REPORT

IST Project - Carlucci Francesco

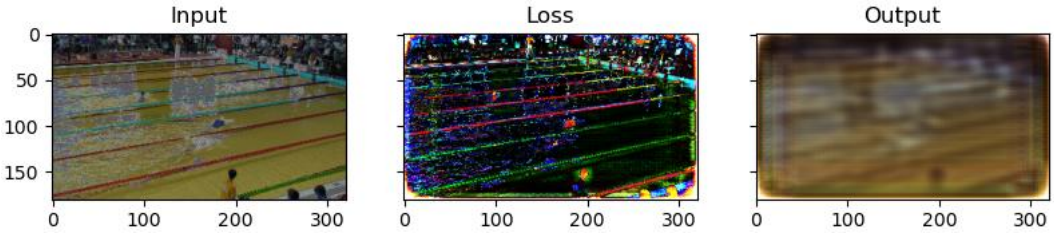
List of all the test trained with the results showed on the same image and the heat map of the reconstruction error, used to compare the different techniques.

The datasets are:

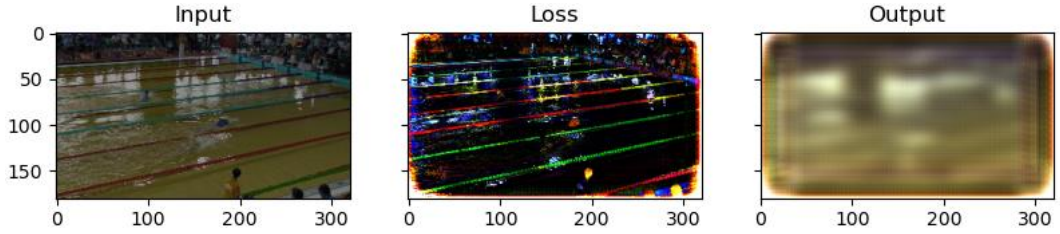
- Normal; 308 images without data augmentation;
- Conservative; a dataset with the same 308 images preprocessed with stricter parameters to completely eliminate the non-pool region
- Augmented 1148; composed of 1148 images, augmented by random cropping, rotating and vertical flip.
- Augmented 2009; include also horizontal flipping, random saturation or brightness change and normal filtering.

Old Model corresponds to the first architecture, oldAE file, with less layers and less compressive.
New Model is the architecture in the AE file with four layers for both the encoder and the decoder. The models have been trained on images resized to 1/5 of the size, from (1600,900) to (320,180), to accelerate the training, and tested on normalized images to reduce brightness and clean the loss. The Model with the best heatmaps are copied just below, before all the others. All the model trained on the 1148 Dataset for more than six epochs have white outputs and the loss increase at the 7th epoch; changing the learning rate of the optimizer to a very low value hasn't solved the problem, can be due to a numerical instability in the weights. Adding noise to the input to generate a noisy target for the MSE function hasn't worked properly, most of the times the results is a black output image. Adding noise to the input passed to the model using as target the clean image, trying to make the model work as a denoising autoencoder, has been tested only on 5 epochs, on the Augmented 2009 Dataset. This model showed perfomance similar to the one trained without noise, if not better, so the noise wasn't able at limiting its reconstruction capability, maybe further test can be performed. . As the old Model architecture usually reconstruct too much, also the swimmers, i've tried to shrink the bottleneck of the autoencoder by increasing the kernel of each layer, these tests are at the bottom. I've tried this last technique on the new architecture too, as it starts to reconstruct also swimmers at the 80th epoch. On the last heat maps generated the brightest spots have been masked, assigning them the average value.

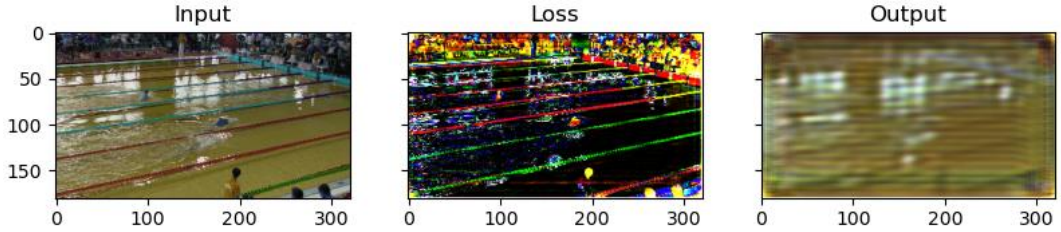
Name	Dataset	Epochs
Aug2009Model50	Aug2009	50



