# Text to Image Synthesis (Storing Results)

**NOTE for OOD users**: select the `torch-gpu-clip` kernel.

This notebook does text to image translation. It uses BigGAN to generate the images, and CLIP (a network from OpenAI that learns associations between images and text) to guide the image generation. It actually does an evolutionary search, so for each iteration it produces a population of candidate images, and then evaluates them towards a fitness criteria to proceed towards better translations.

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Modified to run on HCC OOD/nautilus.optiputer.net/z8 by robert.twomey@gmail.com

## Activities

Change the textual prompt below, then select Run->Run All Cells

## 1. Set the Prompt

This is the text that you want to translate into an image. You can do an array of prompts, with each line in quotes, separated by commas. Or just do a single prompt. Edit the line in red below to be the text that you want to translate into an image.

I've left in a number of my old prompts from this project as comments (green lines with a `#` at the beginning), for your reference.

In [1]:
```
prompts = [
#     "a euglena in a petri dish",
#     "a ginger cat"
#     "a viola provides the potential for communication"
#     "the potentiality of the virtual space"
#     "a human living with a machine"
#     "decomposing matter with the roots of a plant"
#     "a euglena seen through a microscope"
#     "a unexpected surprise"
#     "the decomposition of an artificial intelligence"
#     "the extraction of thought from human writers"
#     "setting our machines loose into rich nourishing nature"
    "putting boy clothes on my avatar"
#     "Paul Rudd eating mac and cheese"
#     "a family of robotic seals"
]
```

## 2. Set the random seed and the iterations

In [2]:
```
# seeding/iteration
```

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```
seed = 10 #128#255#1#5#9#3
iterations = 40 #100#40
terminal_iterations = iterations
```

Set the file paths

In [3]:
```
import os
# work = %env WORK
# work = work + "/clip_biggan"
# work = "/work/twomeylab/rtwomey/clip-biggan/"

# file paths
work = os.getcwd() # get the current path
outpath = os.path.join(work, "outputs/")
storedpath = os.path.join(work, "process/")
resultspath = os.path.join(work, "results/")
```

Make output directories:

In [4]:
```
# directories are defined up top
!rm -rf $outpath
!mkdir -p $outpath
!mkdir -p $storedpath
!mkdir -p $resultspath
```

turn on the timer so we can see how long things take

In [5]:
```
# %pip install autotime
# %load_ext autotime
```

## 3. Setup

CLIP was installed from Install CLIP from source

In [6]:
```
# !git clone https://github.com/openai/CLIP.git
```

## Load Models:

- BigGAN Deep 512
- CLIP OpenAI
- Wordnet
- CMA

In [7]:
```
from pytorch_pretrained_biggan import BigGAN
last_gen_model = 'biggan-deep-512'
biggan_model = BigGAN.from_pretrained(last_gen_model).cuda().eval()
```

In [8]:
```
# %cd CLIP
```

In [9]:
```
import clip
last_clip_model = 'ViT-B/32'
# clip_model = "ViT-L/14"
perceptor, preprocess = clip.load(last_clip_model)
```

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In [10]:
```
import nltk
nltk.download('wordnet')
```

```
[nltk_data] Downloading package wordnet to
[nltk_data]     /home/emar349/elliotiris/nltk_data...
[nltk_data]   Package wordnet is already up-to-date!
```

Out[10]:
```
True
```

In [11]:
```
import cma
from cma.sigma_adaptation import CMAAdaptSigmaCSA, CMAAdaptSigmaTPA
import warnings
warnings.simplefilter("ignore", cma.evolution_strategy.InjectionWarning)
```

## 4. General CLIP+BigGAN+CMA-ES Configuration

We set our prompts and seed above. But these are general guidelines:

1. For **prompt** OpenAI suggest to use the template "A photo of a X." or "A photo of a X, a type of Y." [paper]
2. For **initial_class** you can either use free text or select a special option from the drop-down list.
3. Free text and 'From prompt' might fail to find an appropriate ImageNet class.
4. **seed**=0 means no seed.

In [12]:
```
# prompt is set above
gen_model = 'biggan-deep' #@param ['biggan-deep', 'sigmoid']
size = '512' #@param [512, 256, 128]
color = True #@param {type:'boolean'}
initial_class = 'Random mix' #@param ['From prompt', 'Random class', 'Random Dirichlet',
optimize_class = True #@param {type:'boolean'}
class_smoothing = 0.1 #@param {type:'number'}
truncation = 1 #@param {type:'number'}
stochastic_truncation = False #@param {type:'boolean'}
optimizer = 'CMA-ES' #@param ['SGD','Adam','CMA-ES','CMA-ES + SGD interleaved','CMA-ES +
pop_size = 50 #@param {type:'integer'}
if "clip_model" not in globals():
#     clip_model ='ViT-L/14'
    clip_model = 'ViT-B/32' #@param ['ViT-B/32','RN50','RN101','RN50x4']
else:
    clip_model= last_clip_model
augmentations =  64#@param {type:'integer'}
learning_rate =  0.1#@param {type:'number'}
noise_normality_loss =  0#@param {type:'number'}
embed_normality_loss = 0 #@param {type:'number'}
minimum_entropy_loss = 0.0001 #@param {type:'number'}
total_variation_loss = 0.1 #@param {type:'number'}
# iterations = 100 #@param {type:'integer'}
# terminal_iterations = 100 #@param {type:'integer'}

