CS 523: Multimedia Systems

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creativecoding.evl.uic.edu/courses/cs523

Today

- Project 2 Introduction
- GPU access
- Generative Adversarial Nets (GANs)

Generative Adversarial Nets

One day we'll be talking about good old "hand-crafted" films and instead the norm will be watching AI-generated (infinite) content on demand

–Andrej Karpathy

Generative Adversarial Nets

GANs train a network to generate new data with the same features as other data

Used to generate new, fake examples

- images, videos, 3D models, etc

Generative Adversarial Nets

In the proposed adversarial nets framework, the *generative* model is pitted against an adversary:

a *discriminative* model that learns to determine whether a sample is from the model distribution or the data distribution.

Generative Adversarial Nets

The generative model can be thought of as analogous to a team of counterfeiters, trying to *produce fake currency* and use it without detection, while the discriminative model is analogous to the police, trying to *detect the counterfeit currency*.

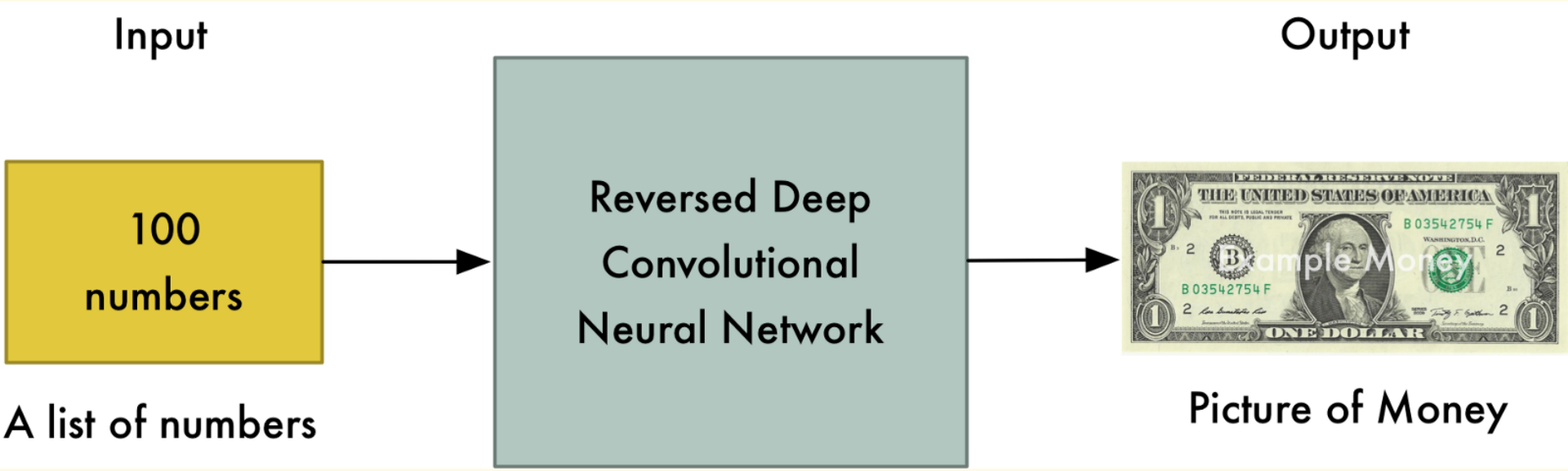
Generative Adversarial Nets

Competition in this game drives both teams to improve their methods until the counterfeits are indistinguishable from the genuine articles.

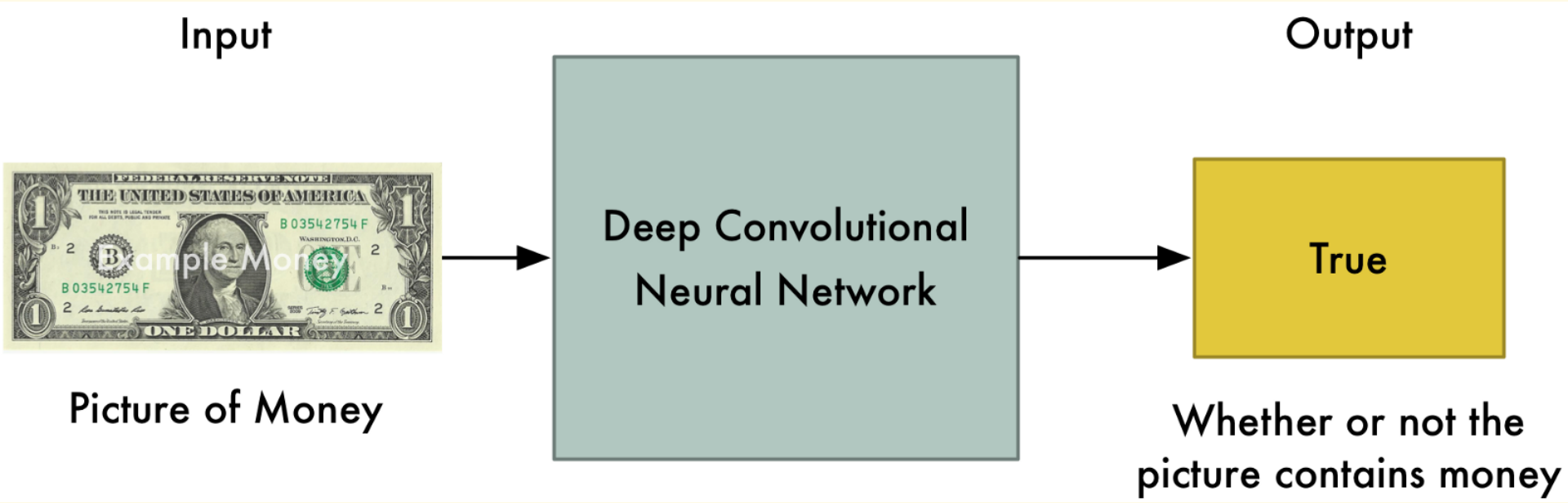
- the generative model generates samples by passing random noise through a multilayer perceptron