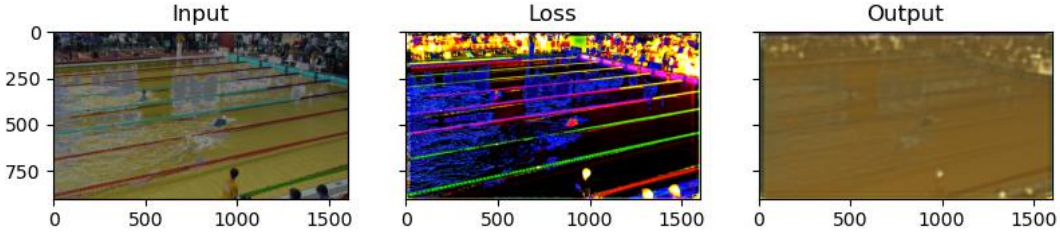
Aug2009Model20 Aug2009 20



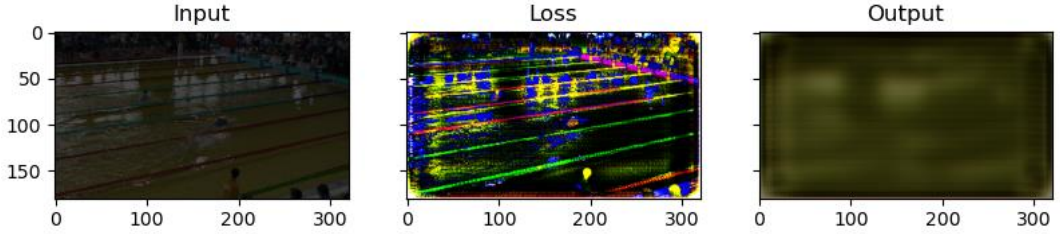
newModel50 Normal 50



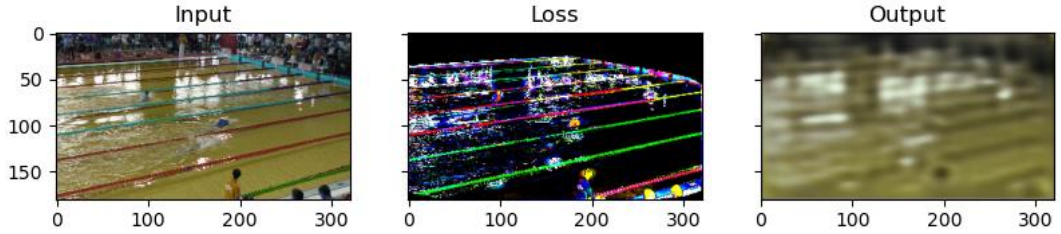
newModel10 Normal 10 Tested on full size images (1600,900)