# # live POM
# iterations = iterations #20#100#40
# terminal_iterations = iterations
# show_every = 1 #@param {type:'integer'}
# save_every = 5 #@param {type:'integer'}
# fps = 1 #@param {type:'number'}
# freeze_secs = 0 #@param {type:'number'}

# non-live POM
# iterations = 50 # from above
                erations = iterations
```

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```
show_every = 1 #@param {type:'integer'}
save_every = 5 #@param {type:'integer'}
fps = 1 #@param {type:'number'}
freeze_secs = 0 #@param {type:'number'}
# seed = 0 #1#@param {type:'number'}

# other settings, don't need to change these
softmax_temp = 1
emb_factor = 0.067 #calculated empirically
loss_factor = 100
sigma0 = 0.5 #http://cma.gforge.inria.fr/cmaes_sourcecode_page.html#practical
cma_adapt = True
cma_diag = 'sigmoid' in gen_model
cma_active = True
cma_elitist = False
```

## 3. Generate

At this point you can click "Run->Run Selected Cell and All Below" if you want.

Imports:

In [13]:
```
import numpy as np
import torch
from torch import nn
import torchvision
import sys
import imageio
from IPython.display import HTML, Image, clear_output
from scipy.stats import truncnorm, dirichlet
from pytorch_pretrained_biggan import BigGAN, convert_to_images, one_hot_from_names, uti
from nltk.corpus import wordnet as wn
#from base64 import b64encode
from time import time
import datetime
```

Seeding (repeatable randomness):

In [14]:
```
if seed == 0:
    seed = None
    state = None
else:
    # torch.manual_seed(np.random.randint(sys.maxsize))
    state = np.random.RandomState(seed)
    np.random.seed(seed)
    torch.manual_seed(seed)
```

In [15]:
```
# noise and class vector sizes
noise_size = 128
class_size = 128 if initial_class.lower()=='random embeddings' else 1000

# load CLIP model unless we just used it
if clip_model != last_clip_model:
  perceptor, preprocess = clip.load(clip_model)
  last_clip_model = clip_model

# image resolution, model name
channels = 3 if color else 1
# clip_res = perceptor.input_resolution.item()
```

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```
        rceptor.visual.input_resolution
```

```
sideX = sideY = int(size)
gen_model = gen_model + '-' + size

# load BigGAN model unless we just used it
if gen_model != last_gen_model and 'biggan' in gen_model:
  biggan_model = BigGAN.from_pretrained(gen_model).cuda().eval()
  last_gen_model = gen_model

# is our image smaller than the clip perceptor?
if sideX<=clip_res and sideY<=clip_res:
  augmentations = 1

# for CMA we produce a population of candidate vectors, otherwise just 1 at a time
if 'CMA' not in optimizer:
  pop_size = 1

# do not optimize class if not using BigGAN
if 'biggan' not in gen_model:
  optimize_class = False

# BigGAN ImageNet class names to WordNet synsets/lemmas
ind2name = {index: wn.of2ss('%08dn'%offset).lemma_names()[0] for offset, index in utils.
```

In [16]:

```
def replace_to_inplace_relu(model): #saves memory; from https://github.com/minyoungg/pix
    for child_name, child in model.named_children():
        if isinstance(child, nn.ReLU):
            setattr(model, child_name, nn.ReLU(inplace=False))
        else:
            replace_to_inplace_relu(child)
    return

replace_to_inplace_relu(biggan_model)
replace_to_inplace_relu(perceptor)
```

Image and vectors saving helpers:

In [17]:

```
def save(out,name=None):
  with torch.no_grad():
    out = out.cpu().numpy()
  img = convert_to_images(out)[0]
  if name:
    imageio.imwrite(name, np.asarray(img))
  return img

def save_vec(out,name):
  with torch.no_grad():
    vec = out.cpu().numpy()
  np.savetxt(name, vec)

def save_all_vecs(out, name):
  with torch.no_grad():
    vec = out.cpu().numpy()
  np.savetxt(name, vec)

