PRESENTATION ON GENERATIVE MODELS

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Generative Model

- *A generative model describes how a dataset is generated, in terms of a probabilistic model. By sampling from this model, we are able to generate new data.*
- Suppose we have a dataset containing images of horses. We may wish to build a model that can generate a new image of a horse that has never existed but still looks real because the model has learned the general rules that govern the appearance of a horse. This is the kind of problem that can be solved using generative modeling.

Generative modeling process

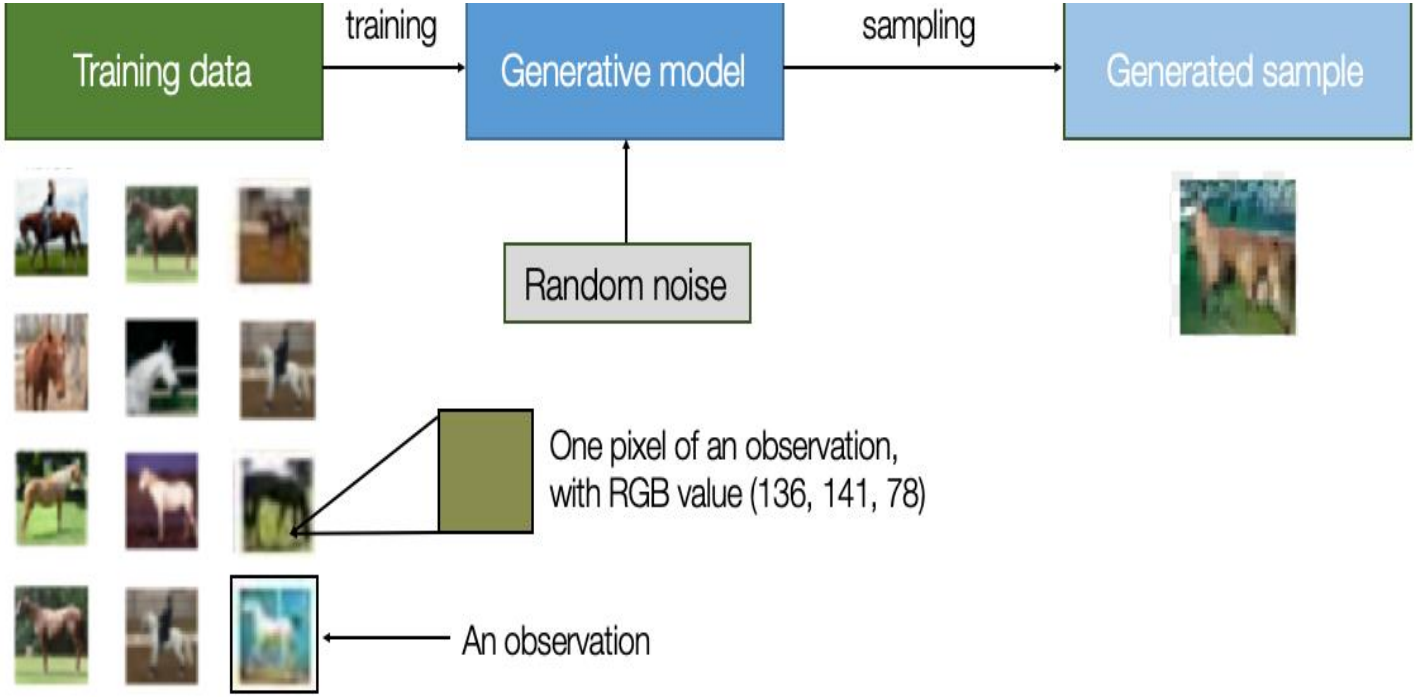


Figure 1-1. The generative modeling process

Generative Vs Discriminative Model

- Generative models can generate new data instances.
- Discriminative models discriminate between different kinds of data instances.

  Suppose we have a dataset of paintings, some painted by xyz and some by other artists. With enough data, we could train a discriminative model to predict if a given painting was painted by xyz.