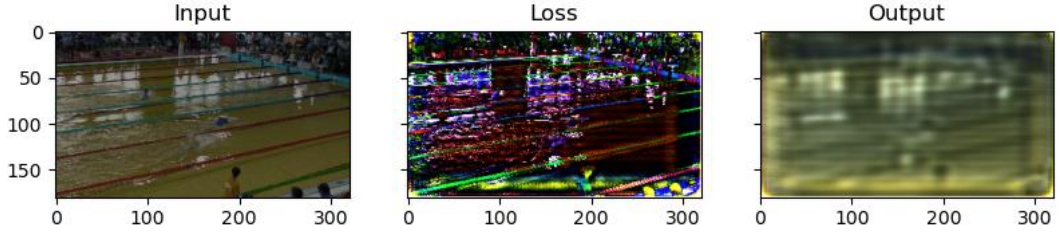
AugModel1 Aug1148 1



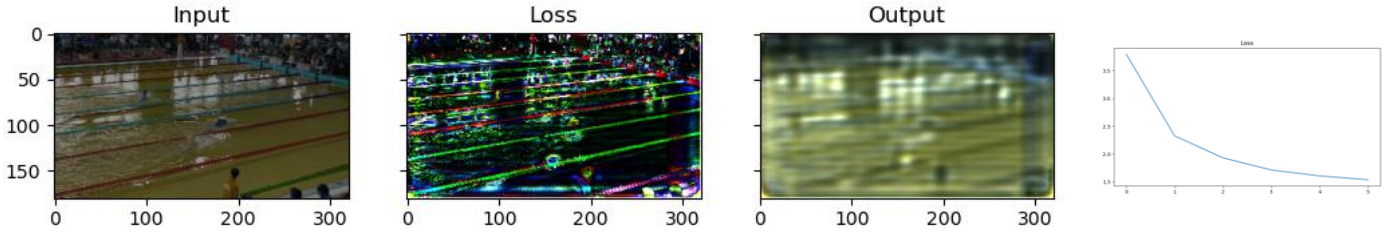
AugModel4 Aug1148 4



AugModel5 Aug1148 5



AugModel6 Aug1148 6



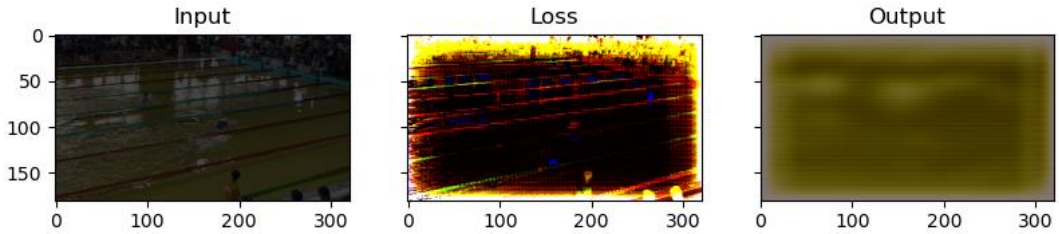
-AugModel7 Aug1148 7 White

-AugModel8 Aug1148 8 White

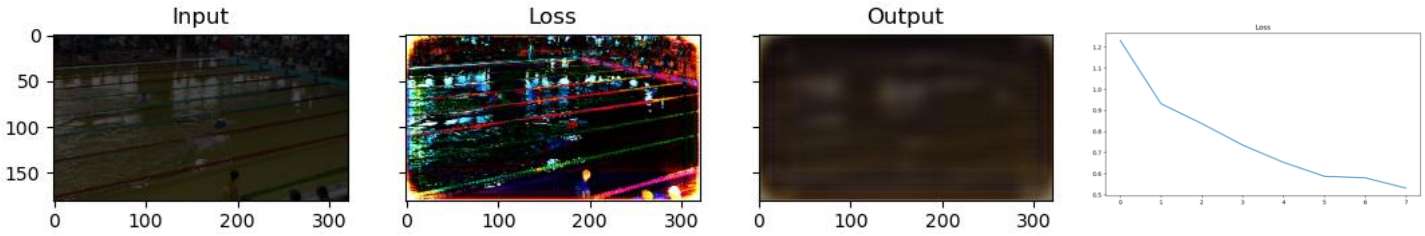
-AugModel10 Aug1148 10 White

-AugNoiseModel1 Aug1148 0.1 noise 1 Black