- Goodfellow et al., “Generative Adversarial Nets”, 2014

GANs

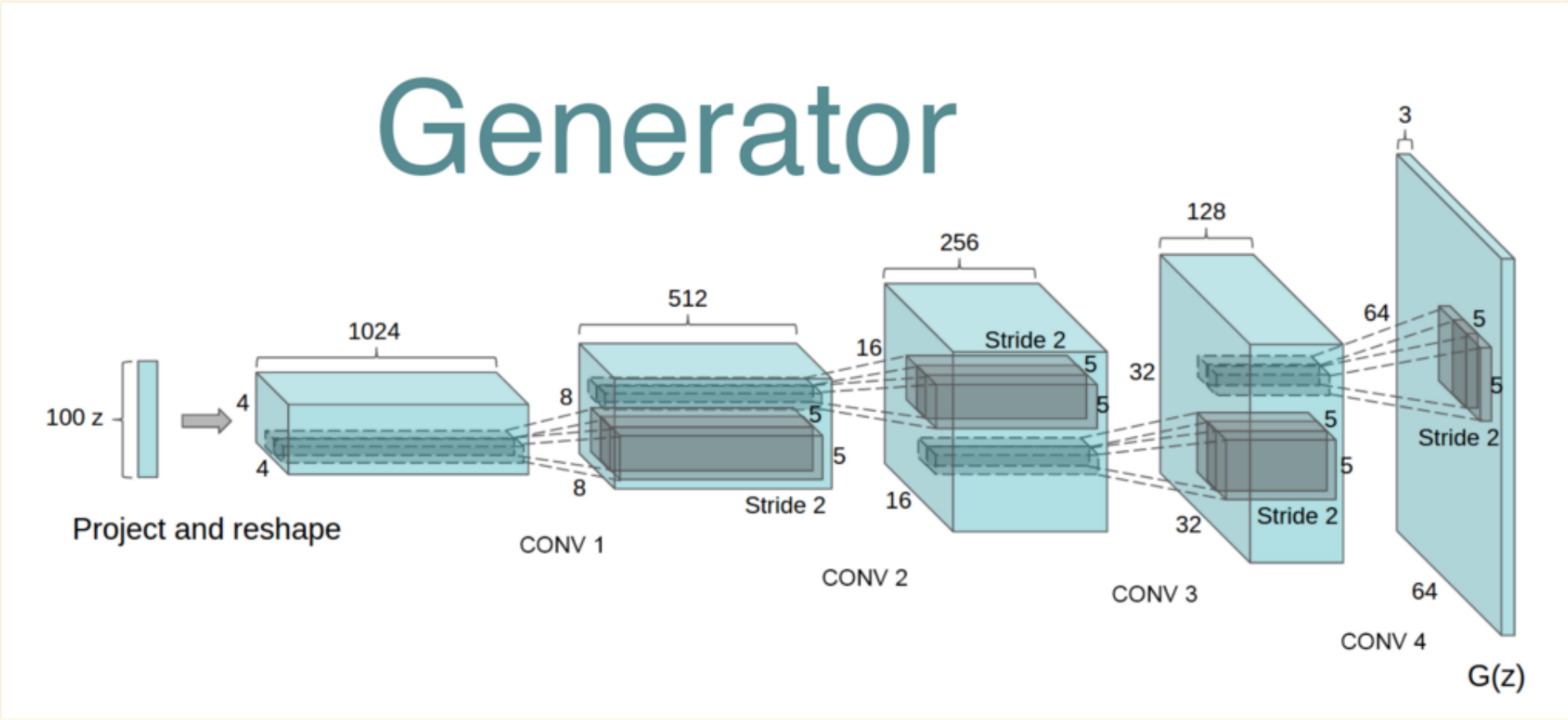

Input
Output
100 numbers
Reversed Deep Convolutional Neural Network
Sample Money
A list of numbers
Picture of Money

GANs

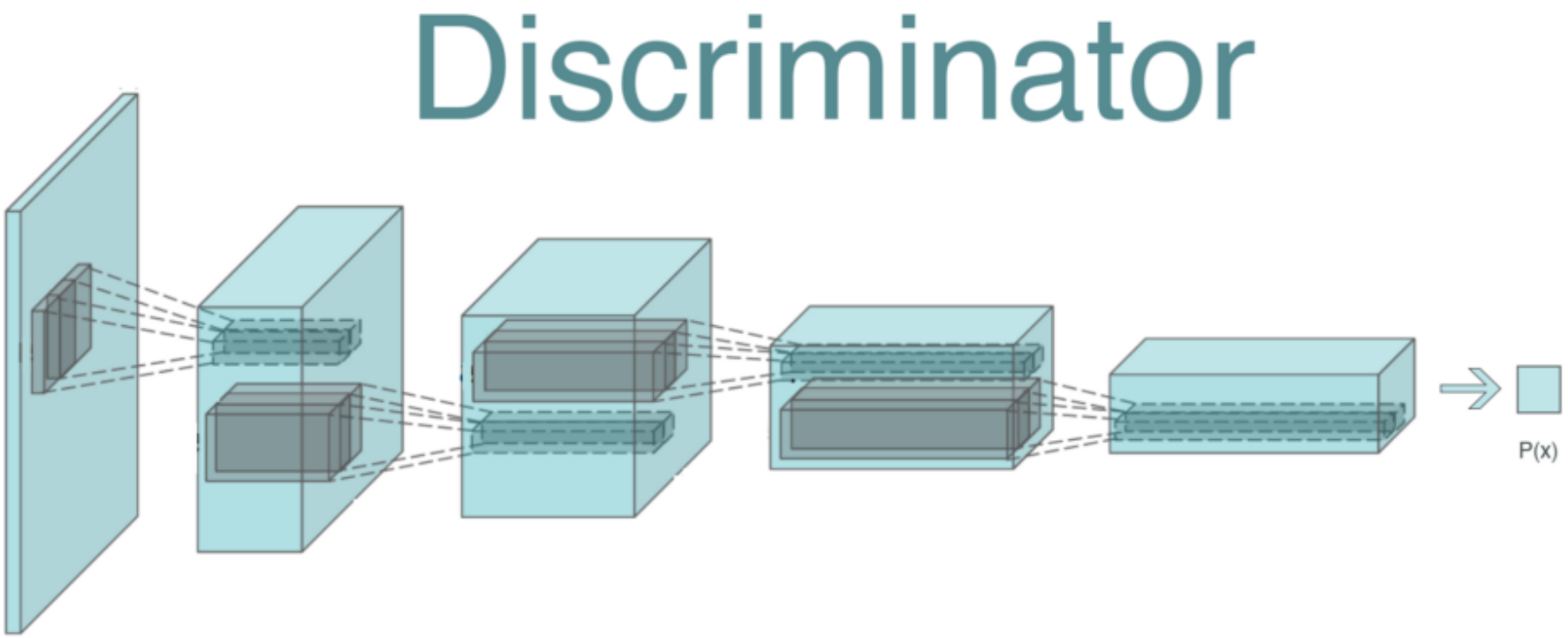


https://medium.com/@ageitgey/abusing-generative-adversarial-networks-to-make-8-bit-pixel-art-e45d9b96cee7#.u7wcnq80h

GANs


Generator
100 z
Project and reshape
1024
4
4
512
8
8
CONV 1
256
16
16
Stride 2
CONV 2
128
32
32
Stride 2
CONV 3
3
64
64
5
5
Stride 2
CONV 4
G(z)

