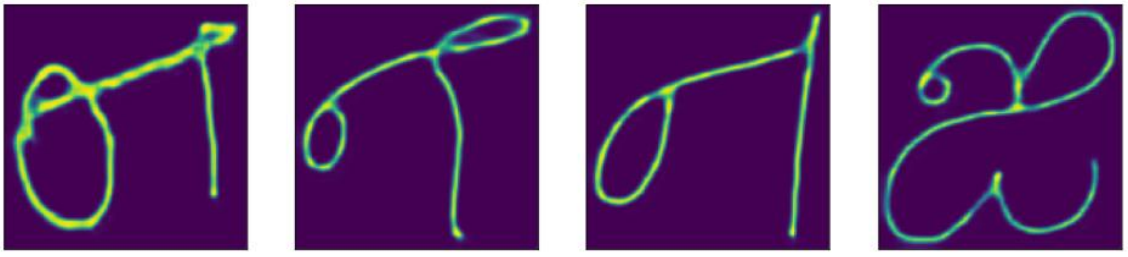
Predicted images ***(Blur noise)*** –



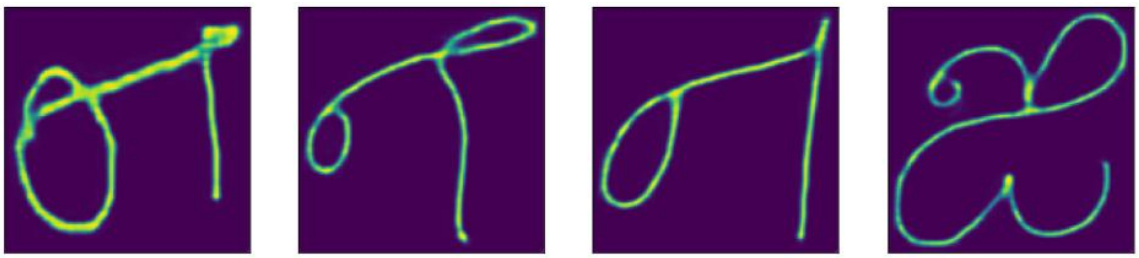
10 epochs



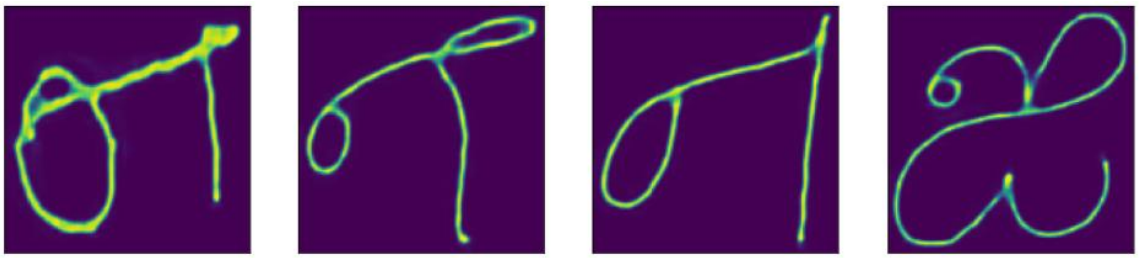
20 epochs



25 epochs



40 epochs



50 epochs

Observations

- The dataset worked really well with the model.
- Predictions were good in both the noises even though there was a slight difference in accuracy.
- There were no fluctuations in the model, loss was gradually decreasing and accuracy was constant for few epochs and improving slightly.
- The batch size used was 75 and 100 by which the model trained well for each epoch.
- The predicted images were improving for every epoch. When it reached 50 epochs, the predictions were good.
- Since it is not a classification problem, accuracy does not matter a lot, however the loss was reasonably low. Minimum loss was 0.07 which is quite good.
- Images with impulse noise were predicted better than blur noise with the highest accuracy of 65.95% and loss of 0.07.
- Overall, the model performed really well. I was able to denoise the images using autoencoder successfully.