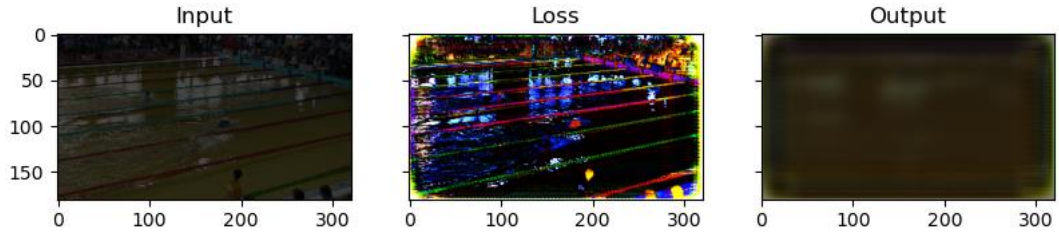
ConsModel2 Conservative 2



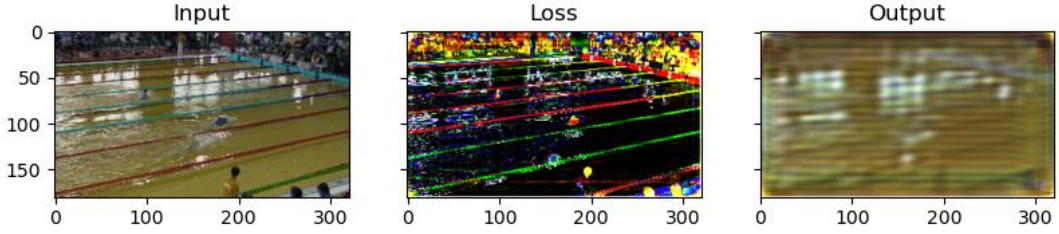
newModel8 Normal 8



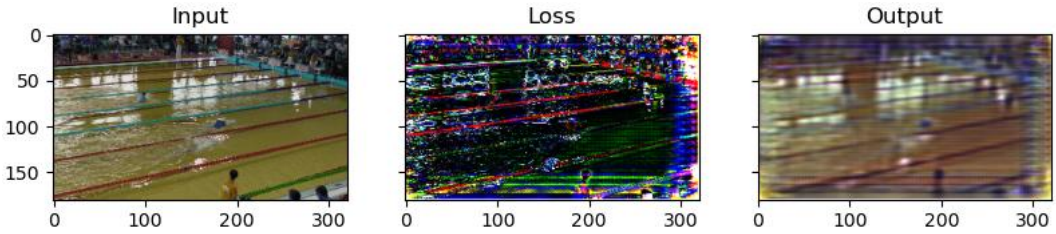
newModel10 Normal 10



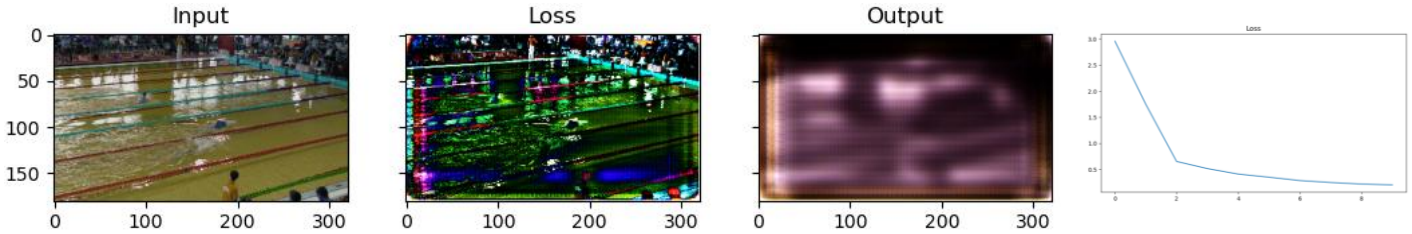
newModel50 Normal 50



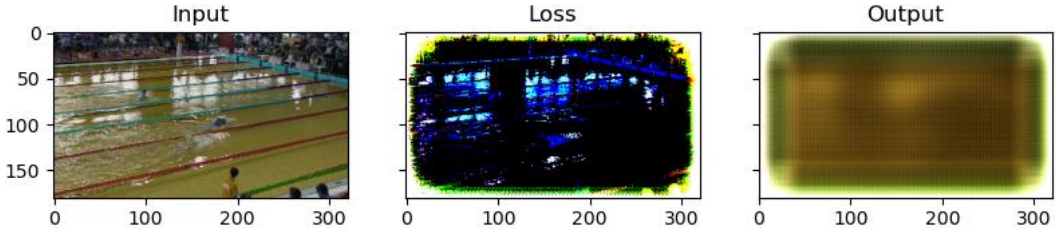
newModel100 Normal 100 Reconstruct swimmers too



