

CREATIVE AI

- Creative AI is a new branch of Artificial intelligence in which AI can create paintings, write compelling stories, and compose new music.
- Check out the world's largest community of artists exploring the impact of AI on art (by Marnie Benney):
<https://aiartists.org/>
- Art creation with AI: <https://www.youtube.com/watch?v=I-EIVIHvHRM>
- Watch the first movie trailer created by AI:
<https://www.ibm.com/blogs/think/2016/08/cognitive-movie-trailer/>

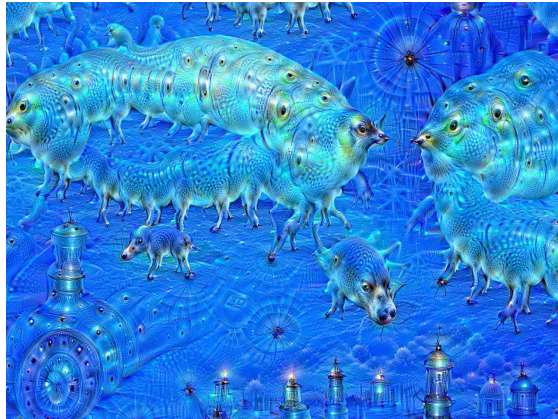


Photo Credit: <https://en.m.wikipedia.org/wiki/File:Aurelia-aurita-3-0009.jpg>



WHAT IS DEEP DREAM?

- Deep Dream is the most freaky, creepy AI algorithm to date!
- Ever wondered what does an AI see? (in the hidden layers)
- Check out this Deep Dream Journey on YouTube :
<https://www.youtube.com/watch?v=SCE-QeDfXtA>

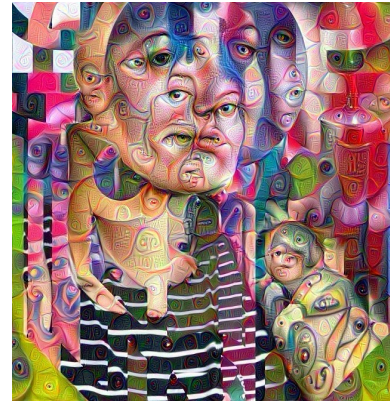


Photo Credit: <https://www.flickr.com/photos/pagedooley/19529912369>

Photo Credit: <https://www.flickr.com/photos/dominicpics/37965696745>



WHAT IS DEEP DREAM?

- Deep dream is a computer vision algorithm developed by Alex Mordvintsev at Google.
- The algorithm works by creating dream-like effect.
- It's like giving humans an extremely powerful drug!
- As the image is increasingly feed to the network, more weird features will start to pop up.
- Remember when you were a kid looking at the clouds and trying to interpret shapes? This is a horse, here's a dog..
- DeepDream does the same thing by boosting the patterns it sees in a given image based on what it has been trained to see in the past (during training).
- If a network has been trained to see animals in images, it will try to extract animal features in any given image.

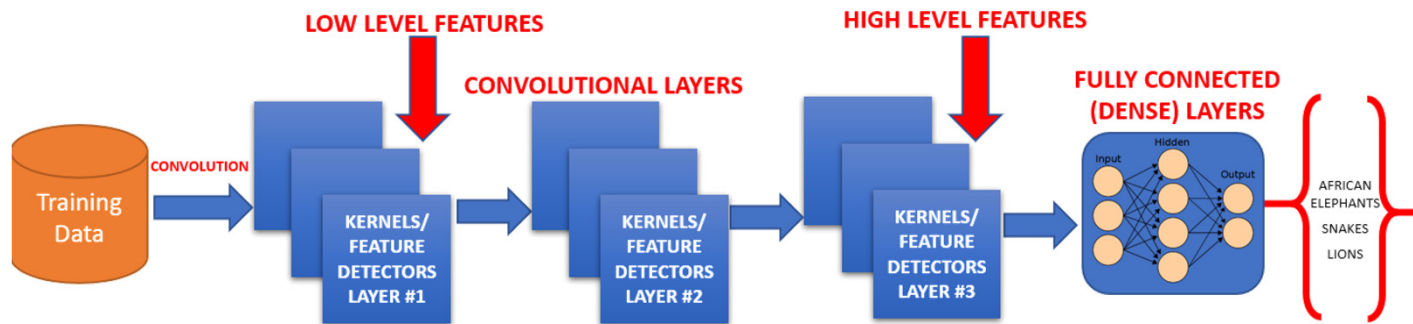


Photo Credit: <https://pixabay.com/photos/child-little-kid-sit-balloons-sky-2747141/>



HOW DOES THE DEEP DREAM ALGO WORK?