GANs



Taehoon Kim's NeuralFace,
http://carpedm20.github.io/faces/

ArtGAN

Tan et al., 2017

ArtGAN

Tan et al., 2017

https://arxiv.org/abs/1702.03410

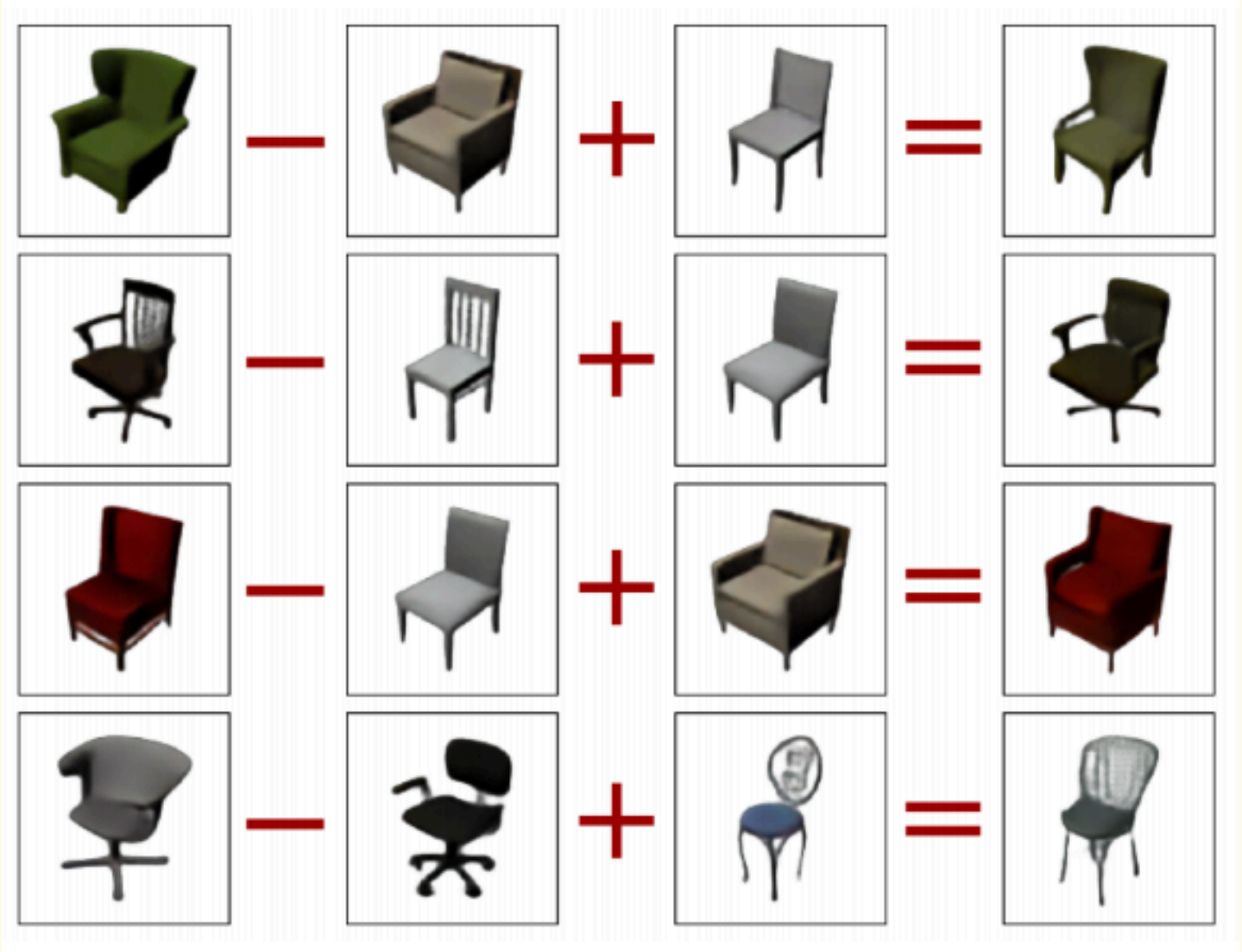
Improved Techniques for Training GANs, Saliman et al. 2016

Figure 6: Samples generated from the ImageNet dataset. *(Left)* Samples generated by a DCGAN. *(Right)* Samples generated using the techniques proposed in this work. The new techniques enable GANs to learn recognizable features of animals, such as fur, eyes, and noses, but these features are not correctly combined to form an animal with realistic anatomical structure.

https://arxiv.org/abs/1606.03498

Learning to Generate Chairs, Tables and Cars with CNNs, Dosovitskiy et al. 2016

https://www.youtube.com/watch?v=QCSW4isBDL0



http://lmb.informatik.uni-freiburg.de/Publications/2016/DTB16/Chairs_PAMI.pdf

Learning to Generate Chairs, Tables and Cars

Neural networks do not merely memorize images but find a meaningful representation of 3D models, allowing them to:

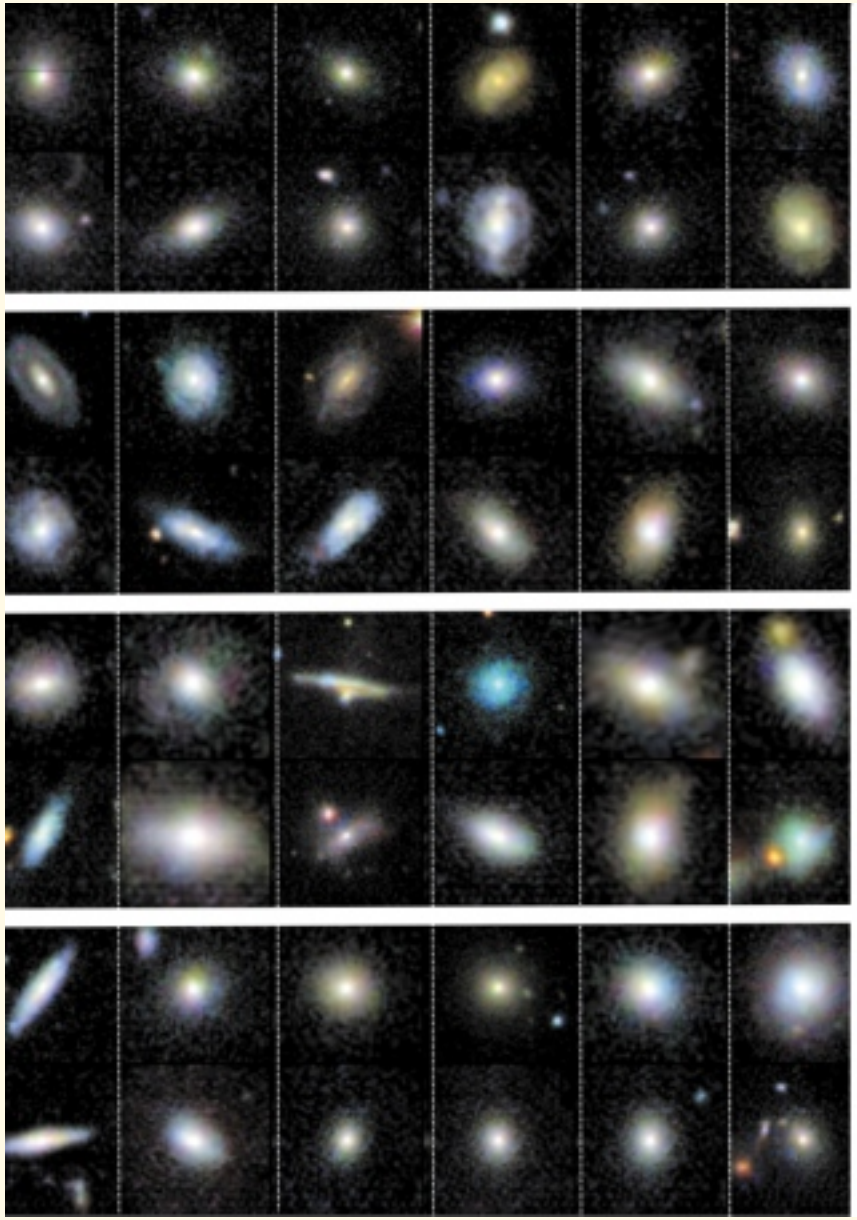
- Transfer knowledge within object class
- Transfer knowledge between classes
- Interpolate between different objects within a class and between classes
- Invent new objects not present in the training set