Discriminative modeling process

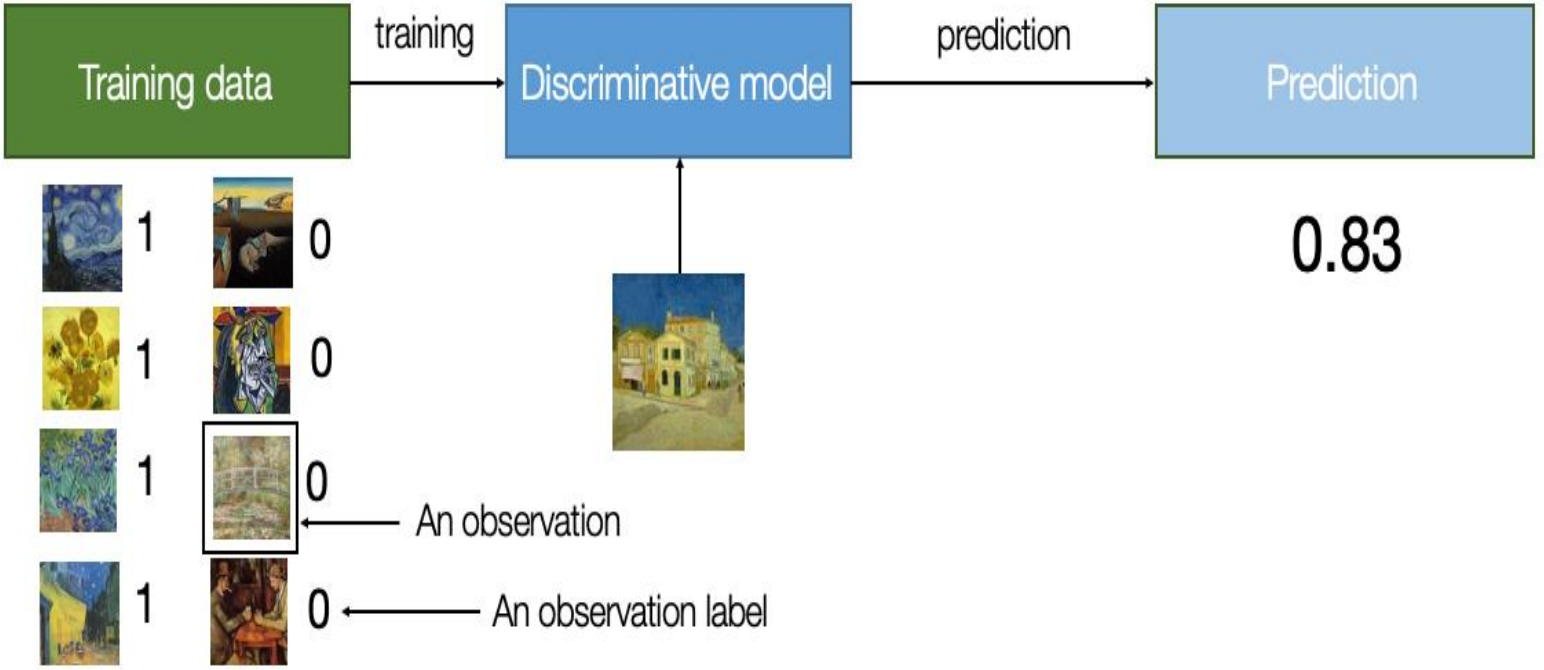