hist = []
def checkin(i, best_ind, total_losses, losses, regs, out, noise=None, emb=None, probs=No
  global sample_num, hist
  name = None
  if save_every and i%save_every==0:
    name = '%s/frame_%05d.jpg'%(outpath, sample_num)
  pil_image = save(out, name)
  vals0 = [sample_num, i, total_losses[best_ind], losses[best_ind], regs[best_ind], np.m
  stats = 'sample=%d iter=%d best: total=%.2f cos=%.2f reg=%.3f avg: total=%.2f cos=%.2f
  vals1 = []
  if noise is not None:
    vals1 = [np.mean(noise), np.std(noise)]
    stats += ' noise: avg=%.2f std=%.3f'%tuple(vals1)
  vals2 = []
  if emb is not None:
    vals2 = [emb.mean(),emb.std()]
    stats += ' emb: avg=%.2f std=%.3f'%tuple(vals2)
  elif probs:
    best = probs[best_ind]
    inds = np.argsort(best)[::-1]
    probs = np.array(probs)
    vals2 = [ind2name[inds[0]], best[inds[0]], ind2name[inds[1]], best[inds[1]], ind2nam
    stats += ' 1st=%s(%.2f) 2nd=%s(%.2f) 3rd=%s(%.2f) components: >=0.5:%.0f, >=0.3:%.0f
  hist.append(vals0+vals1+vals2)
  if show_every and i%show_every==0:
    clear_output()
    display(pil_image)
  print(stats)
  print('Best index: %s' % best_ind)

  # save best vectors
  save_vec(noise_vector[best_ind], outpath+'noise_%05d.txt'%sample_num)
  save_vec(class_vector[best_ind], outpath+'class_%05d.txt'%sample_num)
  sample_num += 1
```

GAN generation helpers:

In [18]:
```
def get_output(noise_vector, class_vector):
  save_class_vector_norm = None
  if 'sigmoid' in gen_model:
    out = noise_vector.sigmoid().reshape(1, channels, sideY, sideX)*2-1
  else:
    if stochastic_truncation: #https://arxiv.org/abs/1702.04782
      with torch.no_grad():
        trunc_indices = noise_vector.abs() > 2*truncation
        size = torch.count_nonzero(trunc_indices).cpu().numpy()
        trunc = truncnorm.rvs(-2*truncation, 2*truncation, size=(1,size)).astype(np.floa
        noise_vector.data[trunc_indices] = torch.tensor(trunc, requires_grad=requires_gr
    else:
      noise_vector = noise_vector.clamp(-2*truncation, 2*truncation)
    if initial_class.lower() == 'random embeddings':
      class_vector_norm = class_vector*emb_factor
    else:
      class_vector_norm = torch.softmax(class_vector/softmax_temp,dim=-1)
    out = biggan_model(noise_vector, class_vector_norm, truncation)
    if channels==1:
      out = out.mean(dim=1, keepdim=True)
    if initial_class.lower() != 'random embeddings':
      save_class_vector_norm = class_vector_norm
  if channels==1:
    out = out.repeat(1,3,1,1)
  return out, save_class_vector_norm

# define forward pass
def my_forward(self, z, class_label, truncation):
  assert 0 < truncation <= 1

  if initial_class.lower()=='random embeddings':
    embed = class_label
  else:
    embed = self.embeddings(class_label)

                    = torch.cat((z, embed), dim=1)
```

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```
  z = self.generator(cond_vector, truncation)
  return z

# set forward pass
if gen_model == 'biggan':
    BigGAN.forward = my_forward
```

Text optimization helpers:

In [19]:
```
def normality_loss(vec): #https://arxiv.org/abs/1903.00925
    mu2 = vec.mean().square()
    sigma2 = vec.var()
    return mu2+sigma2-torch.log(sigma2)-1

def make_safe_filename(s):
    def safe_char(c):
        if c.isalnum():
            return c
        else:
            return "_"
    return "".join(safe_char(c) for c in s).rstrip("_")
```

In [20]:
```
requires_grad = ('SGD' in optimizer or 'Adam' in optimizer) and ('terminal' not in optim
total_iterations = iterations + terminal_iterations*('terminal' in optimizer)

# ====
# NOT EDITED BELOW

for prompt in prompts:

    # initialization
    eps = 1e-8
    class_vector = None
    if 'sigmoid' in gen_model:
      noise_size = channels*sideY*sideX
      noise_vector = np.random.rand(pop_size, noise_size).astype(np.float32)
      noise_vector = np.log((noise_vector+eps)/(1-noise_vector+eps))
    else:
      noise_vector = truncnorm.rvs(-2*truncation, 2*truncation, size=(pop_size, noise_si

      if initial_class.lower() == 'random class':
        class_vector = np.ones(shape=(pop_size, class_size), dtype=np.float32)*class_smo
        class_vector[0,np.random.randint(class_size)] = 1-class_smoothing
      elif initial_class.lower() == 'random dirichlet':
        class_vector = dirichlet.rvs([pop_size/class_size] * class_size, size=1, random_
      elif initial_class.lower() == 'random mix':
        class_vector = np.random.rand(pop_size, class_size).astype(np.float32)
      elif initial_class.lower() == 'random embeddings':
        class_vector = np.random.randn(pop_size, class_size).astype(np.float32)
      else:
        if initial_class.lower() == 'from prompt':
          initial_class = prompt
        try:
          class_vector = None
          class_vector = one_hot_from_names(initial_class, batch_size=pop_size)
          assert class_vector is not None
          class_vector = class_vector*(1-class_smoothing*class_size/(class_size-1))+clas
        except Exception as e:
          print('Error: could not find initial_class. Try something else.')
          raise e

      if initial_class.lower() != 'random embeddings':
```