Anime GAN

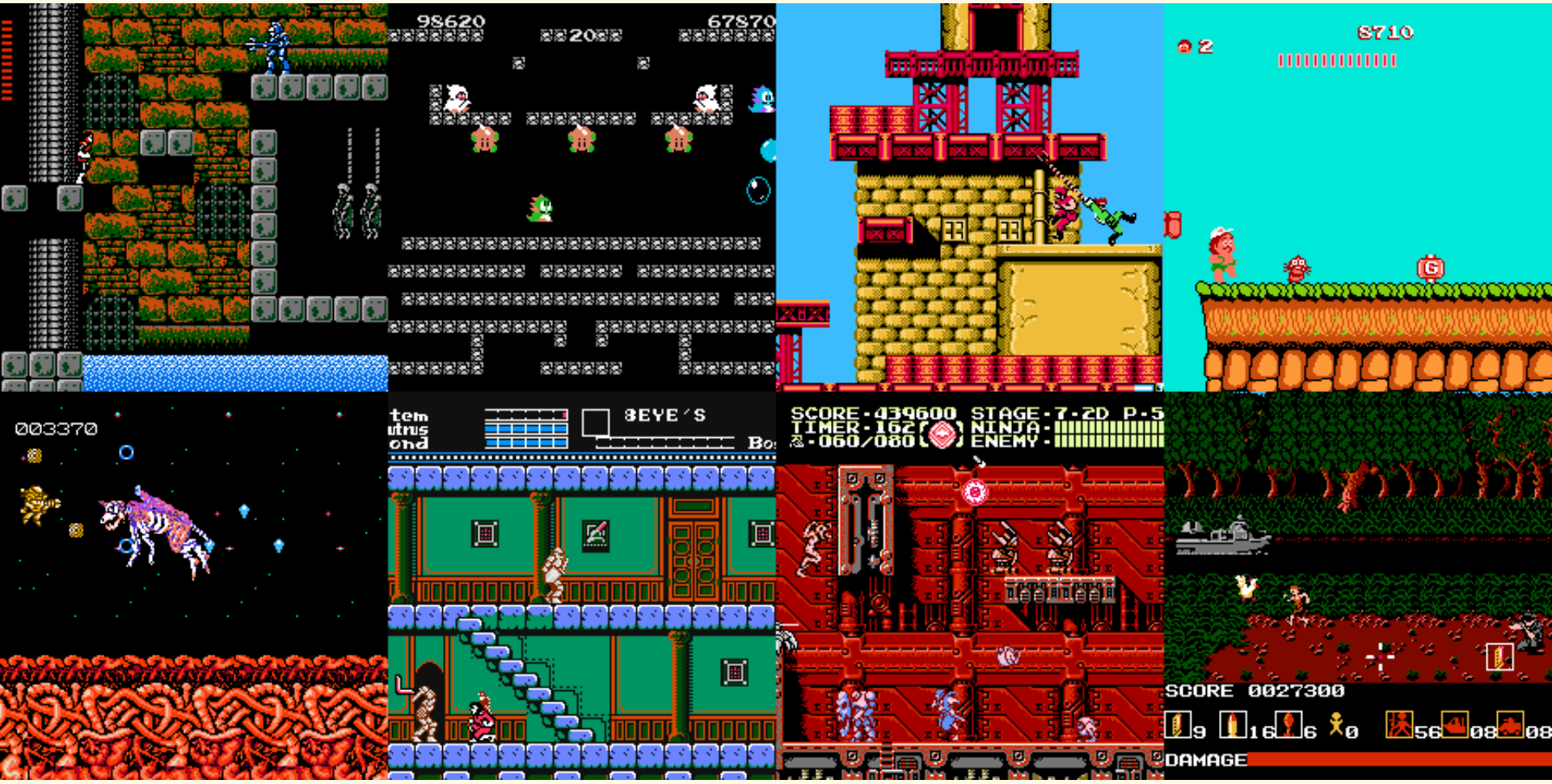
http://
mattya.github.io/
chainer-DCGAN/

"The Square Kilometre Array (SKA), a radio-astronomy observatory to be built in South Africa and Australia, will produce such vast amounts of data that its images will need to be compressed into low-noise but patchy data. Generative AI models will help to reconstruct and fill in blank parts of those data, producing the images of the sky that astronomers will examine."

http://www.nature.com/news/astronomers-explore-uses-for-ai-generated-images-1.21398



Abusing GANs to Make 8-bit Pixel Art



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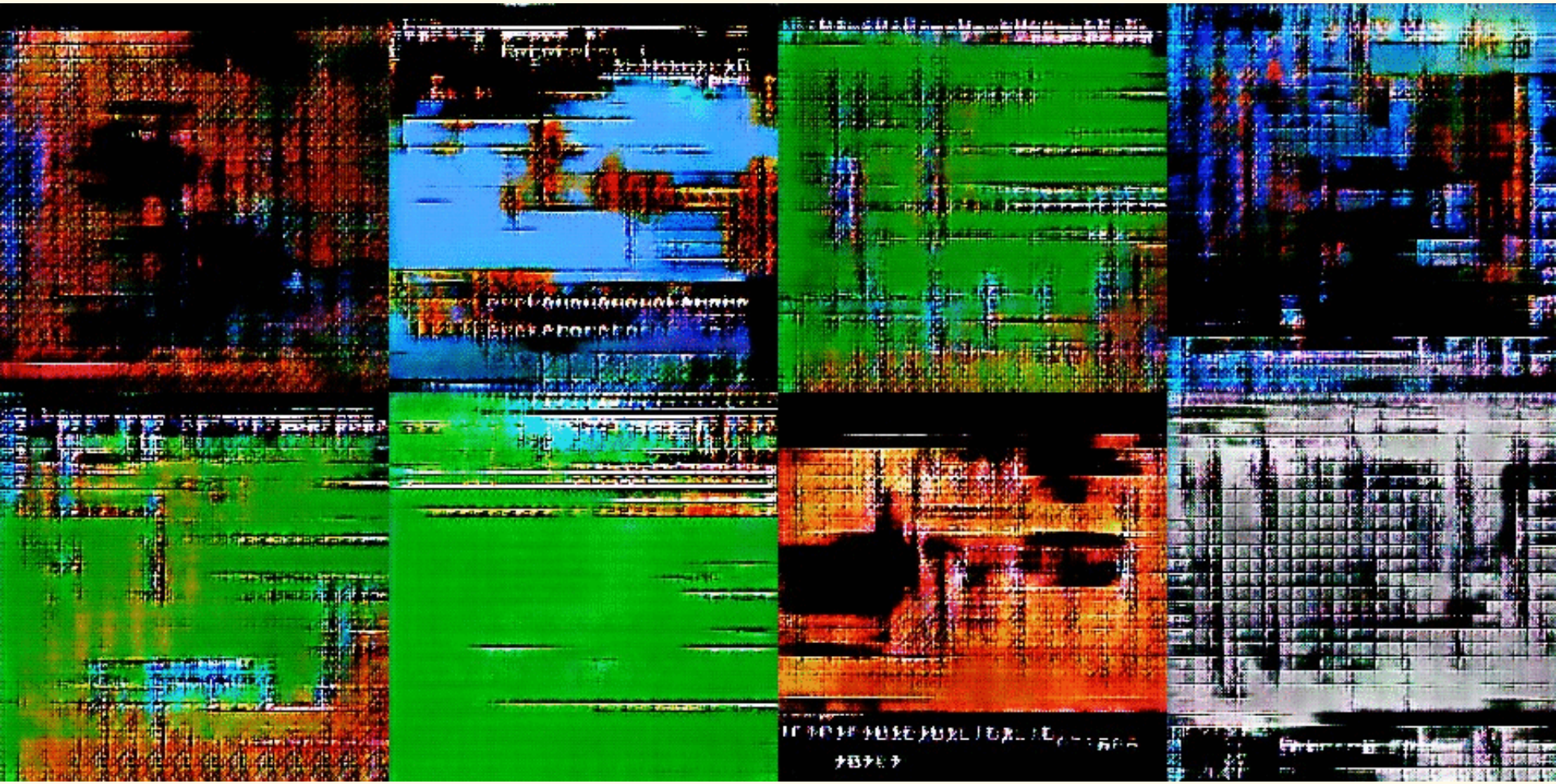

