Image Generation: What's Next?

What we will be covering in this module?

- Introduction to Image Generation
- What are Generative Models?
- Understanding Generative Adversarial Networks
- Project on Texture Generation using GANs
  - Simple Implementation
  - Better GAN Architectures
- What's Next?

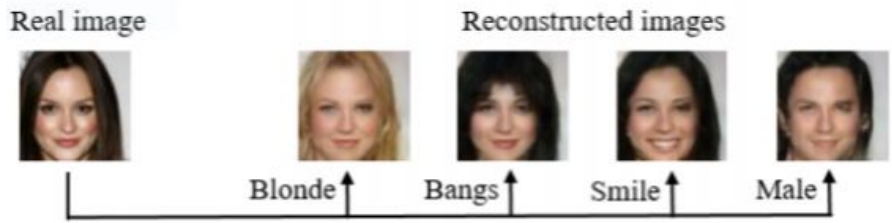
Recap: Image Generation Module

Image Generation is the task of generating completely new realistic images which does not belong to the training dataset, but resembles them

Give me an image of a Dog

Recap: Image Generation Module

- Synthetic Dataset Creation
  - For training DL models
- Image Editing
  - Reconstruct Variations
- Cyber Security
  - Detecting forgery



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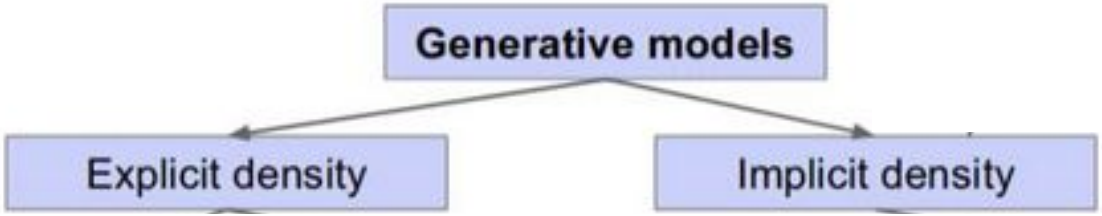
Recap: Image Generation Module



- PixelRNN/CNN
- Variational Autoencoder
- **Generative Adversarial Networks**
- Boltzmann Machine

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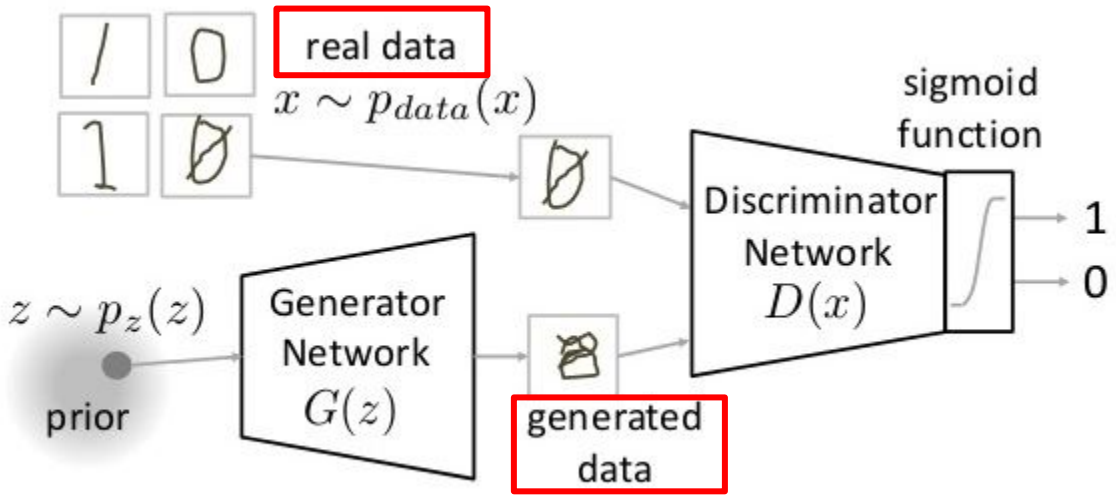
Recap: Image Generation Module

- Broadly a GAN architecture has two main subparts
  - Generator Network (MLP network)
  - Discriminator Network (MLP network)