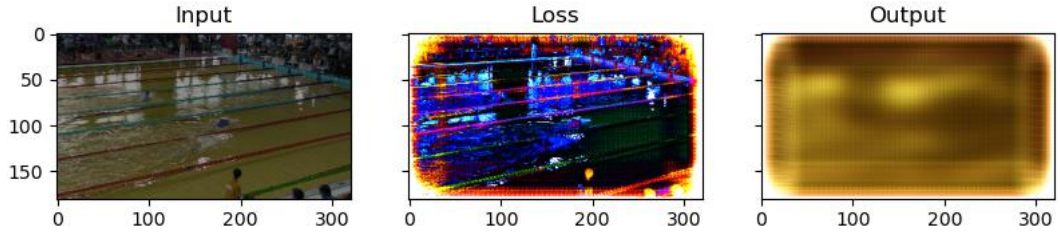
newConsModel10 Conservative 10



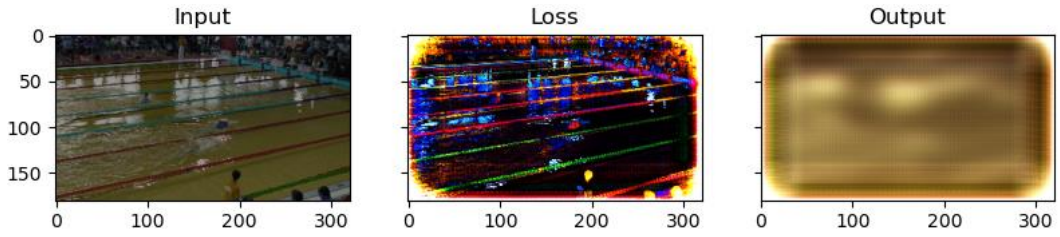
Aug2009Model5 Aug2009 5



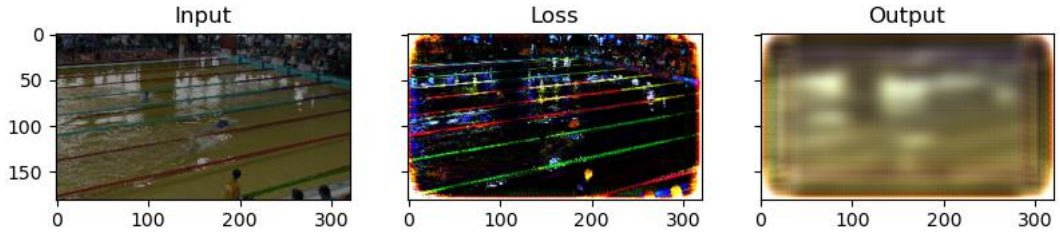
Aug2009Model7 Aug2009 7



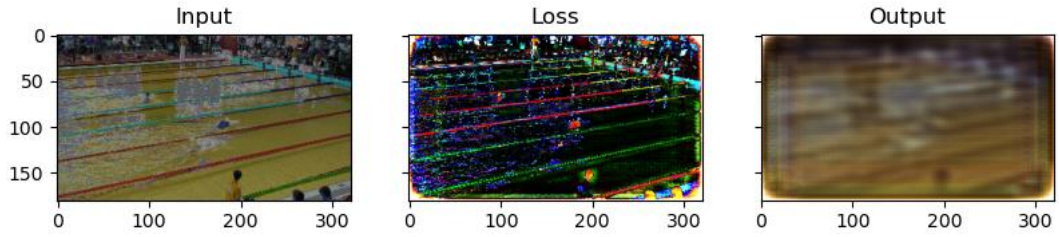
Aug2009Model10 Aug2009 10



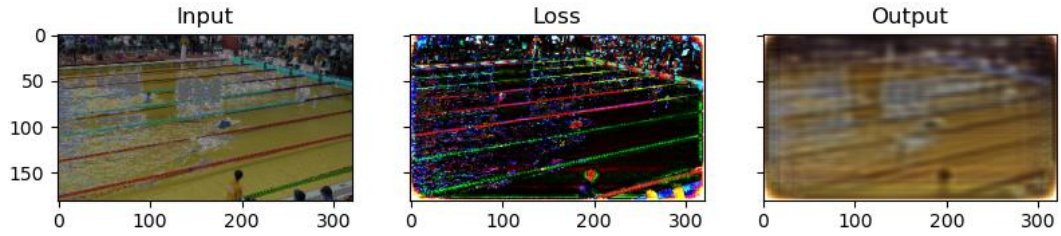
Aug2009Model20 Aug2009 20