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```
        class_vector = class_vector/np.sum(class_vector,axis=-1, keepdims=True)
        class_vector = np.log(class_vector+eps)-np.mean(np.log(class_vector+eps),axis=-1
      initial_class_vector = class_vector[0]
      if initial_class.lower() in ('random mix','random embeddings'):
        initial_class_vector = initial_class_vector*0
      class_vector = torch.tensor(class_vector, requires_grad=requires_grad, device='cud
      smoothed_ent = -torch.tensor(class_smoothing*np.log(class_smoothing/999+eps)+(1-cl
    noise_vector = torch.tensor(noise_vector, requires_grad=requires_grad, device='cuda'

    if requires_grad:
      params = [noise_vector]
      if optimize_class:
        params = params + [class_vector]
      if 'SGD' in optimizer:
        optim = torch.optim.SGD(params, lr=learning_rate, momentum=0.9)
      else:
        optim = torch.optim.Adam(params, lr=learning_rate)

    # convert prompt to tokenized target
    tx = clip.tokenize(prompt)
    with torch.no_grad():
      target_clip = perceptor.encode_text(tx.cuda())

    # store best results as we optimize this prompt
    global_best_loss = np.inf
    global_best_iteration = 0
    global_best_noise_vector = None
    global_best_class_vector = None

    # ascend the text
    def ascend_txt(i, grad_step=False, show_save=False):
      global global_best_loss, global_best_iteration, global_best_noise_vector, global_b
      prev_class_vector_norms = []
      regs = []
      losses = []
      total_losses = []
      best_loss = np.inf
      global_reg = torch.tensor(0, device='cuda', dtype=torch.float32, requires_grad=gra
      if 'biggan' in gen_model:
        if optimize_class and embed_normality_loss and initial_class.lower() == 'random
          global_reg = global_reg+embed_normality_loss*normality_loss(class_vector)
        if noise_normality_loss:
          global_reg = global_reg+noise_normality_loss*normality_loss(noise_vector)
        global_reg = loss_factor*global_reg
        if grad_step:
          global_reg.backward()
      for j in range(pop_size):
        p_s = []
        out, class_vector_norm = get_output(noise_vector[j:j+1], None if class_vector is
        if class_vector_norm is not None:
          with torch.no_grad():
            prev_class_vector_norms.append(class_vector_norm.cpu().numpy()[0])

        for aug in range(augmentations):
          if sideX<=clip_res and sideY<=clip_res or augmentations==1:
            apper = out
          else:
            size = torch.randint(int(.7*sideX), int(.98*sideX), ())
            offsetx = torch.randint(0, sideX - size, ())
            offsety = torch.randint(0, sideX - size, ())
            apper = out[:, :, offsetx:offsetx + size, offsety:offsety + size]
          apper = (apper+1)/2
          apper = nn.functional.interpolate(apper, clip_res, mode='bilinear')
          #apper = apper.clamp(0,1)
```
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```
          p_s.append(apper)
        into = nom(torch.cat(p_s, 0))
        predict_clip = perceptor.encode_image(into)
        loss = loss_factor*(1-torch.cosine_similarity(predict_clip, target_clip).mean())

#         print("tokens:", tx)
#         print("target clip:", target_clip)
#         print("predict clip:",predict_clip)
#         print("cosine_sim:", torch.cosine_similarity(predict_clip, target_clip).mean()
#         sys.exit()

        total_loss = loss
        regs.append(global_reg.item())
        if 'sigmoid' in gen_model and total_variation_loss or 'biggan' in gen_model and
          if 'sigmoid' in gen_model and total_variation_loss:
            reg = total_variation_loss*((out[:, :, :-1, :] - out[:, :, 1:, :]).abs().mea
          elif 'biggan' in gen_model and optimize_class and minimum_entropy_loss and ini
            reg = minimum_entropy_loss*((-class_vector_norm*torch.log(class_vector_norm+
          reg = loss_factor*reg
          total_loss = total_loss + reg
          with torch.no_grad():
            regs[-1] += reg.item()
        with torch.no_grad():
          losses.append(loss.item())
          total_losses.append(total_loss.item()+global_reg.item())
        if total_losses[-1]<best_loss:
          best_loss = total_losses[-1]
          best_ind = j
          best_out = out
          if best_loss < global_best_loss:
            global_best_loss = best_loss
            global_best_iteration = i
            with torch.no_grad():
              global_best_noise_vector = noise_vector[best_ind]
              if class_vector is not None:
                global_best_class_vector = class_vector[best_ind]

        if grad_step:
          total_loss.backward()

      if grad_step:
        optim.step()
        optim.zero_grad()

      if show_save and (save_every and i % save_every == 0 or show_every and i % show_ev
        noise = None
        emb = None
        if 'biggan' in gen_model:
          with torch.no_grad():
            noise = noise_vector.cpu().numpy()
            if initial_class.lower() == 'random embeddings':
              emb = class_vector.cpu().numpy()
        checkin(i, best_ind, total_losses, losses, regs, best_out, noise, emb, prev_clas
      return total_losses, best_ind

    nom = torchvision.transforms.Normalize((0.48145466, 0.4578275, 0.40821073), (0.26862
    if 'CMA' in optimizer:
      initial_vector = np.zeros(noise_size)
      bounds = None
      #if 'biggan' in gen_model and not stochastic_truncation:
      #  bounds = [-2*truncation*np.ones(noise_size),2*truncation*np.ones(noise_size)]
      if optimize_class:
        initial_vector = np.hstack([initial_vector, initial_class_vector])
        #if not stochastic_truncation:
```
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```
      #  bounds[0] = list(bounds[0]) + [None]*class_size
      #  bounds[1] = list(bounds[1]) + [None]*class_size
    cma_opts = {'popsize': pop_size, 'seed': np.nan, 'AdaptSigma': cma_adapt, 'CMA_dia
    cmaes = cma.CMAEvolutionStrategy(initial_vector, sigma0, inopts=cma_opts)