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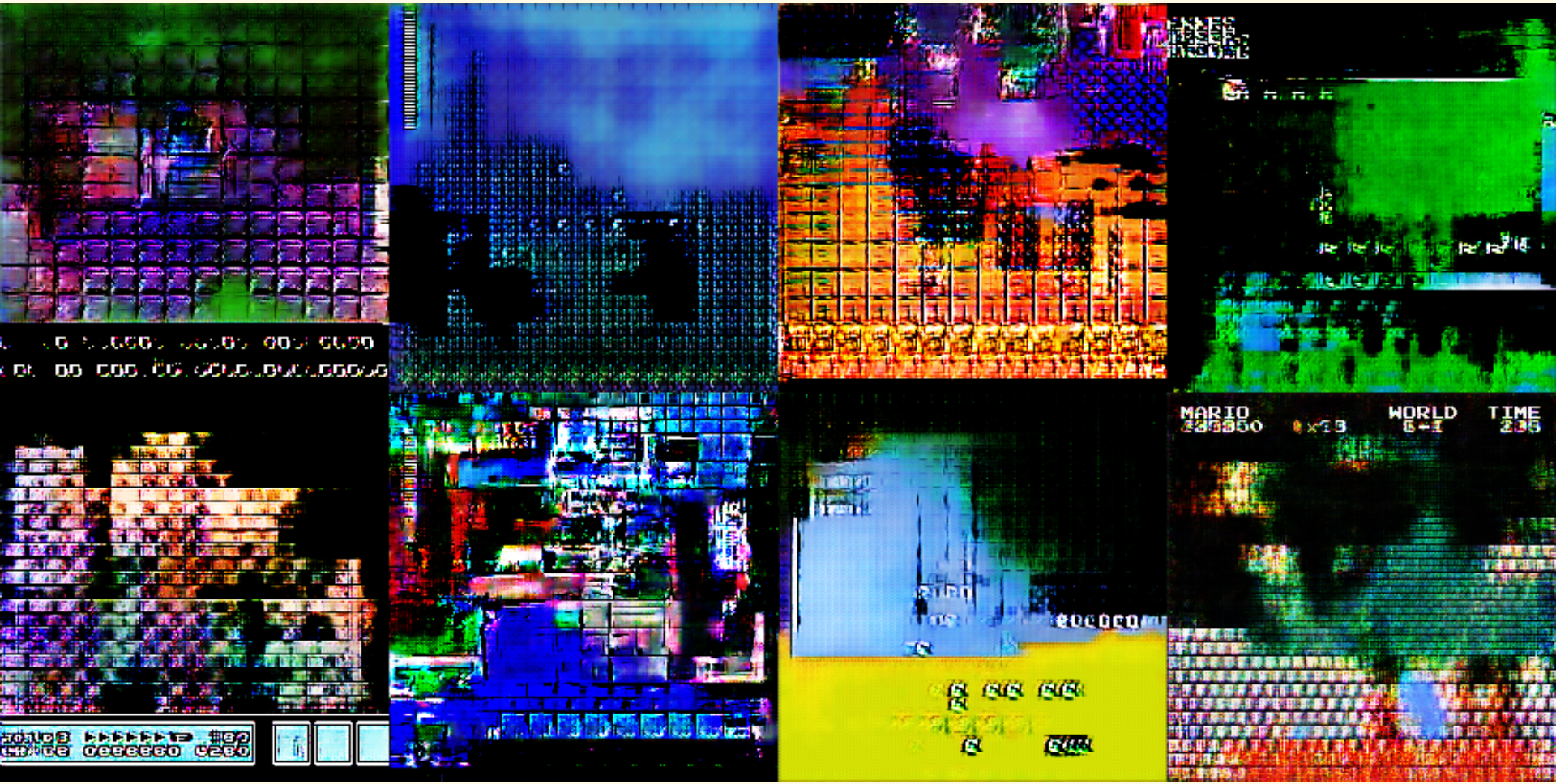


Generative Adversarial Text to Image Synthesis, Reed et al. 2016

this small bird has a pink breast and crown, and black primaries and secondaries.

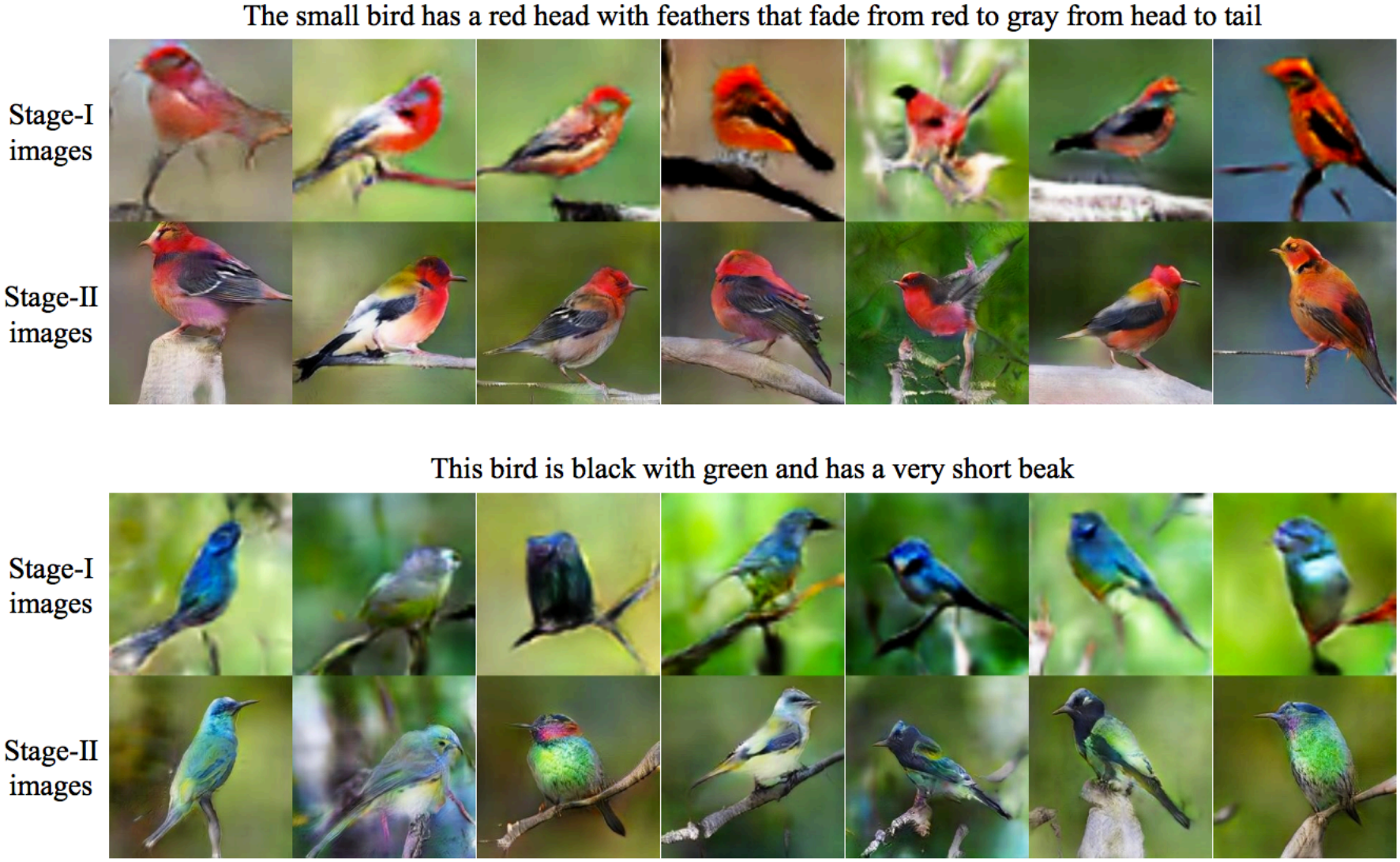
this magnificent fellow is almost all black with a red crest, and white cheek patch.