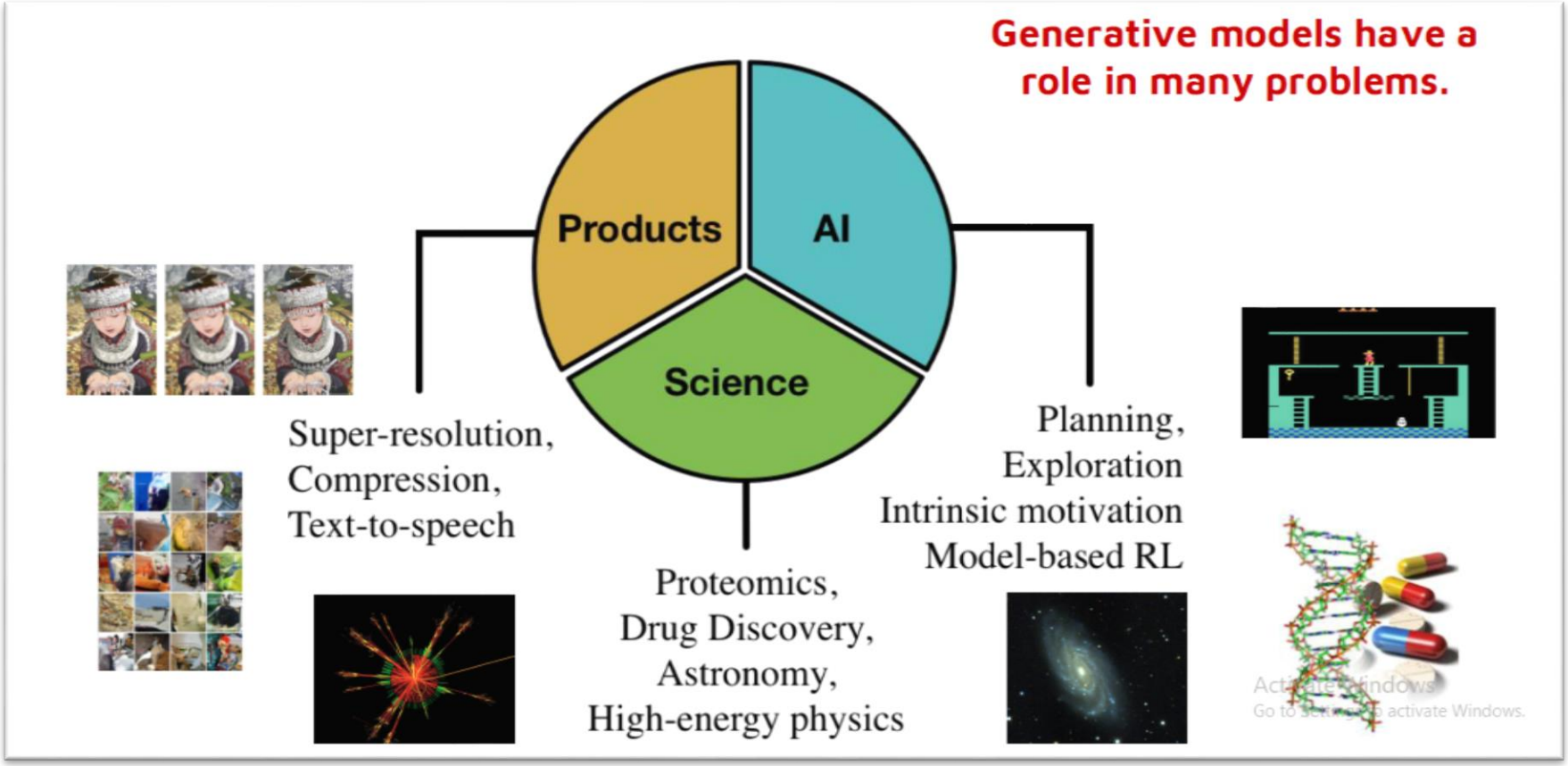


