Short Report on Convolutional Anomaly Detection Autoencoder

Ninnart Fuengfusin

February 12, 2019

- CIFAR10 dataset required the higher capacity model than general densely connected autoencoder. Hence, I used deep convolutional autoencoder to work with CIFAR10.

- The structure of model is $(32C5) - (MP2) - (16C5) - (MP2) - (256FC) - (FC1024) - (UP2) - (32DC5) - (UP2) - (3DC5)$. Where C is convolutional layer, MP is max-pooling layer, FC is fully connected layer, UP is unpooling layer and DC is deconvolutional layer.

- Number of training 300 epoch. Initial learning rate is 9.0 and it reduces to half every 40 epoch.

- Interestingly, common stochastic gradient descent works better than other optimization techniques (gradient descent with momentum, Adam) at-least in this autoencoder.

- The Xavier initialization of weights value was proved to speed up the training process comparing to truncated normal distribution initialization.

- The testing averaged mean square error is 0.019382886588573456 for RGB, 0.01401841826736927 for HSV and 0.006882691290229559 for TUV. Unexpectedly, TUV is lowest of all.

- The process for converting RGB to HSV to TUV will cost the noise within the images. The noise expected to come from overflowing. The noise can be shown in Figures 1, 2, 3 and 4.

- The autoencoder inputs and outputs could be shown in following Figures 5, 6, 7, 8, 9 and 10.

Figure 1: The original RGB images before changing color space.

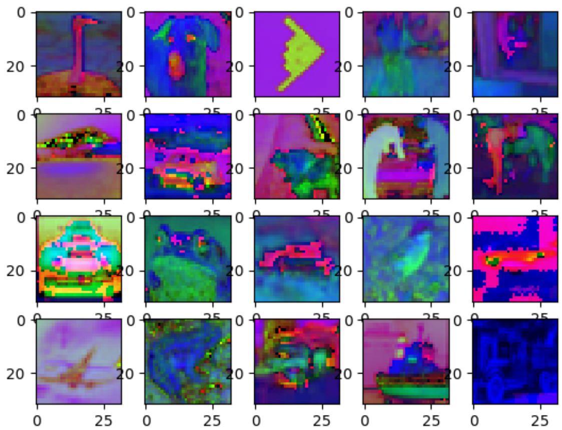

Figure 2: HSV images after converting from RGB. There is some noise which could be seen though-out pictures.

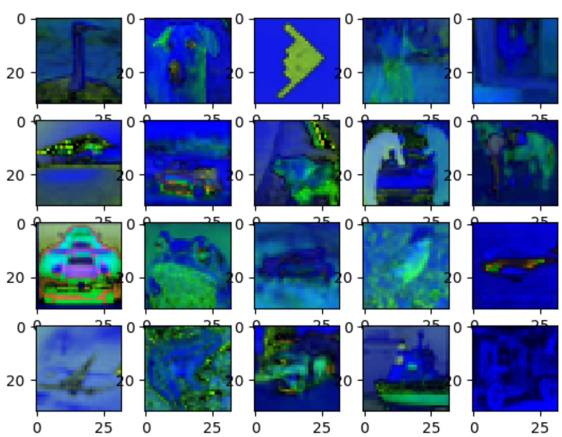

Figure 3: TUV images after converting from HSV. The noise from HSV converting still exist.

Figure 4: Reconstruction RGB images after conventing from RGB to HSV to TUV to HSV and to RGB. The noise from converting still exist.

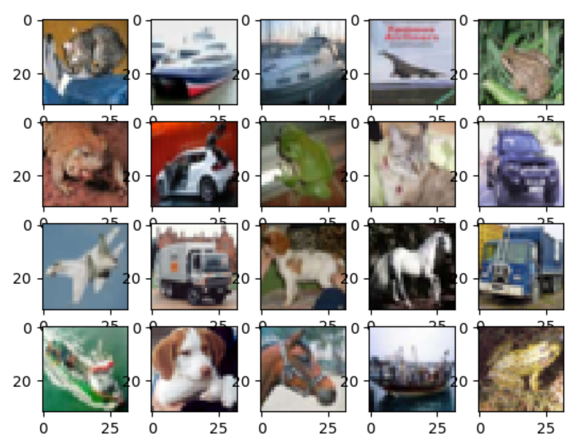

Figure 5: RGB images input into the model.