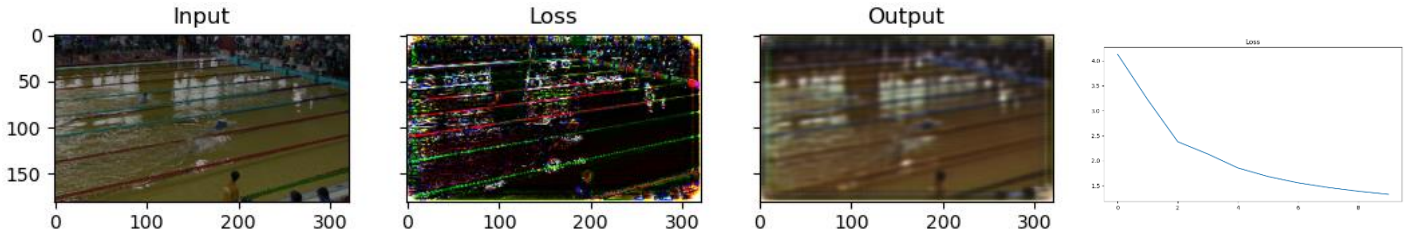
Aug2009Model50 Aug2009 50



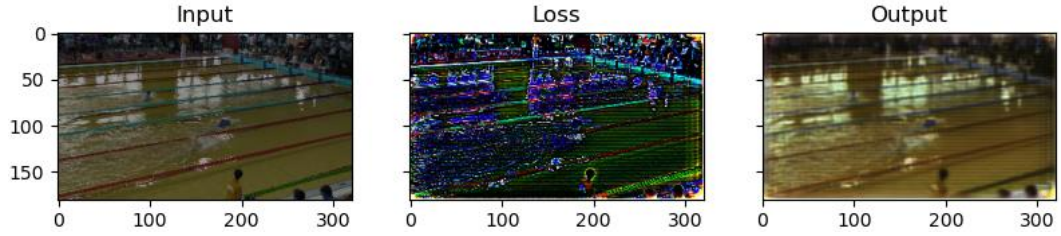
Aug2009Model80 Aug2009 80



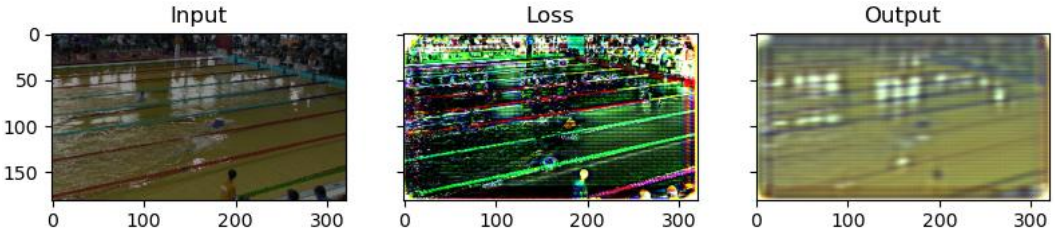
oldModel10 Normal 10



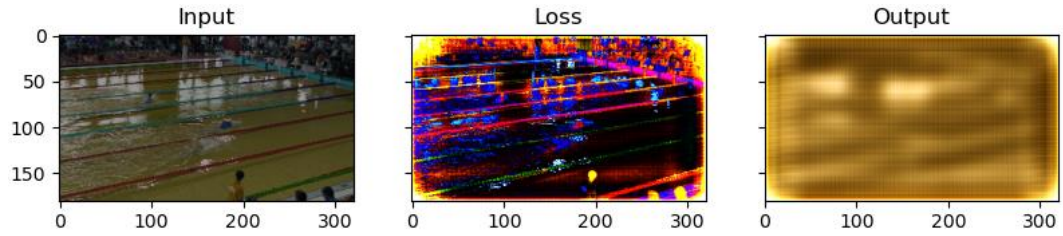
oldModel20 Normal 20 Reconstruct too much



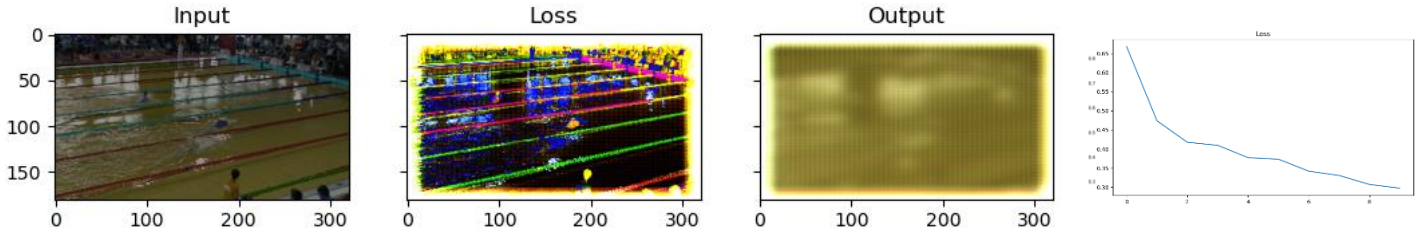
oldOnlyModel20 Normal 20 Reconstruct also swimmers