the flower has petals that are bright pinkish purple with white stigma

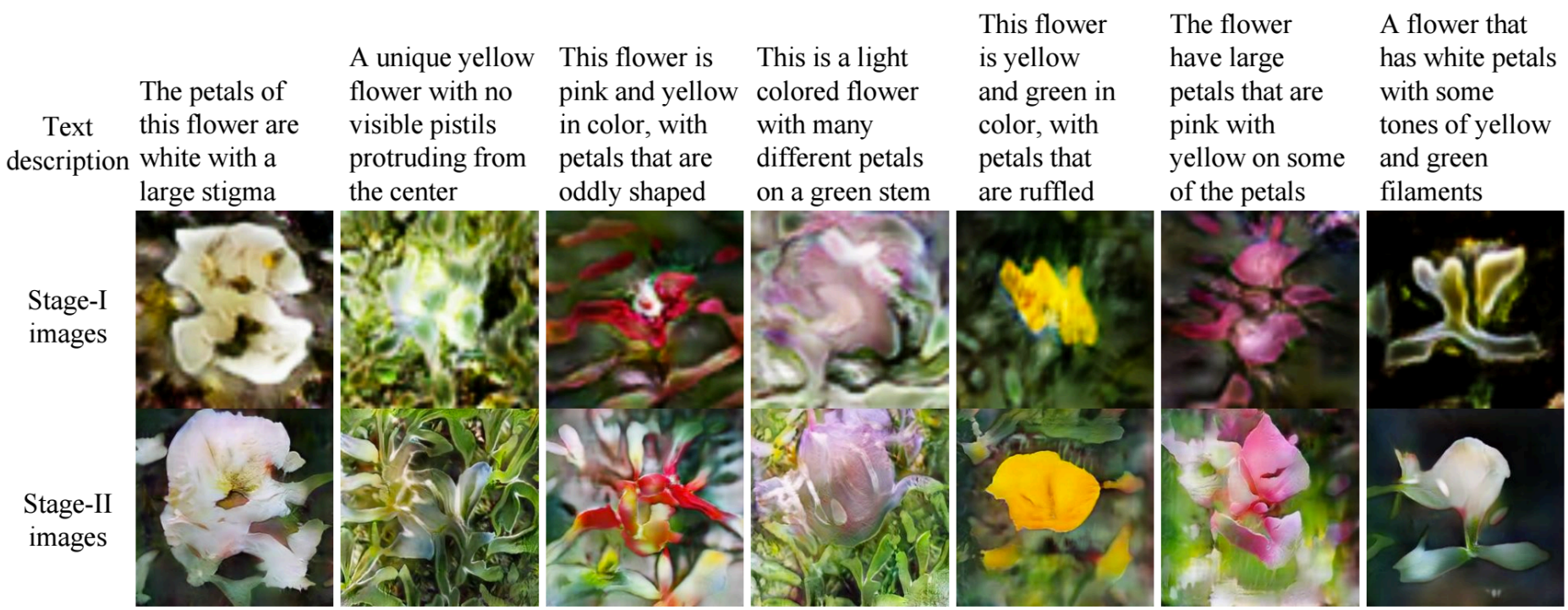
this white and yellow flower have thin white petals and a round yellow stamen

