

Text to Image
generation
using GANs,
CLIP
and
evolutionary
algorithms.

Maciej
Domagała,
Adam
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Text to Image generation using GANs, CLIP and evolutionary algorithms.

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Introduction

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Avocado chair - generated by OpenAI's DALL-E model.



GANs - Generic Adversarial Networks

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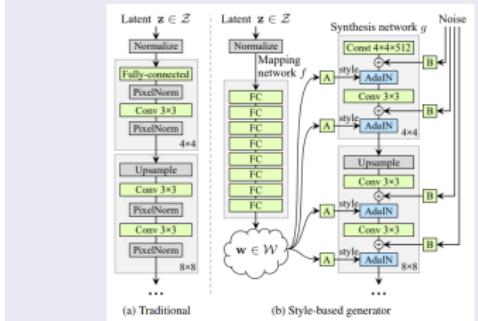
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BigGAN

StyleGAN



CLIP

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CLIP - Contrastive Language-Image Pre-Training new multi-modal model released by OpenAI in January 2021.
Key features:

- it is a neural network trained on over 400 000; 000 (image, caption) pairs
- main usage is to obtain the most relevant text snippet for given image

guacamole (90.1%) Ranked 1 out of 101 labels



✓ a photo of **guacamole**, a type of food.

✗ a photo of **ceviche**, a type of food.

✗ a photo of **edamame**, a type of food.

✗ a photo of **tuna tartare**, a type of food.

✗ a photo of **hummus**, a type of food.

Evolutionary Algorithms

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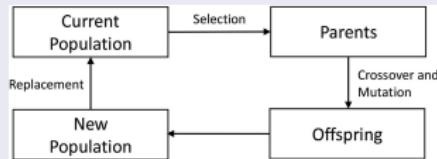
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Genetic Algorithm



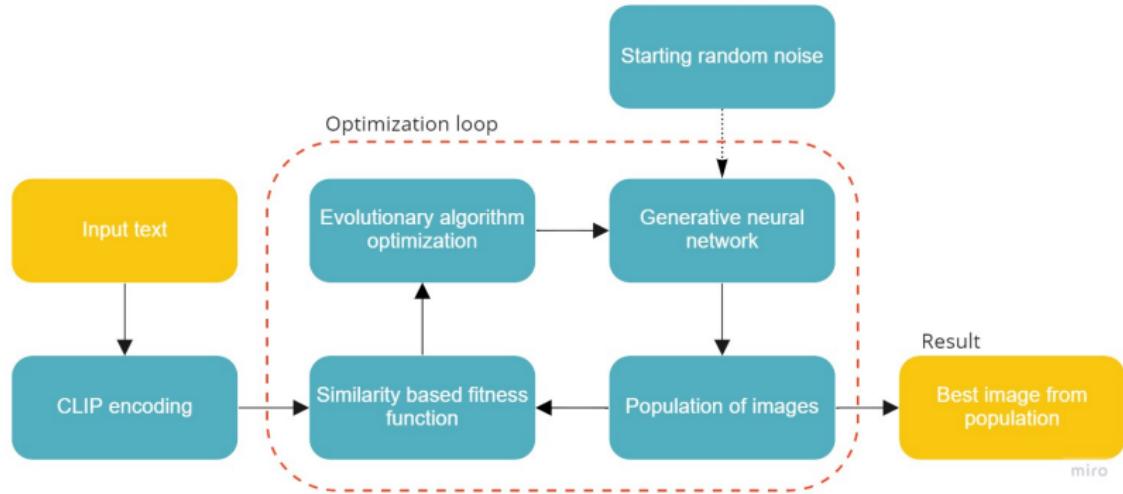
Differential Evolution

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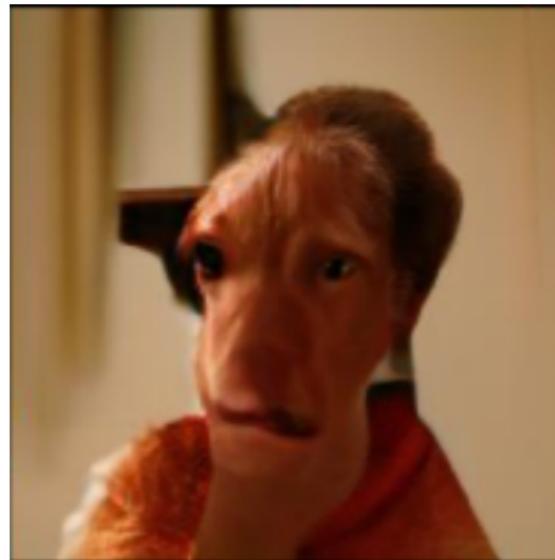
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Evaluation - CIFAR10