Recap: Image Generation Module

- **Step 1:** Define architecture of Discriminator
- **Step 2:** Define architecture of Generator
- **Step 3:** Train Discriminator (for one or more iterations)
  - **Step 3.1:** Take samples from real data
  - **Step 3.2:** Generate fake data from Generator
  - **Step 3.3:** Update the parameters of Discriminator on the combined batch
- **Step 4:** Train generator
  - **Step 4.1:** Generate fake data from Generator
  - **Step 4.2:** Update the parameters of Generator on how well the Discriminator is fooled
- **Step 5:** (Optional) Check if the fake data visually if it seems legit. If yes, stop training, else go to Step 3

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Recap: Image Generation Module

Analytics Vidhya

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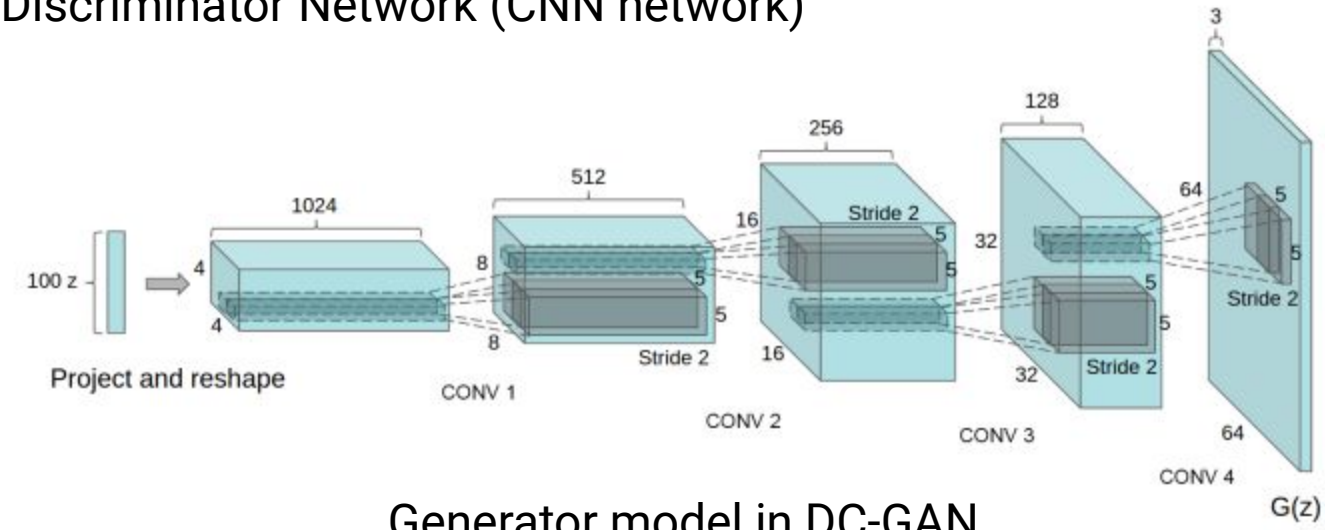
Recap: Image Generation Module

- Broadly a GAN architecture has two main subparts
  - Generator Network (CNN network)
  - Discriminator Network (CNN network)



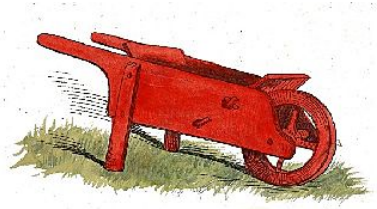
Generator model in DC-GAN

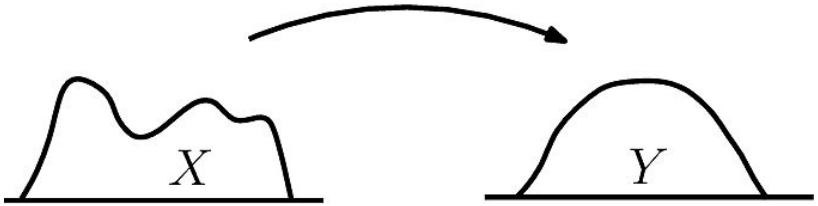
Analytics Vidhya

Recap: Image Generation Module

The *Earth-Mover* (EM) distance or Wasserstein-1

$$W(\mathbb{P}_r, \mathbb{P}_g) = \inf_{\gamma \in \Pi(\mathbb{P}_r, \mathbb{P}_g)} \mathbb{E}_{(x,y)\sim\gamma}\big[\, \|x - y\| \,\big]$$





