# EE599 Deep Learning – Initial Project Propsal

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**Project Title:**   Object transfiguration with attention-aided GANs

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**Project Summary:**   In this project, we propose to do an unpaired object transfiguration focusing on some regions of interest (ROI), leaving other part of the image unchanged. There exists many well-organized recent works focusing on the image-to-image translation with different GAN pipelines. Instead of doing the translation on the whole image like cycleGAN[1], some new methods proposed in [2][3] use attention mechanism to guide the GAN to capture ROI and learn desired texture, making changes on color and texture simultaneously without changing the other part of the image. However, this algorithm is still limited to the color and texture changes of the object and can not change the shape or contours of the objects. For example, these algorithms are well done in the changes like zebra to horse, tiger to leopard, but have bad performance in tasks like dog to cat, where more significant changes in shape is contained. One method we find to address this problem is the DRIT[4] algorithm. Based on these recent works, we want to propose a more versatile object transfiguration method which can localize the ROI as well as do the shape transformation. A desirable outcome would be a generated image which has a different object(with different shape, color and texture) but the same background compared to the original image.

**Data Needs and Acquisition Plan:**   For this task, we need images of two types of objects (e.g. Apples vs. Oranges) in the train stage. In the test stage, we need some images containing one type of the interested objects to change.
Candidate datasets:
**Fruit 360**[5]: including various kinds of fruits and vegetables
**ImageNet**[6]: choosing a subset including images of some classes
**Images crawled from BING**[7]: finding some images of different types of guns for formal training.

**Primary References and Codebase:**   We propose to build on the method used in

- Attention aided GANs [2][3]

- DRIT[4]

- GitHub codebases: Attention Guided GAN code, Attention GAN code, DRIT code,

**Architecture Investigation Plan:** We plan to first implement the DRIT code in its given dataset to make sure it works. Then we would train the model on the dataset collected and builded by us to see its performance and do some fine-tuning and some hyperparameter changes to improve it.

After that, we would dive deep into the attention-aided GAN methods and their codes to see how they add attention onto their architecture. Then, we would consider to adopt their insights and add the attention mechanism into the DRIT method to form our own object transfiguration GAN architecture. The ultimate goal of our model is to only transform the object of interest in the given image. An example is to transform the gun holded by a soldier but leave other background unchanged. Due to the time limit, this final goal may be hard to achieve, so we want to be allowed to change our final objective based on our progress and may finally show some intermediate results for this project.

**Estimated Compute Needs:** Based on the data set size in the original paper, the structure of the neural network, and in this Lamnbda Labs Blog, we estimate that one training run for the GAN architecture with data set obtained by us will take 30 hours on a single Nvidia V100 GPU, which is the GPU resource in the AWS p3.2xlage instance. With spot pricing, which is roughly $1 per hour, we expect $30 per training run. We will train the network tentatively for several times to finetune the structure as well as the hyperparameters, which is estimated to cost $50. To get a better result, we expect to train approximately 2 full runs which brings our total estimated computing cost to roughly $110. To get the training faster, we could also use colab-pro to help our model out, where Tesla P100 GPU is available but kind of unstable.

**Team Roles:** The following is the rough breakdown of roles and responsibilities we plan for our team:

- Haojing Hu: Data collection, Data pre-processing, Video production.

- Zheng Wen: Model construction and modification, Data loader design.

All team members will work on the training and testing of the model, final presentation, slides and report.

**Requested Mentor with Rationale:** We request Jiali to be our team mentor because of his expertise in GANs and computer vision. We have a good codebase and few related thesis to fine-tune our own model, but we are not experienced in training GANs, so even though we are flexible regarding our mentor assignment, we expect someone expert in GANs as our mentor.

# References

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[3] X. Chen, C. Xu, X. Yang, and D. Tao, "Attention-gan for object transfiguration in wild images," in *Proceedings of the European Conference on Computer Vision (ECCV)*, 2018, pp. 164–180.

[4] H.-Y. Lee, H.-Y. Tseng, J.-B. Huang, M. Singh, and M.-H. Yang, "Diverse image-to-image translation via disentangled representations," in *Proceedings of the European conference on computer vision (ECCV)*, 2018, pp. 35–51.

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[7] [Online]. Available: https://www.bing.com/images