Figure 1-2. The discriminative modeling process

• One key difference is that when performing discriminative modeling, each observation in the training data has a *label*.

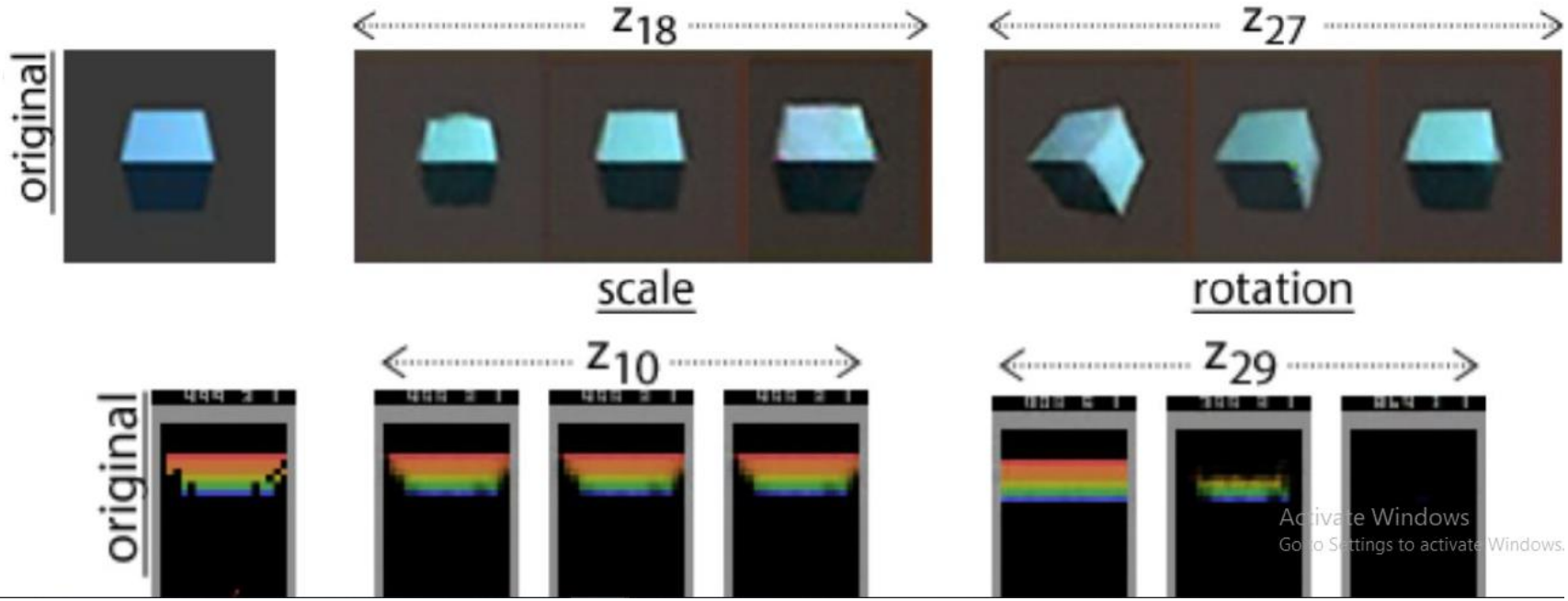
•Generative modeling is usually performed with an unlabeled dataset (that is, as a form of unsupervised learning), though it can also be applied to a labeled dataset to learn how to generate observations from each distinct class.

Advantages


Generative models have a role in many problems.
Products
AI
Science
Super-resolution,
Compression,
Text-to-speech
Planning,
Exploration
Intrinsic motivation
Model-based RL
Proteomics,
Drug Discovery,
Astronomy,
High-energy physics

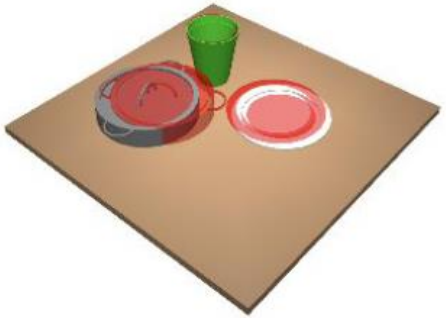
Visual Concept Learning

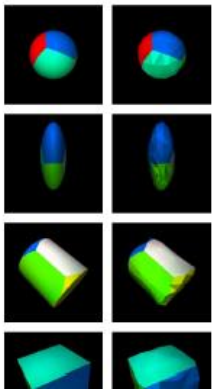
Understanding the factors of variation and invariances.

