Dreaming of Birds: Exploring Deep Dream Generative Phenomena in Computer Vision

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Problem Statement

For this project, I posed the question of how deep dream behavior could be created and how this behavior and the specific visuals generated would change with things like the progression of model training and training parameters. I also wanted to explore the visuals that could be generated through this process.

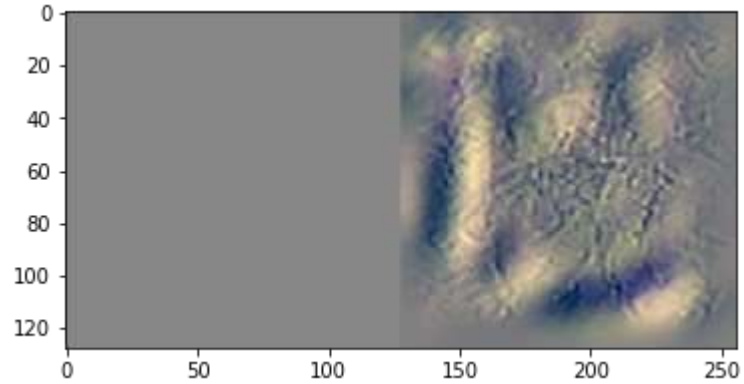
Deep Dream

- When a neural network trained to classify images instead generates images based on what it has learned.
- The dream step: while the model is frozen, propagate gradient from the output (which we fix to be a class of interest) all the way to the input, and make changes to the input.
- Each step makes the input more like an image of the specified class

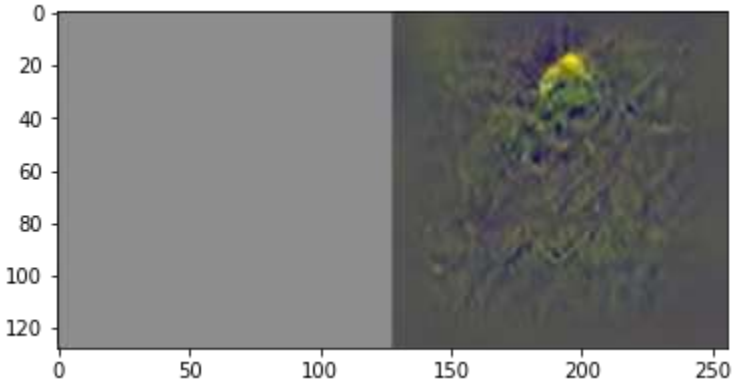
Specifics

- For this project I used the bird competition classification dataset from CSE455 and the Inception_v4 network

Initial Attempts



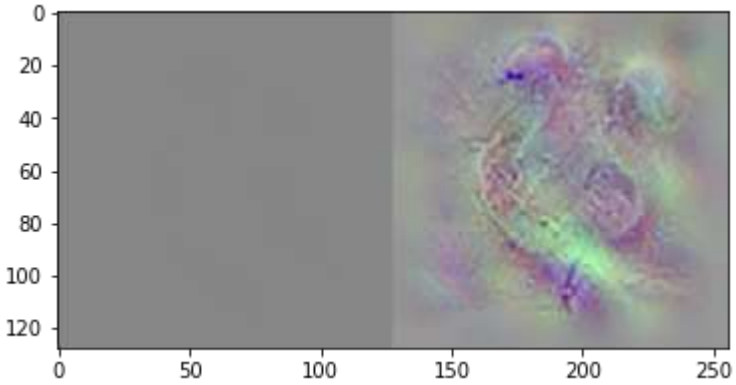
Before Training

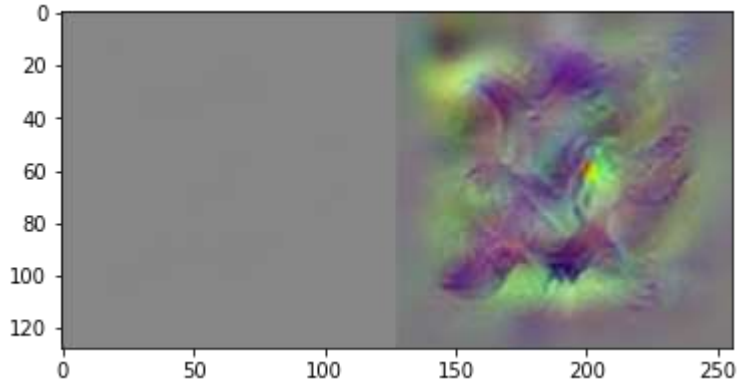


Initial training with old loss function

Customizing The Loss

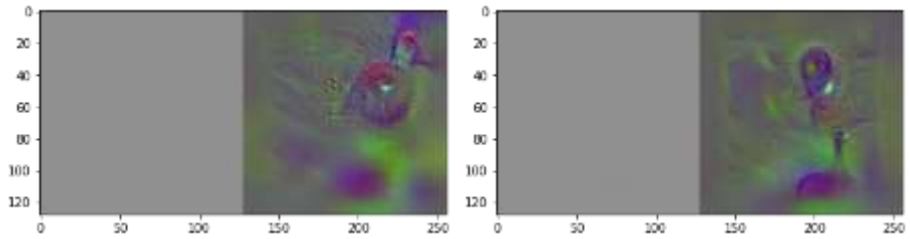
- The loss function proved important
- CrossEntropyLoss pushes output away from all other classes, which isn't what we want
- We care only about the similarity with our chosen class and not at all about any other class
- Use the negative value of the corresponding neuron in the fully-connected layer