- If you feed an image to a CNN, the first layers generally detect low-level features such as edges.
- As you go deeper in the network, higher level features are then detected such as faces, trees, and cars.
- “The final few layers assemble those into complete interpretations—these neurons activate in response to very complex things such as entire buildings or trees,” Google’s engineers explain.
- Check this out: <https://wccfttech.com/nvidia-demo-skynet-gtc-2014-neural-net-based-machine-learning-intelligence/>



HOW DOES THE DEEP DREAM ALGO WORK?

- What if you ask a certain layer to improve what it detects in an image?
- What if you ask the first couple of layers that are experts in detecting edges to maximize what they see?
- What if you ask the last couple of layers (deeper ones) that are experts in detecting elements (higher level features such as cars, faces..) to increase what they really see?
- Things get really dreamy and amazing! That's what Google named: "inceptionism"
- Great article by Kelsey Campbell-Dollaghan:

<https://gizmodo.com/these-are-the-incredible-day-dreams-of-artificial-neura-1712226908>



HOW DOES THE DEEP DREAM ALGO WORK?

- When you feed in an image to a trained ANN, the neurons fire and generate activations.
- The deep dream algorithm work by trying to change the input image in a way that would make some of these neurons fire more (boost the neurons firing or activations). You can select which neurons in which layer you are interested in making them fire more prominently.
- The process is continuously repeated until the input image now contains all features that a specific layer was originally looking for.
- Example: if a certain layer was expert in recognizing dog faces and you feed in an image of a blue sky, the deep dream algorithm will continuously change the input image and start creating images of dogs faces on top of the blue sky. The process keep repeating until the layer of interest is happy with the results!



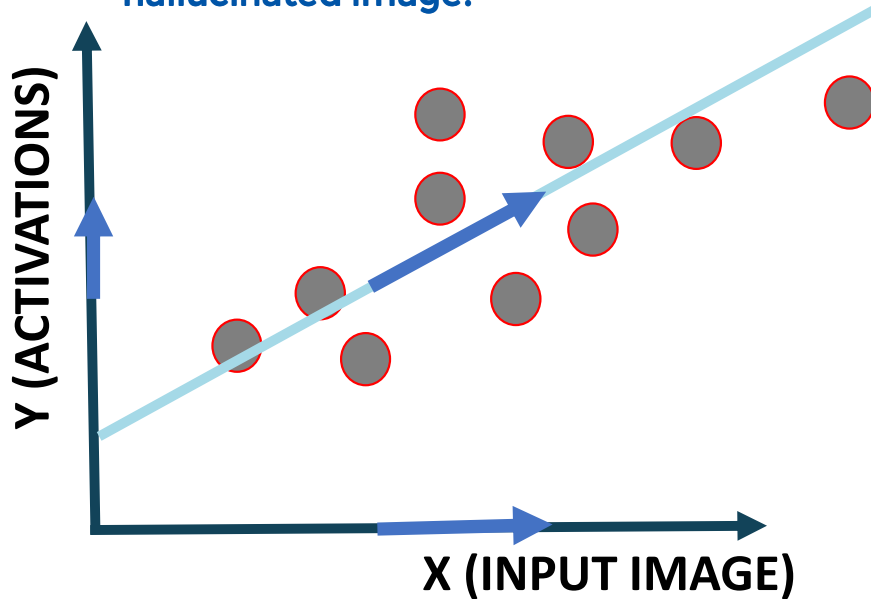
DEEP DREAM ALGORITHM STEPS:

- Deep Dream Steps:
 1. Forward an image through a trained ANN, CNN, ResNet..etc.
 2. Select a layer of choice (first layers capture edges, deep layers capture full shapes such as faces).
 3. Calculate the activations (output) coming out from the layer of interest.
 4. Calculate the gradient of the activations with respect to the input image.
 5. Modify the image to increase these activations, and thus enhance the patterns seen by the network resulting in trippy hallucinated image!
 6. Iterate and repeat over multiple scales.