  sample_num = 0
  machine = !nvidia-smi -L
  start = time()
  for i in range(total_iterations):
    if 'CMA' in optimizer and i<iterations:
      with torch.no_grad():
        cma_results = torch.tensor(cmaes.ask(), dtype=torch.float32).cuda()
        if optimize_class:
          noise_vector.data, class_vector.data = torch.split_with_sizes(cma_results, (
          class_vector.data = class_vector.data
        else:
          noise_vector.data = cma_results
    if requires_grad and ('terminal' not in optimizer or i>=iterations):
      losses, best_ind = ascend_txt(i, grad_step=True, show_save='CMA' not in optimize
      assert noise_vector.requires_grad and noise_vector.is_leaf and (not optimize_cla
    if 'CMA' in optimizer and i<iterations:
      with torch.no_grad():
        losses, best_ind = ascend_txt(i, show_save=True)
        if i<iterations-1:
          if optimize_class:
            vectors = torch.cat([noise_vector,class_vector], dim=1)
          else:
            vectors = noise_vector
          cmaes.tell(vectors.cpu().numpy(), losses)
        elif 'terminal' in optimizer and terminal_iterations:
          pop_size = 1
          noise_vector[0] = global_best_noise_vector
          if class_vector is not None:
            class_vector[0] = global_best_class_vector
    if save_every and i % save_every == 0 or show_every and i % show_every == 0:
      print('took: %d secs (%.2f sec/iter) on %s. CUDA memory: %.1f GB'%(time()-start,
      print('global best iteration: %d' % global_best_iteration)
      print('prompt: %s' % prompt)
      #print('prompt: %s, target-CLIP: %s' % (prompt, target_clip))

  prompt_safe = make_safe_filename(prompt)
  out, _ = get_output(global_best_noise_vector.unsqueeze(0), None if global_best_class
  name = '%s/%s.jpg'%(resultspath, prompt_safe)
  pil_image = save(out,name)
  save_vec(global_best_noise_vector, '%s/%s_noise.txt' % (resultspath, prompt_safe))
  save_vec(global_best_class_vector, '%s/%s_class.txt' % (resultspath, prompt_safe))

  display(pil_image)
  print('best_loss=%.2f best_iter=%d'%(global_best_loss,global_best_iteration))