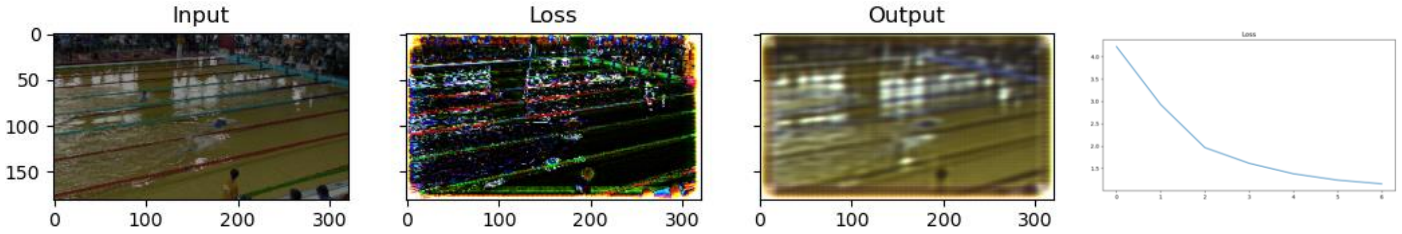
ConsModel10 Conservative 10



ConsoldModel10 Conservative 10

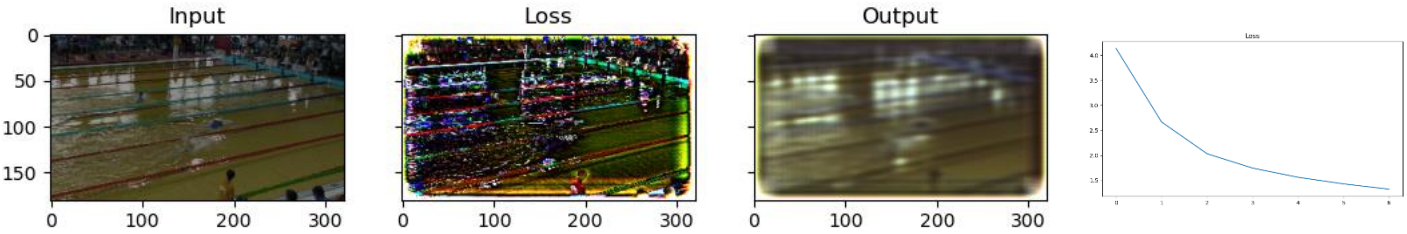


AugoldModel7 Aug1148 7

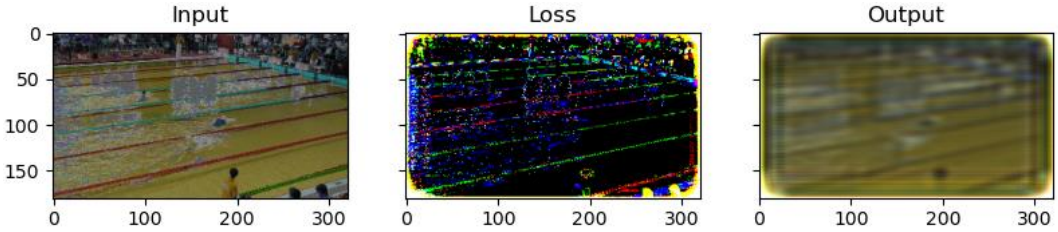


As the old Model trained on 7 epochs already reconstruct too much in the image, the following are some of the tests with the modified kernels.