DEEP DREAM CONCEPT SIMPLIFIED

- Deep Dream Steps:
 1. Forward an image through a trained ANN, CNN, ResNet..etc
 2. Select a layer of choice (first layers capture edges, deep layers capture full shapes such as faces)
 3. Calculate the activations (output) coming out from the layer of interest.
 4. Calculate gradient of loss (activations) with respect to the pixels of the input image.
 5. Modify the image to increase these activations, and thus enhance the patterns seen by the network resulting in trippy hallucinated image!



DEPENDANT VARIABLE
(ACTIVATIONS/LOSS)

INDEPENDENT VARIABLE
(INPUT IMAGE)

$$y = b + m * x$$

TRAINED MODEL

$$Gradient = \frac{dy}{dx} = \frac{d(activations/loss)}{d(input\ image)}$$

$$x|_{new} = x|_{old} + \frac{dy}{dx} * learning\ rate\ (step\ size)$$

DEEPDREAM PERFORMS GRADIENT "ASCENT" TO EXCITE THE ACTIVATIONS (OUTPUTS)

DEEP DREAM VIDEO

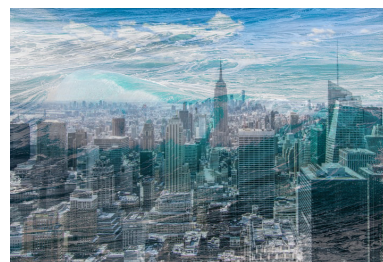
- In this case study we are going to blend two images and execute deep dream algorithm on this blended image.
- These two images are merged by using Python Image Library (PIL).



SKY



OCEAN



SKY OCEAN

- In order to create a deep dream video, we have to consider each deep dream image (blended Image) as a frame in a video
- There are number of ways to fetch a frame from an image. Here, we are going to implement “zooming” in order to create a video

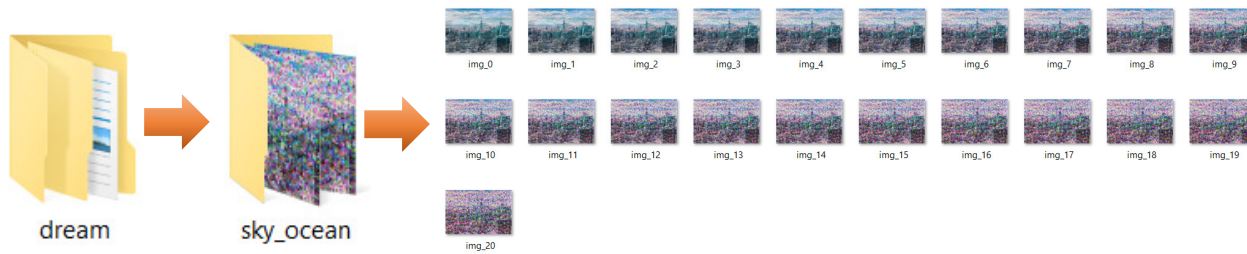
Photo Credit: <https://www.pexels.com/photo/aerial-architecture-blue-sky-buildings-466685/>

Photo Credit: <https://www.pickpik.com/surf-wave-water-sea-foam-spray-87630>

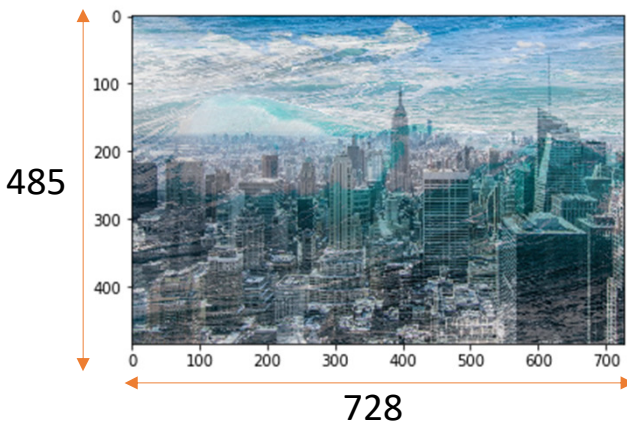


DEEP DREAM VIDEO

- First let's create a dream location to store all of the frames.



