

Literature Review: ML in Animation/Graphics

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Project Description, Motivation, Preliminary Resources

Computer Graphics and Animation is a field of Computer Science that I am very interested in. It is also a field that is heavily influenced by Machine Learning, especially recently. From realistic walk cycles for human/animal characters using auto-encoders, to texture and image generation using GANs, to predicting or generating movements of agents using reinforcement learning, machine learning allows many tasks to be accomplished faster, and better than they used to be. As machine learning, and especially deep neural networks, continue to develop and grow, so do their applications to graphics and animation.

My final project will be a literature review going over some of the most prevalent or interesting papers released over the past couple decades. There is a lot of material to cover in regards to graphics and animation and also how machine learning relates to the field, so I likely won't touch it all, but, like I mentioned above, I am very interested in this topic so I will try to cover as much as possible.

I will be working on this project alone and added below are some resources that I've found so far, to show this is a worthy project with much behind it and with more to come:

[A Data-Driven Framework for Visual Crowd Analysis](#) in which data is gathered from human crowd trajectories are utilized to animate simulated crowds. Machine Learning techniques include SVM, KNN, Pareto Optimality, and Dyads. Animation applications include possible smooth, realistic, and collision-less movement of human-like agents in a simulated scene and possible extension to other types of movement/agents.

[Animating Pictures With Eulerian Motion Fields](#) in which multiple networks are used to perturb deep features of an image in order to generate frames of a video displaying fluid motion. Machine learning techniques include auto-encoders, GANs, splatting, and generating synthetic training data. Animation applications include being able to simulate semi-realistic fluid motion from a still image and possible applications to 3d motion.

[A new fluid flow approximation method using a vision transformer and a U-shaped convolutional neural network](#) in which a transformer/convolutional architecture is used to, well, approximate fluid flow. Basically just restated the title. Machine Learning techniques include those as mentioned above. Graphics/Animation applications include possible fluid simulation. This paper doesn't reference direct applications to animation, however, I will discuss possible applications.

[DeepPhase: Periodic Autoencoders for Learning Motion Phase Manifolds](#) which is easily the coolest, in which very realistic human and animal motion is generated using auto-encoder and Phase Function Neural Network. Machine Learning techniques include as mentioned above, as well as phase manifolds and how the motion is synthesized. Animation applications include, well, motion synthesis, but very much more realistic than what was done in the past, as well as interactions of these characters with outside objects/agents.