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Class	Positive	Negative	Accuracy (%)
AIRPLANE	476	36	92.97
AUTOMOBILE	88	424	17.19
BIRD	12	500	2.34
CAT	177	335	34.57
DEER	0	512	0.0
DOG	255	257	49.8
FROG	39	473	7.62
HORSE	64	448	12.5
SHIP	60	452	11.72
TRUCK	97	415	18.95
TOTAL	1268	3852	24.77

Evaluation - CIFAR10

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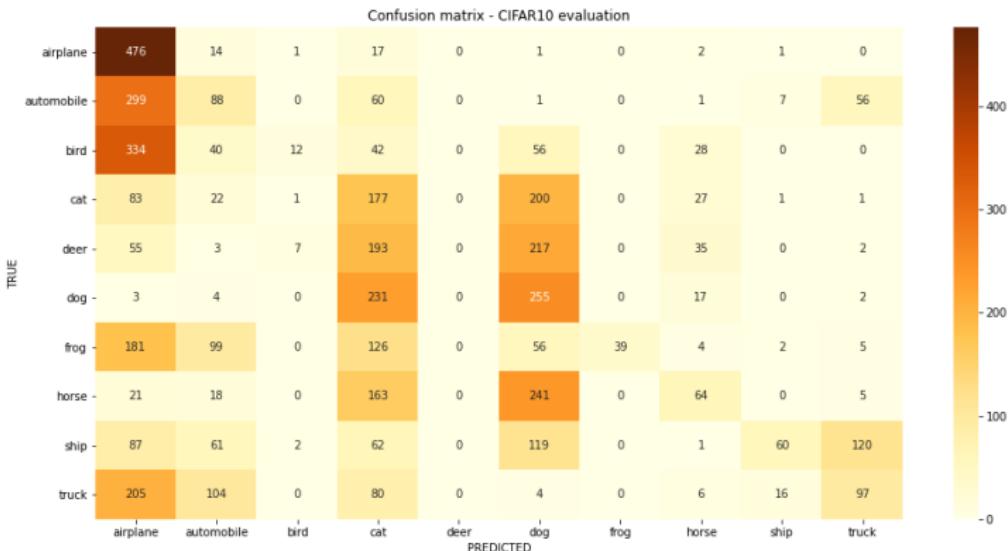
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Evaluation - CIFAR10 - Example

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Airplane

Positive



Negative



Evaluation - ImageNet

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Class	Positive	Negative	Accuracy (%)
BANANA	111	401	21.68
CASH MACHINE	124	388	24.22
HAMMER	141	371	27.54
ICE CREAM	3	509	0.59
LLAMA	36	476	7.03
MINISKIRT	220	292	42.97
PIRATE	5	507	0.98
SHOPPING CART	125	387	24.41
WALL CLOCK	146	366	28.52
KERRY BLUE TERRIER	253	259	49.41
TOTAL	1164	3956	22.73

Evaluation - ImageNet - Example

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Llama

Correct



Incorrect



GA vs DE

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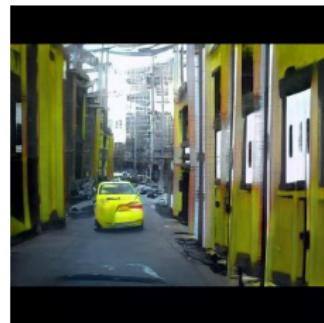
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(a) genetic algorithm



(b) differential evolution

Figure: Final images (with best score) produced by algorithms.

BigGAN vs StyleGAN

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Cosine-Similarity

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Observations:

- *cos-sim* in our solution takes values only in the range $\sim [0.2, 0.4]$

"a big red dog near the sea"



0.365



0.364



0.358



0.358



0.357

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<https://www.image-net.org/>



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<https://habr.com/en/post/537334/>



https://github.com/ewmashash/CTEAP_10_Classification