  # move outputs to saved path with datestampt
  newdir_timestamp = os.path.join(storedpath,prompt_safe+"_"+datetime.datetime.now().s
  newdir = os.path.join(storedpath, prompt_safe)
  !mv $outpath $newdir_timestamp
  !ln -s $newdir_timestamp $newdir
  !mkdir -p $outpath
```

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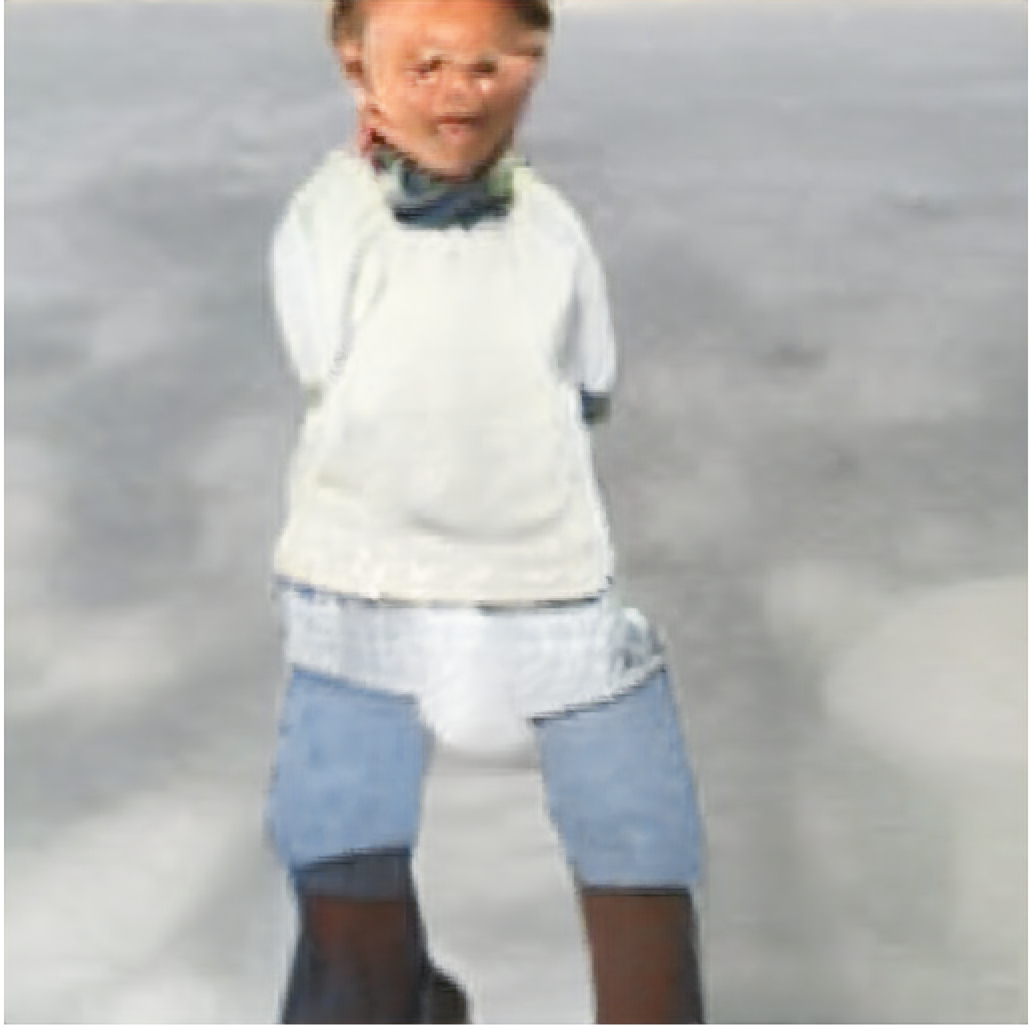
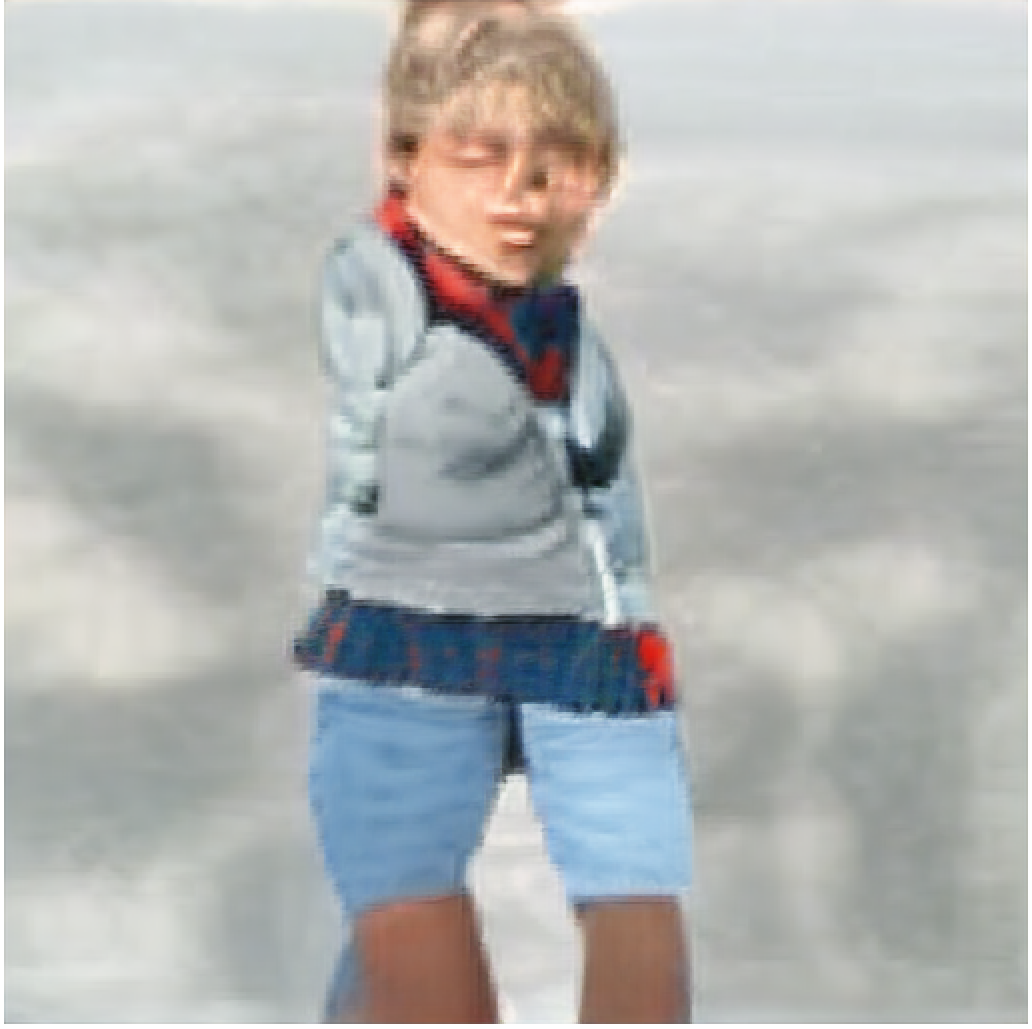