https://arxiv.org/abs/1605.05396

StackGAN: Text to Photo-realistic Image Synthesis, Zhang et al. 2016

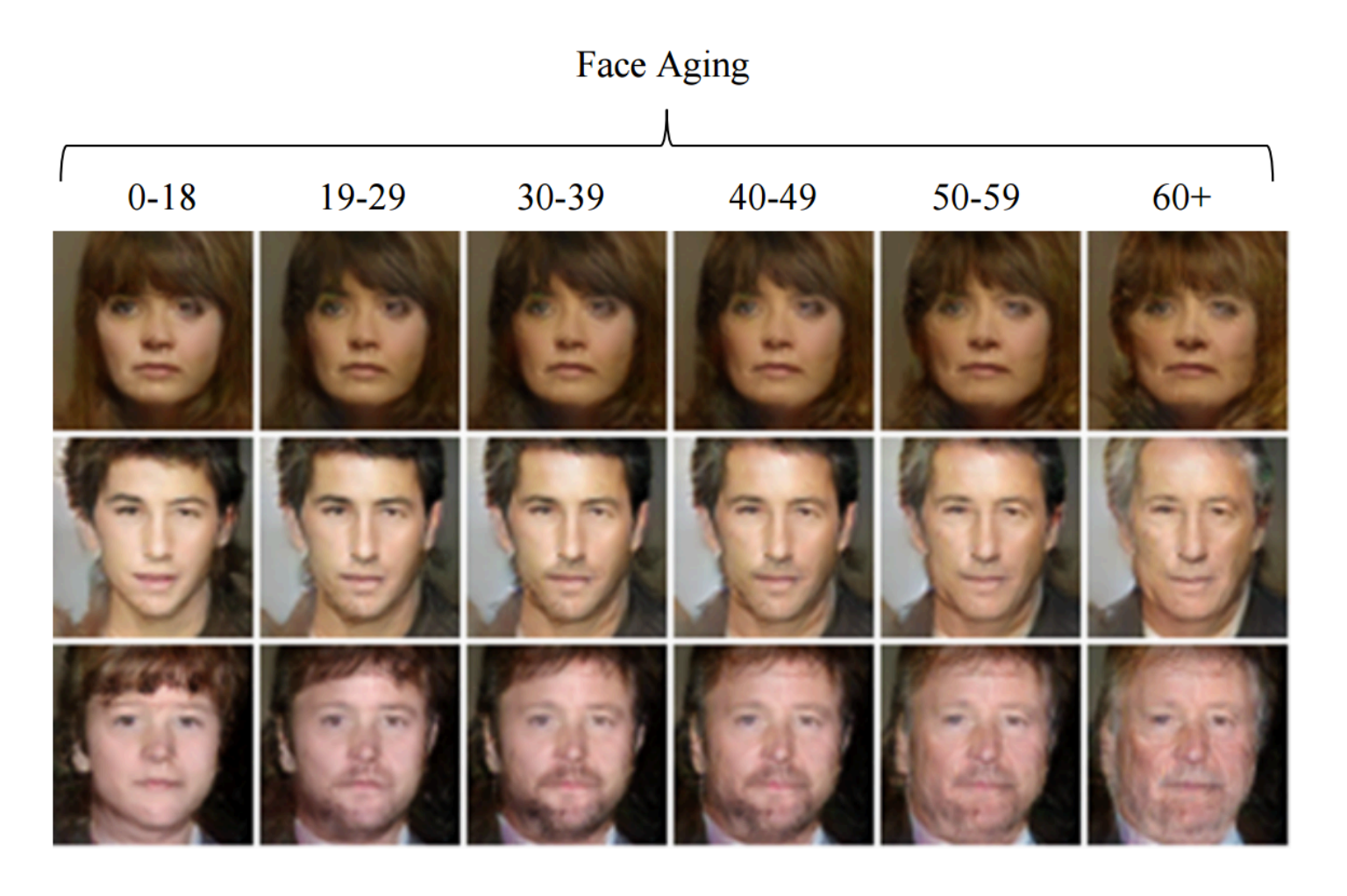


Generative Adversarial Text to Image Synthesis, Reed et al. 2016



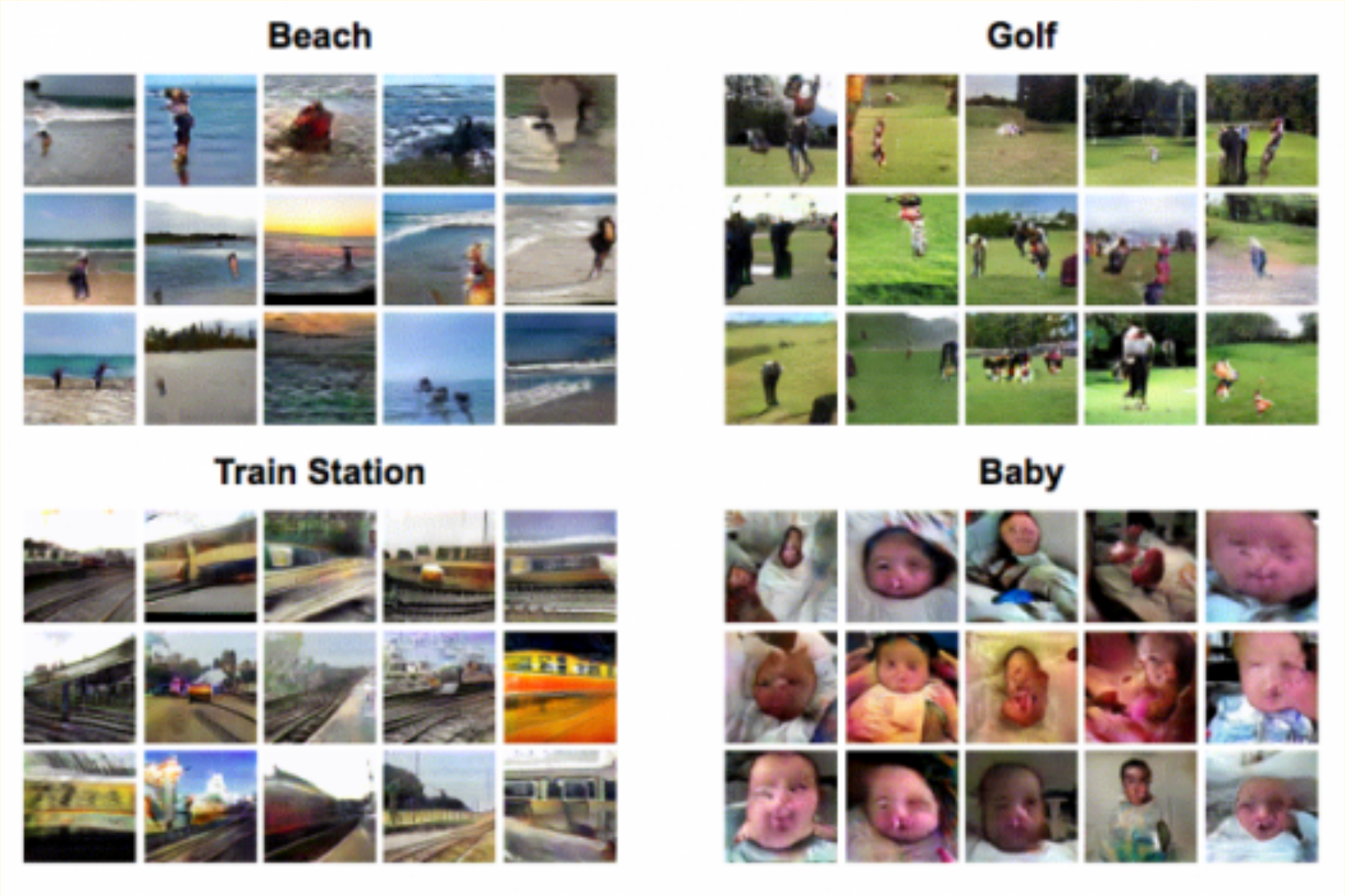
https://arxiv.org/abs/1612.03242

Face Aging With Conditional GANs, Antipov et al. 2017



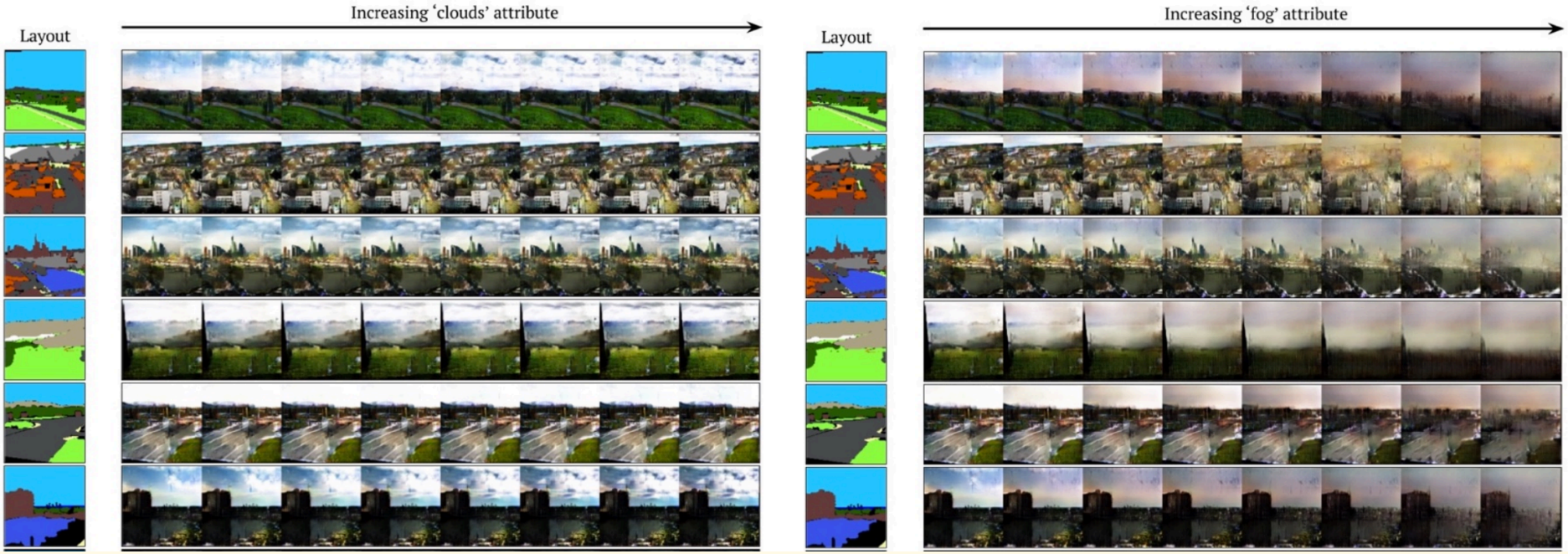
https://arxiv.org/abs/1702.01983

Generative Videos w/Scene Dynamics, Vondrick et al. 2016



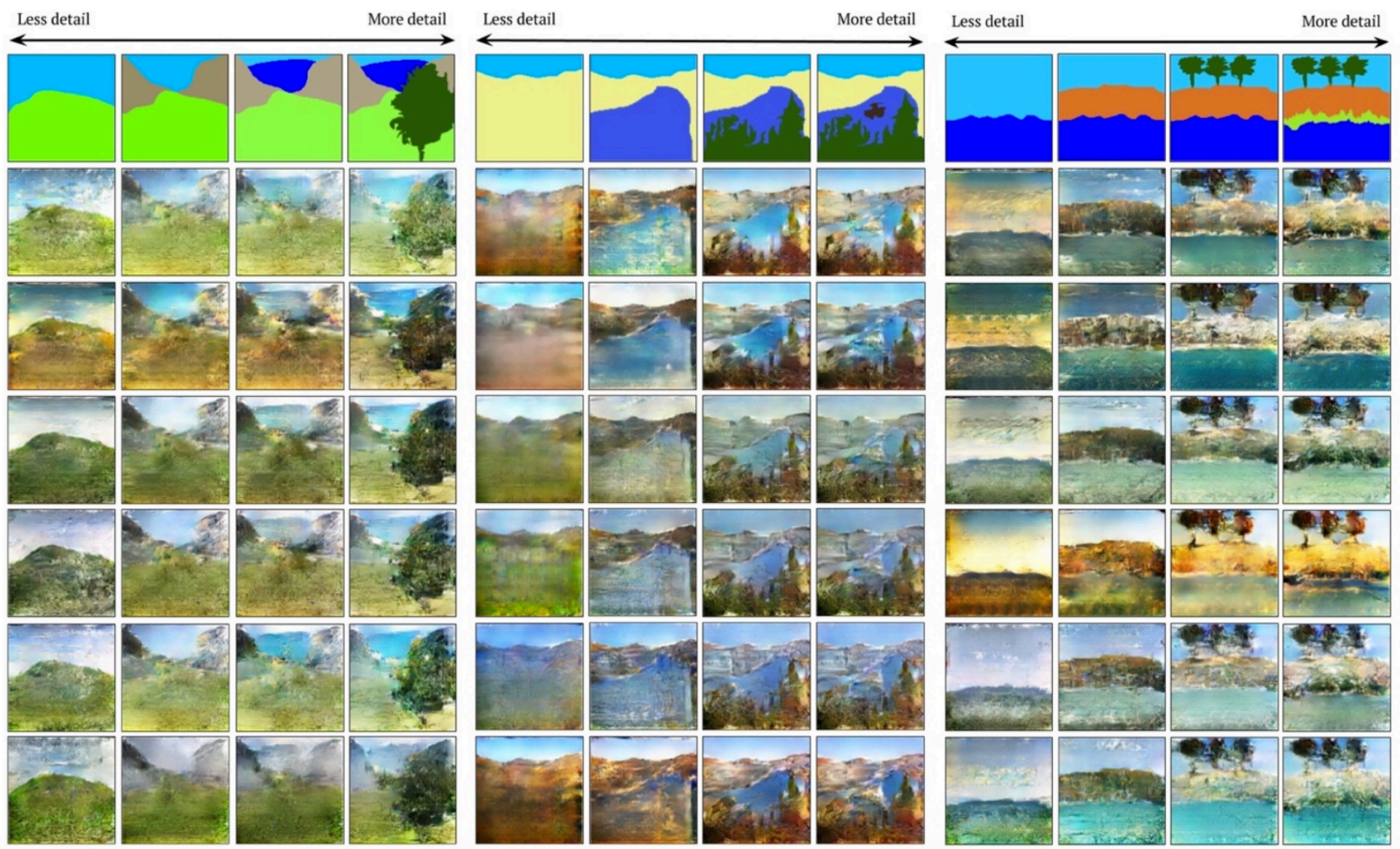
http://www.csail.mit.edu/creating_videos_of_the_future

Learning to Generate Images of Outdoor Scenes, Karacan et al. 2016