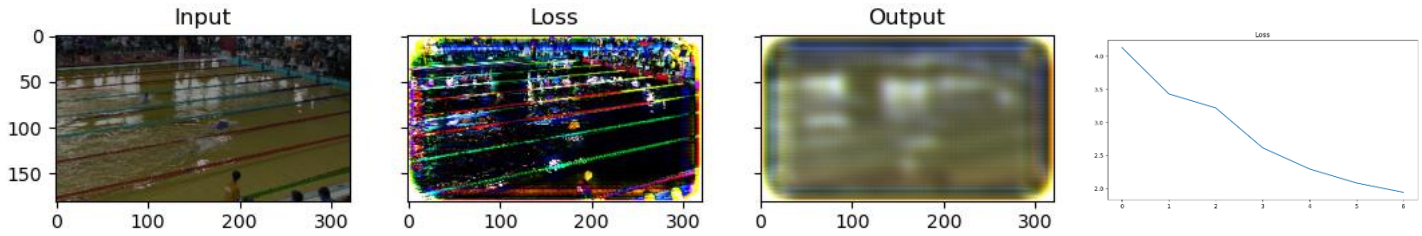
AugoldModel7 (ShrBotNeck) Aug1148 7



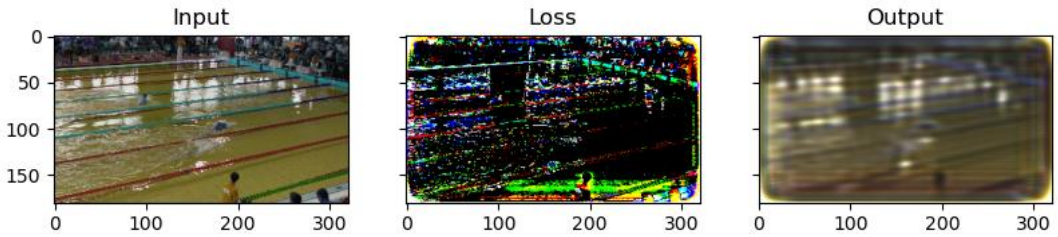
AugoldModel10 (2ShrBotNeck) Aug1148



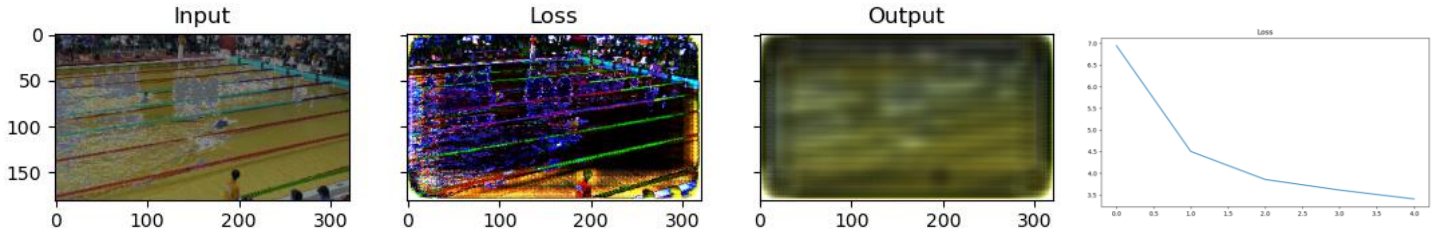
AugoldModel7 (3ShrBotNeck) Aug1148 7 ^1.6



AugoldModel20 (3ShrBotNeck) Aug1148 20



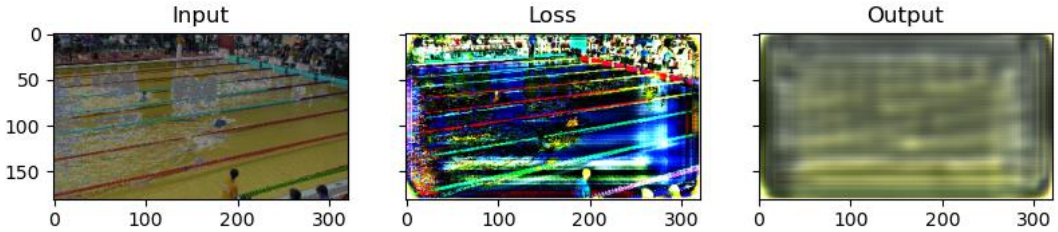
Aug2009Model5Noise Aug2009 with random noise added with 0.05 standard deviation



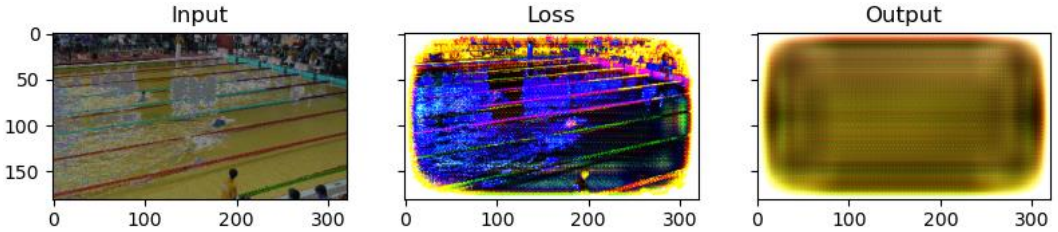
In the case above the noise has been added to the input image, for each batch of 10 images, it doesn't seem very effective in limiting the reconstruction capability of the autoencoder.

In the following models i've tried to shrink the bottleneck of the autoencoder by increasing the kernel of each layer, on the same architecture as before. I've trained them on 5 and 20 epochs to go faster and evaluate if the tecnhique is worth by comparing with Aug2009Model5.

Aug2009Model5 ShrBotNeck Aug2009 5



Aug2009Model5 2ShrBotNeck Aug2009 5



Aug2009Model20 2ShrBotNeck Aug2009 20