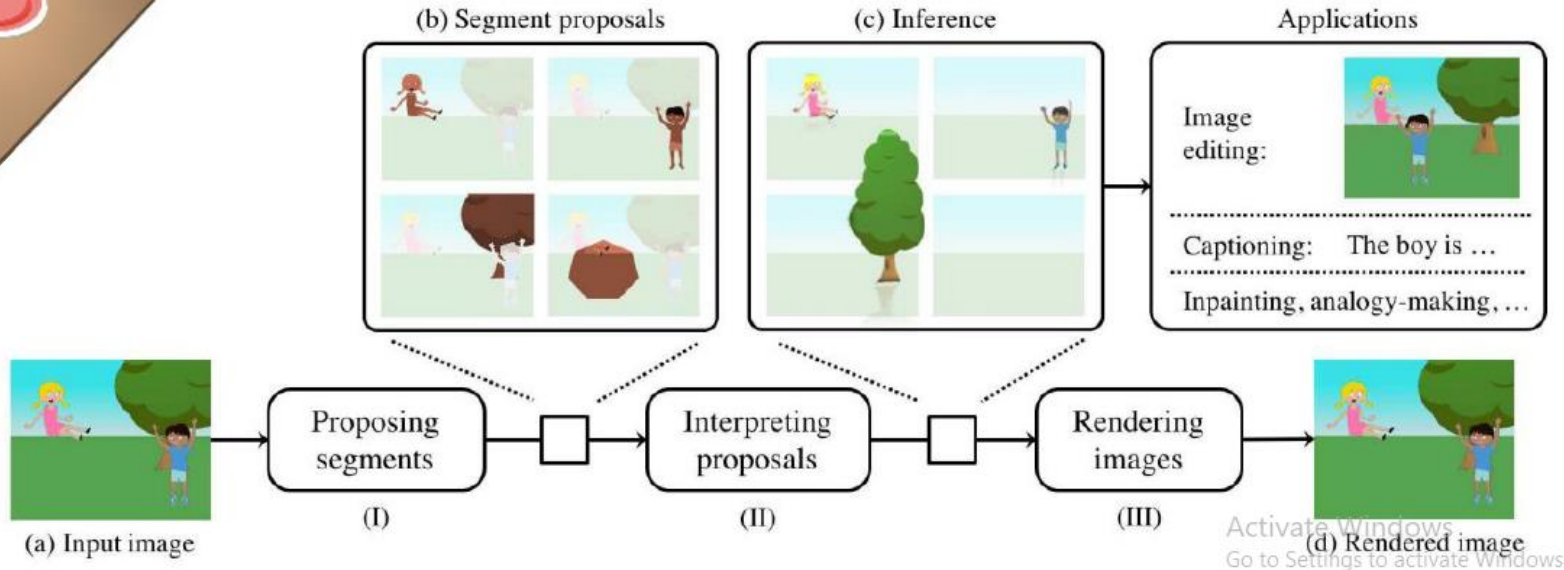


Scene Understanding

Understanding the components of scenes and their interactions







Communication and Compression

Hierarchical compression of images and other data.

Original images

Compression rate: 0.2bits/dimension

JPEG

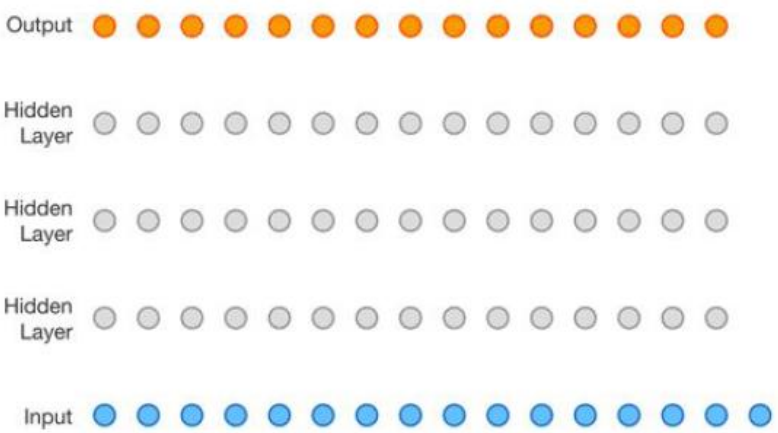
JPEG-2000

RVAE v1

RVAE v2

Text-to-speech Synthesis

Generating audio conditioned on text



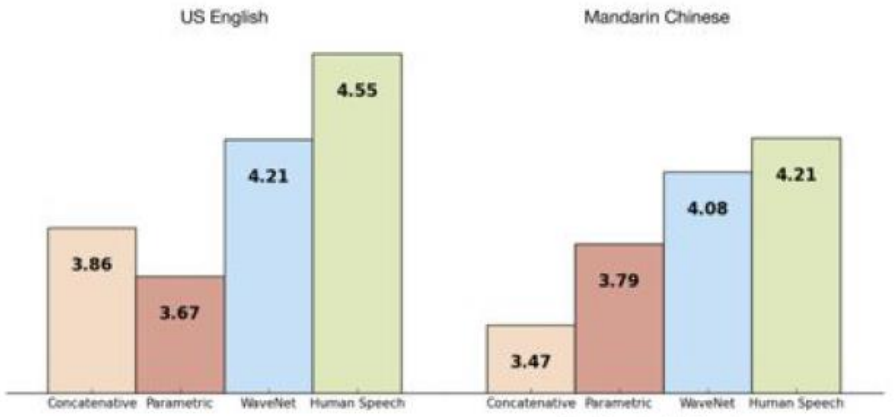


Image and Content Generation

Generating images and video content.