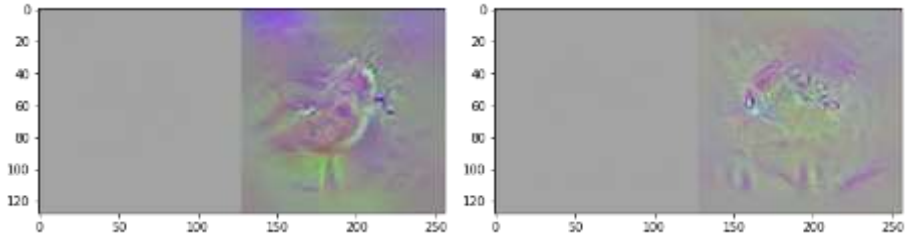


Dreaming for Longer

- Initial dream length was 200 epochs, now increased to 500 and 1000



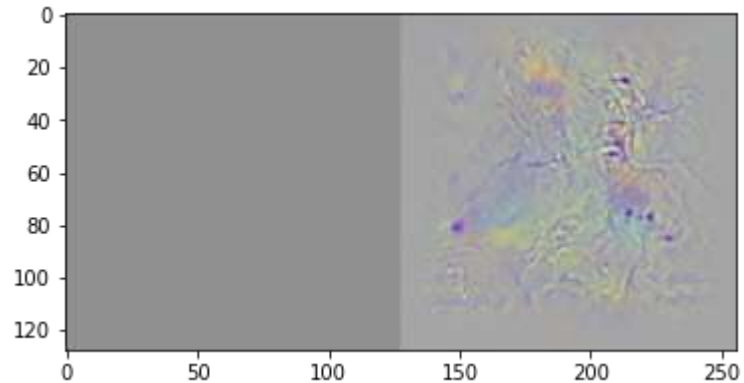
500 epochs

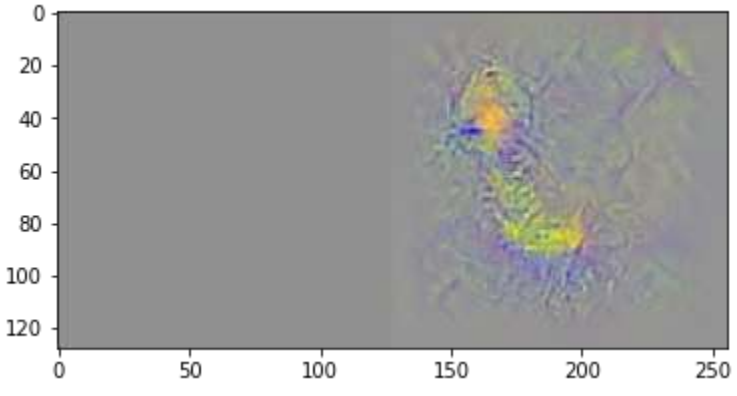


1000 epochs

Overfitting the Model

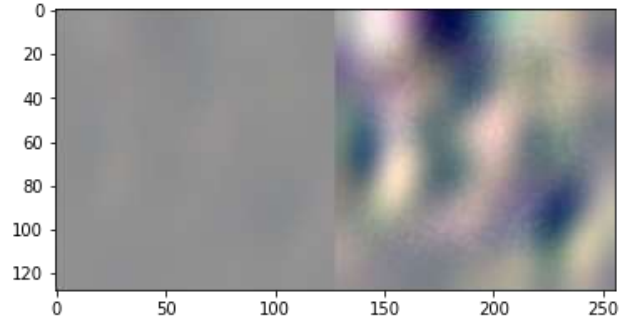
- Overfitting seemed to increase the noise and decrease the prominence of any bird shapes present

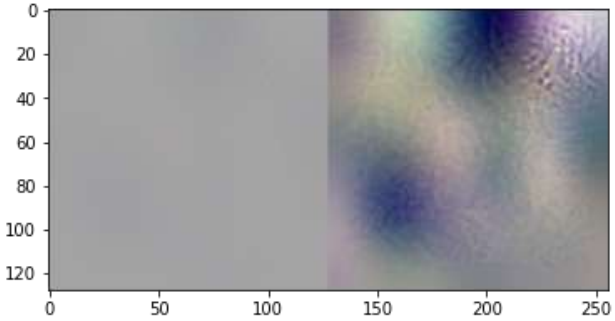


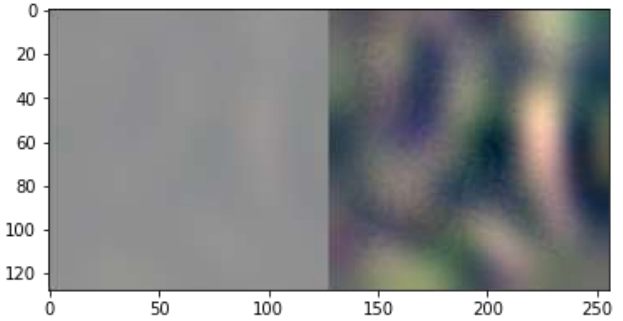


Fine-Tuning IS Required

- When the bulk of the model is frozen and only the linear layer learns, the output is fundamentally different
- Output does not have any bird resemblance at all!







Thank you!