```
sample=39 iter=39 best: total=67.93 cos=67.88 reg=0.055 avg: total=69.79 cos=69.74 reg=
0.055 std: total=1.11 cos=1.11 reg=0.000 noise: avg=-0.16 std=0.988 1st=rock_crab(0.01)
2nd=spider_monkey(0.01) 3rd=isopod(0.01) components: >=0.5:0, >=0.3:0, >=0.1:0
Best index: 1
took: 132 secs (3.31 sec/iter) on GPU 0: Tesla V100-PCIE-32GB (UUID: GPU-7454814a-9472-6
9f3-9d4d-66fb00ed1510). CUDA memory: 1.9 GB
global best iteration: 34
prompt: putting boy clothes on my avatar
```



```
best_loss=67.62 best_iter=34
```

In [21]:
```
print(newdir)
```

```
/home/emar349/elliotiris/ml-art-code/clip-biggan/process/putting_boy_clothes_on_my_avata
r
```

## Explanation

What is happening?

- It generates a population of candidate images.
- It chooses one that minimizes difference to text-to-image model (CMA-EAS covariance)

## Reference

Based on SIREN+CLIP Colabs by: @advadnoun, @norod78

Using the works:

- https://github.com/openai/CLIP
- https://tfhub.dev/deepmind/biggan-deep-512
- https://github.com/huggingface/pytorch-pretrained-BigGAN
- http://www.aiartonline.com/design-2019/eyal-gruss (WanderGAN)

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- Other CLIP notebooks: https://www.reddit.com/r/MachineLearning/comments/ldc6oc/p_list_of_sitesprogramsprojects_that_use_ope
- A curated list of more online generative tools see: j.mp/generativetools

## Leftovers

leftover prompts

In [22]:
```
# prompts = [
#     "over my head, I see the bronze butterfly",
#     "asleep on the black trunk",
#     "blowing like a leaf in green shadow",
#     "down the ravine behind the empty house",
#     "the cowbells follow one another",
#     "into the distances of the afternoon",
#     "to my right",
#     "in a field of sunlight between two pines",
#     "the droppings of last year’s horses",
#     "blaze up into golden stones",
#     "I lean back, as the evening darkens and comes on",
#     "a chicken hawk floats over, looking for home",
#     "I have wasted my life"
# ]

# prompts = [
#     "Midway on our lifes journey, I found myself",
#     "In dark woods, the right road lost",
#     "To tell About those woods is hard - so tangled and rough",
#     "And savage that thinking of it now, I feel",
#     "The old fear stirring: death is hardly more bitter.",
#     "And yet, to treat the good I found there as well",
#     "I'll tell what I saw, though how I came to enter",
#     "I cannot well say, being so full of sleep",
#     "Whatever moment it was I began to blunder",
#     "Off the true path. But when I came to stop",
#     "Below a hill that marked one end of the valley",
#     "That had pierced my heart with terror, I looked up",
#     "Toward the crest and saw its shoulders already",
#     "Mantled in rays of that bright planet that shows",
#     "The road to everyone, whatever our journey.",
#     "Then I could feel the terror begin to ease",
#     "That churned in my heart's lake all through the night.",
#     "As one still panting, ashore from dangerous seas",
#     "Looks back at the deep he has escaped, my thought",
#     "Returned, still fleeing, to regard that grim defile",
#     "That never left any alive who stayed in it."
# ]