- Specify the dimension of the blended image.



Blended image dimension

`x_size= 728` # Larger the image longer is going to take to fetch the frames
`y_size= 485`



DEEP DREAM VIDEO

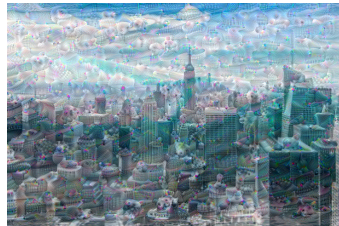
- In order to know how far we have zoomed the starting image (img_0), we are going to randomly check the result of the frames by

```
# Randomly check the result of the frame  
  
created_count= 0  
max_count= 20|
```

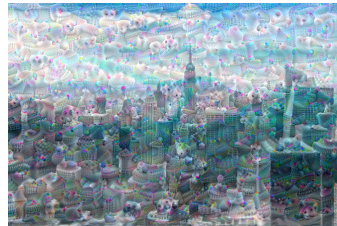
- Enter the max_count (number of frames) value with a smaller number for example <50 to make sure that it works first.
- We need to give values >500 in order to get a longer and beautiful deep dream video.



STARTING IMAGE
(IMG_0)



5TH FRAME
(IMG_5)



10TH FRAME
(IMG_10)



20TH FRAME
(IMG_20)



DEEP DREAM VIDEO

- Now let's zoom in the image. Zooming in an image can be done by chopping off the edges of the image and resizing it back to the original shape.
- Depending on the starting image(img_0), we can adjust the RGB values to combat dimming over time. This has been implemented because zooming effect which we done in the previous step gives the darker image after few iterations.

```
# Adjust the RGB value of the image  
img_result[:, :, 0] += 2 # red  
img_result[:, :, 1] += 2 # green  
img_result[:, :, 2] += 2 # blue
```

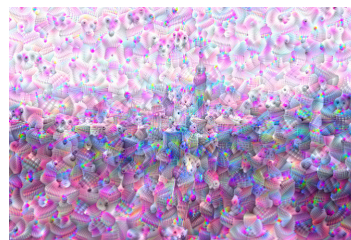


We can adjust these values depends on the starting image. For example, if we enter 2 for red and blue and 1 for green then our deep dream image would be pink in color



- RGB values ≥ 2 gives the result of brighter deep dream images while values < 2 gives darker images
- We can also randomly take over with colors

```
img_result[:, :, 0] += random.choice([3, 4]) # reds  
img_result[:, :, 1] += random.choice([3, 4]) # greens  
img_result[:, :, 2] += random.choice([3, 4]) # blues
```



DEEP DREAM VIDEO

- Call the deep dream model helper function. You can modify steps and step_size according to your dream

```
# Deep dream model
img_result = run_deep_dream_simple(model= deepdream_model, image= img_result, steps= 1000, step_size= 0.001)
```

- Let's clip the image; Artificial neural network doesn't really understand the limitations of color that ranges between 0 and 255, so we want to take our image result, clip it, convert the datatype of the array then convert to an actual image
- Finally we need to save all the frames in the dream location which mentioned in the step 4
- As we are done with creating frames let's move on to create a video with adding up all the frames we have just created
- After specifying dream name and path of the frames, we need to define the codec and create VideoWriter object

```
# Define the codec and create VideoWriter object

fourcc = cv2.VideoWriter_fourcc(*'XVID') # FourCC is a 4-byte code used to specify the video codec

out = cv2.VideoWriter('{}\avi'.format(dream_name),fourcc, 15.0, (728, 485)) # Specify the fourCC, frames per second (fps),
                                                                           # and frame size

# The frames per second value is depends on few important things
# 1. The number of frames we have created. Less number of frames brings small fps
# 2. The larger the image the bigger the fps value. For example, 1080 pixel image can bring 60 fps
```