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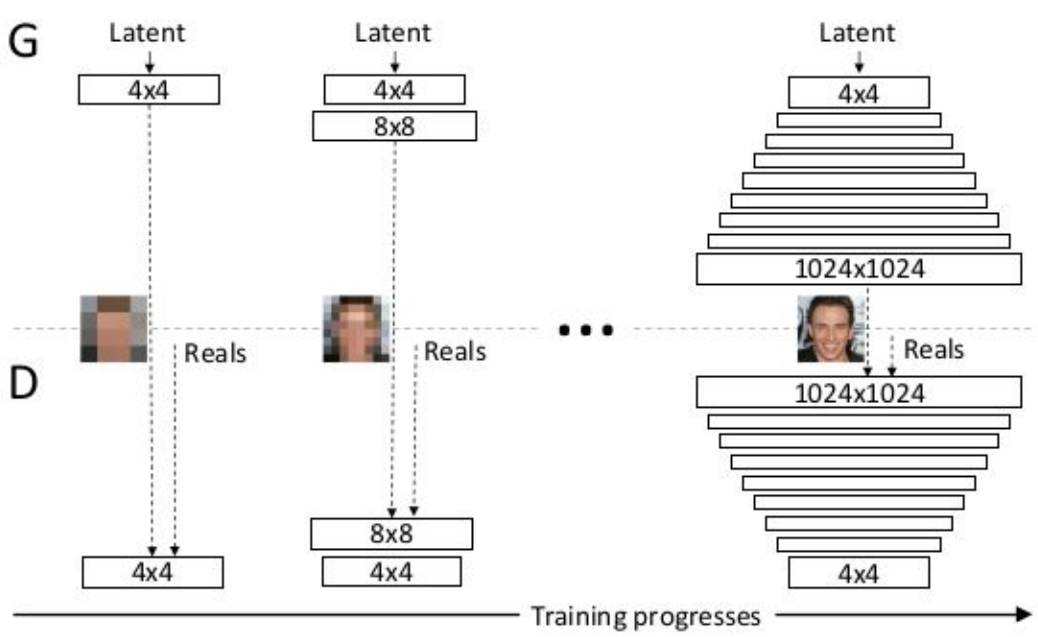
Recap: Image Generation Module



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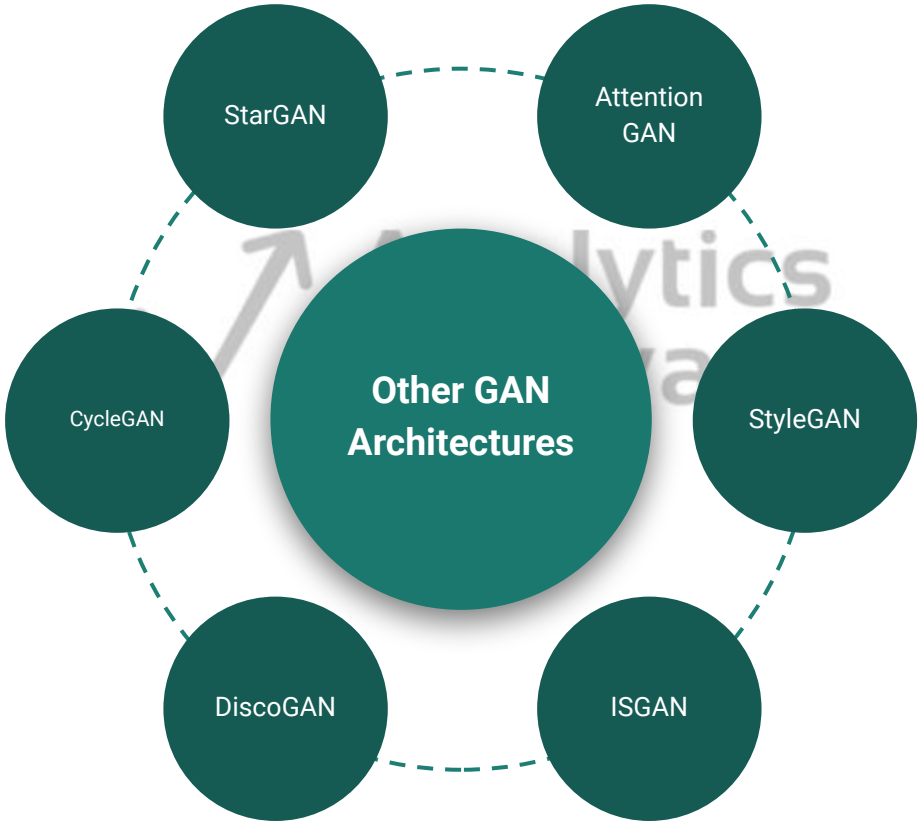
GAN Architectures (GAN zoo)



Thank you

Analytics
Vidhya