Project Proposal : Texture Synthesis

Rohan Chandra Sachin Grover Kyungjun Lee Moustafa Meshry Ahmed Taha
{rohan,kjlee,mmeshry,ahmdtaha}@cs.umd.edu saching@umd.edu

We propose to use the DRAW (Deep Recurrent Attentive Writer) network [1] for texture synthesis. DRAW employs a recurrent neural network design on top of a Variational Autoenconder (VAE) model to generate images in an incremental manner. Thus, instead of the typical one-shot generation, a series of strokes generate the output. DRAW also proposes a novel spatial attention filter that guides the network where to look (glimpse). DRAW can generate MNIST images with one and two digits, as well as Street View House Numbers (SVHN). Besides image generation, attention filters are used in other applications such as image caption generation [2], where a multiple glimpses approach can be useful.

In this project, we will explore using a variant DRAW architecture to handle the problem of texture synthesis. Generative neural networks usually generate new images without any alignment constraint between input and output. We will investigate texture neighborhood synthesis where generated images must smoothly align across borders. Figure 1 shows an input texture block, outlined in orange. Given the input block, multiple neural networks will be trained to generate the neighboring texture blocks, outlined in red.

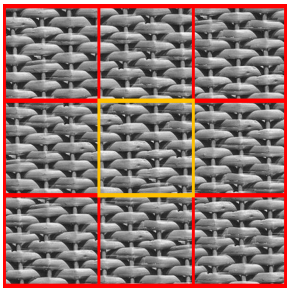

Figure 1: Texture Synthesis using an input texture block outlined in orange. Multiple neural networks will be trained to generate the neighboring blocks outlined in red.

We plan to deploy the DRAW TensorFlow implementation to asses possible technical obstacles. After resolving the technicalities, we will validate the texture synthesis generation idea; The network will be modified to generate neighboring texture blocks. Once texture synthesis results are available, evaluation will follow the texture synthesis literature basis.

Deploy DRAW TensorFlow implementation	Texture Synthesis idea validation	Evaluation
2 weeks	2 weeks	2 weeks

Table 1: Preliminary Project Timeline

In case extending DRAW [1] to handle texture synthesis proves to be more challenging to complete within the allotted time (due to the research nature of the idea), we shall switch to another problem, which is learning interest point detectors. Specifically, we aim to extend the state-of-the-art Transformation Covariant Feature Detectors [3] to use a self-supervised training. A major drawback to learning feature detectors is the lack of labeled data. Thus, finding a comparable self-supervised training pipeline is of great interest. We aim to learn a scoring function of points in a training image, such that distinctive points with higher probability of being redetected under various transformations would score higher. Then the top quantile of ranked points can be used as positive training examples to the network proposed in [3].

References

[1] Gregor, Karol and Danihelka, Ivo and Graves, Alex and Rezende, Danilo Jimenez and Wierstra, Daan *DRAW: A recurrent neural network for image generation* arXiv preprint arXiv:1502.04623, 2015.

[2] Xu, Kelvin and Ba, Jimmy and Kiros, Ryan and Cho, Kyunghyun and Courville, Aaron and Salakhudinov, Ruslan and Zemel, Rich and Bengio, Yoshua *Show, attend and tell: Neural image caption generation with visual attention* ICML, 2015.

[3] Zhang, Xu, et al. *"Learning Discriminative and Transformation Covariant Local Feature Detectors."* Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition. 2017.