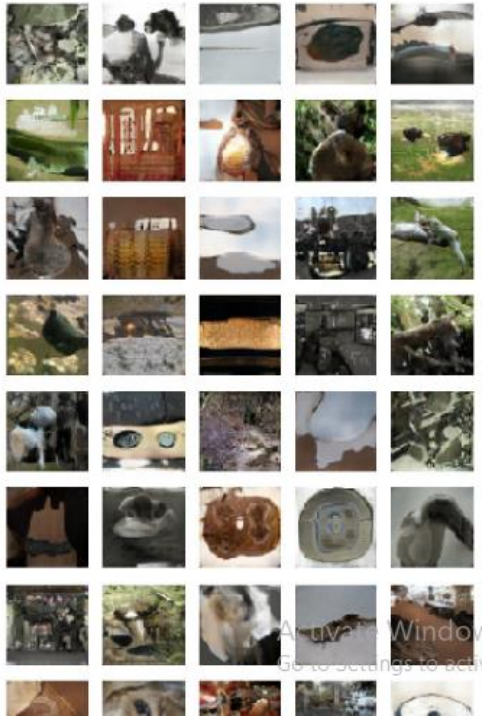


Image super-resolution

Photo-realistic single image super-resolution

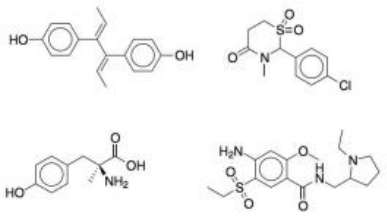
original

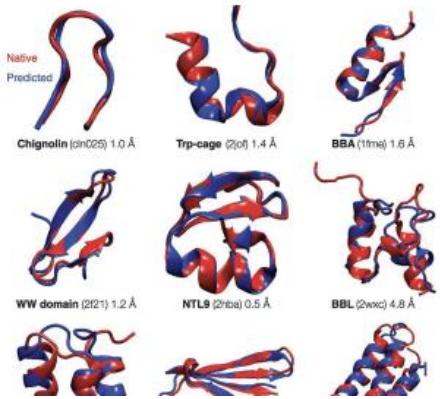
bicubic
(21.59dB/0.6423)

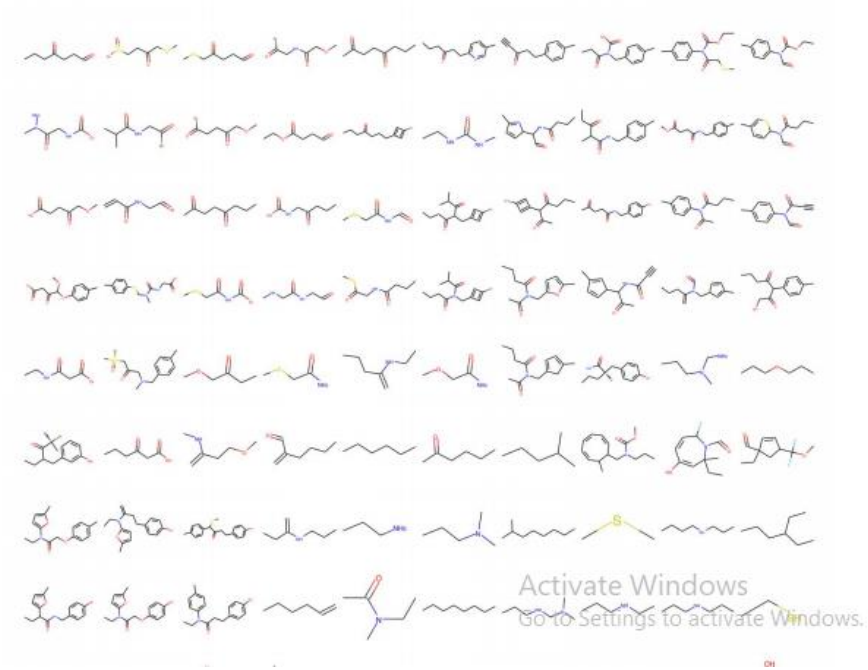
SRGAN
(20.34dB/0.6562)

Drug Design and Response Prediction

Proposing candidate molecules and for improving prediction through semi-supervised learning.







THANK YOU