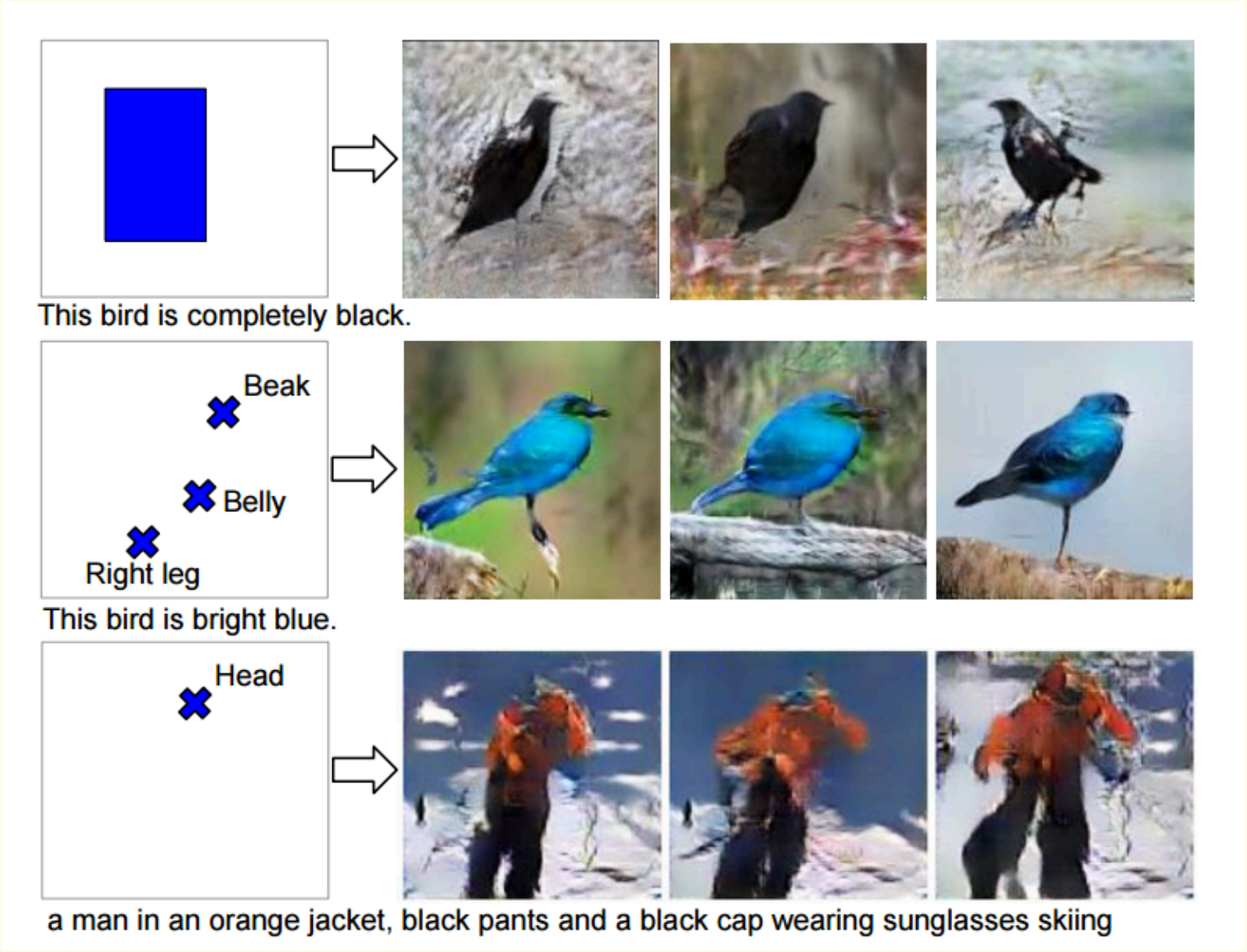


https://arxiv.org/pdf/1612.00215.pdf

Learning to Generate Images of Outdoor Scenes, Karacan et al. 2016



Learning What and Where to Draw, Reed et al. 2016



GAN code

- Lots of code repos online for GANs, DCGANs, StackGAN, etc.
- Many TensorFlow tutorials, video walkthroughs, posts on Medium, etc

Project 2

- Generate novel output using an RNN
- Understand how to read and write Tensorflow code (lots of examples, tutorials online to learn from)
- Can work alone, or in groups of 2 or 3

Next Week

- Project 2, (informal) progress reports
- See syllabus for reading assignment