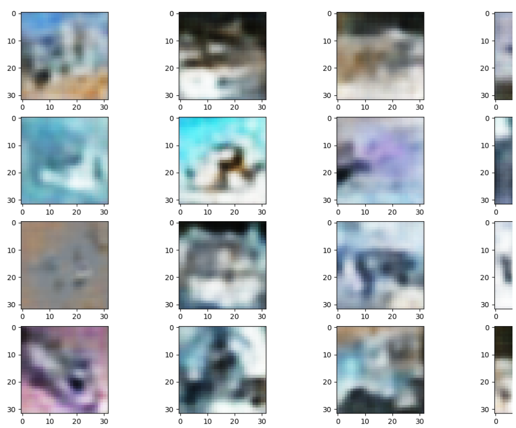

Figure 6: Reconstruction RGB images, output of the model. The anomaly label is all expected zero or airplane. The pictures which are not airplane expected to have the inverse the value of pixel.

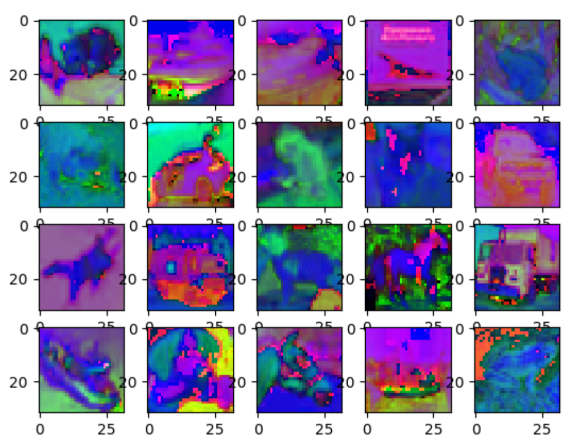

Figure 7: HSV images input into the model.

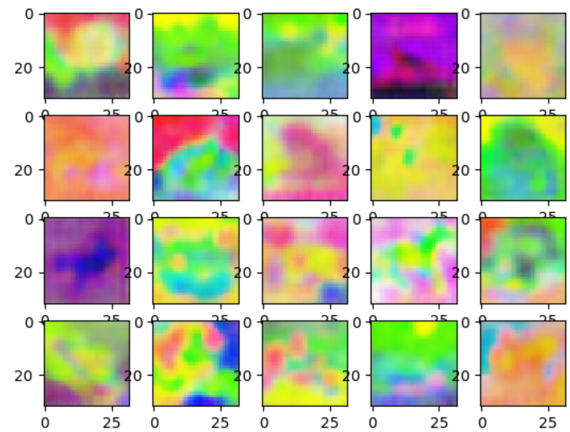

Figure 8: Reconstruction HSV images, output of the model. The anomaly label is all expected zero or airplane. The pictures which are not airplane expected to have the inverse the value of pixel.

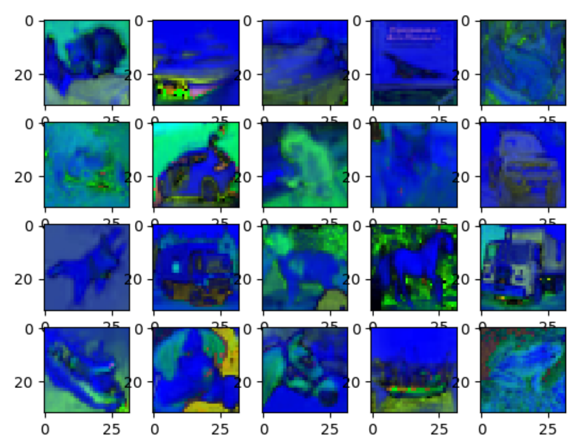

Figure 9: TUV images input into the model.

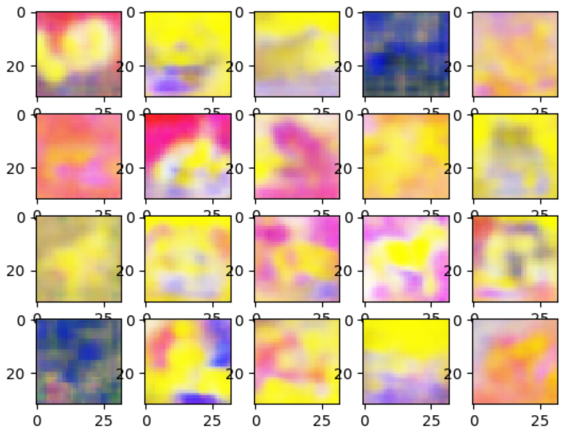

Figure 10: Reconstruction TUV images, output of the model. The anomaly label is all expected zero or airplane. The pictures which are not airplane expected to have the inverse the value of pixel.