# prompts = [
#     'a photo of wild tarragon',
#     'a drawing of wild tarragon, a tasteless plant',
#     'a painting of farm hands, a kind of laborer',
#     'a painting of a farmer’s hands',
#     'a self-portrait of Artemisia Gentileschi, artist',
#     'artemisia Gentileschi is a dragon',
#     'a painting of Artemisia Gentileschi as a dragon',
#     'a photo of the dragon Artemisia Gentileschi',
#     'a portrait of artist as dragon',
#     'a drawing of a dragon',
#     'a painting of uprooted rhizome as a dragon',
```

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```
#     'a sketch of a rhizome, uprooted',
#     'an image of a plant rising',
#     'a drawing of plant roots and mycorrhizal fungi',
#     'an image of growing wiser',
#     'a painting of wise plants',
#     'a drawing of plant wisdom',
#     'a photo of a plant hiding',
#     'a drawing of hiding from elders',
#     'a painting of Susanna and the Elders',
#     'an image of creeps',
#     'a painting of gazing creeps',
#     'a painting of groping creeps',
#     'a painting of invasive elders',
#     'a photo of perverse hope',
#     'a painting of your hatred',
#     'a drawing of killing a mosquito',
#     'a painting of a mosquito, a kind of corpse',
#     'a drawing of malaria',
#     'a sketch of salted fields',
#     'a photo of dancers',
#     'a painting of dancers in a field',
#     'an image of your spit',
#     'a photo of standing too close',
#     'a painting of someone standing too close',
#     'a drawing of an oak sapling',
#     'a painting of an oak in an empty field',
#     'a photo of growing',
#     'an image of growing wilder',
#     'a painting of growing stronger',
#     'a photo of a hand holding high',
#     'a painting of a hand holding the head of Holofernes',
#     'a painting of the head of Holofernes',
#     'a drawing of a head, blood-rooted',
#     'an image of a bloody root',
#     'a painting of autumn gold',
#     'a photo of a golden gown',
#     'an image of a mouth tasting',
#     'a sketch of a mouth',
#     'a drawing of taste',
#     'a painting of the taste of nothing',
#     'a photograph of being invisible',
#     'a drawing of your renown',
#     'a painting of a renowned artist',
#     'a portrait of the artist',
#     'a self-portrait of Artemisia Gentileschi as tarragon'
# ]

# prompts = [
#     "sunrise through a window",
#     "a cat in the refrigerator"
#     "microsoft basic on a tandy 1000"
#     "a canvas on an easel in a field",
#     "a painter painting on an easel in a field",
#     "a painting on an easel in the landscape"
# ]

# prompts = [
#     "sunrise through a window",
#     "a cat in the refrigerator"
# ]


# OLD POM PROMPTS
```

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```
# prompts = [
#     #prompt 5
#     "a painting of pygmalion",
#     "a sculptor who fell in love with his own sculpture",
#     "everyone who saw her would fall in love with her",
#     "beautiful reflections of our digital twinse",
#     "a statue of a woman",
#     "a living breathing woman",
#     "our digital twins, artificial intelligence",
#     "a projection of our deepest fears"
# ]

# prompts = [
#     #prompt 4
#     "the first computing devices were powered by steam engines",
#     "fueled with the burning of fossilized coal",
#     "the bones of sparse data structures",
#     "the slow demise of our geological resources",
#     "extracting lithium",
#     "battery technology",
#     "computing devices can be charged without being plugged in",
#     "key contributor to climate change",
#     "we are powered by imagination",
#     "the machines we use to think",
#     "the machines that are destroying the planet"

# ]

# prompts = [
#     # prompt 2
#     "the glow of a television screen",

#     # prompt 3
#     "an xray of the first silicon chip",
#     "the dover demonstration chip",
#     "a picture of his arthritic hands",
#     "a piece of wire to connect two silicon squares",
#     "smaller and smaller computer chips",
#     "the kilby diode",
#     "a silicon mold of a friends hands"
# ]

# prompts = [
    # prompt 1
#     "a mushroom is the aerial manifestation of a larger infestation",
#     "a mushrooms above ground growth is the result of a set of instructions",
#     "growing mushrooms in the fire-stricken forests of LA",
#     "growing mushrooms in the forests is a way to uncover their potential"
#     "a seed, a plant's basic unit, remains ever in potentia",
#     "they make us have arms and not wings",
#        "the fire-stricken forests of LA",
#    "the fruiting body of a larger organism"
#]

# prompts = [
        # prompt 3
#     "in these containers, we care for machines",
# ]

# prompts = [
    # prompt 2
#     "a family of robotic seals",
#     "nursing homes in japan",
#     "to help the elderly cope",
```

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```
#     "the after effects of the Tsunami",
#     "the children laugh and smile",
#     "their homes washed away",
#     "watching the news on television",
#     "spoke through a microphone",
#     "the robotic seals danced"
# ]

# prompts_pom1 = [
#     # 001
#     "an elegant machine that learns to generate artificial images",
#     "the sublime experience of an iceberg",
#     "ice is a vastness of possibilities",
#     "the vastness of possibilities of water is not a spatial vastness",
#     # 002
#     "a drawing of an elegant machine",
#     "a machine that learns to make images",
#     "a drawing of a machine that learns to make images",
#     # 003
#     "eighteenth century painting of humans encountering nature",
#     "a person encountering nature",
#     "a vastness of spatial dimensions",
#     "a network",
#     "a network of vast spatial dimensions",
#     "a space of unlimited possibilities that the network must explore"
# ]
```

In [ ]:

In [ ]:

In [ ]:

In [ ]:

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